TK
180
.54
V.6
NO. 2

NOTICE TO READER
When you finish reading this magazine, place a one-cent stamp on this notice, mail the magazine, and it will be placed in the hands of our soldiers or sailors destined to proceed overseas.
NO WRAPPING—NO ADDRESS

JAN. 1919
20 CTS.

ELECTRICAL EXPERIMENTER

SCIENCE AND INVENTION

OVER 175 ILLUST.

REG. U.S. PAT. OFF.

SMOKE BARRAGE SAVES ESCAPING 'PLANE

SEE PAGE 612



LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION
www.americanradiohistory.com

FREE BE A CERTIFICATED ELECTRICIAN



YOU MEN LISTEN The country needs more trained, graduate electricians. Thousands have gone into the Government service and there is such an unusual demand for competent electrical men that I am making a wonderful offer at this time. HERE IS YOUR OPPORTUNITY! I want to send you my splendid offer now.

Don't hesitate because of age or experience. Young men, boys and old men must now fill the gaps and keep business going. DO YOUR PART. Prepare yourself for a real position, by my **Home Study Course** in *Practical* Electricity. I am Chief Engineer of the Chicago Engineering Works. I have trained thousands of men and can help you better than anybody else. We also have large, splendidly-equipped shops where you can come at any time for special instruction without charge. No other correspondence school can give you this.

SPECIAL OFFER: Right now I am giving a big, valuable surprise that I cannot explain here, to every student who answers this ad. Write today!

$46.00 to $100.00 a Week

Go after some real money. Qualify for one of the thousands of splendid positions open. All you need to start is a few months snappy, *practical* instruction from a competent engineer. Come to me—*NOW*. I'll give you my personal care to ensure rapid and efficient progress. My course is intensely practical. It is highly condensed, simplified, up-to-date and complete. I am so sure you will make a splendid success in this study, that I will *Guarantee Under Bond* to return to you every cent paid for tuition, if you are not entirely satisfied when you receive your Electrician's Certificate granted you as a graduate of my school.

FREE—Lessons and Outfit—FREE

Send me the Free Outfit Coupon at once. Do it *now!* For a limited period I am making a slashing cut in the cost of tuition, and giving each new student a grand outfit of Electrical Tools, Material and Instruments—in addition—*Absolutely Free.* I will also send you—free and fully prepaid—Proof Lessons to show you how easily you can be trained at home to enter this great profession, by means of my new, revised and original system of mail instruction.

Use this "Free Outfit" Coupon

CHIEF ENG. COOKE, Dept. 21
441 Cass St., CHICAGO, ILL.

SIR Send at once—fully prepaid and entirely free—complete particulars of your great offer for this month.

Name .....

Address .....

.....

ACT PROMPTLY

Get the full benefit of this great offer. Send the Coupon or a postal for free information without delay. Do it *now*—before my free offers and guarantee are withdrawn.

CHIEF ENGINEER COOKE

Chicago Engineering Works

DEPT. 21

441 Cass Street **CHICAGO, ILL.**

www.americanradiohistory.com

Bigger Pay for YOU

"See them first-pay afterwards"

Small Monthly Payment if you're satisfied



You Can Now Know ELECTRICITY

As Experts Know It

When we observe the ever-increasing applications and usages of electricity, we wonder if all the present openings and the newly created positions in the electrical world can ever be filled.

The ending of the war lends a new and mighty impetus to the electrical end of American industries. Salaries are soaring. There is practically no limit to the earning power of the man who educates himself in the finer points of electrical work.

Actual working facts

With the advent of the new Library of Practical Electricity, by Terrell Croft, a new era is marked in the production of self educational electrical literature. This library satisfies a demand never heretofore met—the demand for a home study course which would bring out in detail the actual working facts. This great undertaking has been accomplished. It is a seven-year task completed.

No previous electrical training necessary

Three thousand pages, with twenty-one hundred of the clearest illustrations ever put into book form. Each of the eight volumes is indexed so that everything you want to know about electricity is at the finger's end. And when you find what you want, there is not merely a short question and a short answer. You are told everything you want to know. The explanation is clear to you, regardless of whether you have had a previous knowledge of electricity or not.

Know electricity as the highest paid engineers know it

When you are studying the Croft Library of Practical Electricity, you are studying electricity as experts know it. You are acquainting yourself with the methods employed by the highest paid electrical workers and engineers in America.

This Library of eight volumes sent to you FREE for 10 days' trial

So positive are we that you will be pleased with the Croft Library of Practical Electricity that we offer to send the entire ten volumes for ten days' free use. All you need do in order to have the books sent, charges prepaid, is to fill out the attached coupon and return to us. Keep the books ten full days. Then if you are not satisfied, return them at our expense. On the other hand, if you find that they will help you, as they are helping thousands of others, send us the small sum of $2 per month for eight months.

8 Vols.

Flexible binding

Pocket size

3000 pages

2100 illustrations

A letter that means something to every man in America who is interested in electricity

McGraw-Hill Book Company, Inc.,
239 West 39th Street, New York, N. Y.
Gentlemen: In an attempt to express myself about CROFT'S NEW LIBRARY OF PRACTICAL ELECTRICITY, I have never seen and do not believe there was ever printed in the English language, a more comprehensive set of books. It is a library that is just as valuable to the novice as to the expert, because it is all practice.

Respectfully,
GUY H. PEIFER,
Chief, Doplan Silk Corporation, Hazleton, Pa.

McGraw-Hill Book Co., Inc.
239 West 39th Street, New York, N.Y.

ACT NOW

FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc.
239 W. 39th St.
NEW YORK

Gentlemen:
Please send me the Library of Practical Electricity (shipping charges prepaid), for 10 days' free examination. If satisfactory, I will send $2 in ten days and $2 per month, until $16 has been paid. If not wanted I will write you for return shipping instructions.

Name.....
Home Address.....
City and State.....
Name of Employer.....
His Address.....
Your Position.....

LIBRARY SEP 2 8 1999 UNIVERSITY OF TORONTO

www.americanradiohistory.com

Electrical Experimenter

233 FULTON STREET, NEW YORK

Publisht by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer;) 233 Fulton Street, New York

Vol. VI Whole No. 69 JANUARY, 1919 No. 9

SMOKE BARRAGE SAVES ESCAPING 'PLANE.....Front Cover
From a painting by George Wall.
AMERICAN DESTROYERS THROW DEPTH "BOMB BARRAGE" 605
SOLAR ENGINE USES SUN'S ENERGY..... 607
ELECTRIC DEATH TRAPS IN HUN'S RETREAT.....
By H. Winfield Secor 608
SUBMARINES IN PEACE TIME—WHAT TO DO WITH SURRENDERED U-BOATS..... 610
TELEPHONING FROM MOVING TRAINS..... 610
SMOKE BARRAGE SAVES ESCAPING 'PLANE..... 612
"THE LONG DASH"—A WIRELESS GUN SHOW..... 613
AN ALL-ELECTRIC HOT AIR BALLOON..... 614
THE CITY OF SPLENDID NIGHT.....By Amos Stote 615
"ODD PHOTO" PRIZE CONTEST—A GALAXY OF WORLD-BEATERS..... 616
ELECTRICAL DENTAL AUTO FOR UPTON SOLDIERS..... 617
NEW BRITISH 'PLANE COASTS 20 MILES TO SAFETY..... 617
NEW FLASHLIGHT CUTS OFF AFTER ONE MINUTE..... 618
FOOLING THE DRAFT BOARD?—IT CAN'T BE DONE..... 618
WINTERTIME USES FOR ELECTRIC FANS..By Pauline Ginsberg 619
POPULAR ASTRONOMY—GIANT JUPITER AND HIS NINE MOONS.....By Isabel M. Lewis 620
NIKOLA TESLA TO WRITE "MY INVENTIONS" FOR "ELECTRICAL EXPERIMENTER" READERS..... 622
NEW PROPOSED WIRELESS BILL AND DISCUSSION..... 624
EXPERIMENTAL PHYSICS—ELECTRICAL CONDUCTION THRU GASES.....By John J. Furia, A.B., M.A. 626
MY RADIO "STATIC ELIMINATOR".....By Dr. Nikola Tesla 627
RADIOTELEPHONE GUIDED U. S. FLYERS MANY MILES AWAY..... 629
THE MANUFACTURE OF VACUUM DETECTORS.
By O. B. Moorehead. 630
A VERTICAL CABINET TYPE COUPLER..By Joseph H. Kraus, Jr. 631
BUILDING A 3-INCH SPARK STATIC MACHINE.
By Dr. E. Bade 633
A 25-INCH MODEL GYRO-ELECTRIC DESTROYER—HOW I BUILT IT..... 634
EXPERIMENTS IN RADIO-ACTIVITY—PART I—IONIZATION. 636
EXPERIMENTAL MECHANICS—LESSON IX. By Samuel D. Cohen 637

EDITORIAL

Electric Music

THERE are many different ways of producing music, and as our culture advances the desire for better and still better music becomes a craving of civilization. From the ancient tom-tom to a Stradivarius violin is a long cry, and the chances are that as our musical tastes become more refined, still better instruments will become necessary and highly desirable.

There are few instruments giving a more mellow and a more "human" sound and quality of tone than a fine violin, but we have no hesitancy in saying that it should be possible to obtain still better results by electrical means. The field of purely electrical music has hardly been touched. Some years ago an American inventor produced the Telharmonium. This was one of the earliest and best attempts at pure electrical music. The Telharmonium was invented by Dr. Thaddeus Cahill and he used alternating current generators, each of a certain frequency; if a telephone receiver were connected in the circuit, the latter would give forth a certain very pure note. By using a switchboard arranged in the form of an organ keyboard, wonderful musical effects were produced.

Another more recent attempt was the pure electrical music discovered thru researches of Dr. Lee de Forest. He used his audion bulbs in connection with a telephone receiver, and obtained beautiful flute-like tones of the greatest purity. The two devices just described necessitated the use of a telephone receiver to translate the electrical impulses into sonorous vibrations, and this is a great disadvantage, for it ties us to a thin diafram, which in itself cannot produce the very purest tones obtainable. As one can readily understand, the limitations of a diafram are very great and while it is possible to obtain a single pure note, it is a different matter where several pure notes in different octaves are to be reproduced simultaneously.

A way out is suggested by the writer by pressing into service the thermo-telephone which employs no diafram at all, but uses a very fine platinum wire of microscopic cross-section. This platinum wire, heating and cooling in unison with the electrical vibrations, imprest upon it imparts these impulses to the surrounding air. With this device very pure electrical music can be obtained.

There should be of course many other ways to actually produce pure electrical music, and here is a wonderful opportunity for experimenters and inventors. To the writer's mind, it seems not at all impossible that we should take a metallic wire stretched taut and by impressing an electric current upon it, vary its heating and cooling effects so as to produce pure sounds in a suitable receiver such as a thermo-telephone.

Dr. de Forest has shown us that beautiful music can be produced in a vacuum tube. Paradoxical as it seems, this nevertheless is a fact. There must be many other ways of producing vibrations in a vacuum tube which can be translated into an electrical current, thus producing music.

There are also certain ways of making electromagnets produce music—this without the adjunct of telephone receivers,—by vibrating their entire structure. Many other means will undoubtedly suggest themselves to our students and scientists.

H. GERNSBACK.

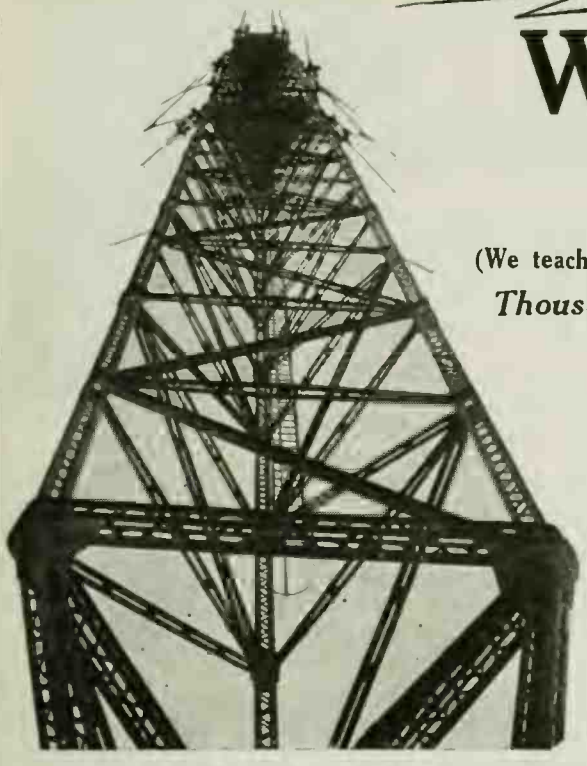
The ELECTRICAL EXPERIMENTER is publisht on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions. Canada and foreign countries, $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 20 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. A green wrapper indicates expiration. No copies sent after expiration.

All communications and contributions to this journal should be address to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

ELECTRICAL EXPERIMENTER. Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered U. S. Patent Office. Copyright, 1918, by E. P. Co., Inc., New York. The Contents of this magaine are copyrighted and must not be reproduced without giving full credit to the publication.

The ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris.

www.americanradiohistory.com



One of the giant wireless towers which keeps us in constant communication with Europe.

Wireless in Ten Weeks

(We teach you in your own home during your spare time)

Thousands of operators needed for America's Merchant Marine

The age of wireless is here. The experimental stage has passed. Wireless now equals in importance telegraphy, and telephony. It has assumed its place among the great commercial industries of the earth. So rapid has been the development and growth of wireless in recent years that there has been left in its wake a tremendous shortage of operators. Actually thousands upon thousands are now needed for permanent "peace time" positions offering wonderful opportunities for advancement.

Earn up to $200 per month

In the short period of ten weeks we can make of you a wireless operator, a man with a profession, independent, and not subject to the rise and fall of wages in the labor market. Salaries are as high as $200 per month. There is a position in the merchant marine, the army, the navy, or a land station, awaiting everyone completing our course. We give you this training at home, by mail, in your spare time. It is not necessary for you to lose any time from your work to take the course.

Free Instruments—

To every student enrolling with us we present a standard set of instruments with which wireless messages may be sent and received.

Travel the world over or locate at a land station in America.

America is spending billions of dollars on the mightiest navy and merchant marine in the world. Practically all vessels are being equipped with wireless apparatus of the most up to date type. Thousands of operators are needed now. The field affords a wonderful opportunity for the man who starts now to master wireless.

Our students actually pass the commercial examination in ten weeks or less.



Get your instruction from the Nation's Capitol. Our course is endorsed by officials of the U. S. Government.

The National Radio Institute, headed by authorities who have been closely allied with governmental training of students, has perfected an easily mastered course in wireless telegraphy whereby students are taught completely in ten weeks, either here in Washington at our large residence school or at home, by mail. Many of our students are ready to take up actual wireless work in much less time. The course is founded on actual practice, hence the rapid progress of the student.

NATIONAL RADIO INSTITUTE

Dept. 67

14th and U Streets, N. W. Washington, D. C.

A Valuable Book Free

Our booklet, "WIRELESS, the Opportunity of the Age," gives you complete information in regard to our course, the quick and easy methods by which you can master wireless, and other important facts you should know. It is free, Just mail the coupon. No obligation whatever on your part.

----------FREE COUPON----------

NATIONAL RADIO INSTITUTE,
Dept. 67, Washington, D. C.

Send me, free of charge, your booklet "Wireless, the Opportunity of the Age," with full particulars regarding your famous 10 weeks' Home Study Course, and your Special Free Instruments Offer.

Name .....

Address .....

Town .....State .....

www.americanradiohistory.com

ELECTRICITY

Learn in New York

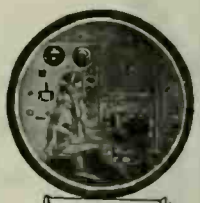
Learn by Doing

Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.


DIRECT CURRENT PRACTICE


WIRELESS TELEGRAPHY


ALTERNATING CURRENT PRACTICE


ELECTRICAL DRAFTING


ELECTRICAL REPAIRS


TELEPHONE INSTALLATION

The Oldest and Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 5,000 Students now holding Successful Positions in the Electrical World

5,000 of our students are today successful electricians.

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Let us explain this course to you in person. If you can't call, send now for 64-page book—it's FREE to you.

New York Electrical School

29 West 17th St., New York


TEST BOARD


ARMATURE WINDING


ELECTRO-MECHANICAL ENGINEERING


ESTIMATING & CONTRACTING

New York Electrical School,
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

Name .....

Address .....


ILLUMINATING ENGINEERING


MACHINE SHOP


STORAGE BATTERY SYSTEM


ELECTRIC VEHICLE CONTROL

www.americanradiohistory.com

Electrical Experimenter

H. GERNSBACK - EDITOR
H. W. SECOR - ASSOCIATE EDITOR

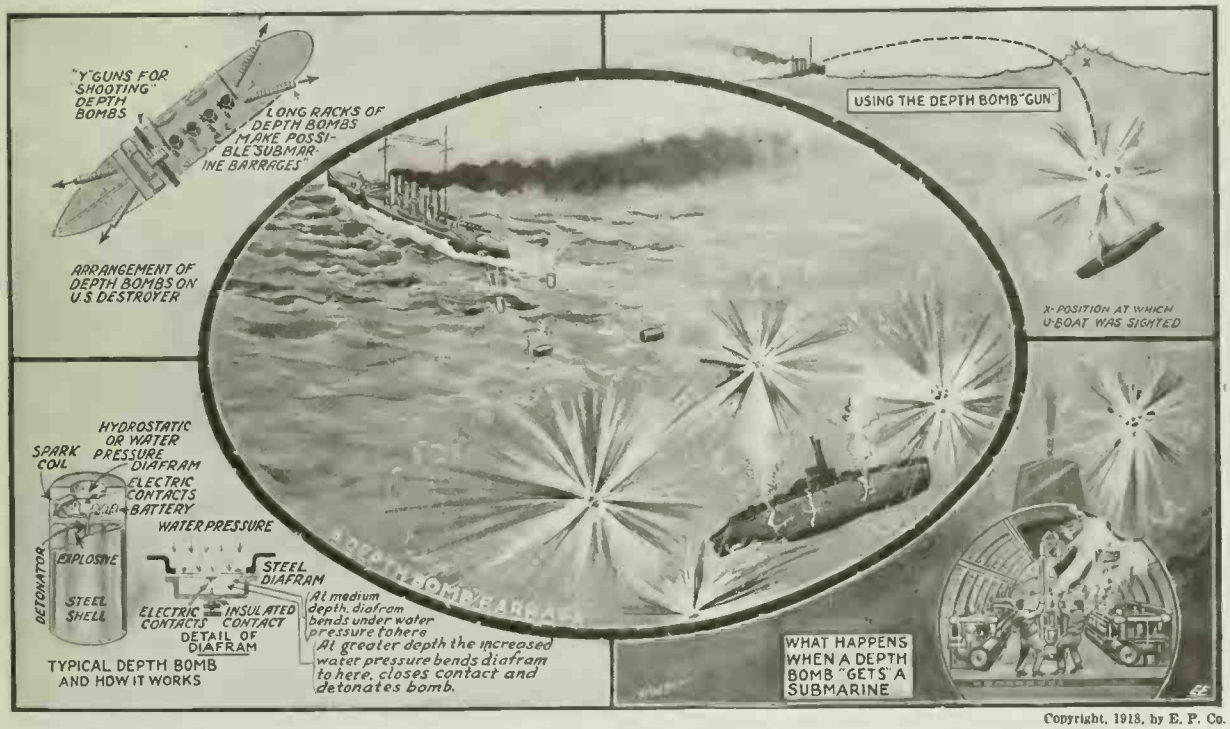
Vol. VI. Whole No. 69 JANUARY, 1919 Number 9

American Destroyers Throw "Depth Bomb Barrage"

AN American destroyer, with her depth bombs ready to be discharged, is a dangerous craft. Running without lights in the darkness she is a menace not only to the enemy but to herself and other ships should a collision occur.

time. The arrangement of the American destroyer's depth bomb armament that struck terror into the heart of German submarine commanders is shown in the accompanying illustration. These depth charges are dangerous to a submarine, even if they are 500 to 1200 feet away from the

square inch for every foot of head or depth. Thus for 1 foot depth the hydrostatic pressure acting on the shell, and also the diafram, would be .433 lb. for every sq. in. of surface area. For a depth of 20 ft. the water-pressure per sq. in. would be 8.6 lb.; for 50 ft. depth, 21.6 lb., and



Copyright, 1918, by E. P. Co.

U. S. Destroyers Have Greatly Profited By Actual War Experience, for They Became So Proficient In the Use of the "Depth Bomb"—a Wonderful New Weapon In Itself—That They Could Set Up a Veritable "Sub-aqueous Barrage." Also They Can "Shoot" Depth Bombs for a Distance of One-half Mile or More. Unlike Shells They Do Not Ricochet or Slip, But Penetrate the Water to a Certain Depth and Then Explode.

The bombs are now released from every quarter of the destroyer. Two can be dropt from the bridge by pressure of a button; "Y guns," amidships, with two barrels, can throw bombs to port or starboard; astern there are two long lines of bombs running on miniature railway tracks, so a complete *barrage* may be fired at any point where the subaqueous explosion occurs.

The detail view herewith of one of these depth bombs shows clearly the principle upon which they operate. The steel tank container is a simple affair, fitted with a sensitive water-pressure diafram. The pressure of the water increases .433 lb. per for 100 ft. depth, 43.3 lb. per sq. in. Hence it is clear how it becomes possible to "set" the diafram of the detonating device, whether electrical or mechanical, to trip off the latter at any desired depth. The farther the contact pin, or trip finger, is set back or away from the diafram, the greater the water-pressure or depth required to press it in that far.

www.americanradiohistory.com

AND NOW THE ELECTRICIANETTE!

We have conductorettes, female bartenders, police women, elevator operators, usherettes and farmerettes, but this is the first instance of its kind where we are having an electricianette.

Mrs. Ada B. Vail of the Atlantic City Electric Company, Atlantic City, New Jersey, has complete charge of an installation of sixty-five electric ranges in one apartment house located at the above address. She is responsible for the proper maintenance and operation of the entire equipment of these stoves and handles her position capably. Beside, she takes care of some thirty-five odd electric stoves thruout the city. In all, she supervises one hundred of these intricate electrical devices.

Her entire tool kit can be summed up into a testing lamp, screw driver and two pair of pliers, one large and one small. Compare this neat and compact equipment that most certainly reflects the characteristics of a *woman* as its owner, with the *modest* (?) tool *chest* of the male species of electrician and the carrying of a large assortment of unnecessary junk, approximating one-half ton in weight, and when he finds that the job will require a screw driver one-sixteenth of an inch smaller in size, we would be asking too much if we should expect him to use one of the next size. Instead he takes an afternoon's vacation on your time, going to the movies or to Coney Island, or Kalamazoo, as far as we know, and by the length of time that he consumes to get this tool.

Can you imagine upon arising from your warm bed on a cold Winter morning, making a quick dash to the electric stove in the sitting room, turning on the switch, and in anticipation of the warmth that you are to get, you find the electric stove is as cold as a chunk of ice. The heat of your indignations warms you thoroly, and you make one grand dive for the telephone. After you have stood there for about a half hour with your teeth chattering, waiting for the telephone boy in the hall below to answer your call, you are finally rewarded for your patience by being allowed the honor to speak with the janitor. After you have told him what you thought of him and his entire family, back to his great, great, great grandfather, he very sweetly answers with a roar like the Kaiser; and tells you that your need will be attended to.

Within a few seconds you hear a short stacatto knock upon the door, and upon opening it you are almost stricken speechless by the appearance of a very neat and chicly attired young lady, in *over-alls*. Taken back with this surprise, you ask her what she desires. "Oh, Sir," says she, "I am the *electrician!* You sent a call for me, and I am here to repair your heater." Her intention is very agreeable to you, and with military precision she brushes past you, takes off the top of the heater, yanks out the heating elements, mutters a monosyllable that sounds like "burnt out," inserts a new unit, attaches another fuse, turns the switch, and the job is finished. It has taken her exactly ten minutes, and the most incredible part of it, when you ask her the charges, and receive a reply, "Oh, that is all right, sir, I am paid by the firm that owns the building." She goes out closing the door very gently, and without even looking for a tip.

Cheer up, fellows, it will be a great old world after the fair sex take our jobs. We will have nothing to worry about except washing the dishes and scrubbing the floor.



Photo Courtesy Edison Electric Illuminating Co. of Boston

Yes, the "Electriclanettes" Are Here! The Present Photo Shows Them Hard at Work at One of the Dynamo Switch-Boards of the Boston Edison Company

WORLD RADIO SYSTEM URGED FOR SOCIALISTS.

Active steps are being taken by the International Socialist movement to establish a private system of wireless thruout the world. Five installations are now definitely projected. Stations will be immediately set up in England, France, Belgium and ultimately in other countries, including America.

Three of the new stations will link up with the German and possibly the Russian Socialist wireless. They will be used to connect Socialist organs in various countries.

In collision there is no danger of the shock exploding the bomb, but some might be thrown into the water and explode when at the proper depth.

And this is not all of the Depth Bomb's story, either. Did you ever hear of the depth bomb "gun"? It *shoots* depth bombs accurately for a distance of half a mile or more. The merchant ships that dodged the U-boats were equipt with such guns, which operate with comprest air, similar to the well-known torpedo tube. The illustration shows how the depth bomb gun is sighted to drop the bomb just at the point where it will complete its trajectory thru the water and explode near the enemy submarine, which has submerged and is sneaking off, or trying to.

Imagine also the effect of a subaqueous barrage on the enemy subsea fighters. Talk about land barrage fire! The water transmits the noise and vibrations from the exploding depth bomb many times better than in the air. Cases have been known where a submarine's plates have been dented in and the seams started at a distance of nearly one-half mile. The concussive wave transmitted thru the water is exceedingly powerful because, for one reason, water is practically incompressible.

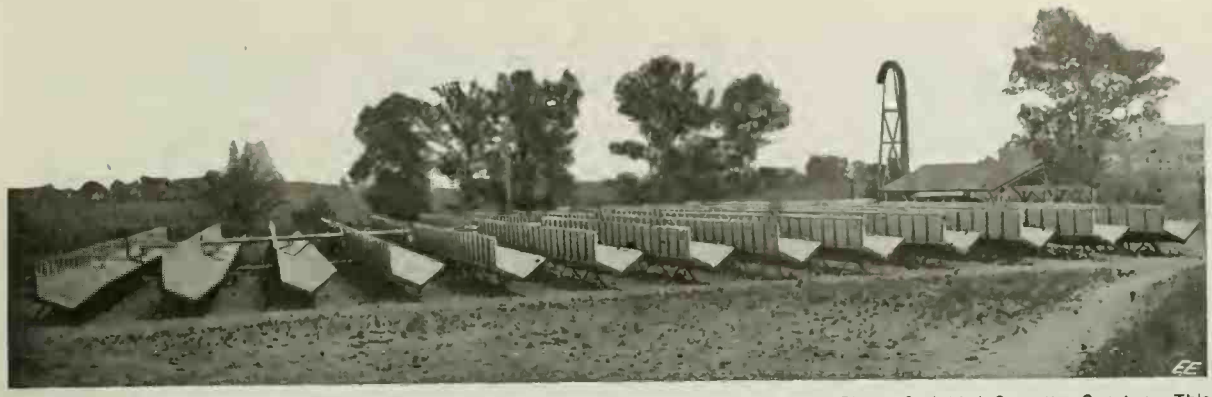
Remembering that stores of mutinies in the German naval ports first gave clear intimations that Germany's military machine was breaking down, it is not surprising that the revolutionary movement first should have assumed serious form among the sailors. And according to the current reports, the terrible hardships and the ghastly number of fatalities among the U-boat crews are what started the final fatal break in discipline and morale.

It can be said, therefore, with some approximation to truth, that not only did unrestricted undersea warfare hasten and make certain the defeat of Germany by bringing into the war the American land and water forces needed to turn the scale against her, but it was the thing which, working from the other side, added speed to the downfall of the Kaiser's hopes and his empire. The fears and the despairs which the submarines could not create in the minds of the Allies they did create in those of the men who had been ordered to commit the atrocious crimes by which the world was shocked.

They did what they were told to do, but the task proved too much for even their docility, and they rebelled against it at last, not, however, so far as any evidence yet presented has shown, because of indignation against the orders received, but because the execution of those orders so often meant for them the fate of drowning rats. Too many of the U-boats that went out did not return, and the mystery of their fate was intolerable to the survivors.

BACK NUMBERS!—Many readers desire to obtain back numbers of this journal. We have a limited quantity of these back issues on hand and can supply them at the following rates:—Back numbers of The Electrical Experimenter not over three months old, 15 cents each; over three months old, 20 cents each; over one year old, 35 cents each.

www.americanradiohistory.com



Some Day In the Near Future We Shall Undoubtedly See Hundreds of These Solar Energy Plants Sprinkled Over the Country. This Large Plant Is In Texas. The Mirrors Reflect the Sun's Rays Onto Special Boilers, the Steam Produced Running a Steam Engine, Connected to a Dynamo. Current From the Dynamo Runs a Motor Pump Which Lifts Water to a Height of Sixty Feet.

Solar Engine Uses Sun's Energy

SIX thousand degrees Centigrade is the computed temperature of the sun. Its light giving power is equal to 27,000,000,000 candlepower, a quarter of a mile away. Scientists tell us that only the 2,735-millionth part of the total energy radiated from the sun reaches our earth, but if this were ever caused to stop for any reason our planet would turn into a dead, frigid ball of rock; the present average annual temperature of 13° C., would change, without the heat of the sun, to 73° C., of frost, it is calculated.

Experiments show that the power of the atmosphere to trap heat is largely due to the *water vapor* that it contains. It is also due to some extent, to the *carbon dioxid gas* that is one of its minor constituents, points out Prof. Garrett P. Serviss. Carbon dioxid is a remarkable heat retainer, but there is only a very small quantity of it in the air compared with the vast bulk of the atmosphere. It only amounts to about 3/100 of 1 per cent. But there is this significant fact about it, viz., that its amount is variable, to a slight degree at the present time, while there is evidence from past geological history that once it was vastly more abundant than it is now.

Now, how much carbon dioxid must the air gain in order that a perceptible effect on the temperature may be produced? Arrhenius answers this question for us. He says that if all the carbon dioxid now in the air were removed, the average temperature would fall nearly 38 degrees Fahrenheit. On the other hand, if the present amount were doubled the temperature would rise more than 7 degrees, and if it were quadrupled the rise would amount to nearly 14½ degrees which would be far more than enough to banish all the glacial suffering that we had to endure last winter. Even the smaller amount of increase (7 degrees) would probably suffice for that.

These facts are very interesting from a technical point of view, indeed. The practical aspect of solar energy lies at present in the hands of those who are endeavoring to perfect a solar motor—i.e., an engine or electric generating device which, when the sun's rays strike it, will develop steam to operate a steam engine, or electricity to charge electric accumulators or storage batteries. Those interested in this branch of science will find of great interest several articles which have appeared in back numbers of this journal.*

Considering later developments of a practical nature in the line of solar engines and boilers, we may take up the work of Mr. Shuman, of Philadelphia, Pa., who later collaborated with a Mr. Boys, of England. They were able in their final developments to operate a 100 horsepower engine by means of solar energy. This plant was built at Meadi on the Nile, Egypt. Prior to this excellent work, however, we may consider briefly the early solar engines developed and tried out at Philadelphia, Pa., by Frank Shuman, upon which work he started in 1906. One of these solar engine plants installed in Texas being illustrated herewith. The heat of the sun's rays strikes a large number of mirrors, which reflect the heat to special boilers. These produce steam to run an engine, the latter operating an electric dynamo. The current thus produced was capable of operating an electric motor pump which pumped water to a height of 60 feet above the ground.

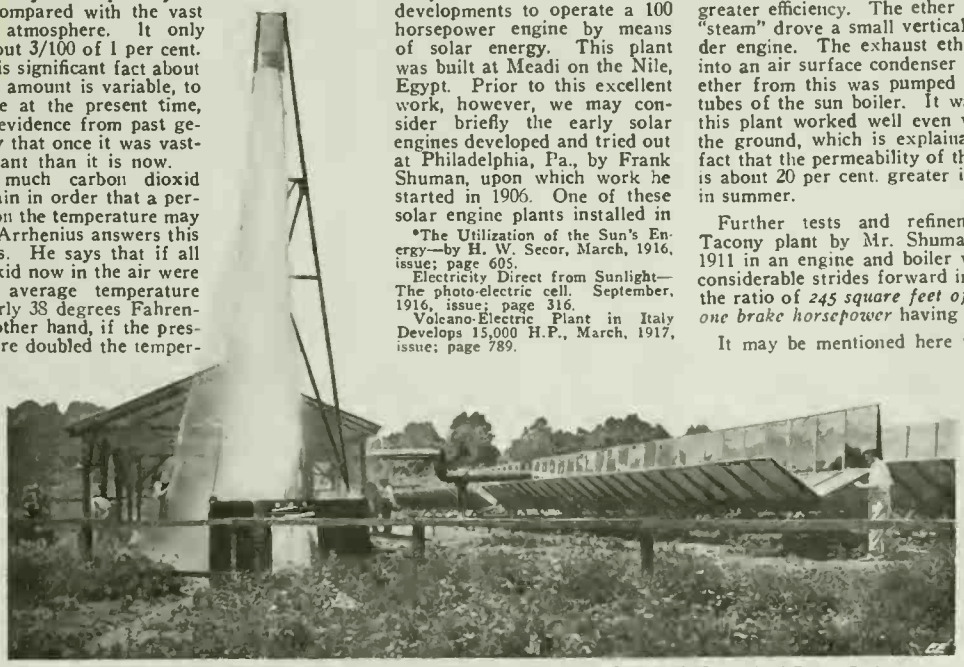
Mr. Shuman had running at Tacony, Pa., a practical plant of this type, which developed about 3½ horsepower by using 1,200 square feet of sunshine that was allowed to fall on a fixt horizontal water box. This box was fitted with a glass top and a series of parallel horizontal black pipes were immersed in the water. These pipes, containing *ether*, exposed 900 square feet of surface to the solar radiation. The water also became heated and carried the heat to the underside of the pipes, thus realizing a greater efficiency. The ether boiled and its "steam" drove a small vertical, single cylinder engine. The exhaust ether vapor past into an air surface condenser and the liquid ether from this was pumped back into the tubes of the sun boiler. It was found that this plant worked well even with snow on the ground, which is explainable from the fact that the permeability of the atmosphere is about 20 per cent. greater in winter than in summer.

Further tests and refinements to the Tacony plant by Mr. Shuman resulted in 1911 in an engine and boiler which showed considerable strides forward in their design, the ratio of *245 square feet of sunshine per one brake horsepower* having been attained.

It may be mentioned here that the pipes constituting the sun boilers have invariably been *blackened*. For low temperatures lampblack has been used as the absorber, but where high temperatures were required platinum black was used.

(*Continued on page 672*)

*The Utilization of the Sun's Energy—by H. W. Secor, March, 1916, issue; page 605.
Electricity Direct from Sunlight—The photo-electric cell. September, 1916, issue; page 316.
Volcano-Electric Plant in Italy Develops 15,000 H.P., March, 1917, issue; page 789.



Photos © by International Feature Service.

Here We See the Sixty Foot Stream of Water, Discharging. The Electric Power to Pump This Stream of Water Is All Furnished By the Mirrors Which Gather and Reflect the Sun's Rays Onto Special Boilers.

www.americanradiohistory.com

Electric Death Traps in Hun's Retreat

By H. WINFIELD SECOR

IF you have any doubt that the Teuton is possest of a cunning mind, then you have but to read the reports that have come back to us every now and then from various reliable sources on the battle-fields of Europe, where the Allied troops have always had to contend with multifarious and indescribable forms of deadly and inhuman offensive schemes, such as liquid fire and gas, which horribly mutilates and disfigures its victims in thousands of cases. The Allies were never sure of what they might expect when they advanced on enemy territory. The Huns resorted to every possible underhand scheme their wily brains could think of in a desperate effort to spread terror among the Allied soldiers, and some of the despicable "traps" they have used, not to mention hundreds of others which we have not the space here to describe, are illustrated herewith.

Fig. 1 shows how the Germans often mined the town pump, or any other pumps on which they could operate, so that when a thirsty Allied soldier endeavored to draw some water, he would be instantly killed by a charge of explosive set off by an electric contact and battery inside the pump, the fuse circuit being closed on the first downward stroke of the pump handle. Of course, hundreds of mechanical traps were used, as well as electrical ones. The electric trap which has been extensively used in these operations is a simple affair, and comprises nothing more than a small dry or other battery, together with a pair of electric contacts arranged to be closed by the movement of some piece of furniture, et cetera, and a piece of fine fuse wire which is placed in the explosive. When the circuit is closed, the fine piece of wire melts, and the heat produced detonates the explosive. Some times the contacts are caused to close a battery circuit thru a spark coil, the secondary circuit of which is connected up with a spark plug, buried in the explosive. There are, of course, numerous other schemes, many of them having been provided with time clocks or switches, for delaying the explosion, as the official reports have frequently indicated.

The open fire place, which is ever a source of welcome to the footsore Doughboys when they have a chance to stop in a captured town, is not always the most healthy place in the world, for as Fig. 2 shows, it may contain a high explosive shell planted within the fire wall, so that when a good fire is kindled on the hearth the shell will be caused to explode, very possibly killing all those within the room.

Fig. 3 illustrates how the retreating Germans often left a trap for the conquering troops of the enemy by placing high explosive mines under the trails of cannon and machine guns, so that as soon as anyone moved the cannon carriage, the spring actuated pin of the mine would spring up and detonate the explosive, thereby possibly killing several men.

One of the cleverest, altho hellish, tricks ever played by the retreating Teutonic hosts probably is that of the "wireless bomb." Fig. 4 shows this trap in action, and the story of its operation is as follows: Before the enemy retreated, he took care to place a number of wirelessly operated bombs in the walls or possibly under the floor of various dwellings and other buildings, so that in the event the victorious troops as they entered the town or locality, might set up a wireless set in proximity to one of the bombs, the first spark would cause the bomb to explode with death-dealing violence. The bomb in this case is detonated by an electric fuse or spark circuit, actuated by a radio coherer and relay, or other similar radio receptor apparatus.

"Say, Hen," sang out a jolly faced Doughboy to one of his "buddies," as they sat about a table enjoying the mid-day meal of "Boston baked" and canned sardines a la *Rhine* in an old French chateau, "there's a telephone on the wall, why don't you call up your best girl," and full of Yankee play spirit the Doughboy arose. But something seemed to tell him not to touch the telephone instrument, and it was well that he did not; for one of the party, who had been cautioned by the intelligence officers to be extremely careful of touching anything in the captured territory until it had been carefully examined ascertained that the telephone instrument contained several pounds of explosive which was connected up with an electrical igniter attached to the switch-hook, so that as soon as the receiver was lifted from the hook, the explosive would be detonated, and so the story rolls on—backed by the facts. See Fig. 5.

DON'T MISS THESE ARTICLES IN FEBRUARY "E. E."

"My Inventions"—No. 1 of a series especially written for the ELECTRICAL EXPERIMENTER *by Dr. Nikola Tesla himself.*

"Cold Light!—What it is and is not," by Rogers D. Rusk, B.Sc.

"Subways of New York"—A wonderfully complete panorama of the underground, surface and elevated systems. An interesting and instructive article.

"How Jimmy Saved the Bank"—A story that will surprise you, by F. W. Russel.

"The Unknown Purple"—A 20th Century drama of Ultra-Science and Psychology.

New Electrical and Wireless "Movie" Stunts.

The "Alkaline" Storage Battery—Its Operation and Maintenance, by J. F. Springer.

Experiments in Radio-activity, Part II, by Ivan Crawford.

Producing Ball Lightning in the Laboratory. With Excellent photos, by Samuel S. Weisiger, Jr.

Wood Finishing for the Amateur, by Arno A. Kluge.

Besides the usual "Constructor", "Wireless", "Chemistry", and "Machine Shop" Departments, and hundreds of other valuable, time-saving wrinkles, ideas and formulas.

Nor were the German dead allowed to rest in peace, for even after life had ceased in their bodies, they must serve the "Fatherland." This is true *"Schrecklichkeit"* efficiency to the Teutonic mind, if not to ours. So the crafty Teutons, when they were forced to retreat, got into the habit of planting small explosive traps under the dead bodies, with the hope in their hearts that when the on-marching Yankees or Poilus got on this territory and attempted to clear it up by lifting the dead bodies, they would meet with unexpected fatalities. See Fig. 6.

In Fig. 7 there is shown the famous German "watch trick." This trick used to be pulled quite often at various points along the battle-line until the Allied troops got so skittish of all such devices that they would not touch anything with their hands, but would poke it with a stick, which invariably caused one of these death-dealing traps to explode harmlessly. In the watch trick, a favorite setting was in a trench or dug-out from which the Teutons had been forced to retire, and when the Allied soldiers had taken the trench, one of them would probably be surprised to see a perfectly good watch hanging on a nail or stick projecting from the trench wall and ticking away merrily. Now who would refuse to take such a watch? But many a brave soldier has undoubtedly lost his life by thinking just that way, and the moment the watch was removed from the nail or other projection from which it hung, this act caused a high explosive trap to detonate.

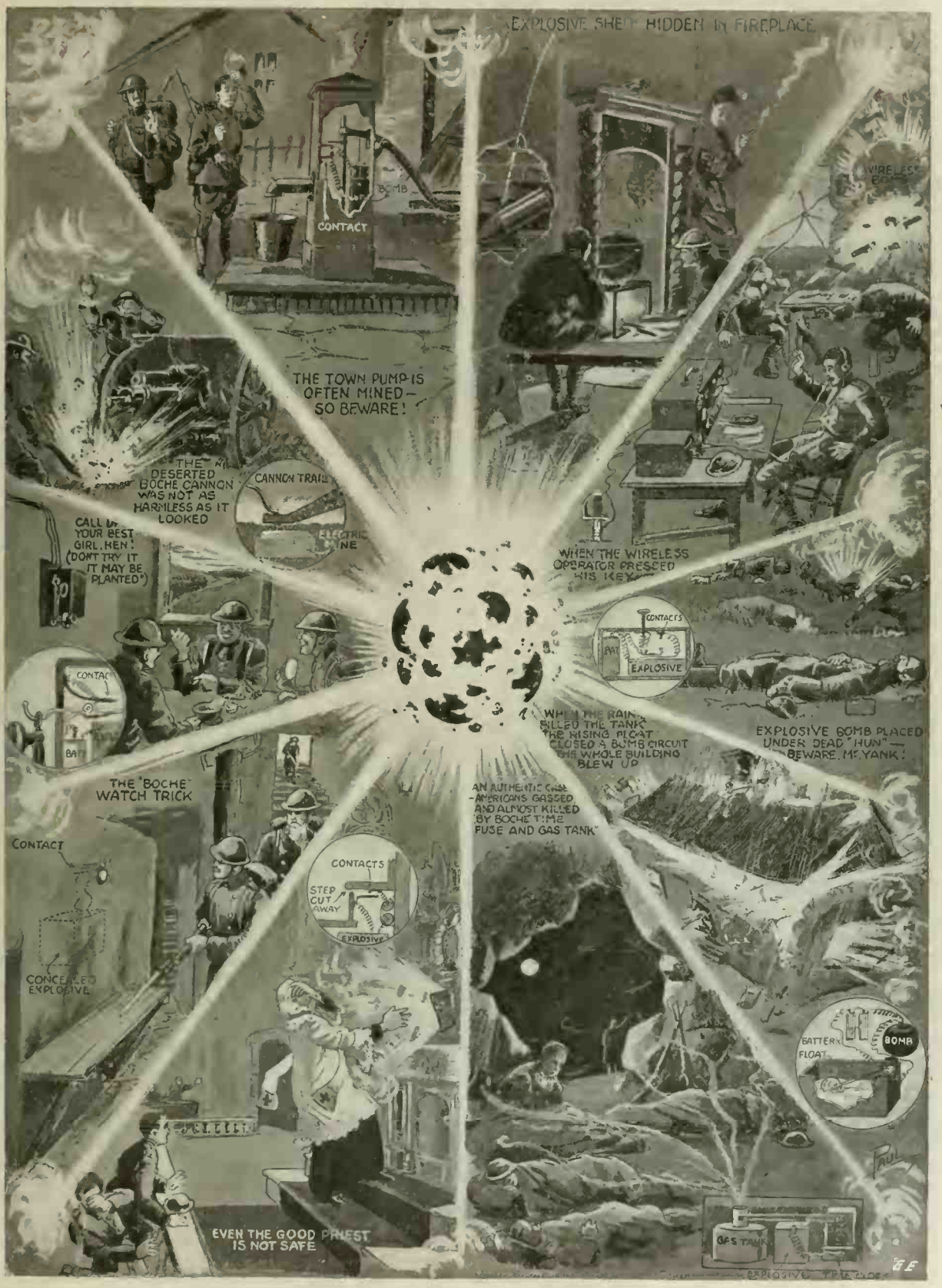
And the churches—what haven't the Teutonic sons of the mailed fist done to these! One case which happened in Belgium comes to mind where a number of Allied soldiers were endeavoring to hold church in a captured town. The priest had no sooner started to ascend the steps of the altar, when a terrific explosion occurred, which demolished the alter and seriously wounded the preacher. This trap utilized an electric contact spring arranged under the step, the riser of one of the steps being cut away so that when a person's weight rested on the tread, it would force it down a slight distance, closing a contact which detonated the bomb. See Fig. 8.

One of the most heinous and criminal death-dealing devices ever planted by the retreating Huns was recently witnest in actual operation by a New York soldier who came home not many months ago. To start with, the soldier who related this tale was a member of a Company which had been marching for several days, and one night when they prepared to rest and get some sleep they discovered a large cave. See Fig. 9. Naturally, unless the weather is quite warm, anyone would rather sleep in a cave than out in the open, for obvious reasons. And so they went to sleep, but long before morning several of the men awoke and were surprised to smell gas fumes, and, what was more astonishing, a large number of the men who were sleeping in the cave were found to be "gast." Those who had awakened, and who were not totally overcome by the gas, at once removed the gast men from the cave and started to investigate, as no fumes of gas had been noticed whatsoever on the previous evening when they had found the cave. "Dirty work, sure enough," said the Sergeant, as he and two of his men started back in the cave to find out what kind of a new trap the crafty Huns had concocted; before long they discovered it, planted several feet below the earth in the rear of the cave, and with a small gas tube leading up to the surface of the ground. They dug up the infernal machine, and were astounded to find that not only did the box contain a small gas generator with a time-clock arrangement rigged up to a valve on it, so that gas would be generated and sent into the cave at a *certain pre-arranged hour*, but that also there was a sufficiently large quantity of high explosive in the container

(Continued on page 669)

www.americanradiohistory.com

ELECTRIC DEATH TRAPS IN HUN'S RETREAT



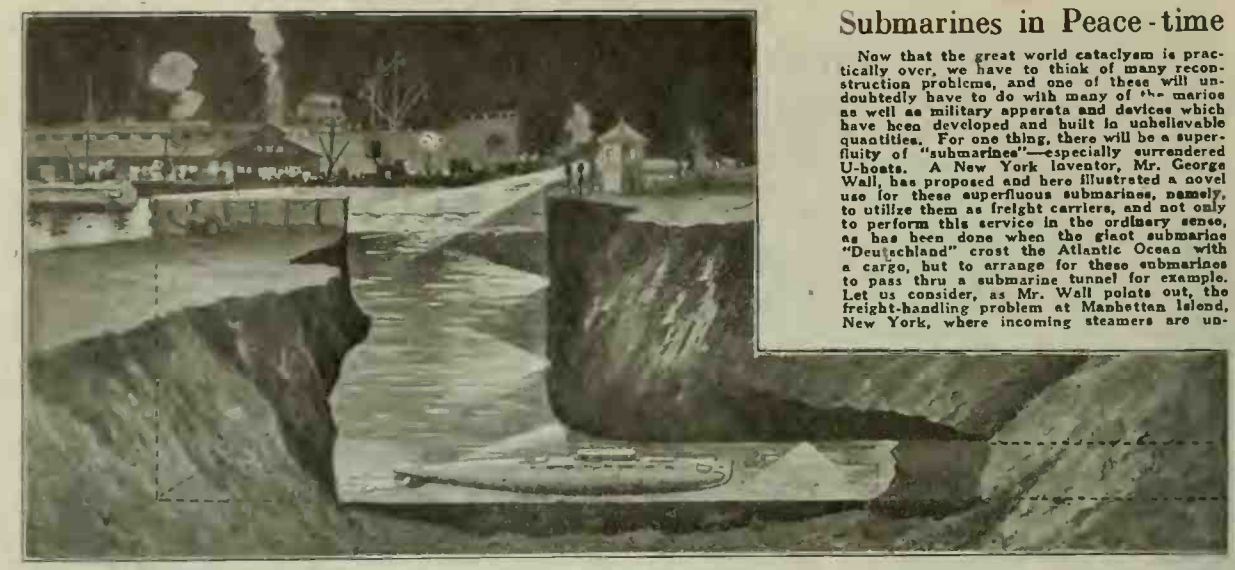
(For Description See Opposite Page)

Copyright, 1918, by E. P. Co

www.americanradiohistory.com

Submarines in Peace-time

Now that the great world cataclysm is practically over, we have to think of many reconstruction problems, and one of these will undoubtedly have to do with many of the marine as well as military apparata and devices which have been developed and built in unbelievable quantities. For one thing, there will be a superfluity of "submarines"—especially surrendered U-boats. A New York inventor, Mr. George Wall, has proposed and here illustrated a novel use for these superfluous submarines, namely, to utilize them as freight carriers, and not only to perform this service in the ordinary sense, as has been done when the giant submarine "Deutschland" crost the Atlantic Ocean with a cargo, but to arrange for these submarines to pass thru a submarine tunnel for example. Let us consider, as Mr. Wall points out, the freight-handling problem at Manhattan Island, New York, where incoming steamers are un-



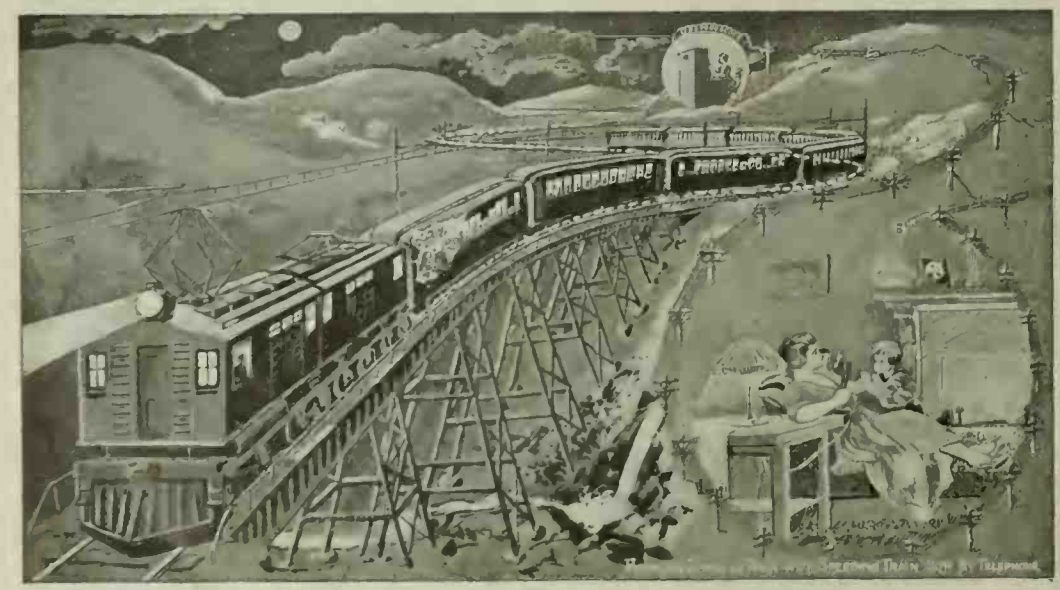
The Above Illustration Shows Mr. George Wall's Peace-Time Utilization of Germany's Surrendered U-boats, or Any Other Submarine Which May Be Scrapt by Uncle Sam or His Co-Allies as Being Unfit for Further Naval Use, but Which with a Little Overhauling Can Be Readily Put In Condition for Use as Freight Carriers. The Scheme Here Illustrated and Described Would Involve the Use of Electrically Operated Locks at Points on the North and East Rivers, If Used to Carry Freight Under New York City, and Also the Submarine Tunnel Would Be Illuminated with Powerful Electric Lights Placed In Sunken Reflectors, So as to Leave the Passage of the Tunnel Smooth and Even.

Telephoning To and From Moving Trains

THREE Americans residing in Toronto, Canada, Messrs. Isidor, Abraham and Samuel Berliner, have invented a moving train telephone apparatus for telephoning to and from trains en route, as depicted in the illustration. This apparatus permits voice transmission to be made automatically and directly thru the ordinary car wheel and axle, without the assistance of any contributing medium, by a special instrument connected to the wheel. Thus electrical connection between the instrument and the rail is made thru the car wheels, and in combination with the ordinary rails properly bonded for the block-signal system, but it will work equally well on any track where the rails are similarly bonded, without regard to the absence or presence of a block-signal installation.

Telephonic speech or voice transmission is conducted thru the ordinary existing axle, thru the wheels and down to the rails, along which it runs and is picked up by other moving trains or any of its desired joined cars, train despatcher's offices, signal towers, stations, city exchanges, cities, towns, villages, hamlets, or with that of any regular telephone subscriber. This railroad telephone invention consists of an apparatus including standard equipment only comprising the well-known telephonic retardation or repeating coils, ordinary rolling stock of wheels and axle, requisite bearing instrument from which it is connected to the wheels, and the usual rails, properly bonded. This transmission and reception is carried on, it is claimed, without regard to the trains' speeds or of trains moving in the same direction, opposite directions, trains crossing over at right angles to another, or any other moving positions, whether this be upon the same track as in the case of a double-track line, or between any tracks.

The control of the system differs in no respect from ordinary telephone operation, and artificial amplifiers requiring delicate adjustment are not employed. The invention now makes it possible for connection to be made between the train instrument and that of any regular telephone subscriber. Train speed is of no material consequence, for the same results are attained traveling 60 miles an hour as when barely moving.



Telephoning Between a Moving Train, Irrespective of Its Speed, and Any Fixt Station, Office, or Home, Is Now Possible—Thanks to a Recent Invention, Which Enables the Telephonic Currents to Travel Thru the Car Wheels and Along the Rails to the Nearest Telephone Exchange.

www.americanradiohistory.com

Submarines in Peace-time

loaded in some cases on the piers at the North River. This freight is frequently trans-shipt by auto-truck or otherwise to points directly across the city. In other words, the goods are often carried thru thickly congested streets over to the East River or in that vicinity. If we had a submarine channel bored thru the solid rock many feet below all of the present subways, it would provide a feasible and economical method of trans-shipping freight from the North to the East River and vice versa. As it is, goods are often shipt by auto-truck or across the city at considerable expense, or else by boat down the East River, around the Battery and up the North River. This is bound to be so, in some cases, owing to the fact that vessels frequently carry mixt shipments of goods. This scheme is undoubtedly feasible and economically applicable to many shipping localities in various other parts of the world.



Copyright, 1918, by E. P. Co.

Thus "Subs" Could Be Economically and Efficiently Used, Which Would Be Applicable in Many Shipping Localities Thruout the World. Where a Great Deal of Shipping Would Have to Be Handled, There Would Be Employed Two Tunnels and Two Sets of Locks, the "Subs" Loading at Either Side of Large Piers to Which the Steamships Anchor. Very Little Handling of the Freight Would Be Necessary—Thanks to the Modern Electric Belt Conveyor and Other Systems. The Submarines Could Be Handled by a Small Crew and the Steering Bearings Taken by Observation Thru Large Glass Windows in the Superstructure of the Submarine.

This system also permits telephoning to be done from one end of a train to the other or to any part of the train. The conversation may be held as easily as from house to house. The tone of the voice is just as clear as with the telephone on a city circuit. One cannot tell that the train is moving, as far as the sound in the instrument is concerned, it is claimed.

A working model of a new moving train telephone apparatus has been very successfully demonstrated by the Canadian Government Railways on their road by Mr. W. W. MacFarlane of New York, who conducted the tests of his new invention, which was tested at Moncton, N. B., Canada, from July 16, 1917, to March 28, 1918, inclusive.

During these tests, which were very complete, the conversations were carried on between the moving train and the dispatcher's office in a clear and distinct manner.

The engine was cut off from the car and proceeded a mile down the track by orders telephoned from the conductor to the engineer. The engine was then stopt by telephone orders from the conductor, who was on the car, and instructed to come back and couple up again. Then an order was given by the conductor to back up the train and take on the flagman, who had gone back to flag.

Before backing up, a telephone message was sent to the dispatcher's office, asking if it was safe to back up, and the answer by telephone from the dispatcher was that this would be all right. After backing up to the flagman, the order was received from the dispatcher's office to go ahead to Humphrey's and cross over to the other track and come back to Moncton. Before reaching Humphrey's a second telephone message was received from the dispatcher countermanding the previous order to cross over, but to return to Moncton on the same track, as the train was protected from the rear.

All these instructions were transmitted by telephone from the dispatcher's office to the conductor on the car and by him transmitted to the engineer by telephone, while the car was running, showing that it is perfectly feasible to control a moving train by telephone from the dispatcher's office at a distant point. The invention is patented in the United States and Canada as well as in foreign countries. This new railroad telephone system promises to completely revolutionize modern railroading.

INDIAN PRINCESS LEARNS WIRELESS.

The accompanying photograph shows an Indian princess learning wireless telegraphy —Miss Emily Moran, descendant of a famous Indian chief. She promptly offered her services to her country in this national crisis, and is rapidly learning the art of radio operating so that she can graduate from clerical work to the wireless room of an ocean liner or possibly a transport.

Many young women have taken up wireless operating, several of the leading schools having classes at which young ladies attend. At the present time there has not been a very large opportunity to place these fair radio graduates, for the reason that the Navy Department controls all the wireless stations, and it is against their rules to have women in any government radio stations. However, there are many ways in which women trained as radio operators can help and have been helping. For one thing, they can be of considerable aid in helping to teach the soldier and sailor "rookies" the rudiments of radio operating—particularly the code, which is always a great stumbling block to most of them. Women should prove particularly efficient in teaching this part of the radio art, for they have proven themselves very adept and successful in imparting knowledge to students of all ages in our public schools thruout the country.



Photo from Paul Thompson

Here We See a Well-Known Indian Princess Learning the Wireless Code. She Is Miss Emily Moran, Descendant of a Famous Indian Chief.

www.americanradiohistory.com

A New Aërial Smoke Barrage

THE airplane has surely come into its own during the recent world war. Hundreds of 'planes were to be seen in the air on various sections of the great battle-front many times during the day, their glistening wings sparkling in the bright sunshine. Pursuer and pursued hurtled thru the air at prodigious speeds. These airplane attacks looked all very tame from the ground until one of them closed in on his adversary, when many a spectacular battle was enacted. Perhaps one of the most spectacular of all aërial battles is that mentioned in a number of the interesting stories that have come to us from the lion-hearted fighters of the air, where an enemy 'plane has dropt out of a cloud, in order to pounce down and surprise an unsuspecting flier below. Some of the German aviators used to practise this trick regularly, sailing upward thousands of feet, only to suddenly disappear in a cloud or cloud bank. Then the crafty flier would suddenly dart out of a cloud at the side or at the bottom, and if a hostile 'plane happened to be anywhere in the vicinity, the factor of surprise would in practically all cases be on the side of the emerging war-'plane.

But clouds would not always be conveniently at hand for carrying on such maneuvers. There is not now, nor is there likely to be an international law on the conduct of aërial warfare to the effect that battle 'planes may not play hide and seek among the clouds if they choose to. Wherefore and hence, we have the latest invention in aërial warfare—the *"airplane smoke producer"*—the particular form of this invention here illustrated and described being due to John Koltko, of Watertown, Connecticut.

As the front cover and accompanying views show, this invention enables an aviator to quickly send out a large quantity of heavy smoke which will entirely envelop the 'plane and prevent, or at least make it extremely difficult for, an enemy 'plane to "plant" a good shot on him. This is more apparent when it is considered that the 'plane would not simply have a dense cloud of smoke blown around it at one point in the air, but it would in a few minutes produce a long trailing cloud of black smoke, and it would indeed be quite difficult for an aviator to tell at exactly what point in this cloud the enemy 'plane was.

The technical details of this smoke-producing apparatus for aircraft are quite simple and it operates as follows: A steel tank is mounted in the body of the 'plane with which there is connected a by-pass pipe connecting with the exhaust of the engine. A suitable valve controlled from the pilot's seat is connected with this pipe, so that when it is desired to produce a smoke cloud to envelop the 'plane, it is only necessary to open the valve and allow the engine exhaust to pass into the tank. The tank contains certain chemicals which when acted upon by the gases from the motor exhaust, produce smoke rapidly in great volume.

As the illustration shows, the diffusing heads consisting of conically-shaped drums with perforated faces on them, are placedaround various parts of the airplane, under the wings and along the fuselage.



Copyright, 1918, by E. P. Co.

Not Only Can the Naval Destroyers and Other Vessels Throw a Dense Smoke Screen, but the Battle-plane as Well. This Recently Perfected Invention Causes the Exhaust Gases from the Engine to Pass Into a Tank Containing Certain Chemicals, Which, When Thus Acted Upon, Produce a Dense Smoke In Great Quantities. The Smoke Is Distributed Thru Diffuser Heads About the Planes.

THE MAGNETIC SURVEY VESSEL, "CARNEGIE."

The Magnetic Survey Vessel, *Carnegie*, arrived safely at her home port, Washington, D. C., a short time ago, where she was put out of commission during the period of the war. During her cruise from Buenos Aires, Argentina, round the Horn to Valparaiso, Chile, Callao, Peru, thence thru the Panama Canal to Newport News, she was in command of Dr. N. W. Edmonds and a number of other scientists of the Government staff.

www.americanradiohistory.com

"The Long Dash"—A Wireless Gun Show

BACKED by an absorbing story enacted and assisted by elaborate scenic and stage effects, "The Long Dash" has proven one of New York's latest and greatest theatrical successes. The play was written by Robert Mears MacKay and Victor Mapes, co-author of "The Boomerang." It has a distinguished cast, including Robert Edeson, Henry E. Dixey, Violet Kemble Cooper, Milicent Evans, and others. The dramatic story revolves around the invention of a marvelous new "radio controlled" cannon. The secret of its operation is stolen by a spy. With the inventor of the gun dead and the radio code by which the gun is operated lost, many curious and exciting incidents result. Interspersed with all these affairs there is a delightful love story in which two brothers, Paul and John Hazelton, both impersonated by Robert Edeson, are concerned.

Now for the dirty work. Those who have seen this show have undoubtedly wondered just how the wireless controlled gun, a large sized and faithfully reproduced model of which is used on the stage, as the accompanying photographs show, is operated. For it surely does give one, no matter how sophisticated in scientific matters he may be, a genuine dramatic thrill. Robert Edeson, who endeavors to solve the mystery of the lost code, presses the key of the wireless transmitter located across the stage from the gun, and every time he presses the key a crashing blue-white spark several inches long leaps across the spark gap at the transmitting apparatus. A similar spark also appears simultaneously at the spark gap fitted on the gun pedestal. Being of a scientific turn of mind, he eventually gets down to the point where he can cause the gun to train around a circle, and also up and down vertically, besides firing. The controlling signals comprise a number of dots or short sparks, and after the proper number of these have been transmitted, a long dash or spark is required to cause the particular function in hand to take place. Thus when the gun is to be fired, after being trained with a previous set of signals or sparks, a number of short flashes are rapidly transmitted, and then the "long dash" or spark is the signal that the gun will fire. A thirty-eight caliber Colt revolver is cleverly arranged inside of the model cannon and this, operated by a stage assistant, produces the explosion whenever the gun is fired.

But this is not all, for to lend still more enchantment to the seeming mystery of this pseudo-scientific drama, the target at the rear of the stage plays a very important rôle, for every time the gun operates another "bullet" goes thru the target. At least the audience thinks so, for does not a hole appear in the target each time the gun fires? Sure it does, and little Willie in the front row as well as his grand-dad probably wonders how in the dickens they can fire a small naval cannon right on the stage and cause a shell to pass thru the target without killing a few dozen actors standing off stage. The truth is, there "ain't no such animal" as a bullet used, but a trusty assistant stands ready with a string in his hand, and each time the gun fires he yanks another wad of paper out of a previously prepared hole in the bull's-eye of the target. "Ye gods!" little Willie remarks, Mr. Edeson is sure some sharp-shooter, and in truth he is, so far as the story of the drama is concerned.



The Wireless Controlled Cannon Speaks—and Hits the Bull's-Eye Every Time. An Exciting Moment from the New York Dramatic Success, "The Long Dash." Mr. Robert Edeson Plays the Rôle of the Radio Genius, Who Works Out the Code Which Will Operate the Gun, Its Inventor Having Died.

As will be recollected, in the introduction it was mentioned that Mr. Edeson impersonates two rôles—that of Paul Hazelton as well as John Hazelton. In another act a clever bit of stage work is carried out, and a few words describing it will undoubtedly prove of interest. In this scene one of the brothers sits down in a large high-back, old-fashioned chair, and presently turns the chair with its back to the audience and starts eating at a table. The audience sees the actor's arms moving as he proceeds to eat his dinner, but the old saying that the "hand is quicker than the eye" still holds good to a dot, for right before your very eyes and while the good Mr. Hazelton No. 1 apparently is enjoying his meal an unseen transposition takes place in a few seconds. The seat of the chair is a spring-actuated affair and collapses when desired. The actor escapes down thru the bottom of the chair by means of an electrically operated dumb-waiter, or "trap," as it is called in stage parlance, and another actor rises on the trap, gets into the chair and carries on the arm movements and other embellishments that go with the assimilation of a hearty repast; and in the meantime the door of the room opens, and in walks the other brother, Mr. Hazelton No. 2, who is no other than our old friend, Mr. Robert Edeson.



A Close-Up View of the Wireless Gun and Radio Transmitter, with Mr. Edeson Studying Its Response to Various Dot and Dash Combinations, from the Play—"The Long Dash."

An electrically controlled machine for sorting coffee beans has been invented by a native of Munich.

India has increased its annual coal production to 12,000,000 tons and is introducing electrical machinery into some mines.

www.americanradiohistory.com

Nikola Tesla and His Inventions

By H. Gernsback

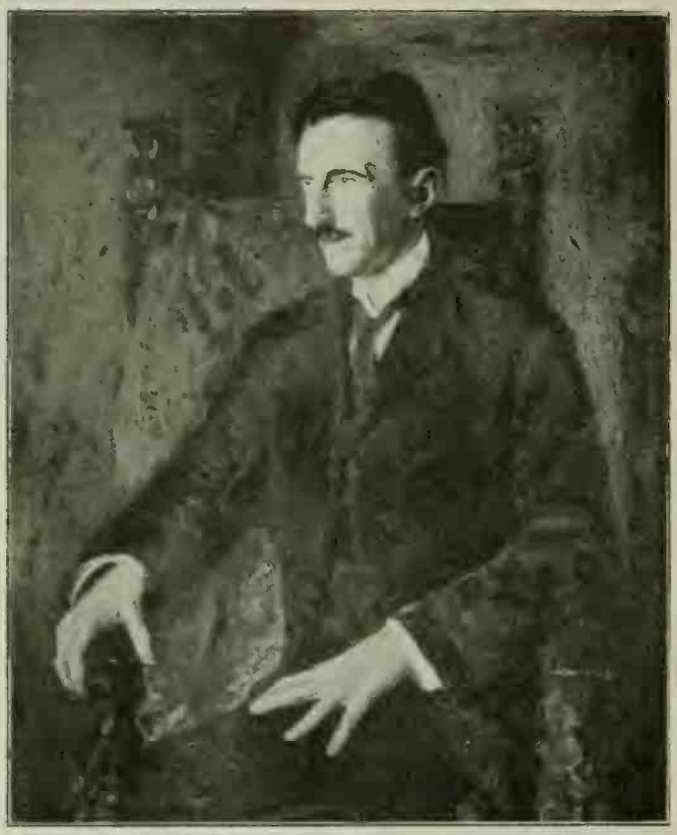
AN ANNOUNCEMENT

SEVERAL years ago, in the course of a discussion, a well-known journalist asked me whom I considered at present the world's greatest inventor. I said: "If you mean the man who really *invented*, in other words, *originated* and *discovered* — not merely *improved* what had already been invented by others, then without a shade of doubt, Nikola Tesla is the world's greatest inventor, not only at present, but in all history."

My friend was much surprised and voiced his astonishment. "Surely," said he, "you do not mean to place Tesla ahead of such great men as Archimedes, Faraday or Edison?"

"That is exactly what I mean," I replied, "and before twenty-five years have elapsed the world at large will echo my opinion."

"But listen," persisted my friend, "who on earth is this man Tesla anyway? What are his wonderful inventions, what great thing has he ever done? How is it that the world at large does not know him?"



Nikola Tesla, from a Painting by the Famous Princess Lwoff-Parlaghy. This Picture Has Never Been Published Before.

"To begin with, and the better to impress you," I replied, "Tesla has secured more than one hundred patents on inventions, many of which have proved revolutionary. Science accords to him over 75 original *discoveries*, not mere mechanical improvements. Tesla is an originator in the sense that Faraday was an originator. Like the latter he is a pioneer blazing the trail; aside from this he is a discoverer of the very highest order."

"Ninety percent of the entire electrical industry pays tribute to his genius. All electrical machinery using or generating alternating current is due to Tesla. High tension current transmission without which our long distance trolley cars, our electrified lines, our subways would be impossible, are due to the genius of Tesla. The Tesla Induction Motor, the Tesla Rotary Converter, the Tesla Phase System of Power Transmission, the Tesla Steam and Gas Turbine and the Tesla Coil and Oscillation Transformer are perhaps his better known inventions.

"As to your last question, namely, why the world at large does not know Tesla, it is answered best by stating that he has committed the unpardonable crime of not having a permanent press agent to shout his greatness from the housetops. Then, too, most of Tesla's inventions, at least to the public mind, are more or less intangible on account of the fact that they are very technical and, therefore, do not catch the popular imagination, as, for instance, wireless, the X-ray, the airplane, or the telephone."

The trouble with Nikola Tesla is that he lives a century ahead of his time. He has often been denounced as a dreamer even by well informed men. He has been called crazy by others who ought to know better. For Tesla talks in a language that most of us do not as yet understand. But as the years roll on Science more and more appreciates his greatness, and begins to pay him tribute more and more.

In 1893, three years prior to the earliest attempts in Hertz wave telegraphy, Tesla first described his wireless system and took out patents on a number of novel devices which were then but imperfectly understood. Even the electrical world at large laughed at these patents. But large wireless interests had to pay him tribute in the form of real money, because his "fool" patents were recognized to be fundamental. He actually antedated every important wireless invention.

A few weeks ago the world read thru news dispatches of a great wireless discovery—the static eliminator. But Tesla had not only patented systems overcoming this and other forms of interference but had actually constructed and successfully operated devices years ago in Colorado, under conditions where static interference was troublesome to an extraordinary degree. A photograph of one form of his apparatus is published with a note from him for the first time elsewhere in this issue of the ELECTRICAL EXPERIMENTER. And so it goes. The world smiles an unbelieving smile, but Tesla's master mind invariably sets the world aright.

I first read about Tesla in a well-known German weekly publication when I was less than 15 years old. The Editor of that publication reproduced his picture on a full page and paid high tribute to Tesla, hailing him as the world's coming greatest electrician.

H. W. Buck, Chief Engineer, President of the American Institute of Electrical Engineers, among others, said: "The work of Nikola Tesla in his great conception of his rotary field seems to me one of the greatest feats of imagination which has ever been attained by human mind."

Lord Kelvin, before the British Association, commenting upon the Tesla Transformer exhibited, said: "This is a wonderful development of the induction coil destined to be of great importance."

Electrical Review, commenting upon the wireless: "Mr. Tesla's

www.americanradiohistory.com

researches in this field have attracted world-wide attention, and his is undoubtedly the master mind."

Der Electro-Technische Anzeiger, Berlin, and *Elektrizität*, Leipzig, Germany, (commenting upon Tesla's work): "It is a combination of the grandest power of technical performance with the most vivid imagination, such as has never before manifested itself in the human mind."

Brigadier Allen, of the United States War Department (commenting upon Tesla's Turbine): "Something new in the world. Officers are greatly impressed with it."

While studying abroad I read every scrap of his work I could lay my hands on. I performed most of his high frequency experiments, and the more I saw of his work the more imprest I became. Some years ago as Editor of *Modern Electrics*, I met him in a New York shop where his famous turbine models were first built. I was fascinated with the tall, gaunt man, then about 50 years old, but looking less than 30. His extraordinary face, with his deep set blue eyes, proclaimed the intense thinker—the philosopher. A few minutes' chat with him left me more than ever convinced of his greatness.

Further contacts during the past few years still enhanced my opinion of him. Tesla is a man of extraordinary knowledge. He is remarkably well read and has a photographic memory whereby it is possible for him to recite page after page of nearly every classical work, be it Goethe, Voltaire or Shakespeare. He speaks and writes twelve languages. He is an accomplished calculator, who has little use for tables and text-books and holds the sliding rule in contempt. Tesla has received numerous honors and distinctions of all kinds. He is a knight of several orders, holder of many titles and diplomas. Some time ago he was awarded the Elliott Cresson gold medal by the Franklin Institute and last year the Edison medal by the American Institute of Electrical Engineers. Many extraordinary distinctions have been offered to him which he has declined. As of timely interest one instance may be mentioned. At the announcement of Tesla's high frequency discoveries, while the former Emperor of Germany was all-powerful and great men were eager for his favors, Tesla received an invitation from him and the Empress to repeat his celebrated experiments at the Royal Palace in Berlin. He forgot all about it and did not answer for one year, when he politely apologized for his inability to avail himself of the honor. Later the invitation was renewed and nearly two years past before Tesla answered to the same effect. After a lapse of time, however, upon the announcement of another important invention, he received the invitation for the third time, with the assurance that an altogether unusual honor was reserved for him. "Well, boys," said Tesla to his assistants after he laid the invitation which he never answered aside, "the Emperor must be a great man. I do not think that I would be capable of acting in this way if I were in his place." Perhaps the most remarkable tribute was paid to him when he made his famous experiments in Colorado in 1899. It was by J. Pierpont Morgan, the elder, who donated $150,000, which enabled Tesla to produce artificial lightning and incidentally to electrify the entire earth.

Some of Tesla's inventions have been of far-reaching importance in the War. The resources and productive powers of the country have been greatly increased thru extended use of his system of alternating current transmission and transformation of energy. Nearly ten million horsepower of water falls have been harnest by this means, thus saving forty percent of the entire coal output of the United States. The railroads have been electrified and his induction motor has revolutionized the steel industry and operation of factories. His electric drive has been adopted on the largest cruisers and battleships as the most perfect means of propulsion. His wireless inventions have proved indispensable and his oscillatory apparatus has been of inestimable service in chirurgical and therapeutic treatment in the field.

The technical prints abound with his work, his inventions, his discoveries. The following is only a partial list of terms now adopted and published in text books and technical works:

Tesla two-phase, three-phase, multi-phase, poly-phase system of power transmission
Tesla principle
Tesla rotating magnetic field
Tesla rotating magnetic field transformer
Tesla induction motor
Tesla split-phase motor
Tesla system of distribution
Tesla rotary transformer
Tesla system of transformation by condenser discharges
Tesla coil
Tesla oscillation transformer
Tesla electrical oscillator
Tesla mechanical oscillator
Tesla high frequency machines
Tesla dynamo-electric oscillator
Tesla tube
Tesla lamp
Tesla high-potential methods
Tesla inductor
Tesla marvels
Tesla impedence phenomena
Tesla electro-therapy
Tesla electrical massage
Tesla currents
Tesla transmission
Teslaic experiments
Tesla capacity
Tesla arclight system
Tesla third brush regulation
Tesla devices
Tesla sparks
Tesla arrangements
Tesla theory
Tesla point
Tesla Steam Turbine
Tesla Gas Turbine
Tesla Water Turbine
Tesla Pump
Tesla Compressor
Tesla Igniter
Tesla condensers
Tesla electro-static field
Tesla effects
Tesla wireless system
Tesla methods of wireless transmission
Tesla magnifying transmitter
Tesla telautomata
Tesla insulation
Tesla underground transmission, etc.

The other night the Editors of the "Experimenter had the opportunity of passing an evening with Tesla. We talked about many things, so interesting, that I will reserve them for another article—but mostly, of course, the conversation centered about Tesla himself.

"Dr. Tesla," I said to him, "you are aware of our great admiration for you, which may or may not be important. But the great public knows little of your mark. Even many of those technically educated—excuse the frankness—think that you are

(*Continued on page* 657)

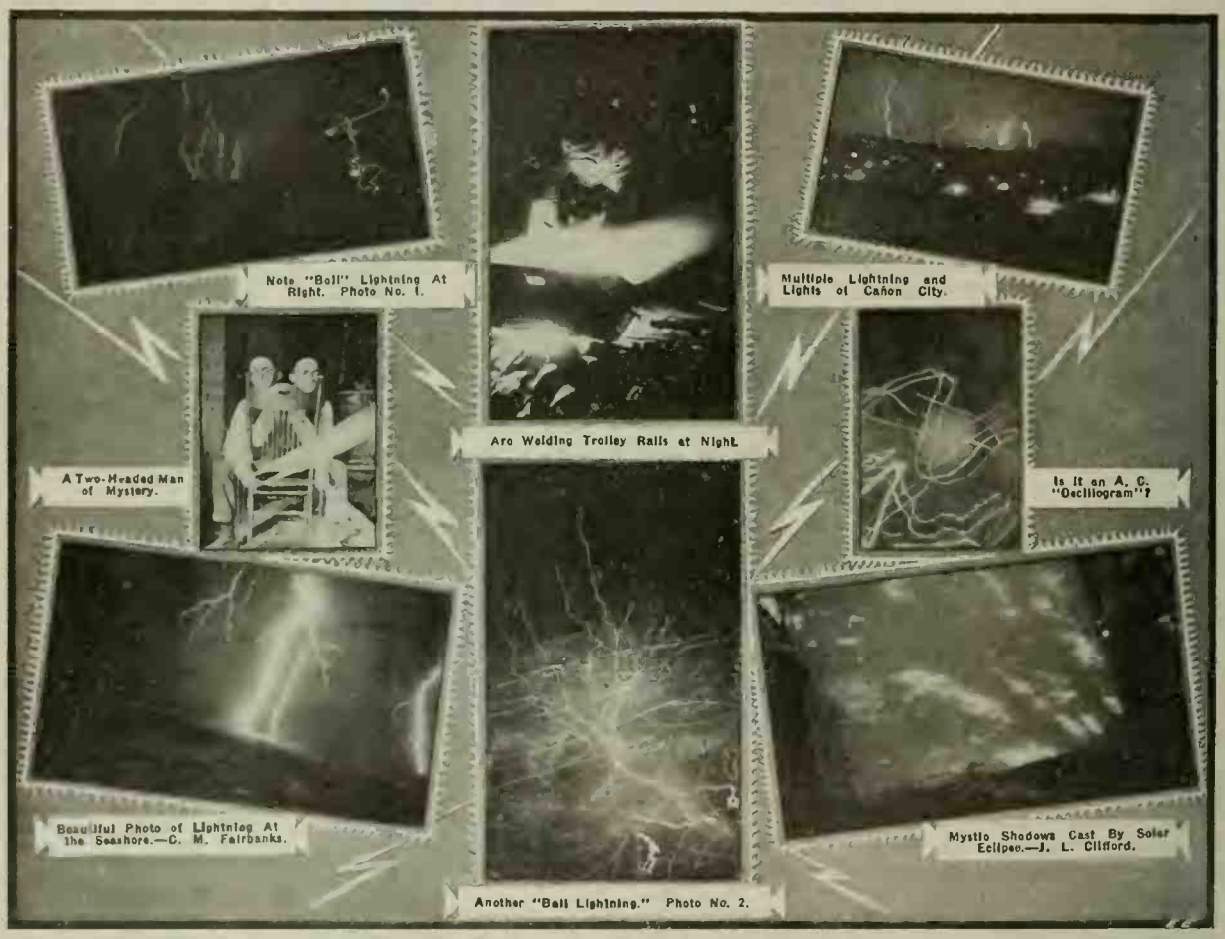
BY special arrangement the ELECTRICAL EXPERIMENTER will, beginning with the next issue, publish a series of articles entitled "My Inventions", by Nikola Tesla. The great inventor will contribute a signed article monthly, which articles will run for several years. Most of this material has never appeared in print before. The articles will be publisht in book form later. We consider this announcement the most important we ever made. THE PUBLISHERS.

NIKOLA TESLA, in the opinion of authorities, today is conceded to be the greatest inventor of all times. Tesla has more original inventions to his credit than any other man in history. He is considered greater than Archimedes, Faraday, or Edison. His basic, as well as revolutionary, discoveries for sheer audacity have no equal in the annals of the world. His master mind is easily one of the seven wonders of the intellectual world.
H. GERNSBACK.

www.americanradiohistory.com

"Odd Photo" Contest

WELL, Readers, what do you think of this perfect galaxy of "Odd Photos"? Fit for a king, eh. That's what we thought and so decided to publish them. Have you ever tried to enter a photo in our "Odd Photo" contest? Now is the time. Just look over this collection, gathered from all parts of the country, and you will gain a clear idea of just what we are after in this direction. We want brainy pictures as well as freak photos. Electrical, Radio and Scientific subjects give you a wide field to choose from. See announcement of "Odd Photo" contest elsewhere in this issue.



WELDING CAR TRACKS AT NIGHT

Herewith is an interesting night picture of men welding car tracks in Buffalo. The welding, of course, is electric, the trolley wire being tapt and a wire fastened to a weight placed on the track, making the connections. The 550 volt current is reduced thru a bank of resistance grids carried on a cart. The men are equipt with a heavy glass mask of special design, to protect their eyes and ears.

Kenneth Strickfaden, New York City.

IS IT AN A. C. OSCILLOGRAM?

I here present a print which resembles an alternating current oscillogram. This, I am told, was caused by the film being wound too fast, thereby causing static electricity.

What caused the lines to be in double, or in pairs? Can anyone explain this?

What causes the lines to have those peculiar peaks?

I hope that your readers can answer it.

Wm. P. Ullrich, Ansonia, Conn.

LIGHTNING AT THE SEASHORE

Here is an excellent photograph of an electrical storm at the seashore.

Last August, while at the seashore, I was awakened about 1 A. M. by the loud crashes of a storm. The flashes were very bright, so I got out my camera. Herewith is the best picture I obtained. In the foreground is a boys' camp and the board walk. The beach can be made out very clearly.

C. M. Fairbanks, Ocean City, N. J.

MYSTIC SHADOWS CAST BY SOLAR ECLIPSE

One of the many interesting phenomena occasioned by a partial eclipse of the sun is the shape of the shadows cast by the light filtering thru the trees. The present picture is one taken during the eclipse of June the eighth, at a spot where the eclipse was 85 per cent. The picture is of a sheet held in the shadows cast by a tree, when the sun was a crescent. It will be noticed that the shadows are all shaped like a crescent—in fact, an exact image of the sun at that time. The explanation of this is that the small apertures in the foliage acted like small lenses and projected the image of the sun on to the ground, or in this case the sheet. During the eclipse the ground and the sides of houses were covered all over with these minute crescents, and it was very interesting to watch them and to note how they corresponded with the changing images of the sun on this particular occasion.

James L. Clifford,
Evansville, Ind.

A 2-HEADED MAN

The photo herewith, altho it does not bear any relation to electricity or radio, you will admit is odd. It is prized especially because of its history. The photo itself is a double duplicate of my homely physiognomy and was taken under several difficulties. In the first place I was home with the mumps and the measles and, being at a loss for something to do, I started to pester my peaceful camera. Secondly, I was alone and had to take the picture myself. Thirdly, my camera is a box type, and I had to rig up a series of wire rings, so

(*Continued on page* 673)

www.americanradiohistory.com

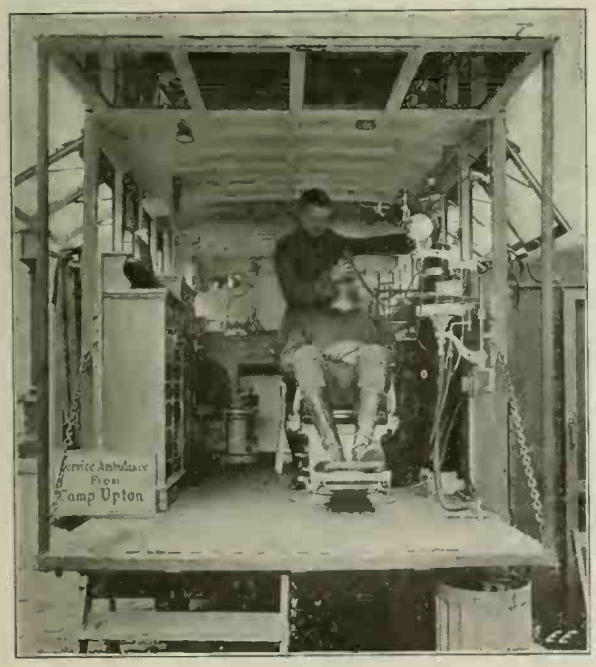
ELECTRICAL DENTAL AUTO FOR UPTON SOLDIERS.

There's nothing like having a "pull"—especially if you happen to be one of Camp Upton's sons. Just think of the pleasure of sitting down in this elaborately equipt dental palace—why we'll bet the D. D. S. hates to leave it at night. Believe the "Doc." when he says—"We send them away with a smile!"

In examining Upton's portable dental car we note that electricity is used to almost the same extent in this portable office as it is used in the private practise of the modern dentist. Altho Camp Upton has an elaborate dental equipment, with twenty-two chairs at the Dental Infirmary, five more for the Depot Brigade, and three at the Base Hospital, and a staff of Assistant Dental Surgeons, there is still need for the dental ambulance, for among the thousands of soldiers who pass thru the cantonment, there are many who for various reasons cannot come to any one of the three permanent offices. With its complete equipment, no case is too severe to be treated, a fact which is admirably borne out by the records of the office. As many as a hundred patients have been treated in a day, the work including everything from preliminary examination to the relief of aching molars or the filling of cavities.

The dental chair, which we here see so well "filled" with a 180 pound Upton patient, with its fountain cuspidor is exactly similar to the chairs found in any well-appointed office. Conveniently located on one side is the familiar bracket table for instruments, while in front of the chair are the electric motor and extension arm of the all important and nerve twiddling drill. The foot control is on the floor behind the chair. Overhead are two incandescent lamps in special reflectors, which assure adequate and well-directed illumination. Even a motor-driven lathe is on hand.

The electric equipment operates at six volts, current being provided by a three-cell storage battery. This battery provides sufficient energy to operate the entire electric equipment for a two weeks' period. It is the only source of electric energy in the outfit, for the auto-engine is not fitted with a dynamo. A rectifier enables the battery to be charged from any lamp socket, however. Also this permits current to be taken direct from the lighting mains when the battery is low.—*Photo courtesy New York Edison Co.*

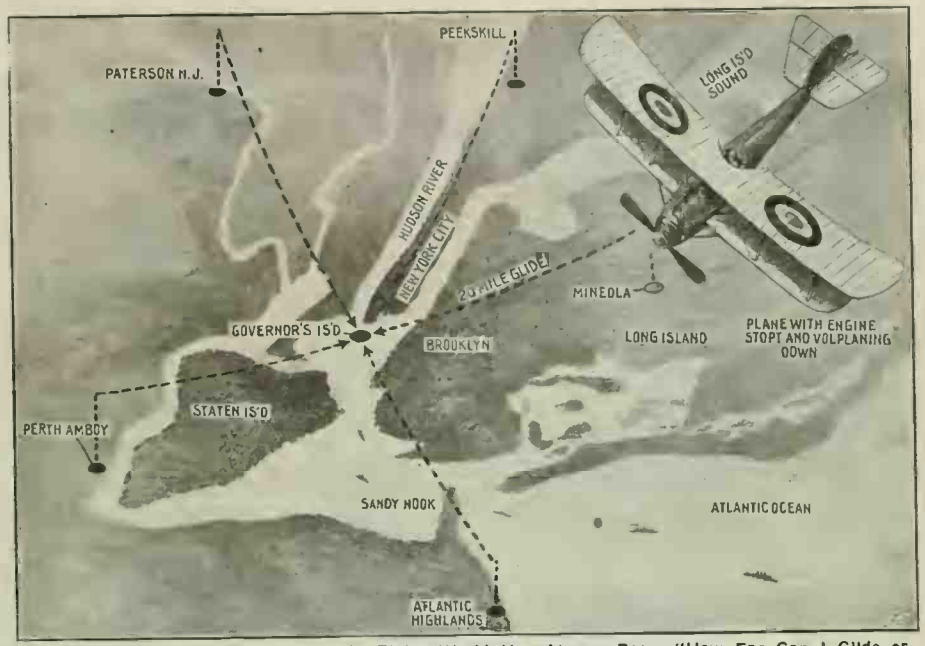


The Camp Upton Boys All Had a Real Pull with the Dental "Docs," for Electricity Provided Every Convenience Necessary for Pulling and Filling Aching Molars "Painlessly."

New British 'Plane Can Coast 20 Miles to Safety

In a recent report from an aviation camp behind the British lines in France comes the news that while the absolutely foolproof airplane has possibly not yet been invented, in the opinion of American pilots who are working in a British airdrome the newest British machines have very nearly solved the problem.

Left to themselves these latest machines will make their way safely to earth, except for slight damages which may follow a landing. They are so balanced and the wings so arranged that when the engine stops they glide gradually and easily to earth, without the pilot's attention.



The One Great Problem Confronting the Flying World Has Always Been—"How Far Can I Glide or Coast, If My Engine Should Stop?" The Answer Is—Twenty Miles; that is, If You Have One of These Newest British 'Planes, One of Which Has Glided That Distance in an Actual Test.

The following test shows how remarkably stable these airplanes are: A pilot climbed to a sufficient height, stopt his engine and took his hands off the controls, merely keeping his feet on the rudder bar.

He steered for an airdrome twenty miles away and, except for keeping it straight, he let the airplane do what it liked. It traveled the whole twenty miles as steadily as a bicycle coasting down a long, straight and gentle hill.

The accompanying illustration shows just what such a performance means to the aviator, who has heretofore always been in danger of being forced to volplane down at a sharp angle as soon as the engine stopt. Thus the aviator had to make a landing while coming down at a fairly sharp angle, and in some cases the plane has practically "dropt out of the sky," killing the aviator and demolishing the machine.

Just think what it will mean to the birdmen when they can volplane down a distance of twenty miles, such as from Mineola, L. I., to Governor's Island, or vice versa. It's really a wonder our flying machine inventors have not perfected such a device before this, when we stop to think of the many military aviators who have had their engines stall when over the German lines, which invariably meant they had to descend in enemy territory, with subsequent capture.. The cities and towns shown about New York City in the accompanying view are all situated approximately 20 miles distant.

Electrical apparatus taking current from a light socket has been invented by a French scientist to purify the air in a room by literally pumping it into a reservoir and washing it.

www.americanradiohistory.com

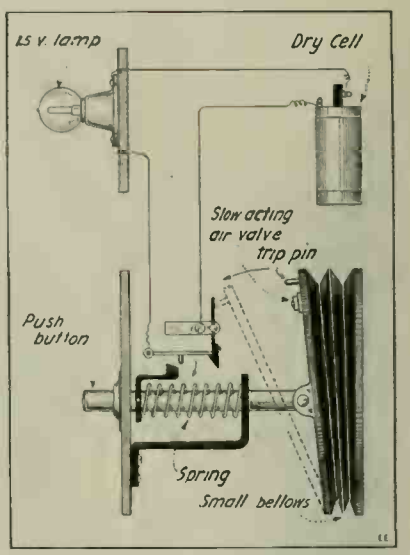
New Flashlight Cuts Off After One Minute

The newly invented and extremely novel electrical flashlight here illustrated incorporates a feature not possest by any other flashlight so far developed, in that when the push button is deprest the lamp circuit is kept closed for a predetermined and specific length of time, such as one minute, and it then opens the circuit automatically. This feature results in a great saving of battery energy, particularly in such forms of the dry battery electric lamp as those made in the form of an ordinary lantern, which are provided with a switch instead of a push button, and which the owners thereof have a great habit of thinking that because it is an electric lantern, it will stand almost any abuse. It would make the heart of any good electrician flutter with extreme anxiety to watch some users of these electric lanterns and see them close the switch and then forget it—a dry battery to them is a veritable electric dynamo; they never give a thought to the fact that the dry cells used in every one of these flashlights, will give several times the life if they would but open the switch or button periodically—say at intervals of one-quarter to one-half minute—in order to give the battery a chance to recuperate.



You Push the Button of This Flashlight—a Minute Later the Lamp Extinguishes Itself Automatically. Result—a Saving in Battery Power and Life.

It is to guard against just such misuses of the electric flashlight that the inventor of the present automatic cut-off push button, Mr. G. H. Parsons of Stamford, Conn., has evolved and patented the device here illustrated. One illustration shows the exterior of his new flashlight, called the "Tempolight," while the second illustration shows a diagramatic view of the interior arrangements. These are simple and comprise the usual lamp bulb, a dry cell, and a circuit-closer or push button, to which he attaches a small air bellows. When the button is deprest this bellows is also deprest, and the air exhausted within it. By means of a slow acting air valve or other suitable arrangement, the bellows, after an appreciable length of time of one-half to one minute, depending upon the period for which it is set to operate, expands and opens the push button contact trigger. A spiral spring on the push button rod tends always to push it outward.



Here Is the Secret of the Automatic Cut-off Mechanism of the Flashlight that Opens Its Lamp Circuit After Burning for a Minute. A Small Air Bellows Does the Trick.

FOOLING THE DRAFT BOARD?—IT CAN'T BE DONE.

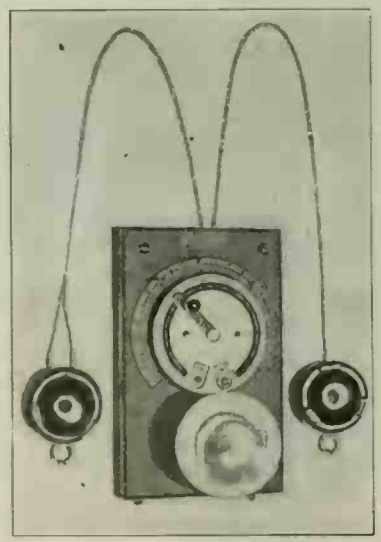
THE sad and distressing fact has been brought forth that to escape a righteous duty, one that every full-blooded American should be proud to fulfill, there are amongst us mortals in this free land, a new generation—small in numbers, to be sure—who deliberately seek to evade the greatest of all things—the protection of the Stars and Stripes and the preservation of the Union.

Amongst the false claims is that of *partial* or *total deafness.*

The French military specialists have already experienced considerable difficulty in this direction. It appears that the malingerer most difficult to detect is the one claiming *complete loss of hearing in one ear.* A moment's thought will show why this should be. Were only partial deafness claimed it would not be difficult to trap him, as he could not possibly be consistent in all his statements thruout an extended series of tests; but, with complete unilateral deafness as the claim, he simply and uniformly replies in the negative to all tests applied to the *alleged* defective ear.

Dr. R. R. Brownfield has devised a test which not only definitely determines the acuity of hearing in either ear, but also quickly detects the unilateral malingerer.

In the device as evolved by Dr. Brownfield batteries and make-and-break contacts are entirely dispensed with. The ordinary 110 volt alternating commercial lighting current is used. The variable current is produced by a potentiometer, and is variable from an absolute zero to maximum. No vibrating iron is used, and the maximum strength of current employed is dependent on no factor except the ratio of the electrical resistances employed. The sound producer is similar to a telephone receiver except in one very important respect—the core is of soft iron and is not magnetized. This results in eliminating the variability due to demagnetization and doubles the pitch, so that the ordinary 60 cycle current produces 240 vibrations per second—about equal to the average tone used in conversation.



The "Slacker" Tries to Fool the Draft Board—But Here's the Electric Telephone "Hearing Test" Apparatus that Fools the Would-be Shirker.

The sound producer is provided with three lugs to hold it away from the ear, so that the sound will be transmitted solely by air conduction. By simply turning the indicator from 100 to zero, one can cause the sound to increase from the point at which it is just perceptible to one of normal hearing, the threshold of audition, or 100 per cent. acuity, to a degree of intensity at which failure to perceive it indicates that the subject has no practical hearing. In addition to the variable receiver, there is a *supplementary* one that always operates at *maximum intensity*, irrespective of the loudness of the other.

In the usual test for the acuity of hearing, only the variable receiver is used. As the subject holds this to the ear, the pointer is gradually moved from zero to a point on the scale is reached, that would normally indicate very defective or almost no hearing for the good ear.

The very nature of the test, it will be noted facilitates the detection of fraud, because the better he can hear in the alleged defective ear, the less he will hear in the other—a condition just the opposite of what he might expect, so that when he makes his usual negative reply he is for once telling the truth and trapping himself. Under these conditions the sound appears to come in some mysterious way from a point at the center of the head; and if the two ears are approximately equal in acuity, there is absolutely no possibility of indentifying the gradually increasing sound in the supposedly good ear until a point is reached on the scale away beyond the reading that would be obtained when the loud receiver is disconnected. Hence in the case of the pretender, the physician has only to repeat the test with the loud receiver disconnected, and a totally different reading will be secured, thus proving the deceit.

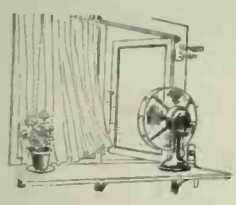
www.americanradiohistory.com

Wintertime Uses for the Electric Fan

By PAULINE GINSBERG

HAS it ever occurred to you that the electric fan can be used to great advantage in the wintertime as a labor and time saver? Probably it has not. This is but natural on account of the popular idea that the fan has only one mission, that of cooling the air. What the fan really does do is to circulate it. By impelling circulation, for instance, about the body, the displacement of the warm air for the cooler, as well as surface evaporation accordingly gives a cooling sensation, but in hot weather such as in July, the forced air from the fan does not change for the cooler, it being equally warm both indoors and out and the fan sometimes causes more discomfort than comfort. As many of us have entertained the idea that the fan cools the air, naturally the fan was invariably hustled to a secluded nook in the attic or down the cellar until the warm zephyrs of the next spring reminded us that it was "fan-time" again.

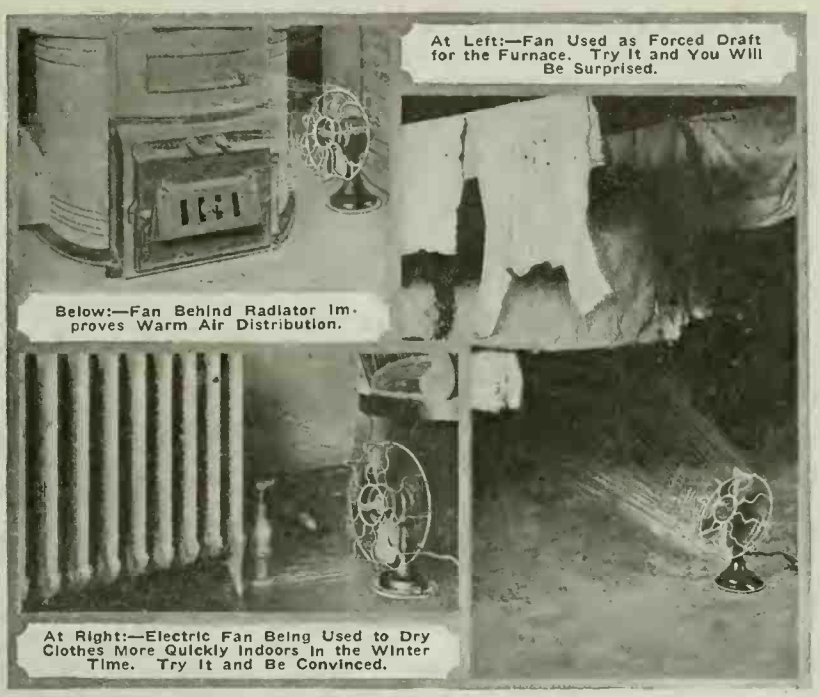
A few suggestions are here given for the wintertime utility of electric fans, and eventually you will find a number of other uses to which the electric fan can be employed with benefit.



Removing Odors from the Kitchen.

When the master of the house (or was it the janitor?) goes down to the cellar, and after much ado about the furnace (no, not "nothing"), finally makes a heroic attempt at starting a fire on a sultry day and it won't work—what to do for a forced draft? Just apply a fan opposite the front or side ashpit door of the furnace as herewith illustrated, and the fire will soon be crackling away merrily. Along this same line of the heating problem it can often be placed behind or in front of the steam radiator to circulate the air around and thru it so that the room is heated more rapidly and evenly.

Something that many women will appreciate is the use of the fan in the laundry for drying clothes. You will notice, in the third photograph, how the fan is placed away from the clothes lines in order to give a freer circulation of air so that it passes over all the clothes, and has therefore almost the effect of a light wind were the clothes outdoors. If the windows are kept open both at the top and bottom, you will be surprised how nicely they will dry.

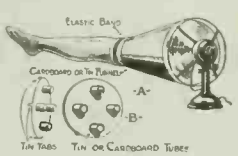


At Left:—Fan Used as Forced Draft for the Furnace. Try It and You Will Be Surprised.

Below:—Fan Behind Radiator Improves Warm Air Distribution.

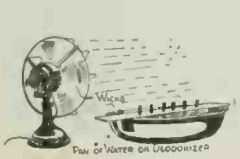
At Right:—Electric Fan Being Used to Dry Clothes More Quickly Indoors In the Winter Time. Try It and Be Convinced.

The fan in the kitchen window solves a problem that confronts every housewife—what to do to prevent cooking odors and smoke from spreading over the whole house? It is particularly annoying when friends pay a visit. Any handy piece of board the length of the window can be attached as a shelf. It should be about three - quarters of an inch thick and can be fastened in place with a pair of brackets and a few screws. On this the fan is placed so as to face the open window and create a strong suction. In a short time the smoke and odors will have vanished. Also to beautify the kitchen a flower or two may adorn the other end of the shelf.



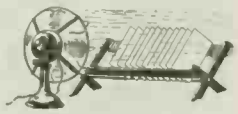
Drying Stockings and Gloves.

Something we all dislike is the unpleasant odor that is the result of a room or rooms having just been painted. With the windows kept open a few inches at the top and bottom and with our friend, the electric fan, kept going, the paint will dry quickly and the odor will have vanished in a much shorter time than had it not been used. Incidently dust will have been prevented from settling on the wet paint; also, it having dried more quickly, there will be a marked luster added to the painted surface. The fan can also be played on any small article that has been painted or enameled, such as a kitchen chair or table.



Humidifying and Deodorizing.

Gas heaters were never in such favor as they were last year and will be this year (the coal problem still being the chief reason). As a rule, with the oncoming of a substitute, some unfavorable feature is bound to spring up—in this case the reduction of humidity—the gas flame consuming a high percentage of the precious vapor which contains the oxygen, so necessary to our lungs. The electric fan again clears the situation. Place a pan about three-quarters full of water anywhere convenient, so that the fan can play directly across it. Over the pan put a thin board or piece of heavy cardboard, which has been perforated a number of times, so that small wicks or pieces of cloth can fit snugly into the perforations. They should be long enough to pass down into the water. The board or cardboard should be of the correct size so as to exactly suit the handles, and so be held in position; it should not be blown off by the fan. This arrangement need not necessarily be kept for a great length of time in one room, but it can be employed for a short period in every room, especially in bedrooms and sick rooms to promote comfort and good respiration, which in turn produce sound healthful sleep. A fan should invariably be kept in the sick room so as to insure good ventilation. It should of course be turned away, and at a considerable distance from the patient. It will greatly ease his suffering and discomfort which come from the difficulty of breathing and from the inability to sleep. The fan can be kept going at intervals and near a slightly lowered window. As the impure air rises and escapes thru the upper opening of the window, and the pure air enters thru the lower section, a good plan would be to have a small shelf made to hold the fan near the upper opening, the suction pumping out the impure air. It should also



Drying Photo Negatives Quickly.

(*Continued on page* 654)

www.americanradiohistory.com

Popular Astronomy

GIANT JUPITER AND HIS NINE MOONS

By ISABEL M. LEWIS



Copyright, 1918, by E. P. Co.

Jupiter as Seen from Its Nearest Moon—Satellite V. This Tiny Moon Is Only 67,000 Miles from the Surface of Jupiter. Its Diameter Is Less Than 100 Miles. The Black Spot on the Face of Jupiter Is the Shadow of Another Moon Projected onto the Giant Planet.

THE most beautiful object in the midnight sky during these winter months is the planet Jupiter, which will continue to be in excellent position for observation far into the spring. Upon New Year's Day Jupiter will be in opposition to the sun and therefore directly on the meridian at midnight. It is then seen at its best and will be visible thruout the night, rising in the east as the sun sets and setting in the west at sunrise.

Jupiter shines by reflected sunlight with twice the brilliancy of the brightest of the stars, Sirius. When seen during the midnight hours the remarkable, unflickering brightness of this largest and most distinguished member of the solar system at once serves to set it apart from the scintillating stars far beyond.

There is but one planet, Venus, that surpasses Jupiter in brilliancy, and as Venus never departs more than forty-eight degrees from the sun Jupiter always shines without a rival at midnight. To one who has observed the two planets together the silvery radiance and surpassing brilliancy of Venus, due not to its size, but to its comparative nearness to the earth, at once serves to distinguish it from the golden yellow glow of Jupiter.

Even the smallest telescopes of two or three inch aperture will show the four historic moons of Jupiter which were the first celestial objects to be discovered when Galileo turned his crude telescope to the heavens in the year 1610.



Comparative Size of Jupiter and the Earth. 90,000 Miles in Diameter, Jupiter's Mass Is 300 Times That of the Earth.

The fact that these tiny points of light were actually revolving around the great planet was soon detected by the famous astronomer and we can imagine with what breathless interest he observed these satellites of another world whose discovery dealt such a severe blow to the old Ptolemaic theory that the earth was the center of the universe. It was not until the great telescopes of modern times were invented that the five additional moons of Jupiter were discovered. The four satellites first observed by Galileo were fancifully named Io, Europa, Ganymede and Callisto, in the order of their distances outward from the planet, but these names are rarely used now, the satellites being designated for convenience I, II, III and IV, respectively. The first of the new satellites to be discovered was Satellite V, which is the nearest to Jupiter of all the nine moons. It is an extremely small body, not more than one hundred miles in diameter, and to discover this tiny body as it skirted rapidly around the great planet within sixty-seven thousand miles of its surface, nearly lost in the glaring rays, was a diffi-

www.americanradiohistory.com



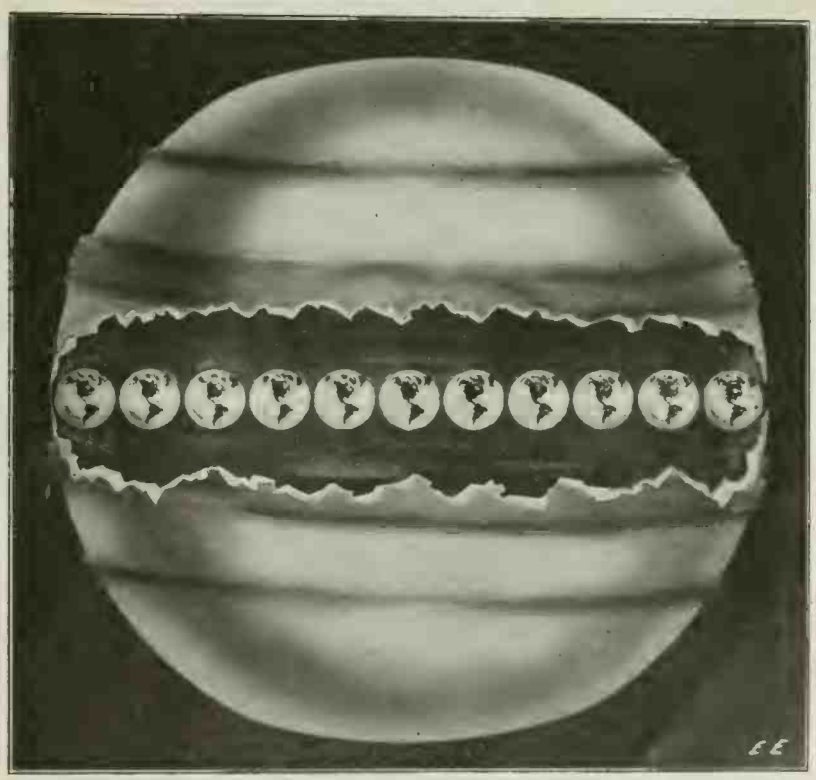
Jupiter Photographed October 19, 1915, with the 24-inch Refractor by E. C. Slipher of the Lowell Observatory.

cult feat even for an experienced observer. It was accomplished, however, by Prof. Barnard with the great Lick refractor in 1892. Satellite V is hopelessly beyond the reach of any but the greatest telescopes, as are also the four satellites discovered since that date. In fact, most of these tiny moons are observed photographically. Satellites VI and VII were discovered photographically in 1905. They are both about seven million miles from the planet and their paths loop thru one another; they are, moreover, highly inclined to each other at an angle of nearly thirty degrees. When nearest together they are separated by a distance of two million miles. Two more extremely small bodies, known as Satellites VIII and IX, have been discovered quite recently, one at Greenwich, England, in 1908, the other at the Lick Observatory in 1914. These excessively faint bodies are the most remote satellites of Jupiter and they are of particular interest because they travel around the planet in a direction *opposite* to the direction of revolution prevailing in the solar system. The ninth and most distant satellite of Saturn also retrogrades; that is, it revolves in a clockwise rather than a counter-clockwise direction around the planet. One explanation given for this peculiarity of the outermost satellites of Jupiter and Saturn is that this backward revolution around the planet is more stable when the satellites are at great distances from the primary and the gravitational control that the planet exerts, therefore weak. The moons of the planets are, of course, subject to the attraction of the sun as well as to the attraction of the controlling planet, and the greater the distance of the satellite from the planet the stronger the pull exerted by the sun and the weaker the bonds that bind such a moon to the planet. Beyond a certain limit it would be impossible for the planet to hold the satellite against the sun's greater attraction and the satellite would leave the planet to revolve directly around the sun, thereby becoming a planet. It appears that as this danger limit is neared it is safer for the satellite to "back" around the planet than to follow the usual "west to east" direction of revolution. The eighth satellite of Jupiter is more than fourteen million and the ninth more than fifteen million miles from the parent planet and they require about two years and three years, respectively, to complete one trip around Jupiter. When we consider that Satellite V darts around the planet in less than twelve hours at a distance of only sixty-seven thousand miles from its surface we realize what tremendous differences exist in the distances and periods of revolution of the nine moons. There is also great disparity in the sizes of the various moons. The five moons discovered in modern times are all excessively faint and therefore extremely small. The diameter of the largest of these, Satellite V, is less than one hundred miles. On the other hand, the four historic moons of Jupiter are of planetary dimensions. The smallest, Satellite II, is slightly larger than our own moon, while the largest, Satellite III, has a diameter according to measurements made with the 40 in. Yerkes refractor in 1916, of three thousand nine hundred and eight miles, which is only four hundred miles less than the diameter of Mars. The periods of revolution of these four satellites range from one day and eighteen hours for the nearest, which is about two hundred and sixty-one thousand miles from the center of Jupiter, to sixteen days and sixteen and one-half hours for the most distant, which is more than one million one hundred and sixty thousand miles from the planet. These four moons of Jupiter are most interesting members of the solar system. They are so near to the great planet that they are continually dipping into his huge shadow and experiencing an eclipse of the sun's rays, which, owing to the nearness and great size of Jupiter, lasts for two or three hours. At times of eclipse the moon suddenly disappears from the observer's view, tho it may be considerably to one side of the planet. Its reappearance later on is just as sudden, or it may pass out of the shadow while hidden from us behind the disk of the planet, in which case its reappearance is invisible from the earth. The occultations of the satellites, or, in other words, their disappearance behind the planet's disk, are also interesting phenomena to observe, as are their "transits" across the disk of the planet as the satellite passes in front of the planet. Not only the satellite itself but its shadow as well can be seen, a small black dot passing over the surface of Jupiter. The satellite is totally eclipsing the sun for this small dark portion of the planet. Two satellites and their shadows are frequently seen crossing the face of the planet at the same time. It is possible to observe all the phenomena of the satellites' transits and shadows, eclipses and occultations with very small telescopes. From observations of the eclipses of Jupiter's satellites the important discovery of the finite velocity of light was first made as far back as the year 1675.

Faint surface markings have been made out at certain times on the largest of the four satellites, Satellite III, and also on Satellite I, or Io. Observations of the markings on the former seem to indicate that it always keeps the same face turned toward Jupiter as does our own moon toward the earth.

There are also reasons for believing that the equatorial regions of Satellite I are light colored and the polar regions dark.

(*Continued on page* 668)



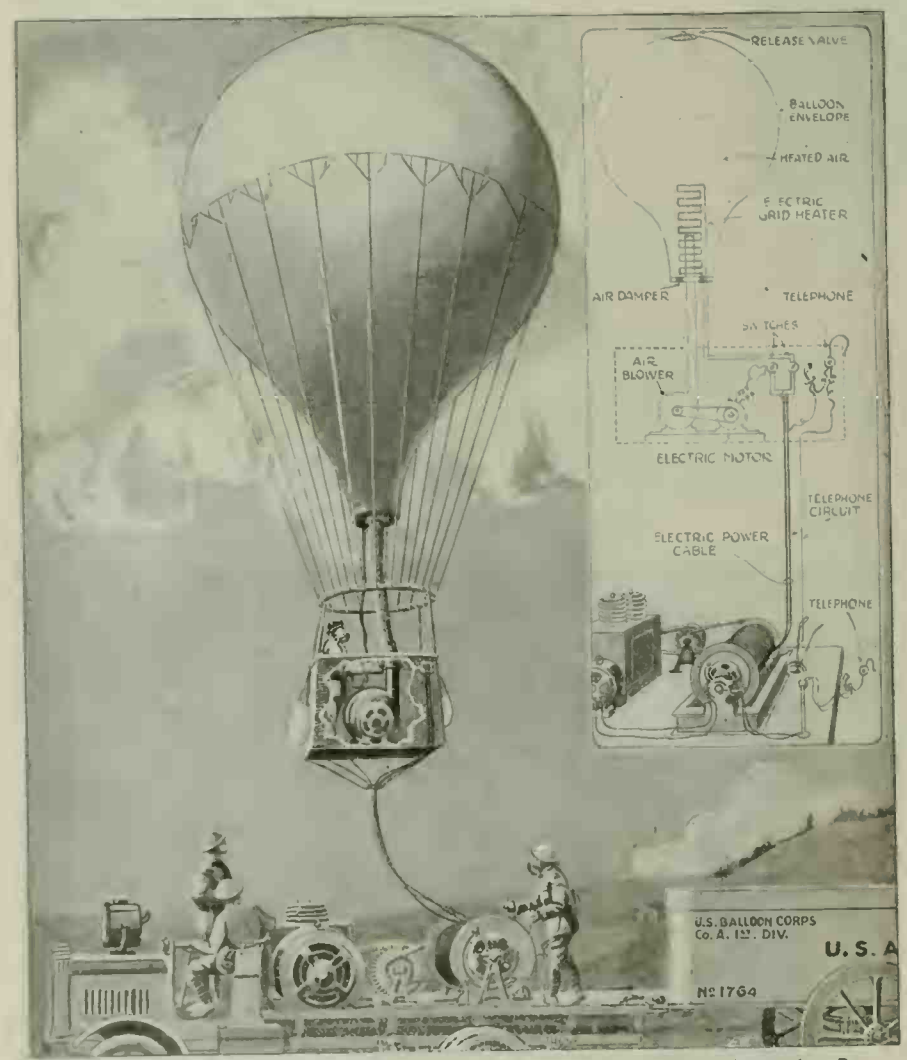
How Immense This Monster Planet Is,—the Largest of Our Planetary System,—Can Be Judged Best by This Illustration. If We Took Eleven Globes the Size of Our Earth, They Could All Revolve Within Jupiter Without Touching Each Other, and Still Have Room to Spare.

www.americanradiohistory.com

An All-Electric Hot Air Balloon

THE captive balloon as used by the Allied armies at the present time is invariably filled with hydrogen or other gas supplied from steel bottles containing this gas stored at a high pressure, or else it is obtained from manufacturing supply stations on the field. The first balloons ever used—the old "Montgolfières" of 1783—were made to rise by means of hot air, for, as we all know, heated air is lighter than cold air, and will always rise. If the heated air is of sufficient volume, it will also carry a body up with it, such as a balloon envelope for example. All of us have seen the simple balloons which patriotic Americans are wont to liberate on the Fourth-of-July, and which are composed of nothing more than a balloon-shaped paper bag at the bottom opening of which there is secured either an absorbent wick containing gasoline, or a small alcohol lamp. We simply light the lamp, and after a short time the heated air rushing up into the balloon causes the envelope to become very light and it rises in the air. Some of these balloons will travel for miles, and years ago it was not an uncommon sight in Europe to see hot-air balloons ascend with several men.

There has always been, however, a serious objection to a hot-air balloon where the heater was of the flame or similar type, for there was always in this case the constant danger of the balloon becoming ignited, with disastrous results. It has remained for Mr. James N. Lewis of Detroit, Michigan, to invent and patent an all-electric hot-air balloon, which is illustrated in detail in the accompanying illustration. Mr. Lewis makes use of an automobile winch to haul in the balloon, and to act as a mobile station, a trailer being hooked behind the winch, in which to carry the balloon bag and basket while being transported from one point to another. Either the automobile engine or a separate gasoline engine mounted on the truck drives a dynamo, which supplies current for an electric heater in the balloon. By means of suitable clutches, the engine may be caused to drive the dynamo, or else thru a chain drive, it may be connected up to rotate the cable winch drum. The dynamo makes connection to a duplex power cable reeled around the drum, and this leads up to the balloon basket. Also the telephone circuit is carried up to the balloon thru the drum or otherwise, so that those on the ground are in telephonic connection at all times with the observer in the balloon basket, and under battle conditions he would also be in telephonic communication at all times with "field headquarters," so as to report the position of enemy guns, troops, etc.



A New Form of Heated Air Balloon, the Air in the Bag Being Kept Continually Hot, to Any Degree Desired, by an Electric Heater in the Neck of the Envelope. Current is Sent Up to the Balloon Basket from a Gasoline Engine-Dynamo Set Mounted on the Truck Below. Telephone Connection Between the Truck and the Observer Aloft is Available. A Motor-Blower Drives Heated Air into the Balloon Envelope.

Referring to the balloon in detail, we find that it is provided with an electric grid heater, and also a motor-driven blower and connecting tube, so that whenever the blower is operated, air is pumped up into the balloon envelope, the air passing thru the electric grid heater. The balloon bag is fitted with a suitable damper in the lower opening and a relief valve at the top in the usual manner, the relief valve being connected to the observer's basket by means of a small rope. When it is desired to descend, the observer may open the motor blower switch in the basket, and thus aid the hauling in of the balloon, for as the temperature of the air within the balloon bag falls the balloon naturally tends to descend toward the earth.

8,700,000 AMERICAN HOMES LIGHTED BY ELECTRICITY.

From the compilation made by the *Society for Electrical Development* it is shown that there are 20,689,000 families in this country, of which 7,000,000 have yearly incomes of $900 or more. However, the yearly average family income before the war was under $626.

Over 13,000,000 families are too poor, too illiterate, or otherwise unfitted to buy electrical goods. Over 8,700,000 homes are electrically lighted and 120,000,000 sockets contain Mazda lamps. In over 30,000,000 sockets are carbon lamps. It is estimated that 9,000,000 sockets are empty.

Homes lighted by other means, 15,000,000; some are wired but not connected up for service. Electric service is available in 10,613 communities of the United States, compared with 3,545 communities that are being served with gas.

ELECTRIC SEARCHLIGHTS.

Ranges of electrical searchlights vary from between one thousand to two thousand yards in foggy weather to ten thousand yards or more when the air is very clear. The average sea range is approximately six thousand yards, but there are cases on record where ships have been spotted at a distance of nine miles. These figures are based on a sixty-inch mirror and a twenty-thousand watt arc.

www.americanradiohistory.com

The City of Splendid Night

By AMOS STOTE

A 20th Century poet strolled at night enraptured thru the highways and byways of Manhattan, agleam in all her nocturnal glory —not one night, but many nights—some moonlit, others rainy, but always—the magic of millions of electric lights threw its spell over him. And as he walked along this street or that, or mayhap thru the park, or along the shimmering Hudson, the very soul of the city seemed to commune with him. The poet's name was Amos Stote, and he has here set down three literary gems describing New York City at night as it appealed to him. We like Mr. Stote's soulful word-pictures of the Greater City electrified—he gives us something to think of besides the lights themselves. Thought is the keystone of all intellectualism. Our poet has given us a new pair of soul spectacles thru which to view many splendid sights—which the everyday man never as much as suspects.



"Blot Out the Stars! Let the Skies Open Every Pore. . . . Fields Are Sodden, Villages Sordid. . . . But Old New Amsterdam Is Glorious. The Romance of Masonry and Electricity Is Before You. It Is a Drama Done In Pouring Pantomime."

THERE is a habit, born of Manhattan, that comes to possess the souls of men who wander thoughtfully. It is the habit of night. Not the star-strewn night of mountain tops where God's myriad incandescents sow the skies. Not those shores concerning which poetic folk write rhapsodies around the central station of the heavens. (To me the moon across the sea is a great searchlight laying a restless path that I long to follow.) No, it is not to mountain or shore, not even to deep, mysterious woods, where the firefly sprinkles sparks amid green leaves, that I would go in quest of those good men who have the habit of night.

To these men, and to me, the night of nights is to be found in the rugged, slumberless zone of Manhattan and its fringes of resting streets. Perhaps you know those softened hours that tread upon the heels of the noontide of the night, those hours that have gained a new, entrancing charm because—because of a man named Edison.

In the old days of shrouded streets, when darkness threw a mantle of mourning over the city, good men went in groups for safety sake. Then only the brave and the brute cruised singly abroad, for of course we except the gallant, suffering from love's fever. But now a million gleams of light insure the safety of the streets and give the night-bedecked city over to the admiring glances of those who have learned the beauty that lies in the silent battlements of commerce; and in the old homes and highways.

I have wandered down unfavored streets, idle channels from which the thinning traffic of the closing day has been diverted into the congested spillways of frivolity. Here, along these hushed courses, where life dozes on the border of gaiety, as an outworn chaperone naps in the antechamber to the ballroom, here I have seen ancient doorways with the beauty of the binding of a rare first edition.

Once upon a time periwigged and gouty old gentlemen, and haughty grand-dames, past in and out these doors. On state occasions, when they ventured forth at night, armed servants escorted them and fleet-

(*Continued on page 673*)



New York—"the City of Splendid Night." A Wonderful View of the Theater Section from Times Square—the Hub of Manhattan's Ever-Seething Traffic. The Hotel Astor Appears in the Left Foreground.



And a "Night In the Park." For Within the Sylvan Solitude the Voice of the City Speaks Faintly, and Its Sparkling Eyes Are Veiled with the Romance of Contrast.

www.americanradiohistory.com

The RADIO LEAGUE of AMERICA
HONORARY MEMBERS
CAPT. W.H.G. BULLARD, U.S.N. NIKOLA TESLA.
PROF. REGINALD FESSENDEN. DR. LEE DE FOREST.
Manager, H Gernsback

Prussianizing the American Ether

By H. GERNSBACK

WHEN, on April 6, 1917, the President of the United States, by executive order, closed all wireless stations, the order was carried out to the letter by all Radio amateurs willingly and cheerfully. No notice has come to our attention where an amateur disobeyed the President's wishes.

All amateurs stood solidly behind the President when war was declared because all realized that everyone had to bear great sacrifices willingly and cheerfully. When the armistice was finally signed, the whole world breathed a sigh of relief, including the American amateur who had been given to understand that as soon as peace was actually declared the ether would be free for all once more. The amateurs were satisfied to go back to pre-war conditions, to take up their studies in an art which has few parallels as far as instruction and ennobling of the mind is concerned.

Unfortunately, however, in certain quarters in Washington, a feeling seems to exist that the amateur at best is a nuisance and should be done away with entirely. On November 21st two identical bills were introduced, Senate 5036 and H. R. 13159, the former by Senator Fletcher, the latter by the Honorable Joshua W. Alexander. These bills are reproduced elsewhere in this issue, as well as a statement given out by the Navy Department. The Navy Department frankly admits that these bills are not a war measure and it also endorses these bills. The Navy Department also makes the extraordinary statement that "experimenters" and scientists will not be interfered with, to wit:

IT SHOULD BE NOTED THAT THIS BILL IS NOT TO CREATE A COMPLETE GOVERNMENT MONOPOLY. THE SCIENTIST, MANUFACTURER, AND SHIP OWNER ARE SPECIALLY PROVIDED FOR, AND NO CHANGE IS PROPOSED IN THEIR STATUS UNDER EXISTING LAW. STATIONS MAY BE LICENSED FOR SPECIAL COMMUNICATION, AND THESE ARE EXEMPTED FROM GOVERNMENT OPERATION.

Any intelligent person reading this paragraph must come to the conclusion that amateurs would revert to their *ante bellum* days the minute peace was declared by Presidential proclamation.

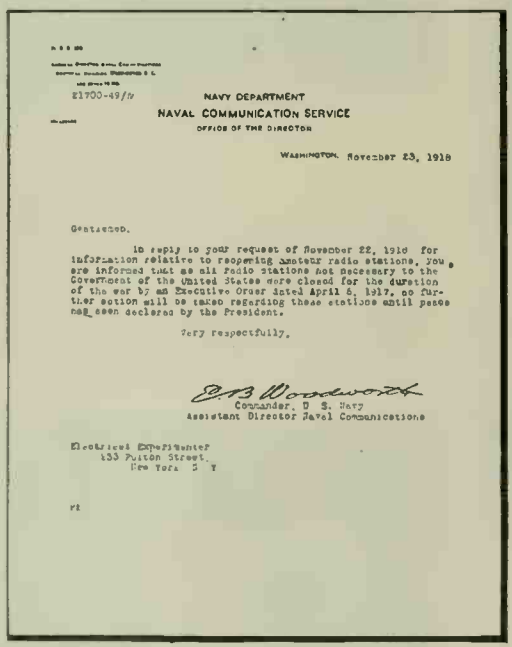
So far, so good. We now turn to the Alexander and Fletcher identical bills, and read them attentively. To our amazement not a word is mentioned about the amateur. This bill also contains the extraordinary statement that:

"Experiment station means a radio station actually used for conducting experiments for the development of the science of radio communication or the apparatus appertaining thereto, and used for no other purpose except as a technical and training school station."

In other words, a technical training school station is an experiment station and vice versa. Of course, this statement alone, unless modified means that if the bill is actually past by both Houses the amateur will be just as dead as that sensitive spot on a galena detector after it was hit by lightning.

A second reading of the Navy Department's statement also informs us that the President approved a similar bill: H.R. 2573.

We now turn our attention to this bill



21700-49/fv

NAVY DEPARTMENT
NAVAL COMMUNICATION SERVICE
OFFICE OF THE DIRECTOR

WASHINGTON, November 23, 1918

Gentlemen.

In reply to your request of November 22, 1918 for information relative to reopening amateur radio stations, you are informed that as all Radio stations not necessary to the Government of the United States were closed for the duration of the war by an Executive Order dated April 6, 1917, no further action will be taken regarding these stations until peace has been declared by the President.

Very respectfully,

E. H. Woodworth
Commander, U. S. Navy
Assistant Director Naval Communications

Electrical Experimenter
233 Fulton Street,
New York, N. Y.

rt

and read it carefully. We are struck with the fact that it was first introduced in the House of Representatives by Mr. Padgett under date of April 9, 1917, *a year and a half before* Messrs. Alexander and Fletcher introduced their bills. Strange to say, all the three bills read alike *except* that Mr. Padgett's bill right after the fifth paragraph, referring to the technical and training school stations, has the following:

> The term "Amateur" station means any station not an experiment station or a technical and training school station and not operated for financial profit.

We also find in this bill, under Section 3, the following:

> This section shall not apply to experiment stations, technical and training school stations and amateur stations, duly licensed by the Secretary of Commerce as provided by the act to regulate radio, approved August 13, 1912.

Here the similarity ends. In all other respects the three bills read actually and almost entirely word for word the same. We heartily approve Mr. Padgett's bill, which also has the approval of the President as admitted by the Navy Department.

Now then, as Mr. Padgett's bill was introduced on April 9, 1917, and as Mr. Alexander's bill was introduced on November 21, 1918, one and one-half years later, and inasmuch as Mr. Alexander's bill reads exactly alike word for word all the way thru with the exception of the paragraphs mentioning amateurs, Mr. Alexander necessarily must have copied Mr. Padgett's bill. But when he came to the paragraphs mentioning amateurs he ran his blue pencil right over them.

And that is the joker. President Wilson approves of Mr. Padgett's bill favoring amateurs. Mr. Alexander with the stroke of his pen,—or was it the blue pencil?—wants to shut out the amateur from the ether forever.

Not that Mr. Alexander is not familiar with the amateurs. He knows them well. For Mr. Alexander was the author of the original radio bill before it was a law. The writer in 1912, as will be remembered by most amateurs, fought the Alexander bill for the reason that it did not make mention of the amateurs. Finally Mr. Alexander and his committee became convinced that it would be an injustice to silence the amateurs, and in April of that year the Alexander Wireless Bill *amended* appeared. As will also be remembered, Mr. Alexander and his advisers accepted the writer's recommendation pertaining to amateurs as set forth in the writer's editorial in the February, 1912 issue of *Modern Electrics*, and this bill later in the year was signed by President Taft, thus making it the present wireless law.

It strikes us as remarkable that inasmuch as in 1912 Mr. Alexander could not see the amateurs with an ultra-microscope, his eyesight as far as the amateur is concerned has not grown better in 1918. As soon as we knew that there was to be a new wireless measure, we got busy immediately and we found out that there will be a hearing of Mr. Alexander's bill on December 12th which will continue from day to day until all have had a chance to be heard. Inasmuch as this issue of the ELECTRICAL EXPERIMENTER does not come out until about the 12th of the month, it would have been impossible to inform all amateurs of the impending measures, and for this reason we took it upon ourselves to mail out at once some 50,000 letters broadcast to all amateurs giving them the facts of the case.

Of course it is not too late even now for those who have not received our letter. Mr. Alexander's bill has not as yet been

www.americanradiohistory.com

past, and we doubt very much if it will. What we want is Mr. Padgett's clauses reinstated—in other words, what we want as far as the amateurs are concerned is the passing of the bill H.R.2573, which has the full approval of the President, so admitted by the Navy Department; or, what amounts to the same thing we want Mr. Padgett's clauses regarding amateurs inserted in Mr. Alexander's bill. One is exactly the same as the other. This is all that we want, and it is fair to all concerned. It simply means that the present wireless law is to remain the same, and this, we are certain, will satisfy every amateur in the country.

The licensing system whereby the amateur was licensed by the Department of Commerce for the five years during which the law was in force, proved satisfactory to all concerned. No amateur has ever harmed anyone, and as the stations were licensed the amateurs refrained from sending out false calls or otherwise making a nuisance of themselves, a condition which prevailed before the 1912 wireless law was past.

It has been proved time and again that radio apparatus enormously sharpen the senses of a young man by making him keener all the way around, besides teaching him an art that is worth while.

Hundreds of thousands of radio amateurs in the Signal Corps have helped towards winning the war, and they will do so again when called upon. If it had not been for wireless, the United States would not have had such a large body of telegraphers at the outset of the war, and nearly all of these volunteered. Furthermore, radio telegraphy has been the great cause to keep the young man away from questionable company during his spare evenings, and this alone overbalances any criticism that could possibly be brought against the amateur. Any parent who has a growing son is thankful for being allowed to spend all he possibly can for radio apparatus because he realizes more than anyone else that it keeps together the home ties between son and home.

It is not too late as yet to protest against Mr. Alexander's bill, and those who have not as yet done so should write or wire to Mr. Alexander's committee at once. When you write refer to H.R. 13159 and address your letter to the Honorable J. W. Alexander, House of Representatives, U. S. Committee on The Merchant Marine and Fisheries, Washington, D. C.

A BILL TO FURTHER REGULATE RADIO COMMUNICATION.

Statement by the Navy Department.

This bill was introduced by Senator Fletcher, Chairman of the Senate Committee on Commerce, and by Judge Alexander, Chairman of the House Committee on the Merchant Marine and Fisheries, on November 21, 1918 (S. 5036 and H. R. 13159). A similar bill (H. R. 2573) has had the direct approval of the President, and the principles contained in the bill have the approval of practically all of the executive departments, as shown in the previous hearings before the House Committee on the Merchant Marine and Fisheries.

In general, the bill provides for the acquisition and operation, by the Navy Department, of all radio stations on shore used for commercial purposes. Irrespective of the general subject of government ownership, this principle is clearly indicated as necessary in the case of this particular public utility. Since the early days of the use of radiotelegraphy many companies have tried to operate radio stations as a commercial enterprise in the United States generally, or in certain localities. Except in very special circumstances, these enterprises have failed to make an adequate return, and in most cases no profit has been made except through the sale of stock. The reason for this is that a complete monopoly is necessary. That is, all stations must belong to one system. A period of about 18 years has clearly demonstrated that the United States Government is the only concern able to obtain and maintain such a monopoly, although many attempts have been made.

The first law regulating radio stations was enacted in 1912. At that time Congress recognized the fact that a complete system of radio stations having been established by the Navy Department for the national defense, the maximum public good could be obtained from them if they were permitted to assist commerce by handling the radio business of merchant ships. A certain number of naval radio stations were authorized to handle commercial business. This business has been successfully handled for four years. The Navy Department has demonstrated its ability to handle smoothly and efficiently, wherever permitted to do so, all communication between ship and shore, without any restrictions on the nationality of the ship or the ownership of the radio set on board, and quite irrespective of the ownership of the connecting land lines and cables to which the radiograms were delivered for further transmission if originating at sea, or from which traffic was received if destined seaward. The Navy Department is now prepared and desires to handle all commercial work of all stations.

The part played by high-power stations in this war and before the United States became a party to it, shows very clearly the necessity for Governmental operation of these stations. Transoceanic radiotelegraphy is not a serious competitor of the cables. High-power stations are not yet able to receive from one another all day in all seasons, cable communication is secret, while signals from radio stations are transmitted in all directions, and all nations can read the business of all others. Only the most carefully devised codes can make radio traffic secret, and experts will not admit that any code or cipher cannot be broken in time. Signals from high-power stations become international matter at once. Even the signals of an ordinary shore station transcend the three-mile limit and are capable of interfering with the legitimate work of an installation under a foreign flag. Only by the most careful regulation of radio traffic, through international agreement, can the maximum good be obtained, and only by each nation having the operation of radio stations under its direct control can international agreements be properly executed.

In spite of the claims of inventors, radio communciation is still hampered by atmospheric disturbances commonly termed "static" and by interference. In congested districts, as in the case of important seaports, communication is limited and must be controlled by a central organization, otherwise a serious situation ensues. In the case of high-power stations where there is a limit to the number of long wave lengths which can be used, interference is encountered regardless of the distance between stations. For instance, a station in Washington is liable to be interfered with by a station in San Francisco, while attempting to receive from France or Italy.

IT SHOULD BE NOTED THAT THIS BILL IS NOT TO CREATE A COMPLETE GOVERNMENT MONOPOLY. THE SCIENTIST, MANUFACTURER, AND SHIP OWNER ARE ESPECIALLY PROVIDED FOR, AND NO CHANGE IS PROPOSED IN THEIR STATUS UNDER EXISTING LAW. STATIONS MAY BE LICENSED FOR SPECIAL COMMUNICATION, AND THESE ARE EXEMPTED FROM GOVERNMENT OPERATION.

By agreement with the Department of Commerce, the licensing of stations above mentioned, the licensing of ship stations and of commercial operators for them would be transferred to the Navy Department, since naval operation of commercial shore stations would eliminate a number of the duties assigned to the Secretary of Commerce.

This is not a war measure. In accordance with the Act of 1912, all radio stations in the United States and possessions, which were not already in the Government's hands, were taken over by the Navy Department as a war measure, and are now being operated by that Department, promptly in April, 1917. Many changes have occurred during the war. Stations formerly operated commercially have been found to be unnecessary for either commercial or war purposes. On account of the submarine menace the necessity for instant control of troop convoys, and the sudden rise in importance of transatlantic communication for naval and military purposes, a few additional stations and some special arrangements were necessary on the Atlantic coast. The busi-

(*Continued on page* 665)

Radio Law and Existing Restrictions

By WILLIAM B. DUCK

The following interesting article by an attorney well versed in the subject, should answer the thousands of letters with which we, as well as all amateur Radio Supply Houses have been bombarded since Nov. 11th of this year.—EDITOR.

MANY wireless amateurs never had very clear notions concerning the regulations of Congress upon wireless sets, and fewer yet grasped the legal effect of the existing restrictions upon the use of such apparatus.

The existing wireless law derives its authority and likewise its legality from the so-called interstate commerce clause of our national constitution, giving to Congress the right to regulate commerce among the several states. Were it not for this provision in our constitution, Congress never would have had any authority to legislate upon any phase of this subject. Our national constitution embodies a wide variety of powers given up by the thirteen sovereign states when the constitution was adopted. All other powers and rights were reserved by the states. Consequently when Congress enacts any law, it must find its authority in some provision in the constitution. For instance Congress cannot pass any law regulating the rates of railroads both terminals of which are within the borders of the same state. The state only has such authority.

Our supreme court has given a very wide interpretation to the interstate commerce clause of our constitution. It has declared, for instance, that communication carried on by line wires extending from one state into another may be regulated by it. No wireless amateur has ever bothered to go to the expense of having the courts pass upon the question as to whether Congress has the power to license a transmitting station for exclusive use *between two cities in the same state*, if as an incident to this communication, the station may be heard beyond the borders of the state. In fact it is better for the amateurs that Congress compels the high power amateur stations to submit to its decrees in the regulation of their stations.

It is for this reason that the wireless law provides that no license is necessary for a receiving station or for a transmitting station with a range within the limits of the state where located. If Congress had attempted to exercise jurisdiction over these stations the entire law would have been unconstitutional.

When the United States entered the world war, the president, on April 6th, 1917, as Commander in Chief of the Army and Navy, ordered all the wireless stations dismantled. The existence of a previous law on this subject in no way added to his power to order the stations closed. It was a military act, and its authority was founded on recognized law on this subject, which it is unnecessary to discuss here. It will be observed that the order of the president embraced all wireless equipment, both transmitting and receiving. The moment peace is declared, all amateurs will "ipso facto," without promulgation of any decree by the president or any one else, have the right to use their receiving sets and small power transmitting sets whose range does not extend beyond the border of the state. A great many other war powers will likewise cease at this time.

www.americanradiohistory.com

Experimental Physics

By JOHN J. FURIA, A. B., M. A., (Columbia University)

LESSON EIGHTEEN

Conduction of Electricity Thru Gases.

GASES, the air included, under normal conditions will not conduct electricity. However, when a high potential is establisht between two points in a gas, as for example when a Wimshurst Machine is excited or a spark coil operated, the gas offers less and



Fig. 95-A. Vacuum Tube for Demonstrating That Cathode Rays Cast a Shadow. The Rays Travel In Straight Lines, as the Metal Cross and Its Shadow Prove.

less resistance as the potential is increased and finally electricity is discharged between the two points. The subject of the conduction or the discharge of electricity thru gases with its causes, effects and results is a vastly important one. It has attracted the attention of the foremost Physicists and has given rise to modern Physics with all its information regarding the *electron*.

Experiment 103

Attach the terminals of a spark coil to a pair of combs consisting of several needle points and keep the pair separated by a distance several times greater than the rated spark length of the coil. Darken the room and a glow will be observed surrounding the points. If more current is supplied to the coil so that a higher voltage is developed, the glow will increase in size and intensity. This glow is technically known as a *brush discharge* or *corona*, see Fig. 93-A. Now bring the terminals of the spark coil close together. A spark jumps across the gap in a straight line path. See Fig. 93-B. As the terminals are gradually separated the spark passes thru an irregular path until finally the limit of the coil is reached and no spark passes. The *spark discharge* then differs from the brush discharge in that the former is the passage of electricity from one point in a gas to another point and the latter is the passing of a gas from a point into the surrounding gas. As more current is past thru the primary of the spark coil a higher potential is developed at the secondary terminals and therefore a longer spark is produced, i. e., the length of the spark is proportional to the potential; a *one inch spark being produced by a potential of about* 30,000 *volts.*

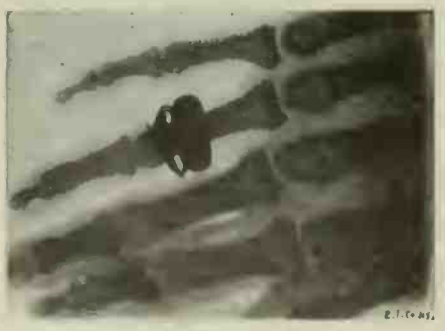


Fig. 97-B. Typical X-Ray View of the Hand, Showing Rings on the Finger.

Experiment 104

A straight glass tube about an inch and a half in diameter and fifteen inches long has platinum electrodes attached to aluminum discs. An air pump is connected at the opening *a*. The electrodes are connected to the secondary of a spark coil and also to the spark gap in figure 94, the gap being smaller than the rated spark of the coil. If the coil is now operated, a spark passes thru the gap *g* and nothing is observed in the tube. As the air in the tube is gradually exhausted by the pump the spark thru the gap disappears and a discharge is seen thru the tube which is neither spark nor brush. It will have the appearance of a ribbon of crimson light. The discharge then broadens out into a bluish, fuzzy column. When the pressure reaches about five-tenths of a millimeter of mercury, the negative electrode (cathode) becomes covered with a thin luminous layer. Next to this we find a dark space known as *Crookes' dark space,* next to which is a luminous part called the *negative glow,* and beyond this a second dark region known as



Fig. 96. Deflection of Cathode Rays by a Magnet. The Screen a-b Is of Fluorescent Material, So as to Make the Rays Visible.

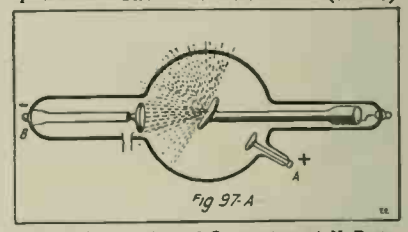
the *Faraday dark space.* From this space to the positive electrode we have the *luminous positive* column. By adjusting the pressure slightly the positive column can be made to divide up into a series of luminous and non-luminous spaces called *striae.* (Geissler tubes are partially evacuated tubes bent into fancy shapes and surrounded with jackets containing colored liquids to produce pretty color effects.) If the pressure is lowered still further, to about 1/100 part of a millimeter, the column will gradually disappear and the walls of the tube will begin to fluoresce, the fluorescing color depending on the nature of the glass. This fluorescence is produced by streams of small particles issuing from the cathode and we consequently call them *cathode rays.* This fluorescent property of cathode rays is useful as a means of detection and observation of the rays. Glass is not the only substance to fluoresce under the bombardment of cathode rays. Calspar, barium platino-cyanid, potassium cyanid, yttrium and thorium also fluoresce.

Experiment 105

Cathode rays travel in straight lines and hence form shadows when striking an obstruction. In figure 95A *c* is the cathode. A piece of metal hinged at its lower end stands in the path of the rays. A distinct shadow of the same shape as this obstructing metal is formed at the end of the tube. On dropping the metal down at the hinge by shaking the tube the shadow disappears.

Experiment 106

In figure 95B the cathode is concave and spherical. The other electrode (anode)



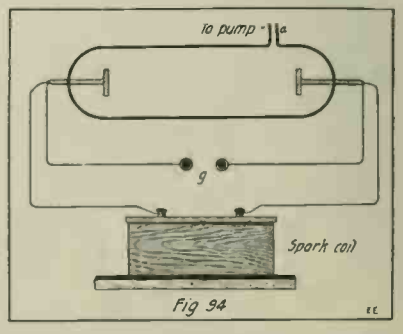
For the Production of Concentrated X-Rays, a Special Form of Focus Tube Is Used. Cathode Rays Coming from the Concave Electrode at Left, Converge and Strike Platinum Target at Right, Where X-Rays Are Generated.

consists of a small piece of very thin sheet platinum. The cathode rays are converged, focus on the platinum and are therefore very concentrated. The platinum incandesces, showing the heating effect of the cathode rays. Of far greater importance than either the fluorescent, the shadow, or the heating effect is the *magnetic effect,* especially as this gives us an insight into the nature of the cathode rays.

Experiment 107.

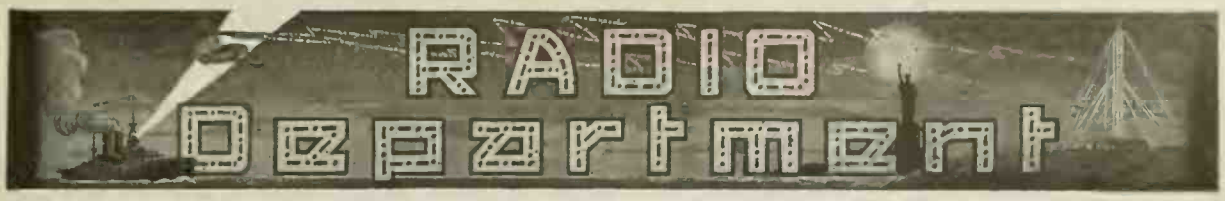
In figure 96 *a-b* is a fluorescent screen of zinc sulfid, or barium platino-cyanid; *c* is a mica strip with a narrow slit in it. The cathode rays emerging at *d* are absorbed by the mica *c,* except for a small part passing thru the slit. These travel straight thru for the full length of the tube and cause a narrow band of the screen *a-b* to fluoresce brilliantly. Hence, the path of the rays, which are themselves *invisible,* is readily seen. If now a horseshoe magnet is brought near the tube the rays are deflected toward it at right angles to the magnetic field. This is precisely what would happen if the cathode rays con-

(*Continued on page* 670)



A Variable Vacuum Tube Experiment with a Spark Coil. As the Vacuum Increases an Electrical Discharge Begins to Take Place Within the Tube.

www.americanradiohistory.com



The Effect of Statics on Wireless Transmission

By NIKOLA TESLA

Written for the ELECTRICAL EXPERIMENTER

A FEW statements regarding these phenomena, in response to a request of the ELECTRICAL EXPERIMENTER, may be useful at the present time in view of the increasing interest and importance of the subject.

The commercial application of the art has led to the construction of larger transmitters and multiplication of their number, greater distances had to be covered and it became imperative to employ receiving devices of ever increasing sensitiveness. All these and other changes have cooperated in emphasizing the trouble and seriously impairing the reliability and value of the plants. To such a degree has this been the case that conservative business men and financiers have come to look upon this method of conveying intelligence as one offering but very limited possibilities, and the Government has deemed it advisable to assume control. This unfortunate state of affairs, fatal to enlistment of capital and healthful competitive development, could have been avoided had electricians not remained to this day under the spell of a delusive theory and had the practical exploiters of this advance not permitted enterprise to outrun technical competence.



Tesla's Static Eliminator, Patented and Used by Him over Twenty Years Ago. It Will Be Fully Described in an Early Issue of the Electrical Experimenter

With the publication of Dr. Heinrich Hertz's classical researches it was an obvious inference that the dark rays investigated by him could be used for signalling purposes, as those of light in heliography, and the first steps in this direction were made with his apparatus which, in 1896. was found capable of actuating receivers at a distance of a few miles. Three years prior to this, however, in lectures before the Franklin Institute and National Electric Light Association, I had described a wireless system radically opposite to the Hertzian in principle inasmuch as it depended on currents conducted thru the earth instead of on radiations propagated thru the atmosphere, presumably in straight lines.

The apparatus then outlined by me consisted of a transmitter comprising a primary circuit excited from an alternator or equivalent source of electrical energy and a high potential secondary resonant circuit, connected with its terminals to ground and to an elevated capacity, and a similar tuned receiving circuit including the operative device. On that occasion I exprest myself confidently on the feasibility of fiashing in this manner not only signals to any terrestrial distance but transmitting power in unlimited amounts for all sorts of industrial purposes. The discoveries made and experimental results attained I made with a wireless power-plant erected in 1899, some of which were disclosed in the Century Magazine of June, 1900, and several U. S. patents subsequently granted to me have, I believe, borne-out strikingly my foresight. In the meantime the Hertzian arrangements were gradually modified, one feature after another being abandoned, so that now not a vestige of them can be found and my system of four tuned circuits has been universally adopted, not only in its fundamentals but in every detail as the "quenched sparks", "ticker", "tone wheel", high frequency and rotating field alternators, forms of discharges and mercury breaks, frequency changers, coils, condensers, regulating methods and devices, etc. This fact would give me supreme satisfaction were it not that the engineers, misinterpreting the nature of the effects, are making installments so defective in construction and mode of operation as to preclude the possibility of the great realization which might be brought within easy reach by proper application of the underlying principles and one of which—the most desirable at present—is the complete elimination of all static and other interference.

During the past few years several emphatic announcements have been made that a perfect solution of this problem had been discovered, but it was manifest from a casual perusal of these publications that the experts were ignoring certain truths of vital bearing on the question, and so long as this was the case no such claim could be substantiated. I achieved early success by keeping these steadily in mind and applying my efforts from the outset in the right and correct scientific direction.

I may contribute to the clearness of the subject in answering a question which I have been asked by the Editors of the ELECTRICAL EXPERIMENTER with reference to the report contained in the last issue, that signals had been received around the globe. an achievement the practicability of which I have fully demonstrated by experiment eighteen years ago.

The question is, how can Hertz waves be conveyed to such a distance in view of the curvature of the earth? A few words will be sufficient to show the absurdity of the prevailing opinion propounded in text books.

We are living on a conducting globe surrounded by a thin layer of insulating air, above which is a rarefied and conducting atmosphere. If the earth is represented by a sphere of 12½" radius, then the layer which may be considered insulating for high frequency currents of great tension is less than 1/64 of an inch thick. It is held that the Hertz waves, emanating from a transmitter, get to the distant receiver by successive reflections. The utter impossibility of this will be evident when it is shown by a simple calculation that the amount of

(*Continued on page* 658)

www.americanradiohistory.com

GERMANS USE BICYCLE DYNAMO TO OPERATE RADIO SET.

The accompanying illustration shows an ingenious German method of generating the necessary electric current for operating a radio installation in the trenches, which was captured in a recent British advance. As the photograph shows, a tandem bicycle with its wheels removed has been fitted with a supporting frame so as to stand upright and the pedal wheels connect with a belt to a small dynamo.



© Central News Photo Service

The Above Illustration Shows an Ingenious German Method of Generating Electricity for a Wireless Installation in the Trenches, Captured in a British Advance. A tandem bicycle with its Wheels Removed Has Been Fixt to the Ground, and the Pedal Wheels Connected by Belting with a Small Dynamo.

Such an outfit will produce considerable electricity which can be used for radio or lighting purposes, etc. In fact, this scheme is not new to the American wireless amateur, for we published an article on such a device for producing current to operate a wireless transmitter several years ago. A person sitting on a bicycle fitted with proper gearing, exerts a great deal more power than would be imagined off hand, and besides for warfare requirements the outfit is noiseless, albeit it is not quite so handy as the small gasoline engine outfits used by some of the other armies.

NEW TELESCOPING RADIO TOWER.

A device that promises to be of great importance to the field wireless service is a telescopic tower that can be rasied almost instantly on the throwing of a lever. This tower, the invention of R. W. Dean, of Des Plaines, Illinois, has been presented to the Government, says *The Oscillator*.

The tower that carries the wireless aerial works on an extremely simple principle. A number of light steel pipes fit inside of one another, the space between them being made air-tight by a series of washers at the top of each but the middle pipe. The base-pipe connects with a comprest-air reservoir which is always kept filled by an air-pump.

The operators turn on the comprest air lever. Air from the tank rushes to the top of the innermost pipe and pushes up on it with a force upward of twenty-five pounds for every square inch of its surface. The sections shoot upward, one after another.

Of the 8,000 girls who applied for service as military telephone operators with the American forces abroad 650 were accepted.



No Wonder the Naval Radio Students at "Harvard" Get a Headache Now and Then. Excuse Him, Folks, If He Don't Write Every Day. The Boy Is Busy! What?—Courtesy the "Oscillator."

Marconi Company Claims Famous "Static Preventer" Discovery

"With the conditions that pledged us to absolute secrecy no longer prevailing, the Marconi Wireless Telegraph Company of America is permitted to announce a discovery and invention in wireless telegraphy that will mark a new era in world communication," says a statement issued by Edward J. Nally, Vice-President and General Manager of the Marconi Wireless Telegraph Company of America.

"Ever since the genius of Marconi made wireless telegraphy a fact, the only limitation of this method of communication was the deadly phenomena of 'static conditions.'

"It remained for an American radio expert, Roy A. Weagant, Chief Engineer of the Marconi Wireless Telegraph Company of America, to discover the solution of the static problem.

"Among the revolutionary changes that the new system effects in wireless installations will be the immediate disappearance of the huge steel towers, heretofore built at great heights to catch the incoming wireless waves. Equipt with the Weagant invention, the wireless receiving antennæ are stretched merely a few feet above the ground.

"Heretofore, also, the increasing number of high power stations that were being erected in every part of the world raised the difficult question of 'interference.' Crossing wireless messages that shot thru the ether sometimes made the wireless signals so indistinct that they could not be understood, or drowned the weaker transmission entirely. The Weagant system, based on a unique selective principle, eliminates 'interference' and permits absolutely clear communication, regardless of the operation of other stations even in the immediate vicinity.

"The notable contribution to wireless telegraphy opened by Mr. Weagant's discovery makes continuous wireless communication over the oceans and between continents an absolutely assured fact for twenty-four hours of the day and at every season of the year, regardless of atmospheric conditions. All the Marconi high power stations are being equipt with the Weagant system, and the stations of the Pan-American Wireless Telegraph and Telephone Company, which are to link North and South America, will likewise be equipt."

This invention sounds almost too good to be true. However, Mr. Weagant, in an interview with the ELECTRICAL EXPERIMENTER's representative, stated that by very careful study of the subject over a considerable period, discovery of an entirely new basic principle had been made, and by accident at that. It was not expected, but while making investigations along other lines this particular effect became more and more noticeable until it developed into a full-fledged invention. "As soon as official 'Peace' is declared," said Mr. Weagant, "I will present a technical paper before the Institute of Radio Engineers, describing the invention. Also a body of technical men will be invited to one of our stations to hear it work."

SHIPS PERMITTED TO USE RADIO AGAIN.

Announcement has been made by the Naval Communication Service that commercial wireless traffic between United States merchant vessels and naval radio shore stations would be resumed at once.

This means that wireless messages may be sent to passengers on board steamships and that travelers at sea may communicate with shore.

During the war steamships were forbidden to use their wireless except to listen, the precaution being taken to prevent submarines and surface raiders from learning of the positions of Allied vessels.

OCTOBER MEETING OF INSTITUTE OF RADIO ENGINEERS.

The Institute of Radio Engineers held a meeting on the evening of Wednesday, October 9, 1918, in the Engineering Societies Building, New York.

A paper on "SPECIAL HEATING EFFECTS OF RADIO FREQUENCY CURRENTS," by PROF. EDWIN F. NORTHRUP of Princeton University was given.

www.americanradiohistory.com

Radiotelephone Guided U. S. Flyers Many Miles Away

SQUADRONS of American airplanes fighting in France up to the moment of the armistice, were maneuvering under the vocal orders of the squadron commander that reached each pilot by radiotelephone.

News of the successful development of this device, hitherto a military secret, tho some inkling of it had reached the Germans just before hostilities ceased, was made public recently by John R. Ryan, Director of Aircraft Production.

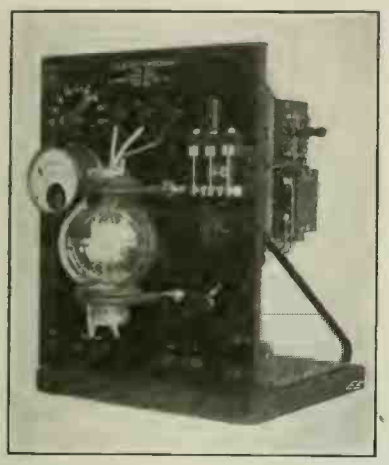


Fig. 5. High Power Oscillion Bulb Radiotelegraph Transmitter. The Meter At the Left of the Panel Is a Hot-Wire "Radiation Current" Indicator.

"There are some details concerning it which we cannot discuss yet," Mr. Ryan said, "but the radio devices worked out during months of experiment went into actual service some weeks ago. I have myself, standing on the ground, given orders to a squadron flying in the air and watched them maneuver accordingly.

"The transmission of the voice is clear enough to be heard distinctly thru the sound of the airplane motor. It is in every way the most satisfactory means of communicating between 'planes in the air and from the ground to 'planes."

The distance over which the radiotelephone talks from earth to 'plane is a matter of several miles.

"For some months," said William C. Potter, of the Equipment Division of the Bureau, "it has been possible in our offices in Washington to hear the 'planes flying miles over the city, talking to each other and to the ground as they worked out and perfected the device."

The accompanying views show several new wireless telephone apparata which can also be used for wireless telegraphic transmission when desired and utilizing the De Forest *Oscillion* bulb, having a filament, grid and wing. The oscillion comprises an exhausted glass tube or bulb, the size of which depends upon the output in watts, and which greatly resembles an ordinary incandescent lamp. This bulb contains two additional elements besides the usual incandescent filament, which are known as the *plate* and *grid* respectively. In these oscillions, the grid consists of a spiral winding of very fine tungsten or other wire wound upon a glass frame, and so placed as to entirely surround but not touch the filament. The plates, of which there are two, are placed one on each side of the filament, outside of, but not in contact with, the grid. In operation, the oscillion or vacuum bulb, oscillation generator requires two sources of potential, one of low voltage for lighting the filament, and one of high potential for supplying current from plate to filament across the vacuous space within the tube. A small motor-generator suitably wound to supply the proper voltage is generally employed as the most convenient source of current. Reception of radio-telephonic or telegraphic waves is accomplisht by the use of a similar but smaller sized vacuum bulb, which is capable of generating oscillations by a re-action between two or more tuned circuits, so that either damped or undamped oscillations can be interpreted.

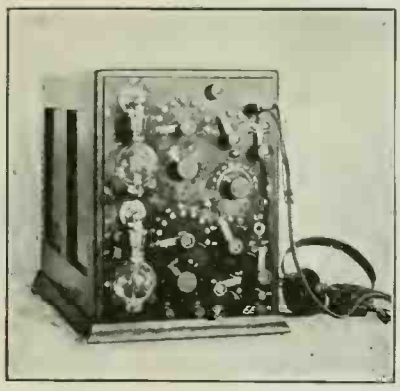


Fig. 2. New Combination Audion, Ultra-Audion and One-Step Amplifier Designed By de Forest.

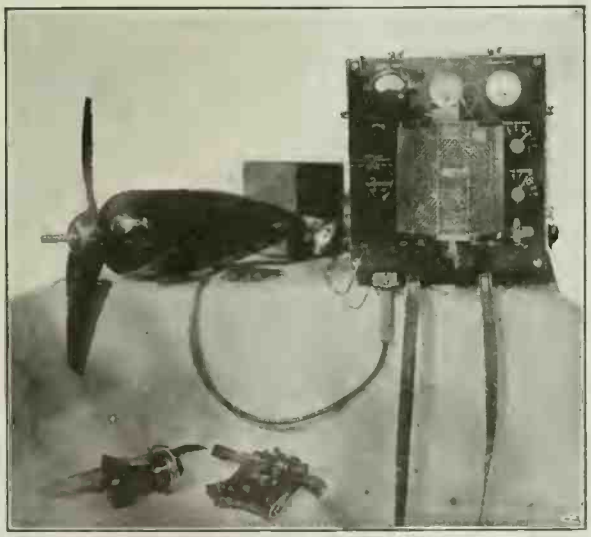


Fig. 1. Complete Airplane Radiophone Oscillation Transmitter Fitted With Self-Exciting Generator of the Wind-Driven Propeller Type (Left), "Chopper" Calling Key and Oscillion Bulb In Guard.

Fig. 1 of the accompanying views shows a complete airplane Radiophone oscillation transmitter, especially designed for military use. In this set the weight has been reduced to a minimum. A special *chopper* or calling key is fitted to the instrument as well as a special type of microphone for modulating the oscillations in the form of speech waves. At the left of the photograph will be observed a small dynamo resembling an airplane bomb, one end of which is fitted with a small size propeller. This dynamo is driven by the force of the air turning the propeller, as the airplane speeds along, and thus current is produced for the operation of the oscillion. The large oscillion bulb is enclosed in a wire cage to protect it from breakage, and the necessary measuring instruments are mounted on the front of the panel, viz: a hot wire ammeter in series with the antenna circuit to measure the radiation current, a milli-ammeter indicating the "B" battery current, and a filament battery ammeter. Suitable tuning inductance and capacity control knobs are mounted on the front of the panel. The connections between the various parts of the apparata are accomplisht with flexible twin conductors sewn in leather straps, the ends of which are provided with separable jack plugs.

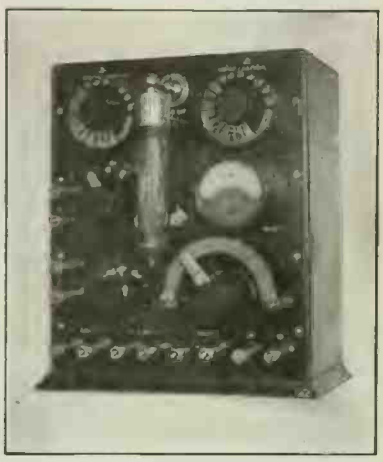


Fig. 4. New Vacuum Tube Control Cabinet. 110 Volt Direct Current Is Frequently Used On These Sets for the Wing Circuit, Using a Suitable Potentiometer in the Circuit.

The illustration in Fig. 2 shows a combination audion, ultra-audion and one-step amplifier. This combination is similar to the audion two-step amplifier outfit, with the exception that the apparatus is arranged for one-step amplification. This set will meet conditions perfectly, it is claimed, where the intensity of the normal signals does not

(*Continued on page* 651)

www.americanradiohistory.com

The Manufacture of Vacuum Detectors

By O. B. MOOREHEAD

ALTHO the majority of radio engineers are familiar with the use and operation of vacuum tube detectors, a brief description of their manufacture may be interesting. In the early experimental work on this type of device, we strove to produce a detector which would combine maximum operating efficiency with inexpensive manufacture. The next point considered was the production of desirable conditions, i. e., tubes that possest oscillating characteristics, tubes that were exceptional detectors, and tubes that displayed both qualities, says O. B. Moorehead, in a paper recently presented before the Institute of Radio Engineers. The third consideration was the production of a device easily handled and shipt without disturbing the adjustment of the elements and damaging the filaments.

Tubes and bulbs of various shapes and sizes were tried, using a gaseous medium ranging from one millimeter to 0.025 millimeter of vacuum, many materials being employed as elements. Various exhausts were applied, but it was soon found that the employment of a gaseous medium introduced considerable difficulty in the matter of accurate reproduction of a desired result. Gases at pressures ranging from one millimeter to 0.0013 millimeter were next experimented with.

I found that a tube containing a platinum filament in an atmosphere of hydrogen, at pressures comparable with one millimeter, gave fair results. Tungsten filaments were then tried in higher vacua as well as at the so-called "gaseous medium" pressure. It was immediately noticed that conditions could be duplicated as soon as a vacua above that which allowed a "gaseous medium" to exist, were obtained. Moreover, tungsten was ideal as a filament not only because of its refractory qualities and low volatility but also because it acts as a purifying agent by attacking any traces of residual gases that may remain in the tube and forming compounds which are then volatilized on the walls of the tubes.

As the parts are small and complicated, the glass is worked before the blowpipe, after it has been brought into the form of tubes by the glass works. This tubing is obtained by first blowing a bulb, then fusing an iron rod to a point diametrically opposite the blowpipe and rapidly separating the two points of attachment from each other.

Various grades of glass were experimented with, and a mixture containing a high percentage of lead and a small quantity of silicic acid was found to be the easiest to work and produced a detector of maximum sensitiveness when used in conjunction with the aluminum plate and copper grid. In the selection of the glass to be used, the devitrification of the glass had to be considered, as during exhaustion of the tubes it is necessary to subject them to a temperature near the point of softening and nearly all glasses, when maintained at this temperature for any length of time, have a tendency to separate out into the crystalline state.

There has been considerable discussion regarding the elements in this type of device and I may say that aluminum plates and copper grids were first selected on account of their electro-chemical relation to the tungsten filament. Later, numerous other metals were tried under the same and other conditions of exhaustion and showed widely different operating characteristics.

The selection of metals for the elements is very difficult, as a slight difference in either the copper or aluminum changes the whole system of exhaust. For instance, copper and aluminum purchased from one factory lot will require a certain degree of applied temperature during the evacuation, while another factory lot of the same weight and size will require an entirely different exhaust.

I have eliminated this variation to some extent by subjecting the aluminum plates to a temperature of approximately 600 degrees Fahrenheit (315° C.), immersing them in a saturated solution of cyanide of potassium, and finally rinsing in alcohol. The copper is subjected to heat until it glows, when it combines with the oxygen of the air to form a black, brittle oxid which breaks off in scales and exposes the underlying metal which is of rose red color. It is then placed in a current of moist air and becomes covered with a layer of oxygen compounds, which remains very thin but successfully closes the pores of the metal.

The exhaustion of the tubes is the most important operation because of the fact that the low vacuum of the round bulb, nickel element audion which permits of gas conduction is not used in the tubular "electron relay," wherein all gas phenomena must be eliminated.

To produce the high vacuum necessary, I have found that a Gaede mercury pump capable of producing a vacuum of 0.00001 millimeter, backed by a piston pump, such as the Geryck type, is the most satisfactory method of evacuation.

The manifold to which the tubes to be exhausted are attached and the vacuum line connecting the manifold to the pumps, are preferably made of large diameter tubing. A container filled with pentoxid of phosphorus is connected in the vacuum line between the pump and the manifold. The manifold is contained in an oven heated by gas and arranged so that the tubes during exhaustion may be heated to high temperatures.



"A Great Moment We All Experienced"—Not Many Moons Ago. This Self-explanatory Oscillation the Third, Comes From Over the Bounding Foam Via Wireless Operator H. B. Burney, of H. M. C. S. Stadacona.

The lead glass tubing, used as the container for the elements in the tubular type detector, is obtained from the glass works in lengths of 6 feet (2 m.) with an inside diameter of 0.875 inch (2.2 cm.) and a wall of 0.032 inch (0.7 mm.) thickness. This tube is cut in lengths of about 6 inches (15 cm.) and one end is drawn down to a point. Two stems are made of glass tubing similar to those used in an incandescent lamp, one stem contains the grid and two filament leads, and the other contains the plate connection and one filament lead. After the wire is sealed into these stems, they must be annealed very carefully. The annealing consists in allowing the temperature to drop very slowly, since quickly cooled glass is subject to internal strains which arise in the following manner: In rapid cooling, a low temperature is soon established at the surface and the outermost layer solidifies while the interior tends to contract, thereby exerting a pressure on the outer layer which is directed inwards. This may cause the stem to crack.

After the stems are annealed, the grid is wound to the proper diameter and the filament is clamped onto the two leads. The plate is mounted on the other stem and the two stems are then connected together by means of the filament. Final adjustment of the plate and grid is then made. The spacing between the elements is not very critical in this type of device, but it is best to wind the grid to a large enough diameter so that it will strike the plate rather

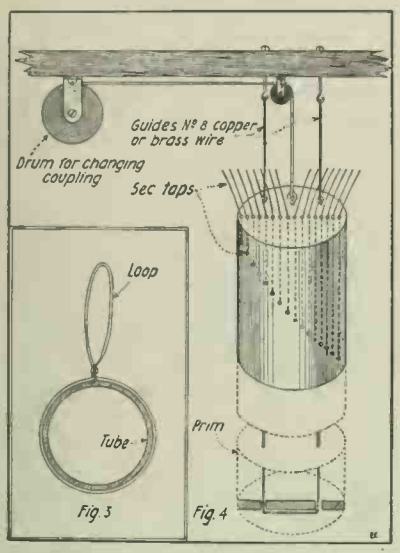
(*Continued on page 671*)

www.americanradiohistory.com

A Vertical Cabinet Type Coupler

By JOSEPH H. KRAUS, Jr.

CABINET couplers, altho handsome and efficient, are quite expensive, even if the amateur attempts to make one himself. In the following article is given a description of a large cabinet coupler which did remarkable work and the cost was surprisingly low. An instrument such as this is an asset to any station and will well repay the ambitious Radio Amateur for the time and trouble involved.

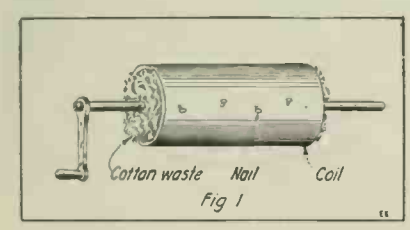


Arrangement of Vertical Coupler Secondary, Showing Friction Held Drum on Which Cord Supporting the Secondary Is Wound. The Taps Are of Flexible Stranded Lead and Cabled Together.

THE PRIMARY (WINDING WITHOUT A LATHE)

Two cardboard tubes are first procured, eleven inches long by five and four and one-half inches in diameter, respectively.

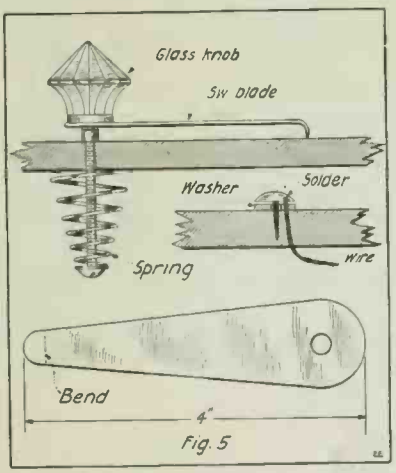
The five inch diameter tube is first wound in the following manner: In the center of a rod of wood about two feet long and of a diameter that will easily pass into both the five and four and one-half inch tubes (a broomstick handle will do) drive several nails, in such a manner that their heads protrude about one-half inch from the wood. This wooden rod is then placed in the five inch primary tube and held as near to the central axis as possible while cotton waste is packed in around the axle. The friction of the cotton waste against the tube will prevent it from slipping when it is being wound and the nails will act as grips for the axle (Fig. 1). A crank is now fastened to one end of the axle and the whole is suspended from two "Y" shaped uprights nailed to the opposite ends of a small box (Fig. 2). By using this cotton-waste method there is no necessity of fitting a rod tightly into the tube and a lathe is not essential. The winding is now commenced three-fourths of an inch from one end of the tube and a tap eight inches long is taken off every turn for the first twenty turns. Number these starting with the first wire as No. 20, then 19, 18, 17 and so on down until we get No. 1, and then No. 0. These taps must not be taken off directly under each other, but they zig-zag or spiral one-third around the tube, so as not to allow the least chance for a *short circuit* between two turns. Each must be carefully insulated and No. 22 black enamel wire used.



The Cardboard Tube on Which the Wire Is to Be Wound Is Mounted on the Crank of the Winding Rig by Stuffing Cotton Waste Inside It.

The manner in which a tap is taken off doesn't make much difference and every Amateur has a method of his own. However, here are two "standard" methods. For the primary the preferred method is to solder a wire to the place where the tap is taken off and insulate it carefully. Another method is to twist a loop into the wire and then continue winding; this will constitute a double wire lead (see Fig. 3). (This method will save trouble in the secondary winding.)

After the twentieth tap has been taken off (No. 0) the wire is wound for twenty turns and then a tap taken off. In this way the tube is wound until one-half inch from the other end and one tap taken off every twenty turns. These may be taken off in a perpendicular line, as there is enough winding between each to prevent a short. Number the taps in order from one to fifteen. The wire if carefully wound will result in about thirty-six turns per linear inch, and wound for a little more than 8¾ inches, will net 320 turns, giving twenty taps of one turn each and fifteen taps of the twenty turn variety. Remove from crank and shellac well.



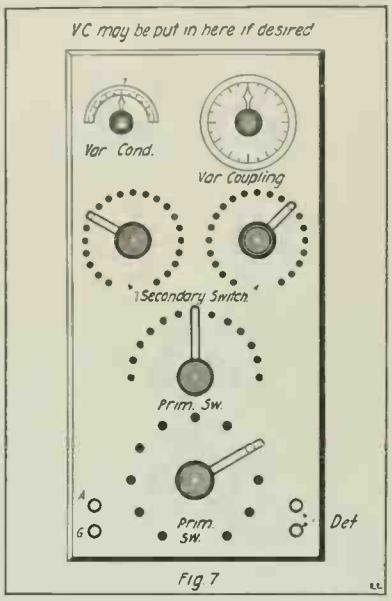
Detail of "Glass" Knob Switches Used On Vertical Coupler Here Described. They Give Very High Insulation Efficiency.

THE SECONDARY

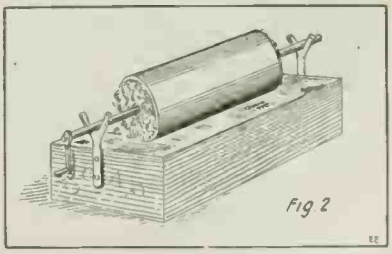
The secondary or four and one-half inch tube is now mounted in the same way and wound with No. 30 enamel wire. Leave a length of eight inches at one end and commence winding one-half inch from the end. A tap of the loop variety (Fig. 3) is taken off every three-quarters of an inch of winding. These loops are made one inch long and are taken off spirally one-third way around the tube. As the winding proceeds and as each tap is taken off a hole is punched into the cardboard tube immediately under each tap and a match stick inserted into the opening; each respective tap is to be drawn thru its particular opening. When complete there should be fifteen taps. Now to each of these is soldered a piece of flexible cotton or silk covered wire about twenty inches long, a piece of rubber tubing slipt over the joint and the wire drawn thru the center of the coil toward one end thru its respective opening. Number each tap in order, shellac and allow to dry.

Note: These wires are not soldered on until the tube has been fully wound and removed from the crank.

(*Continued on page 671*)



Front View of Finished Panel of Vertical Coupler Receiving Set. The Variable Coupler Control Handle Is Placed in the Upper Right Corner of the Panel.

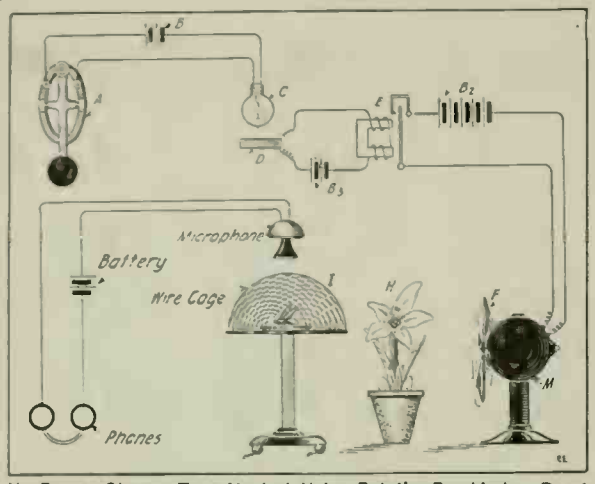


Where No Lathe Is Available for Winding the Coil, Resort May Be Had to a Home-made Winding Rig Like That Shown.

www.americanradiohistory.com

NEW "BUMBLE-BEE" HY-TONE CODE PRACTISE SET!

Here's the hy-tone code teaching outfit you have been looking for, Radiobugs!



No Buzzer Gives a True Musical Note—But the Bumble-bee Does! Hence, Combine the Bee, a Fan to Waft, Periodically, an Aroma of Hyacinth His Way, When We Have a Pure Musical Note Producer. The Microphone Carries His Tuneful Buzzings to Our Ears, Via the Telephone Receivers.

The set works as follows: The sending key (A) closes the circuit thru the battery (B) and lamp (C). The light works the selenium cell (D), operating the relay (E), which closes the circuit of the specially quick-starting and stopping motor (M). A fan (F) on the shaft of this motor plays a breeze on the plant (H), wafting an *Aroma de hyacinth* to the unsuspecting bumble-bee (I), which is tuned to a clear hy-tone. The microphone picks up the bumble-bee's buzzes faithfully and reproduces them in the telephone receivers. Every time you press the key it buzzes. Voila! Contributed by

WM. E. R. MIDDLETON.

WIRELESS MESSAGES REACH ARCADIA, CAL., FROM BROOKLYN YARD.

The wireless station at Arcadia, Cal., by using for an aerial the cable of a balloon, put aloft from the training field, has intercepted messages sent by the Brooklyn Navy Yard wireless station, according to an announcement by the War Department. This balloon cable probably makes the highest aerial in the world.

This announcement was made by the Division of Military Aeronautics, indicating increasing efficiency in both the work of students and the equipment of the War Department's various balloon training fields. The balloon school at Arcadia has 106 miles of wire in use for teaching military communication. For the purpose of demonstration it has a complete system of wiring strung as it would be in the front line trenches on the battlefield. Communication posts and stations for all kinds of messages are used by the students the same as soldiers use them at the front.

A good part of the country southeast and southwest of Arcadia is laid out with lines of communication to this balloon school, similar to part of a sector at the front. All of the balloons, when aloft, are so wired that they can be lined together with any trench, doubled up for any work together, or they can be cut off from the trenches and talk only with their own chart room and winch or operating crew on the ground below.

It is reported that the U. S. Government purchased the Sayville, L. I., Radio Station shortly after the declaration of war.

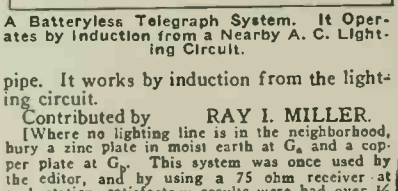
SPAIN TO AMERICA BY AIR IS PROJECT IN MADRID.

Captain Herrera, chief of the Spanish military air forces, has had a number of interviews with King Alfonso on the subject of an aerial postal and passenger service between Spain and the United States. The scheme also has been discust at Cabinet meetings and it is said that a leading shipping company is willing to finance it.

The plan, it is understood, is to manufacture large airships capable of carrying forty pasengers, besides the mails. The rate charged for a passenger, if the scheme is carried out will be $400, and letters will be charged for at the rate of $1 per hundred grams weight (about three ounces and a half). It is estimated the journey would take two and a half days.

A BATTERY-LESS TELEGRAPH.

A simple telegraph set may be put up between two chums' houses by running a small wire from house to house about 20 feet above the ground and 50 feet from the lighting wires in the street; connecting a key and receiver as shown in the following diagram. No batteries will be needed. One wire is grounded to the gas or water



A Batteryless Telegraph System. It Operates by Induction from a Nearby A. C. Lighting Circuit.

pipe. It works by induction from the lighting circuit.

Contributed by RAY I. MILLER.

[Where no lighting line is in the neighborhood, bury a zinc plate in moist earth at G_a and a copper plate at G_b. This system was once used by the editor, and by using a 75 ohm receiver at each station, satisfactory results were had over ½ mile. This "ground battery" gives about .07 volts. —Editor.]

ANENT THAT RADIO COMPUTATION GRAPH.

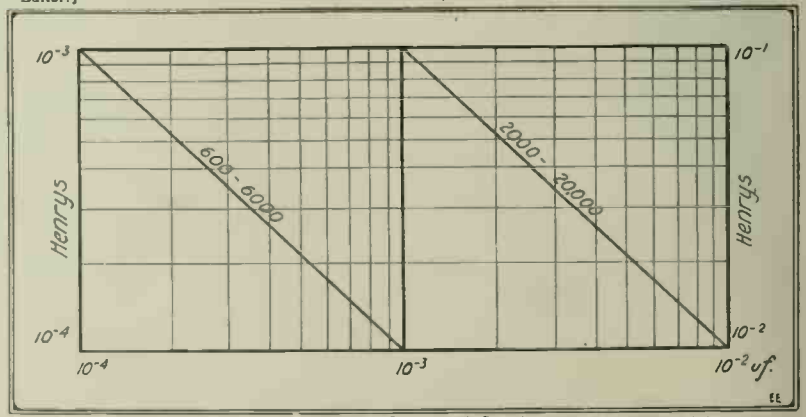
By K. N. Cummings, Asst. Engineer, Marconi W. T. Co., of Canada.

WITH regard to the article in your September issue, *"A Graph for Solving Wave Length, Frequency, Inductance and Capacity,"* I would like to point out that all the commercial values of the quantities can be represented by use of the two squares of the published diagram bounded by the lines representing one milli-henry, 0.1 milli-henry, 10^{-4} uf. and 10^{-3} uf. (uf. = microfarad.) To do this two inductance scales are required as in the diagram herewith.

Each diagonal line represents two wave lengths, one being ten times the other, as shown for 600-6,000 and 2,000-20,000 meters; giving directly a range of 600 to 20,000 meters, the left-hand inductance scale being used for the lower range of wave length, the right-hand for the upper range.

Only a part of the commercial waves below 600 m. are obtainable directly, but values not on the chart can easily be obtained as follows: To find, say, the inductance required for 300 m. with 0.003 uf., note that the 0.003 uf. line intersects the 3,000 m. line at 0.00084 h. Divided by 100 we obtain 0.0000084 h., the required value. In general, using the line representing 10 times the wave length, divide the value indicated by the graph by 100 and vice versa. Values of inductance and capacity not shown directly may be used as follows: Suppose we wish to find the inductance required with a wave of 8,000 m. and capacity of 1.7 uf., which are approximate values of the Glace Bay transmitter primary; divide the capacity by 1,000. The line for 1.7×10^{-3} intersects the 8,000 m. line at about 1.06×10^{-3} h. Dividing by the same number by which we divided the capacity (1,000) we obtain 1.06×10^{-6} h., the required value. The procedure would be exactly similar with a known inductance and wave length.

By extension of the above procedure, which is simply based on the fact that wave length varies as the square of the capacity or of the inductance, as the case may be, and that the product of capacity and inductance is constant for any particular wave length, we can obtain any wave length, inductance and capacity, but if many values are required which are not on the chart, it would be better to construct another pair of squares of the original graph from which the values could be read directly. The advantage of this graph over the original one is its increased scale, which is ten times that of the original for the same size paper. It is also easier to construct, the number of logarithmic lines required being but 3/17 of the number required for the original.



For All Ordinary Radio Calculations This Simplified Graph Fills the Bill as Well as the Larger One Publisht in the September Issue. It Gives the Value of Inductance and Capacity for Wave Lengths from 600 to 20,000 Meters.

www.americanradiohistory.com



Building a 3-Inch Spark Static Machine

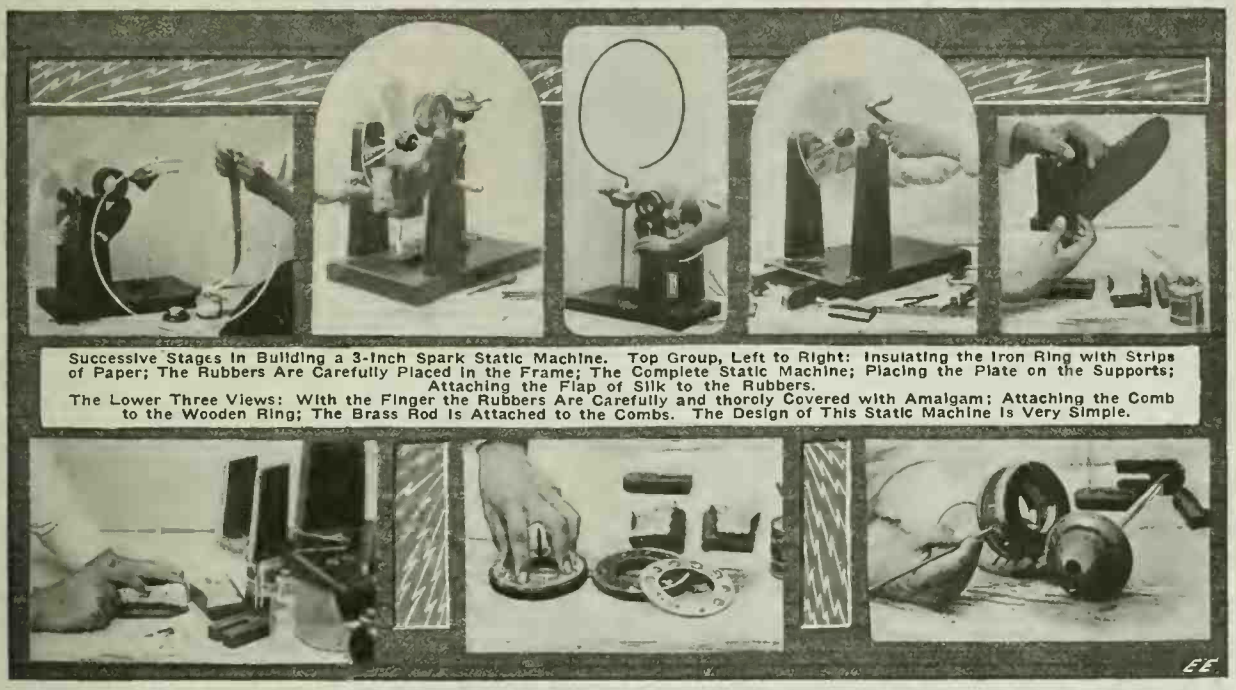
By DR. E. BADE

FRICTION is one of the commonest sources of static electrical excitation. Every one has noticed how the hair crackles under the comb in dry weather. The same sound is heard on stroking the back of a cat, and, if the room is dark, sparks may be drawn from pussy's fur. But for developing large quantities of electricity by friction a static machine is utilized. The simplest form of such a static machine which will develop sufficient electricity for all kinds of devices, as it gives a spark ranging from *one to three inches in length*, according to the neatness and exactness of the finished apparatus, altho one of excellent construction will give a larger spark, consists of a revoluble glass plate, a rubber and a conductor. The capacity of the conductor can be heightened with a well insulated iron ring capable of being attached or taken off from the conductor at will.

The wooden frame is to be made first. It is constructed from hard dry wood (walnut or mahogany); the base is 20 inches long, 12 inches wide, and 2 inches thick; the edges are beveled off. The two supporting arms can be made from thinner wood, but each should be 15 inches long, 4½ inches wide at the bottom, and 3 inches wide at the top. These arms, which are dovetailed to the base, are fastened with two screws countersunk; the holes being later plugged up. But before they are fastened two holes of suitable size for a glass rod which is used as an axle are provided for.

A round glass plate one foot in diameter is procured. This is usually the most expensive part of the machine. It is best to purchase it from a large electrical supply house, so that one does not get a plate unsuited for electrical purposes. A glass rod one foot long and a half to ¾ of an inch in diameter is taken for an axle. Two small wooden rings serve to hold the cemented plate to the rod. One should be careful to see that the axle is perfectly horizontal and the plate exactly perpendicular. One end receives a handle and a wooden ring which prevent it from slipping from the supports.

Now a "*rubber*" is made from three pieces of wood. The lower part is made from a piece 2½ inches wide and 4 inches long. The sides, which are made to slant slightly upward, are 4½ inches high. This frame is supported by a glass rod 4 inches long which is sunk into the wood. The other end is placed in a fork 4 inches long, 2 inches wide, and ½ inch thick. With the aid of this fork the frame is fastened to the base board by winged screws. But before this is done a small brass knob or ball is attached to the frame which in turn is attached, by means of tinfoil, to the rubbers. Each of the two rubbers consist of a board on which soft, thick felt is glued. A spring presses the rubbers lightly against the glass plate. In order to prevent the rubbers from falling out a short piece of wood is nailed to them so that it projects and catches against the frame. Each rubber is now covered with an amalgam consisting of two parts of mercury, one part of tin, and one part of zinc. This must be evenly distributed over the surface with the finger. If this will not adhere a little lard (fat) may be used.



Successive Stages In Building a 3-Inch Spark Static Machine. Top Group, Left to Right: Insulating the Iron Ring with Strips of Paper; The Rubbers Are Carefully Placed In the Frame; The Complete Static Machine; Placing the Plate on the Supports; Attaching the Flap of Silk to the Rubbers.
The Lower Three Views: With the Finger the Rubbers Are Carefully and thoroly Covered with Amalgam; Attaching the Comb to the Wooden Ring; The Brass Rod Is Attached to the Combs. The Design of This Static Machine Is Very Simple.

The conductor with the metal comb is made next. The former consists of a four or five inch hollow brass ball fastened to a glass support. The ball receives two holes thru which a brass rod is placed carrying the comb. The top of the ball also receives a hole which will later carry the ring as well as other pieces of apparatus for experiments. The metal points of the comb are attached to two rings of tin, each of which is fastened to a wooden ring. The metal rings are each 3 inches in diameter. The points consist of ordinary thumb tacks. When the rings are placed between the glass plate, the points should be at least *⅛ of an inch from the glass.* Under no circumstances should they touch the plate.

A flap of silk is glued to the rubber which

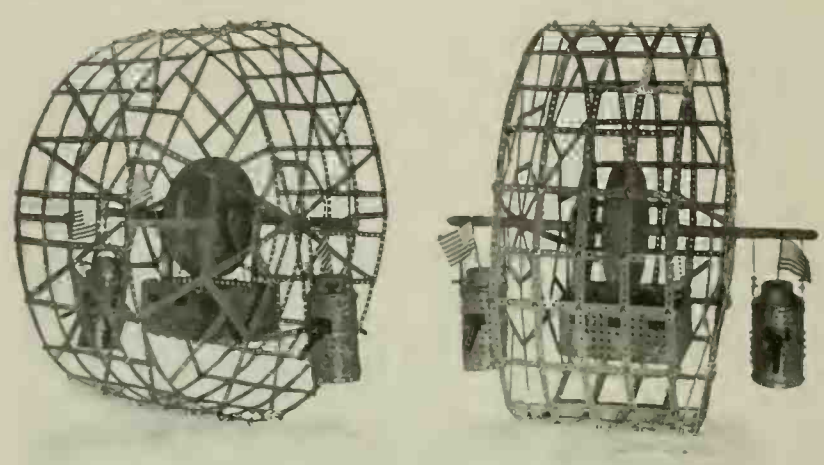
(*Continued on page 673*)

www.americanradiohistory.com

How I Built a Model Gyro-Electric Destroyer

By LeROY H. MAHONY

THE illustration represents a 25-inch model of Mr. Gernsback's "Gyro-Electric Destroyer." The entire machine with the exception of the Gyroscope and the driving motors was built of "Meccanno" parts.



Here Is a Fine Model of the "Gyro-Electric Destroyer." It Is Fitted with Electric Motors and All. It Was Constructed by the Author from "Meccano" parts. It Stands 25 Inches High and Weighs 15 Pounds.

I first constructed each side of the big wheel. To a bush wheel I bolted eight 12½ inch strips equally divided into angles of 45 degrees. I then bolted together seven 12½ inch strips overlapping two holes each. I bent this around the ends of the side braces and fastened it to them by means of angle brackets. In the same way I constructed the other side. I selected pairs of 5½ inch strips and bolted each pair together, overlapping them one hole. Three center treads, the same in circumference as the sides, were then made of seven more 12½ inch strips, overlapping two holes. It now remained to connect the two side and the center tread together by means of the preconstructed pairs of 5½ inch strips. One pair was bolted at right angles to each side brace and one equally placed between them. To preserve more stability, I connected the side braces with 3½ inch strips. This completed the main wheel.

The next part to consider was the engine cage. Three small plates fastened side by side with 3½ inch strips, composes each side, while each end comprises a large plate with the flanged edges flattened out. The sides and ends were fastened together by angle brackets. It is necessary to fasten inside the cage two motors (preferably electric), one to drive the gyroscope separately, and the other to propel the entire machine. As to the position in the cage for these motors—that is left to the discretion of the builder as his type and size of motors may differ from those of the writer. However, the motor driving the gyroscope must be placed in the center as the gyroscope must be driven in the center. The other motor must turn the axle of the wheel by means of chain and sprocket. On each side of the cage is fastened a 3½ inch strip so that the cage is suspended from the center axle.

I next turned my attention to the main axle and the gyroscope. The gyroscope I turned from two pieces of ⅞ inch wood 8 inches in diameter. To the side of it I secured a small sprocket for the driving chain. The gyroscope must run FREE of the main axle. The axle itself is 18 or 20 inches long and must be securely fastened to both sides of the wheel. The axle carries two armored cars (the construction of which I will explain further on), two sprockets, equidistant from the center, and also securely fastened to the main axle, the gyroscope, and the engine cage. A lever action that moves the gyroscope from left to right may be constructed also, at the discretion of the builder, because his material for the gyroscope will again undoubtedly differ. The lever action must be extended down into the engine cage.

The armored cars were lastly put together. For each car, eight large plates, with the flanged edges flattened out, were bent so as to form half a cylinder. Each pair was fastened together, overlapping one hole and making a complete cylinder. Then two of the cylinders were fastened, one on top of the other, with strips bolted to each side and extending over the top so that the car might hang from the main axle. Two inch axles (or better wooden models) were collared to the front and rear of the car to give the appearance of projecting guns. The model was now complete. The builder may elaborate on his model by cross-bracing with string, and so forth. The entire model weighs 15 pounds.

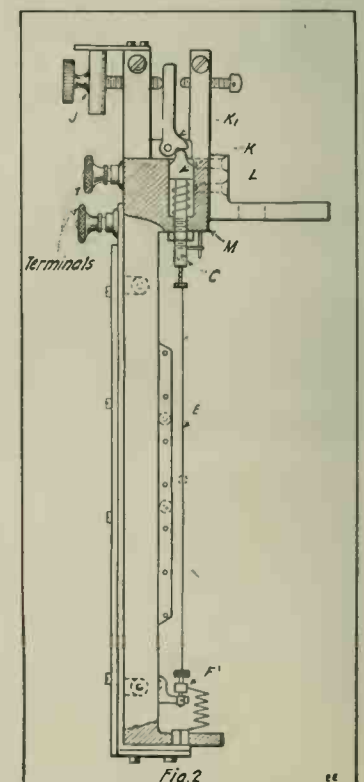
TEAK THE HARDEST OF ALL TIMBERS.

People familiar with different kinds of wood are aware that African teak is the hardest timber known to the mechanical industries. So indestructible is this teak wood that vessels built of it have lasted over one hundred years. The peculiarity of this wood is its hardness and great weight, causing extraordinary durability. Its weight varies from 42 to 52 pounds per cubic foot. It works easily considering its hardness, but the large quantity of silex in the substance require the tools to be extremely hard and even then they are subject to rapid wear. It also contains an oil which prevents nails driven into it from rusting.

EINTHOVEN GALV. STRING.

A commercial form of Einthoven galvanometer string is shown below. The case, E, contains the fine wire carrying the current to be measured. The figure shows schematically the detailed construction of the suspension for the fine wire E, which must be as fine as possible. Platinum, silver or aluminum can be used, but it was found that even a smaller diameter can be obtained by using quartz or glass fibers, these being platinized or silvered. The ends of the wire are soldered to T-shaped members, which are held by the set screws C and F at the ends. Adjusting the tension of the wire is a close operation and it is carried out by mounting the upper wire carrier upon a rod having the cam K at the upper end, the rod being normally pushed up by a spring L. The lever K^1, presses the rod down, this lever being operated by the micrometed screw J. With this arrangement a very fine adjustment of the wire is secured.

Contributed by SAMUEL COHEN.



Those Who Are Interested In Building an Einthoven String Galvanometer for Measuring and Recording Radio Signal Currents, as Described In the September and October Issues, Will Find This Detail of the String Suspension of Value.

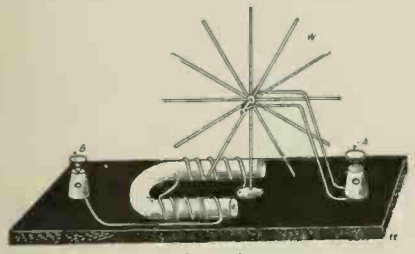
www.americanradiohistory.com

A Simple Study of Currents and Magnets

By Prof. E. H. JOHNSON, Dept. Physics, Kenyon College

(Conclusion)

IF now the wires J and K are joined to a direct current circuit of several volts, the wire, H, will rotate about the iron rod, D, which is now a magnet, and it will be found that the *direction of this motion will depend on the direction of the current in the wires.* It may take a little study to see how the action is in accordance with the principles previously defined, but it will be found to be no exception to the rule.



Barlow's Wheel
Fig. 6

Barlow's Wheel—the Simplest Electric Motor for Experimental Studies in Magnetism. The Spoked Metal Wheel Makes and Breaks Contact for the Field Magnet, by Passing Thru a Mercury Well.

Another method of producing motion by the interaction of a magnetic field and a current-bearing conductor is illustrated in Fig. 5. A heavy wire, A, is bent into the form shown with a hook at the upper end, B, from which is suspended loosely a straight wire, C. The lower end of this wire just touches in a pool of mercury, G, which is contained in a small hollow in the supporting base board. A horseshoe electromagnet, M, lies with one pole on each side of the drop of mercury. This magnet may be made from a rod of soft iron 6 inches long and ¼ inch in diameter, bent into the required form, and having its two limbs wound with several layers of insulated copper wire (about No. 20 or No. 24). One end of the wire from the magnet dips into the mercury and the upper end is joined to a binding post, E. When a direct current is past between the posts, F and E, the wire, C, will be moved sidewise so as to leave the mercury contact, and thus break the circuit at that point. Then, since the magnetic field about the wire, C, is gone, it will again swing back into the mercury, completing the circuit. Thus the process will go on much after the manner in which an electric bell continues ringing.

Again, one of the rules should be applied to see why the wire, C, moves just as it does, and how its motion is effected by the direction of the current.

Still another simple device illustrating the same principle is that known as *Barlow's wheel.* See Fig. 6. The electromagnet used in the preceding experiment may also be used here. The wire C (Fig. 5) is replaced by a carefully balanced, rimless wire wheel, W, which is mounted on two wire supports held by the post A. The wheel may be made of light copper wire (say No. 20) with spokes about 3 inches long, and the only difficulty will be to get it accurately balanced. It should have 10 or 12 spokes, which may be soldered to a heavier copper wire for a shaft to be laid across the slightly hooked ends of the supporting wires from the post, A. When the balancing is fair the wheel should turn as easily in one direction as the other, or remain at rest in any position. The mercury pool, with which the ends of the spokes make contact, is connected as before, by a wire to one end of the coils of the magnet, and their other end is joined to the other binding post, B, so that a current may pass thru the apparatus between A and B. In this case the action will be continuous with the proper current, and we have a fair type of *electromagnetic motor.* Again, our *right-hand rule* should be applied, considering the current as flowing up or down, as the case may be, in the spoke touching the mercury, to see if the rotation is what should be expected.

Other experimental devices such as these will readily suggest themselves to the experimenter, and he should learn to look at all such arrangements with that keen appreciation which sees not only the wires and mechanism, but which recognizes at once the *underlying principle* of its operation. When this habit has been formed and some of the information which it will inevitably bring, has been acquired, the entire field of electromagnetism, including dynamo-electric machinery in all of its phases, will open up with a surprising simplicity and consequently with endless interest.

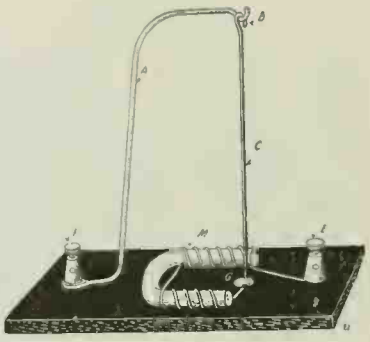
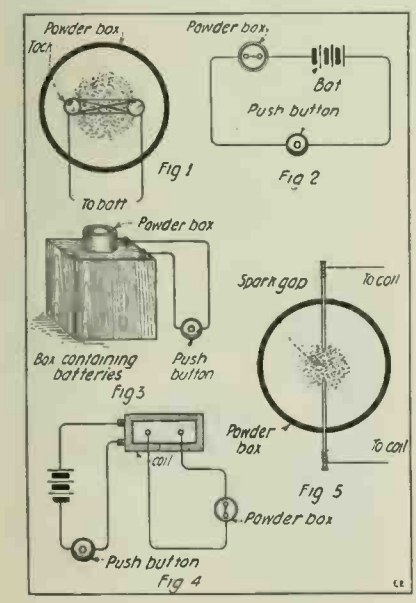


Fig 5

An Interesting Method of Producing Motion by the Interaction of a Magnetic Field and a Current-Carrying Conductor "C." The Suspended Wire "C" Dips into a Mercury Well "G," Completing the Field Coil Circuit. The Wire Swings Back and Forth Rapidly.



Several Useful Schemes in Igniting Flash-light Powder Electrically.

ELECTRIC FLASH-LIGHT IGNITER.

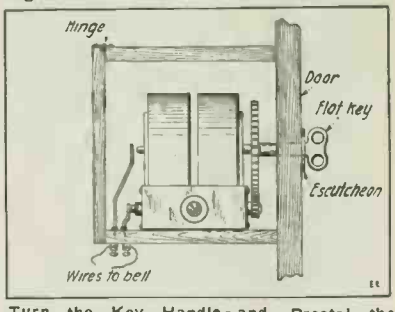
Having some difficulty when taking flash-light pictures with cartridges, with the fuse not igniting the powder or putting the subject on guard, frequently catching him with his eyes closed, and being badly burnt by the powder once, I constructed the apparatus shown in the accompanying sketch. It will run nicely on four dry cells. The principle is that when the batteries are short-circuited, the wire gets red hot.

The wires leading from the powder box are the kind known as bell or annunciator wire. Inside the box, the wire wound between the tacks is about No. 40 gage. When the box is constructed, place some powder in the box, press the push button, and off goes the powder. To make the apparatus portable, put the batteries in a box, and mount the powder box on top of this. In this way the operator may appear in the picture himself, if the wires are concealed behind furniture and his person. This also catches the subject off his guard, giving him a natural pose; it enables the operator to be at a safe distance from the powder. If a spark coil is procurable, it can be used instead of batteries by running a pin thru each side of the box making a spark gap, connecting up to the coil, and pressing the button. I have used this apparatus extensively and successfully myself.

Contributed by FRED C. DAVIS.

A "BATTERY-LESS" MAGNETO DOOR BELL.

A small magneto generator is placed in a box (properly stained and finished) on the back of the door. A turn of the knob rings the bell, which may be an ordinary vibrating bell. Best results are obtained by rewinding it to from 100 to 300 ohms. An old crank escutcheon plate from a magneto telephone may be placed on the front of the door. This device when properly made is neat in appearance and does away with all battery troubles.



Turn the Key Handle—and, Presto! the Generator Rings the Bell, Doing Away with Batteries.

Contributed by CHURCHILL GERRY.

www.americanradiohistory.com

Experiments in Radio-Activity

By IVAN CRAWFORD

PART 1—Ionization

RADIO-ACTIVITY is one of the greatest mysteries of today. The modern scientists, however, thru extensive experiments have succeeded in throwing considerable light upon the subject. The term radio-active is generally employed in referring to such elements as uranium, thorium, radium and their compounds which possess the property of emitting radiations capable of penetrating many substances opaque to ordinary light. These radiations also have the power of affecting photographic plates, ionizing the gas thru which they pass and causing fluorescence on certain substances placed in their vicinity. It is deemed unnecessary to enter further into the explanation of radio-activity as it has been well described by Mr. Jerome Marcus in previous issues of this magazine. It is the purpose of this series of articles to merely outline some experiments on this extremely interesting subject.

The most important property possest by the radiations of radio-active substances is the power of discharging electrified bodies. The theory has been formulated that this discharge is due to the production of positively and negatively charged carriers by the rays. These carriers, or ions as they have been termed, move with uniform velocity and the rate of production is proportional to the intensity of the radiation. The discharge of an electroscope placed in the vicinity of the radio-active substance furnishes an efficient means of measuring the intensity of the activity.

The construction of a super-sensitive electroscope suitable for making these measurements is clearly depicted in Fig. 1. The metal shell consists of a large oil can with the bottom and spout removed. Two round holes are cut opposite each other about half way up the side. As is clearly shown in the drawing the gold leaf is fastened to a brass strip which in turn is suspended from a sulphur bead. Into the other side of this bead is fastened a wire which passes thru the sulphur block at the top of the chamber. Another wire is then past thru the block and bent as shown. The sulphur block is made by pouring melted sulphur into the opening and allowing it to harden. In order to charge the electroscope the bent wire, A, is turned so that the lower portion makes a contact with the brass strip. A charged rod is then applied to the other end, B, until the desired charge is attained, when the wire may be turned back with the rod. The gold leaf is attached to the brass strip by means of a small drop of some adhesive. In order to observe the discharge, a small low power microscope having a scale on the eyepiece is used. This is mounted in one of the apertures by fastening a brass tube to the shell of sufficient size to allow the microscope to be easily adjusted. A similar brass tube with a ground glass window is mounted in the opposite aperture. This is to facilitate the illumination of the chamber. Using this instrument the rate of discharge may be accurately measured by noting the fall of the gold leaf on the scale. The substance to be measured is placed on a grounded plate and the electroscope placed over it. The radiations by means of their ionizing properties cause the charge of the gold leaf to be dissipated. In Fig. 2 is shown a photograph of such an instrument which was constructed by the author. Some very accurate measurements have been made using this instrument.

To determine the activity of an unknown substance the electroscope should first be charged until the gold leaf coincides with one of the markings on the scale. The time required for the leaf to pass over five divisions on the scale should then be noted with the electroscope empty. The reciprocal of this time is then the measure of the discharging current. The electroscope is then recharged to the same point and placed over the substance to be measured. The time required for the leaf to pass over the same five spaces is again noted. The difference between the reciprocals of these two time elements is then the measure of the discharging current due to the presence of ions produced by the radiations from the substance. Exprest mathematically the discharging current I, which is proportional to the radio-activity is proportional to $I\alpha (1/t'-1/t)$ where t' is the time of discharge in the presence of the substance, and t is the time when empty. Thus by comparing times the radio-activity of equal masses of various substances can be measured. Uranium oxid is taken as a unity and uranium nitrate, thorium nitrate and uranyl chloride were compared with this. The results are shown in the following table:

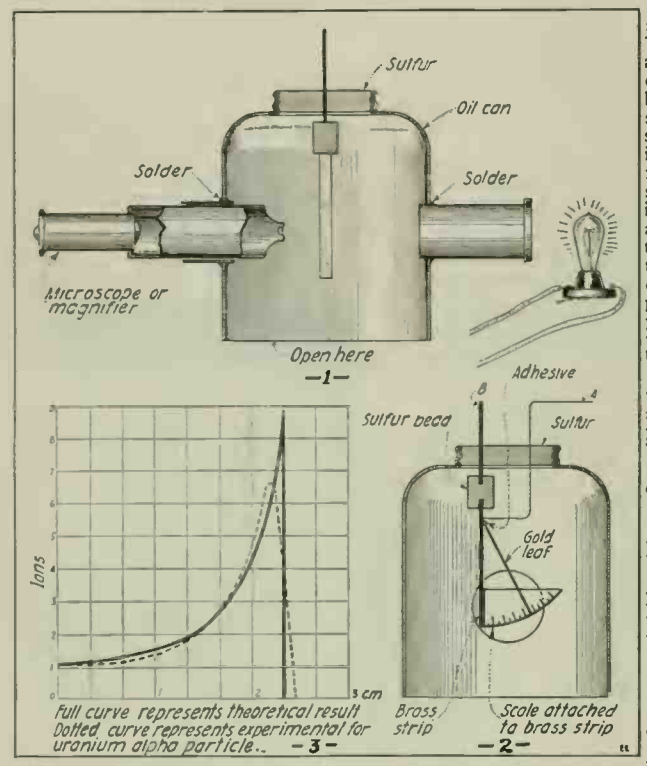
Substance.	Formula.	Time.	Relative activity.
Empty.....		412 sec.	
Uranium oxide.....	UO_3	26	1.00
Uranium nitrate....	$UO_2(NO_3)_2.6H_2O$	86	.26
Uranyl chloride.....	UCl_4	41	.61
Thorium nitrate.....	$TH(NO_3)_4.12H_2O$	63	.38

It will readily be seen that the activity of a substance is proportional to the amount of uranium or thorium it contains. There are other considerations, however, which affect the experimental results, such as the state of the substance, whether powdered or in lumps. Every electroscope also is different, and all quantitative experiments should be conducted using the same instrument.

It will be found that the distance between the substance and the gold leaf affects the rate of discharge. For uranium compounds the most effective distance is about 3 c.m., while for thorium compounds it is about 5 c.m. Ionization by radio-active rays is by no means uniform along the path of the rays. In Fig. 3 is shown the ionization caused by a sheaf of parallel rays as determined by Geiger. The range is laid out horizontally in c.m., the number of ions are laid out vertically. It will be seen from this graph that when the alpha particle begins to lose some of its enormous speed it becomes a more effective ionizer; near the end of its path, however, its power suddenly decreases.

The experimenter will find innumerable other applications for this electroscope to

(*Continued on page 673*)



The Most Important Property Possest by the Radiations of Radio-Active Substances Is the Power of Discharging Electrified Bodies. Hence, the Discharge of an Electroscope Placed In the Vicinity of the Radio-Active Substance, Furnishes an Efficient Means of Measuring the Intensity of the Activity.

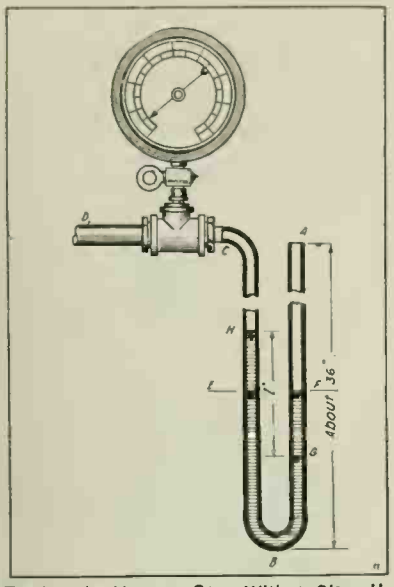


Finished Super-Sensitive Electroscope for the Measurement of Radio-Activity. It Is Made from an Oil Can.

www.americanradiohistory.com

TESTING THE VACUUM GAGE.

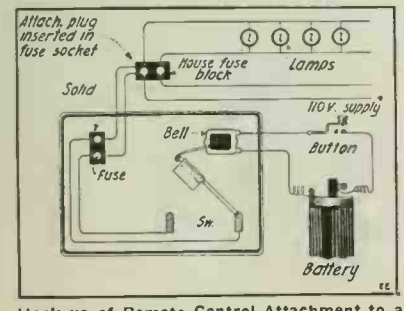
The experimenter often wishes to test a vacuum gage. The best way to test such a gage is to compare it with a glass U-tube mercury gage as indicated in the



Testing the Vacuum Gage With a Glass U-tube Mercury Gage. The Latter Is a Common Instrument Used By All Engineers and Can Be Made Very Easily. The Atmospheric Pressure Acts on the Mercury In the Open Tube "A."

sketch. The bent tube ABC, having about 3/8-inch bore, is connected by suitable fittings to the pipe or nipple D, and the latter is connected with an air pump or condenser. The gage to be tested is placed on a tee-connection. The U-tube should be about 36" over all and about half filled with mercury. When there is a partial vacuum made at D, the atmospheric pressure acting on the surface of the mercury in the open tube AB, being greater than the pressure acting on the surface of the mercury in the tube CB, the mercury at the original level EF will fall in AB, as to G, and rise in CB, as to H, and the difference of level between H and G as indicated by the dimension "*l*," measured in inches, will be the *inches of vacuum* which the vacuum gage should indicate. While most manufacturers of vacuum gages are equipt with a U-tube mercury gage, they generally make comparisons with another gage, known to be correct with the U-tube gage. For testing a vacuum gage at a plant not equipt with a mercury gage, the usual practise is to compare the gage to be tested with one considered to be correct.

Contributed by
PETER J. M. CLUTE.



Hook-up of Remote Control Attachment to a Two-wire Lighting Circuit. The Control Circuit Wires May Be Ordinary Bell Wire as This Is a Battery Circuit Only.

REMOTE CONTROL SWITCH FOR LIGHTING CIRCUITS.

After obtaining the necessary material listed below, remove the handle from the knife switch and substitute a weight made from 2" length of conduit pipe and 5/16" x 2½" stove bolt. The head of stove bolt is filed flat on one side so as to be properly engaged by the trip arm. The bolt is placed in one side of pipe, and pipe filled with melted lead and allowed to cool off. The threaded end of bolt is then inserted thru hole (in insulating bar across knife switch) formerly occupied by screw holding handle. If properly placed this weight does not come in contact with either of the switch blades.

Now place the fuse block in upper left-hand corner of the iron box as shown on sketch, then place knife switch in bottom, the one side of base being against back of iron box and the whole switch so mounted as to allow weight to swing down and close switch without hitting side of box. The rubber bumper is then placed on bottom of box either with small stove-bolt counter-sunk in the rubber or with a small wood screw from the under side.

The object of the bumper is to prevent the weight from snapping off the insulating cross piece of switch when switch drops.

The casting on bell for holding gong should be removed with a hack-saw just beyond the screw hole, and the ball hammer can be cut off with a pair of cutting pliers, leaving the hammer arm intact.

In placing the bell it will probably be necessary to build it out from the back of box so that the trip arm centers over weight on switch. This building out should be done with either a piece of fibre, porcelain or iron washers. No wood or combustible material should be used. Bend trip arm as shown in sketch, so as to engage the filed side of stove-bolt-head which protrudes thru the weight.

All mountings should be made with stove-bolts, drilling holes in iron box where necessary. If box is thick enough to allow threading machine screws may be used.

The rubber bushing to protect bell wires can be inserted in the box at any convenient place and a narrow piece of linen tape or wire twisted tightly around the inside will serve to hold it intact.

Place the attachment plug on one end of the lamp cord, knock out one of the punchings in the iron box and place the B. X. connector, insert the cord thru this and wind the cord with tape on the inner side of the connector so that the clamping device can be tightened thereby holding lamp cord, preventing pull on the connections at fuse block and at the same time serving as a bushing for the cord. Connect other end of cord to fuse block as shown.

Make all connections as shown using the No. 14 wire for the lighting circuit and ordinary bell wire for battery circuit.

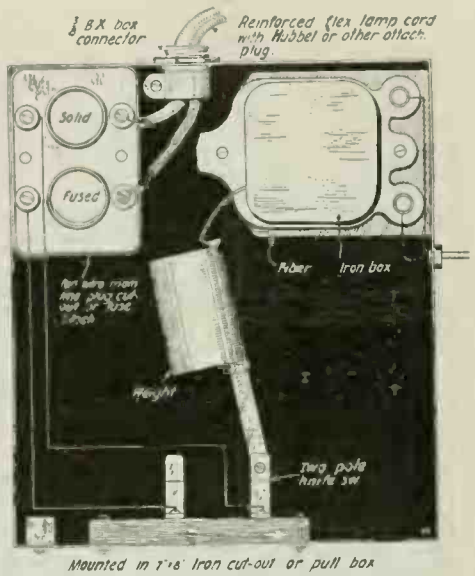
Only one blade of the knife switch carries current for the ordinary two-wire lighting circuit. For the three-wire circuit the two blades are used and an additional lamp cord and attachment plug are required.

Installation: This apparatus should be mounted on wall close to house fuse box and not more than 6 or 6½ ft. from floor.

To connect to an installation one fuse is removed from the house fuse box and the attachment plug inserted in its place, the fuse can then be placed in the "fuse" socket of the apparatus. The bell circuit can easily be run and the button and batteries installed at any convenient point.

Operation: By closing battery circuit, the bell magnets become energized, which lifts the hammer or trip arm and disengages the weight, allowing switch to drop and close lighting circuit.

To reset and cut out lights; open door of iron box and lift weight until engaged by



Construction of "Remote Control" Switch Which Can Be Made With a Buzzer or Bell Movement to Trip the Weighted Knife Switch Blade.

hammer arm of bell, then close the door.

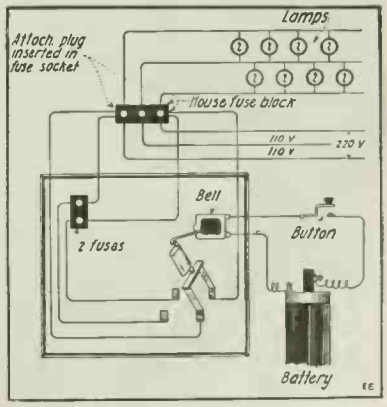
Keep pivoted and contact clips of knife switch lubricated with vaseline. This switch can be used for distant cut-in control or in conjunction with burglar or fire alarm systems, cutting in the lights when alarm operates, and doing away with the necessity of running heavy lighting wires.

Where the law requires it, a ground wire can be attached to the iron box with a short stove-bolt, and the box grounded to the electric conduit system.

The following material is required to make this apparatus:

One 7" x 8" iron cut-out or switch box.
One two-wire main line plug fuse cut-out block.
Two dry batteries
One two-pole single-throw knife switch.
One iron box bell.
One push button.
One ½" B. X. box connector.
One rubber lamp socket bushing.
One attachment plug.
One 3/16" x 2½" stove bolt.
One rubber knob from old door bumper.
One 2-inch length of 1" conduit pipe.
Two ft. No. 14 B. S. gage double-braided wire.
Two ft. reinforced flexible lamp cord.
Proper quantity of bell wire.

Contributed by E. C. O'DONNELL.



How the Remote Control Switch Is Connected Up to a Double-pole Knife Switch For Controlling Lamps on a Three-wire System.

www.americanradiohistory.com

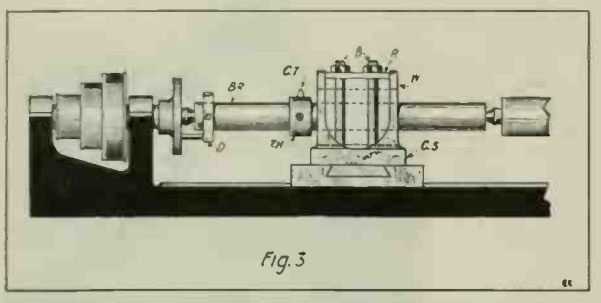
Experimental Mechanics

By SAMUEL D. COHEN

LESSON IX

Boring and Drilling.

THAT the lathe can be used with success for drilling purposes is mentioned in one of the earlier lessons of this course. The subject will be further considered in the present lesson, and several useful kinks regarding drilling in the lathe will be given. Whenever it is desired to make a hole of general size in some material, it is usually done by the use of a drill of the desired diameter, said hole being made in one operation. There is still another method of making a hole, and that is by *boring*. It can be done by a single pointed tool cutting into the material in successive cuts, which gradually enlarges the opening until the desired diameter is obtained.



Boring Out a Casting in the Lathe by Means of a Boring Bar "BR." The Casting Is Secured by Bolts "B" to the Saddle "CS."

Practically all small holes are always drilled, while large ones are bored. In order to drill a large hole it requires considerable driving power, also the removal of a considerable amount of metal. However, if the method of boring is utilized, a rough hole may be *cored* thru the casting when the latter is made in the foundry, and this can be enlarged later by the use of the boring tool. If the work is not made of cast material, it will be necessary to drill a hole large enough to permit the boring tool to make its first cut.

In drilling small holes, say up to one inch in diameter, it will be found that twist drills give most favorable results, as they are dependable for producing an accurate and straight hole. It is usual, in practise, to fasten the drill in a self-centering chuck, as explained previously, and to feed the work up against the drill by means of the mandrel of the tail stock in the lathe. The first step before attempting to drill is to accurately mark the spot where the hole is desired, making a heavy center-prod or mark, so as to guide the point of the drill at the start. To drill large holes, a circle the size of the hole should be marked with a pair of compasses, first chalking the surface, and four center impressions should be made at opposite points on the line. These are necessary to act as guides should the line get effaced. A start is then made, but before the point of the drill has fully entered the metal an examination should be made to see that it is cutting truly within the circle marked out. If so, the work may be proceeded with.

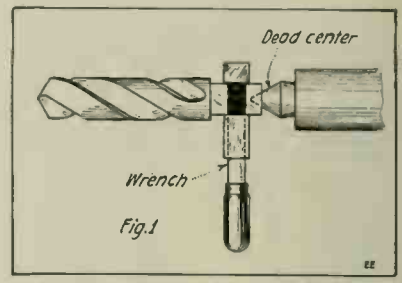
Should the drill by chance happen to cut slightly to one side, the fault can be remedied by cutting a narrow groove at one side of the hole. This may be done with a narrow-pointed diamond chisel. The groove should be made at the side toward which the hole requires to be corrected. Here the drill may again be applied, the effect of the newly made groove being to draw the drill toward the center of the circle. The drill should then be turned several times and the hole again examined. If necessary, the drawing process can again be repeated until the hole is exactly central. The reader, of courst, fully understands that this drawing process should be done before the full diameter of the drill commences to cut, as the grooving plan can have no further effect in drawing over the hole, after the full diameter of the drill enters the hole.

At certain times it happens that the relative positions of the parts are reversed. Thus the work to be drilled is held in the chuck, the drill being fed up to the work. Many times it proves convenient to first drill a small hole, then a larger size, and lastly use the full size drill.

If the work is held in the *live* chuck, the drill should be fed by means of the tail-stock center, and held firmly thereto. The drill can be held either in a drill chuck fitted with a mandrel for the dead center spindle, as shown in Fig. 10, Lesson 6, or by setting the center hole of the drill onto the dead center, its shank being held with a wrench in order to prevent it from turning, see Fig. 1. When the hole is made in this manner it is necessary to start the drill centrally. An accurate starting point is obtained by the use of the cutting tool placed in the slide rest. This method will insure a proper drilling point.

Boring is chiefly used when it is desired to make a large hole. However, at times it is simpler and easier to bore a small hole of proper diameter and accuracy than it is to drill it. But care must be exercised to see that there is a proper clearance at the lower part of the cutting tool, as indicated in A, Fig. 2. If the tool is improperly set so that the lower part scrapes against the side of the work, as shown in B, Fig. 2, its proper functioning will then be interfered with. The tool will not only be prevented from cutting into the metal, but due to the rubbing action against the metal, it will be heated and caused to lose its temper, thus destroying the cutting qualities of the tool, besides making an inaccurate hole.

It is advisable to make the first cut a fairly heavy one, in order that the hole may be cleaned up perfectly true around its circumference. Thercafter several lighter cuts may be made, until the diameter is brought to the proper size. The *inside caliper* should be used in this work to ascertain the diameter. Precaution should be taken to set the slide-rest perfectly true so as to insure a parallel hole being bored. If the diameter is found to alter, (should it taper, for example), the slide rest can be changed accordingly. By the use of a self-acting feed on the slide rest, the hole should be perfectly parallel, provided the head stock and lathe bed are set true, the position of the slide rest not at all affecting the work in this case.

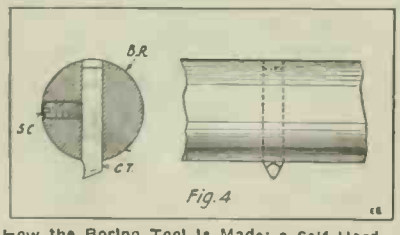


Holding a Twist Drill in the Lathe by Means of a Monkey Wrench. The Back of the Drill Is Placed on the Tail-stock Center.

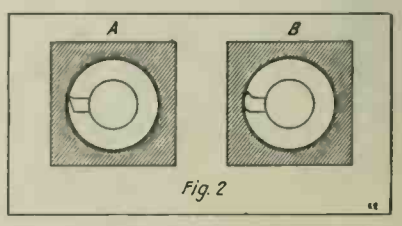
If it is desired to bore certain work which is too large to be chucked on the face-plate or chuck of the *live* spindle, it is practical to secure the work to the saddle of the lathe, as shown in Fig. 3. This is done by supporting the boring rod between the live and dead centers, the boring rod carrying the cutting tool. Engine and pump cylinders, field magnets for dynamos and motors, also bearings of engine bed plates are examples of work which can be done in this manner. It is essential to have a lathe with a saddle, actuated by a self-acting feed motion, unless a complicated boring bar fitted with its own screw feed motion is used. Fig. 3 shows a cylinder W of an engine, which is secured to the lathe saddle, C. S. This is done by clamping the cylinder with two bars, each having two holes, the distance between which should be greater than the diameter of the work to be secured. The bars, R, R, are laid across the top of the work and clamped down by means of two bolts, B. These heads fit into the slides of the lathe saddle. The cutting tool, C. T., is held on the boring rod, B. R. It is revolved by the *live* center while the cylinder is slowly carried along the lathe bed toward the live headstock by the self-acting feed motion applied to the saddle.

Before attempting to bore into the work, it is advisable to see that the work is firmly

(*Continued on page* 670)



How the Boring Tool Is Made: a Self-Hardening Tool Steel Point Is Fitted Slidably In a Hole In the Boring Bar. The Point May Be of Square or Round Stock.



Proper Clearance on Boring Tool (Left) and Improperly Ground Tool at Right.

www.americanradiohistory.com

Experimental Chemistry

By ALBERT W. WILSDON

Thirty-second Lesson

PHOSPHOROUS: History.

PHOSPHOROUS was discovered by Brandt, an alchemist, in 1669 at Hamburg. He gave it the name *Phosphor* [light bearer]. Gahn, in 1769, found it to be a constituent of boneash, and about 1775 Scheele first publisht his method

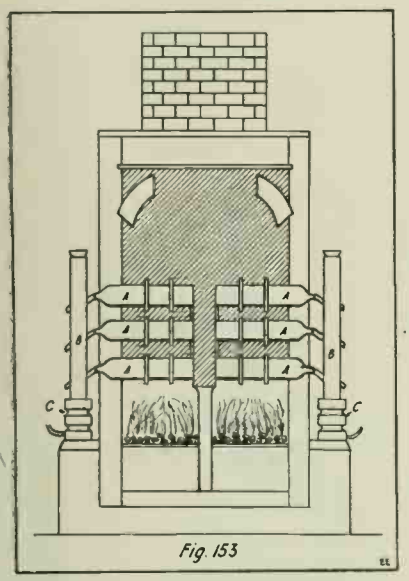


Fig. 153

In the Preparation of Phosphorous Great Care is Taken Not to Have the Hot Phosphorous in Contact with the Air, and the Retorts Are Arranged so That the Phosphorous Runs Into Cold Water.

of preparation from this source. Liebig in 1840 used phosfates as a fertilizer for plants, while Romer [about 1833] first applied it to matches, thus revolutionizing the means of obtaining fire and light.

Occurrence.

It never is found in the free state, but chiefly as calcium phosfate [$Ca_3[PO_4]_2$], the principal constituent of bones. This occurs in certain minerals as *Apatit* [$3Ca_3[PO_4]_2$] and *Phosforite* [$Ca_3[PO_4]_2$]. The latter being also known as *Phosfate Rock*, being extensively used for fertilizing purposes.

Phosphorous is always found in plant and animal tissues, in the soil, and in sea water.

Preparation and Manufacture.

It is obtained mainly from bones of vertebrate animals, which usually contain from 55 to 60% of calcium phosfate, the hard parts of invertebrates being mostly Calcium Carbonat, $CaCO_3$. These bones are first burned or else distilled. In either case the ash is the same, but in the latter the carbon is retained as boneblack, which in the former gives rise to carbon dioxid. The volatile substances driven off are ammonia and other nitrogeneous products, such as water, carbon dioxid, etc. The ash, mostly Calcium Phosfate with a little calcium carbonat, is reduced and phosphorous obtained by three steps.

First.—It is treated with Sulfuric Acid, which changes it to a soluble phosfate $H_4Ca[PO_4]_2$.

$$Ca_3[PO_4]_2 + 2H_2SO_4 = H_4Ca[PO_4]_2 + 2CaSO_4$$

It might be expected that the Sulfuric Acid would change the phosfate salt into phosforic acid, but the Sulfuric acid used is not very strong and the reaction goes but halfway, producing an acid salt. It, however, changes the insoluble phosfate to a soluble one and precipitates the Calcium Sulfate, which is then separated by filtration or settling.

Second.—The liquid is next evaporated, and the solid residue from the evaporation is strongly heated, a process which breaks it up into Calcium Metaphosfate [$Ca[PO_3]_2$].

$$H_4Ca[PO_4]_2 = Ca[PO_3]_2 + 2H_2O$$

Third.—The reducing agent, carbon, is next added and thoroly mixed, and heat is again applied. When two-thirds of the Phosphorous distills over, the remainder again forms Calcium Phosfate.

$$3Ca[PO_3]_2 + 10C = Ca_3[PO_4]_2 + 10CO + 4P$$

To obtain the whole of the Phosphorous, Silica [SiO_2] in the form of sand is introduced, and the following reaction takes place:

$$2Ca[PO_3]_2 + 2SiO_2 + 10C = 2CaSiO_3 + 10CO + 4P$$

Great care is taken not to have the hot Phosphorous in contact with air, and retorts are arranged so that the Phosphorous runs into cold water. See Fig. 153. The Phosphorous must be either redistilled or prest thru chamois skin to get rid of carbon particles, etc. It is then run into small moulds of copper or glass.

The manufacturing process is detrimental to the health of the workmen. Some of the fumes have to be inhaled, and the breath at night is often luminous. The element attacks the teeth and jawbones, especially the lower jaw, which is sometimes entirely eaten away thru failure to cleanse the teeth.

The electrical process has practically replaced the old method. In an upright pear-shaped furnace, an intimate mixture of Carbon, phosfate, and flux is heated by means of carbon electrodes in the electric furnace, as shown in Fig. 154. The mixture is fed in thru the hopper H, the carbon electrodes entering at GG. The phosphorous vapors pass off above to a condenser, being condensed under water, while the slag is tapt off below at C.

$$2Ca[PO_3]_2 + 2SiO_2 + 10C = 2CaSiO_3 + 10CO + 4P$$

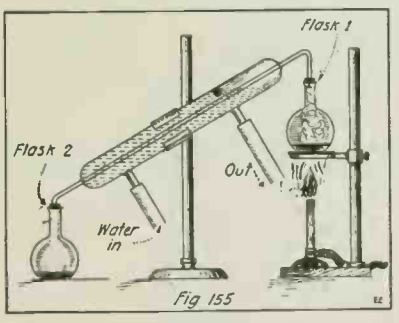


Fig. 155

An Interesting Experiment in Which the Phosphorous from Match-heads Is Extracted by Means of Distillation.

Physical Properties.

1. It is found in several *allotropic* forms, the most important being the yellow and the red varieties.

2. *Yellow phosphorous* is a colorless, transparent to translucent, wax-like solid. At ordinary temperatures it is sufficiently soft to be cut with a knife, but at lower temperatures it becomes more brittle.

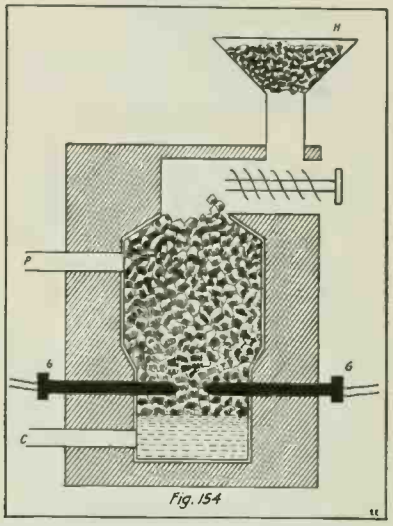


Fig. 154

Preparation of Phosphorous in the Electric Furnace. A Mixture of Carbon, Phosfate and Flux Is Heated by the Passage of the Electric Current. Electrodes at G-G. The Phosphorous Vapors Pass Off Above to a Condenser, Being Condensed Under Water, While the Slag Is Tapt Off Below at C.

3. It burns the flesh when handled out of water, and these burns are slow to heal, on account of the poison absorbed. For this reason this element should always be manipulated with a pair of forceps.

4. It is insoluble in water. It is soluble in 350 parts of absolute alcohol at 15° C, and in 240 parts of boiling absolute alcohol. It is soluble in 85 parts of absolute ether, in 25 parts chloroform, and in about 50 parts of any fatty oil. Carbon-disulfid is probably its best solvent, dissolving from 18 to 20 times its weight without losing its fluidity. All solutions of phosphorous in carbon disulfid should be preserved with the greatest care. When spilled or otherwise exposed, the solvent rapidly evaporates, leaving the phosphorous in such a finely divided condition that *it inflames spontaneously*.

5. It possesses a garlic odor, and is very poisonous. This odor somewhat resembles *Ozone*.

6. The phosphorescence, visible in the dark, when exposed to the air appears to be due to the slow formation and spontaneous combustion of phosphin.

7. Phosphorous is a very inflammable element, igniting spontaneously in air at 50° C. For this reason it is kept and cut under water. Phosphorous, when kept under water and exposed to the light, undergoes slow oxidation, becoming covered first with a white, opaque film, which slowly turns red.

(*Continued on page* 666)

www.americanradiohistory.com

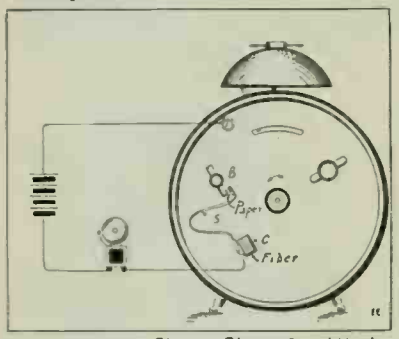


This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 is awarded; for the second best idea a $2.00 prize, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

FIRST PRIZE, $3.00

SIMPLE ELECTRICAL ALARM CLOCK.

Herewith are submitted the details for an electrical alarm clock which I believe is the simplest one I have seen publisht in



An Easily Made Circuit Closer for Attachment to Any Alarm Clock. The Bell Will Ring Until Shut Off.

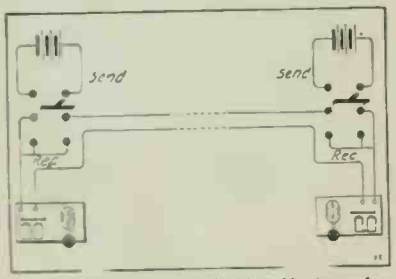
your valuable magazine. A brass spring (s) is supported on an insulating block (c). A piece of blotting paper is glued on to the end of the strip to insulate it from the alarm-winder. The operation of the alarm can be easily understood. When the clock alarm rings, winder key revolves which releases the spring. When the spring is released it strikes against the side of the clock, thus closing the circuit.

Contributed by CHAS. WALLER.

UNIQUE "HOOK-UP" FOR TELEGRAPH SETS.

Herewith is a hook-up used by myself and friend on our telegraph sets, the main object being to eliminate closed circuit cells and to use dry cells. When one fellow wishes to call the other he opens his key and throws his switch over to "send." When receiving, he throws switch over to "receive" and closes his key. The apparatus used comprises two sets, *i. e.*, sounders and keys; two D. P. D. T. switches, 2 sets dry cells (3 each). Our system works fine and the extra-switch throwing is worth the battery saving.

Contributed by G. E. MEARS.

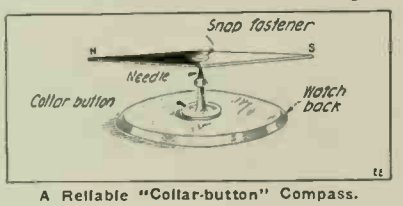


Simple and Effective Switching Hook-up for Two-Way Telegraph System.

SECOND PRIZE. $2.00

A "COLLAR BUTTON" COMPASS.

This compass is very easy to construct, and can be made with a needle, collar button, snap fastener, and a piece of thin steel, cut in the shape of a compass needle. After having cut the needle to the desired shape and size, punch a hole in the center. Over this solder the bottom part of a snap fastener. This completes the needle. Next, force a steel needle up thru the collar button so that it protrudes out of the top about one-sixteenth of an inch. Solder it firmly from the under side. The needle is magnetized by rubbing it over a magnet. When it is thoroly magnetized, place it on the needle point and adjust it so that it will balance and revolve freely. It can be mounted either in or out of a case as desired. I find that an old dollar watch *back* makes a good



A Reliable "Collar-button" Compass.

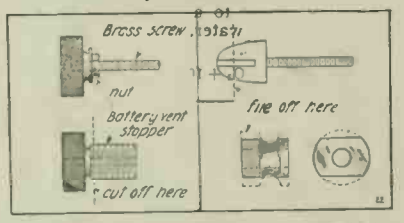
base as it does not affect the needle. This compass is very handy for performing experiments.

Contributed by J. H. ENGLAND.

KNOBS FOR ROTARY SWITCHES.

Knobs for rotary switches may be easily made from the vent stoppers on old storage batteries. This is done by cutting the part off which has threads on it and drilling a hole large enough to put a brass bolt thru, as shown in sketch. (Vent stoppers may be purchased from garages). See cut below.

Contributed by MARION HENSEL.



Left:—Old Storage Cell Vent Stoppers Make Good Switch Knobs. Right:—Discarded Dry Cell Terminals Used as Switch Points.

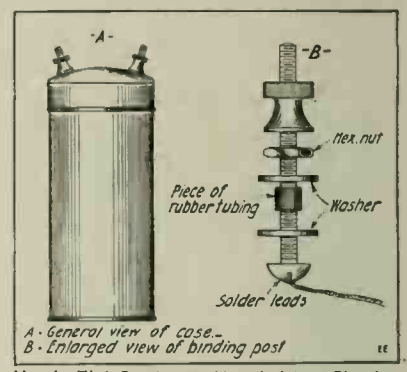
The negative binding posts on dry cells make good contact points for rotary switches when filed down as shown above. Remove them with the pliers while the nuts are still on. Take one of these nuts and file to opposite sides flat; see sketch. Then screw the screw post in it, placing both in a vise. Then the head can easily be filed down without injuring the threads.

Contributed by P. B. KINGSLEY.

THIRD PRIZE, $1.00

FIXT CONDENSER IN A SHAVING STICK TUBE.

An efficient and neat fixt condenser can be made from a nickel-plated shaving stick



Handy Fixt Condenser Mounted in a Shaving Stick Tube. It Can Be Embedded in Paraffin Wax.

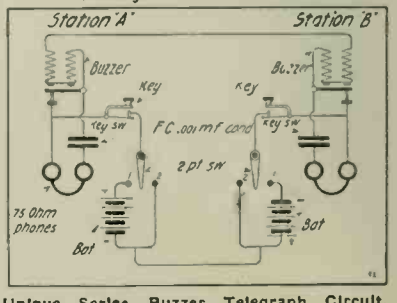
can as a container. First cut some tinfoil to about 2 foot lengths and 1-3/4 inches wide, separated by 2-1/4 inch width paraffined paper. This can be made as large as desired, and by heavy pressure a large condenser can be placed in the tube. Solder all lugs and make connections with flexible conductor to binding posts. Bore holes in the cover and make washers as in (B). Fill the case with molten paraffin wax.

Contributed by E. S. HAGEMANN.

A SERIES BUZZER TELEGRAPH SET.

Here is an efficient series buzzer telegraph system. When the set is not in use put switches on No. 2, then when you wish to call up your friend put your switch on No. 1, disconnect the key switch and start sending. As soon as your friend hears your signal, he puts his switch on No. 1, thus increasing the battery strength. Remember to reverse the batteries; *i. e.*, if it is *positive* at your switch on one end, make it *negative* at the other station.

Contributed by PRESCOTT OVERTON.

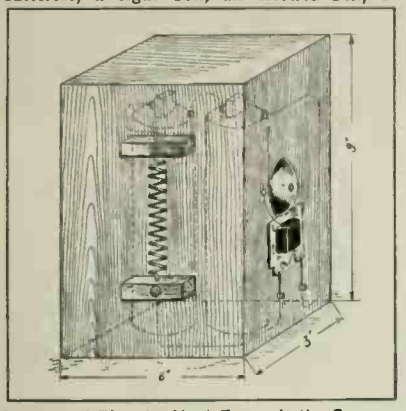


Unique Series Buzzer Telegraph Circuit. Both Buzzers Work When a Station "Sends."

www.americanradiohistory.com

AN ELECTRIC FIRE DETECTOR.

Herewith is a plan of a fire detector which I made myself. It consists of two batteries, a cigar box, an electric bell, a



In Case of Fire the Heat Expands the Copper Wire Spiral, Causing It to Touch the Lower Contact Block, Thus Ringing the Bell.

piece of bare copper wire made into a spiral spring, two blocks of wood, four screws, and two binding posts. Normally the wire made into a spring does not touch the lower contact block, but when fire breaks out it expands the wire spiral and completes the contact, causing the bell to ring.

Contributed by JOSEPH WOHLPART.

SPARK PLUG TESTER MADE FROM SPARE PLUG.

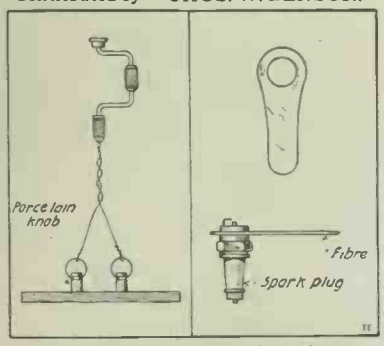
Most autoists carry a spare spark plug in their tool chests which can be made to serve as a spark plug tester without destroying its usefulness.

The only thing necessary is to cut a piece of fiber or heavy cardboard to the shape shown in the illustration. The hole in the end is made large enough to pass the threaded end of the plug and serves as a holder.

To test the plug in the engine, hold the spare plug, sparking points up, by means of the fiber strip. Touch the post on the plug to the engine cylinder and bring the thread end of the plug in the strip against the binding posts of the plug in the engine.

A small spark or none at all will indicate a broken porcelain or carboned and short circuited plug. A heavy spark will show that the points of the plug in the engine are too far apart. In cases of emergency any means may be employed that will hold the test plug without giving the driver a shock.

Contributed by THOS. W. BENSON.



At Left—Twisting Cables With a Bit Brace. At Right—Using the Spare Spark Plug as a "Test" Plug for the Auto Engine.

TWISTING CABLES IN THE SHOP.

In looking over your October, 1916, issue under the head of "How-to-make-it," I noticed a scheme for twisting telephone wires, contributed by Mr. Leach. While this is a good method, I would like to suggest one that will not ruffle or twist the insulation of the individual wires as other methods do.

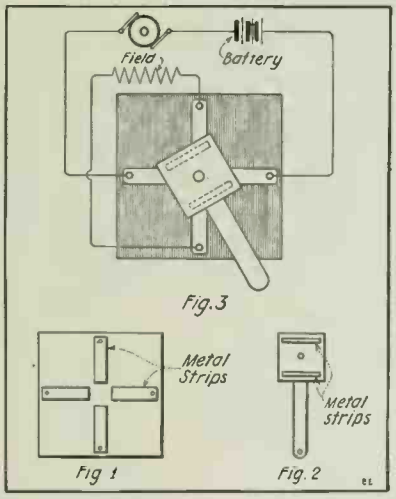
Porcelain knobs may be used as swivels. Attach two knobs to shop wall, do not tighten up screws, knobs should turn freely. Attach No. 14 wire loops to receive ends of insulated wires. Have wires same length; turn brace five or six times, pulling on it to take up slack and keep knobs from turning. Now slack off slightly on brace and knobs will spin, thus relieving the twist in each individual wire. Almost any length of wire can be handled in this manner, equalling the factory product.

Contributed by J. ESHLIMAN.

A REVERSING SWITCH FOR SMALL MOTORS AND TOYS.

A small but thoroly effective reversing switch for small battery motors and other apparatus can be made from scraps found about most any workshop.

First procure a fiber base about 1½" square and ⅛" thick. Next cut four strips, each ½" long and ¼" wide out of a piece of brass about 1/16" thick. Then bore a hole in one end of each strip and fasten it to the base by means of small wood-screws as shown in Fig. 1.



A Handy Reversing Switch for Battery Motors, Toy Railway Cars, Locomotives, Etc. Throw It to Either Side to Reverse the Motor.

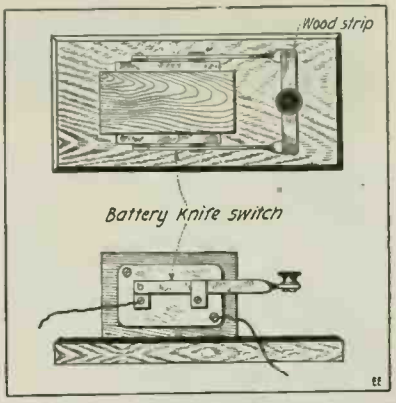
Then take another piece of fiber about ¾" square and ⅛" thick and fasten two metal strips to it as shown in Fig. 2. A handle may then be made and soldered to one of the strips. (In constructing this reverser, be sure and do not short-circuit any of the strips because it will not work.)

A hole should then be bored exactly in the center of the small piece of fiber and fastened to the main base by means of a wood or machine screw. The complete reverser and connections are shown in Fig. 3. If desired a metal base and body can be made to enclose the working parts. If so constructed a slot should be cut in the body for the extending handle so the switch can be easily operated.

Contributed by WALTER SELLENEIT.

HOW TO MAKE A S.T.D.P. SWITCH OUT OF TWO S.P. KNIFE SWITCHES.

Nail a block of wood on to a base of proper size. Next procure two S. P. battery knife switches. It must be made certain that one opens to the right and the other to the left. The reason for this can be seen when they are mounted. If they are the same, just take off the knife and terminals and remount them in reverse or-



An Effective Double-Pole Single-Throw Knife Switch Constructed from Two S. P. S. T. Knife Switches.

der. Then get a thin strip of wood or fiber to fit across the ends of the knives. This can be fastened on with small stove-bolts. In the center of the strip bolt a small porcelain knob.

Contributed by HENRY RHEIMS.

DRAFTING HINTS.

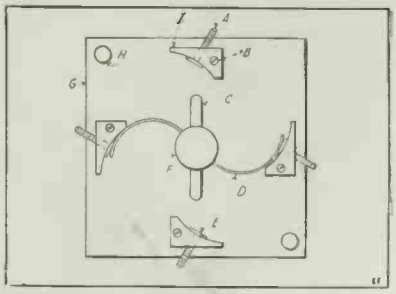
Tracings may be very readily cleaned and pencil marks removed by the use of benzine, applied with a cotton swab. It may be rubbed freely over the surface without fear of injury to the lines drawn in ink, or even water colors, but pencil marks and dirt will quickly disappear. The benzine evaporates almost immediately, leaving the tracing unharmed. The surface, however, will be somewhat softened, and should be rubbed down with a little powdered talc or chalk before drawing more ink lines.

Always sprinkle chalk or talc on surface (dull side) of cloth, rub in with fingers, and wipe off before starting to draw ink lines.

SIMPLE HOME-MADE SNAP SWITCH.

This is a very durable but simply constructed snap switch. (A) is the screw from an old dry cell carbon, the head (E) being filed flat and inserted in a small block of wood (I) drilled as shown. The block (I) is fastened to wood base (G) with screw (B). A strip of spring bronze (D) inserted thru the slot in spindle (F) assures an excellent contact. (C) is a pin for handle and (H) the supporting screw holes.

The spindle is held in the base by a small rivet at the bottom. This can be



Here's a Way to Make Home-Made Snap Switches. It Works Very Well, Too.

used either as a single or double-pole switch.

Contributed by HENRY O. WUELFING.

www.americanradiohistory.com



SPIRIT LAMP FROM FAN GREASE-CUP.

A novel but efficient spirit lamp can be made from a fan grease-cup when cleaned and filled with alcohol and a wick inserted.



Simply Fill a Fan Grease Cup with Wood Alcohol, Insert a Wick in the Hole, and You Have a Serviceable Little Spirit Lamp for Light Soldering

It will burn for one hour. This lamp can be used for numerous purposes, such as removing enamel from enameled wires, et cetera. A small brass tube can be easily soldered to the cup for the purpose of providing a blast of air and a side-wise concentrated flame tip, by blowing thru the tube. The upper end of the tube must be closed, and a tiny hole drilled in it—about No. 64 drill.

Contributed by EDWIN WOLBER.

SOME INTERESTING CHEMICAL EXPERIMENTS.

When a very little dry powdered potassium permanganat is moistened with sulfuric acid, brownish-green oily drops of permanganic anhydrid (Mn_2O_7) are formed. This compound is volatile, giving a violet vapor and is apt to decompose explosively into oxygen and manganese dioxid. Its oxidizing power is such that combustibles like paper, ether and illuminating gas are set on fire by contact with it.

White phosphorous, when heated with sulfur unites with explosive violence. By using red phosphorous the action can be controlled. The product is phosphorous sulfid and the kind depends upon the proportions used.

If a small piece of sodium is placed on a piece of filter paper and placed on water, the water is decomposed and the heat liberated is sufficient to set fire to the sodium, which burns with a characteristic yellow flame.

Powdered magnesium and potassium chlorat in the proportions of 10:17 is used in making flashlights for use in photography.

Cordite, a variety of smokless powder, is made by dissolving guncotton (65 parts) nitro-glycerin (30 parts) and vaseline (5 parts) in acetone. The resulting paste is rolled out and cut into small pieces. When the acetone evaporates the horny cordite remains.

Javelle water (solution of sodium hypochlorit) is an ingredient of ink eradicators. The solution is first applied to the ink and a dilute solution of hydrochloric acid is rubbed over it. The chlorin which is liberated is responsible for the bleaching effect.

Contributed by ALBERT TOTH.

TEST CLIP MADE FROM BINDING POST.

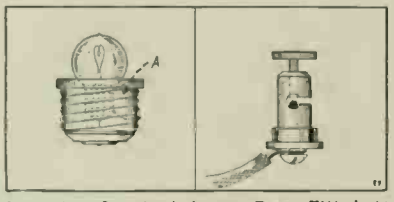
For making contact with insulated wires take an old binding post and file the thumb screw to a point. Also cut a portion of one side out with a hack-saw as shown in the drawing. To make contact with an insulated wire, simply slip the wire in the slit in the side and force the thumb screw point thru the insulation. This saves the time and bother of skinning the wire. It also may be used as a helix clip.

Contributed by MERLE E. NANTZ.

FITTING A MINIATURE BULB TO STANDARD SOCKET.

First we need a broken Edison bulb, a miniature lamp and some sealing wax or paraffin. Then break all the glass from the bottom of the large lamp base. Now solder the two wires from the Edison shell to the rim and center of the miniature bulb. Heat some sealing wax and pour in around the shell and set aside to harden. This attachment will be useful to anyone who has a socket with a snap on the side or a pull-chain socket.

Contributed by STAN. DIRVIN.



At Left: Standard Lamp Base Fitted to Miniature Lamp. At Right: Handy Test Clip Made from Binding Post.

CHEMICAL EXPERIMENTS.

No. 1: Put on a clean white plate or saucer, a mixture of pulverized sugar and potassium chlorat. Upon adding a few drops of sulfuric acid a vivid combustion will ensue. By adding with the sugar a few iron and steel filings, and performing the experiment in a dark room, or out of doors at night, fiery rosettes will flash thru a rose colored flame, and produce a fine effect.

No. 2: Mix a teaspoonful of nitric acid with a teaspoonful of sulfuric acid; place a little turpentine in a teacup out of doors, and pour the mixture upon it at arm's length. The turpentine will burn with almost explosive violence.

No. 3: Make a saturated solution of sodium sulfate (Glauber's Salt), in warm water; pour the mixture in a bottle, and let it stand. The salt will remain for months without crystallizing; but if taken up, and shaken a few times, the whole mass will instantly form into crystals, so filling the bottle that not a drop of water will escape. Should there be any hesitation at the moment of shaking, drop a small crystal of the salt into the bottle, and the effect will be instantly seen, by the darting of new crystals in every direction.

No. 4: Heat a piece of tin until the coating begins to melt; then cool quickly in water and clean in aqua regia. The surface will be found covered with beautiful crystals of the metal.

No. 5: Pour dilute nitric acid upon bits of tin. Dense red fumes will pass off.

No. 6: Throw crystals of any nitrat on red hot coals; they will deflagrate with dense red smoke.

Contributed by GLENN HELWAGEN.

PERCENTAGE SOLUTIONS.

The difficulty about percentage solutions, says *Studio Light*, will disappear if the worker will always bear in mind that one fluid ounce of water weighs 437½ grains, which is, of course, equivalent in weight to one ounce avoirdupois. It follows that if one-tenth that number of grains—*i.e.*, 43.75 grains—of any ordinary soluble chemical is put into a graduated glass and water added to make up one fluid ounce, the result will be a 10% solution.

In the following table the figures are worked out for solutions of various strengths. If the number of grains indicated in the table are taken and sufficient water added to make up one fluid ounce, it will be found that the solution has the required strength.

For a	1%	solution take	4.37	grains
"	5%	" "	21.87	"
"	10%	" "	43.75	"
"	20%	" "	87.50	"
"	30%	" "	131.25	"
"	40%	" "	175.00	"
"	50%	" "	218.75	"

HOW TO FILE SOFT METALS.

The teeth of a file are soon filled when the file is used on lead, tin, soft solder or aluminum. It cannot be cleaned like the wood rasp by dipping it into hot water, but if the file and the work are kept wet with water, there will be no trouble as the already wet particles of lead, soft solder, etc., do not readily adhere to the file.

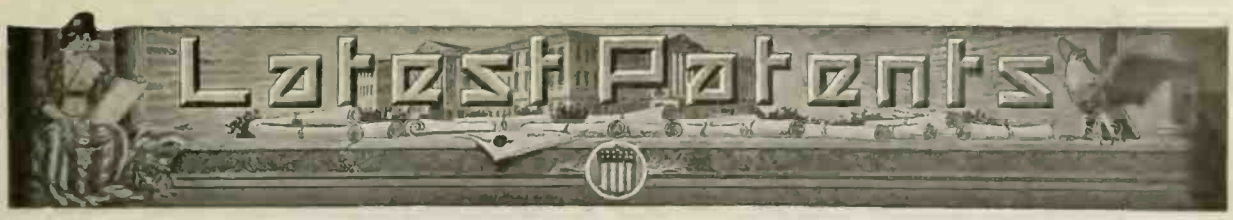
HANDY COMPUTER FOR MECHANICS.

Here's the latest vest-pocket computer for electrical and mechanical men. By rotating the cap on end it shows at a glance the size of drill to use for taps from ¼ to 2 inches. U. S. S. Pipe ⅛ to 3½ inches. A. L. A. M. to 1 inch. S. A. E. to 1½ inches also 15 small numbered sizes below 1¼ inches. It has the advantage over blue-prints and chart that it can be easily carried in the vest-pocket.



A Useful Computer for Machinists and Experimenters. It Shows the Size of Drill for Any Tap Instantly.

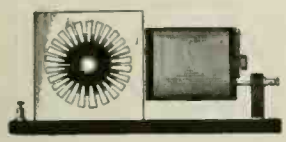
www.americanradiohistory.com



Loose Coupler

(No. 1,276,618, issued to Carlyle B. Campbell.)

This patent relates to an improvement in tuning transformers and particularly to a switching arrange-

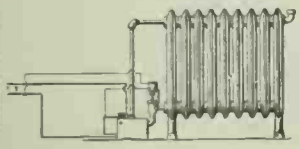


ment by which unused portions of the inductance or winding are completely cut off from the circuit, thereby eliminating undesired effects on the wave lengths. The arrangement shown provides for a plurality of separate coils in close inductive relation. The terminals are connected with solid and spring contacts, adapted to be separated by a revoluble insulating disk in order to cut out certain coils when so desired. In other words, it incorporates a revoluble form of dead-ending switch.

Electrically Heated Radiator

(No. 1,276,573, issued to James J. Rohan.)

An electrically heated steam radiator of novel design in which there is provided a radiator of the usual form, together with an electrically heated steam generator, this latter being very rapid and economical in operation, it is claimed. Simple and positive means are provided for

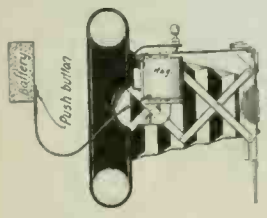


automatically controlling the flow of electric current to the heater, and likewise for automatically controlling the flow of water of condensation from the radiator back to the heating device; this automatic control being effected thru the medium of the steam pressure developed within the heating device.

Electric Shutter Trip for Cameras

(No. 1,277,592, issued to Gilbert R. Horton and John M. Miller.)

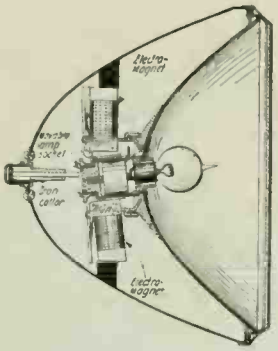
By means of this electromagnetic actuating mechanism for camera shutters, photographs may be taken at a considerable distance from the operator, such as where animals are to be photographed. The length of circuit over which this shutter device may be operated is governed only by the strength of the battery used. A push button or switch is located at the battery, the current completing a circuit thru the small electromagnet fitted to the shutter trip as shown. When the magnet is actuated the shutter is opened; continued pressure on the push button will hold the shutter open.



Electric Headlight

(No. 1,276,605, issued to Overton Winston.)

An improved electric headlight for automobiles and other machines and providing a special means for shifting the electric light bulb with respect to the reflector, whereby the bulb may be moved transversely toward and from the axis of the reflector. A soft iron or steel collar is secured to the rear end of the lamp base, which serves as an armature in cooperation with an upper and lower control electromagnet. These electromagnets are secured to and supported by an annular ring mounted in the lamp housing back of the reflector. Thus the lamp bulb proper may be thrown up or down, simply by actuating one or

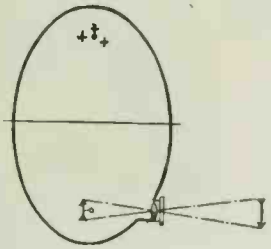


the other of the electromagnets, throwing the light beam either far ahead of the machine or else just in front of it on the ground, as may be desired.

Apparatus for Concentrating and Projecting Radiant Energy

(No. 1,278,026, issued to Salvatore Salto.)

An apparatus for the concentration of light, heat and electric rays and for the projection of these rays in a certain desired manner. This apparatus for concentrating and directing light rays has for its purpose to illuminate objects by concentrating light rays thereon, by means of reflectors with elliptical curvature.

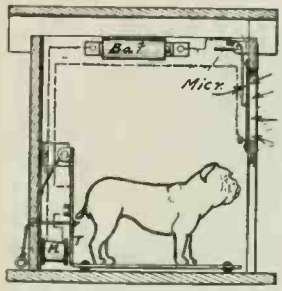


The object to be examined or illuminated may be observed directly by placing it inside the hollow ellipsoid, or projected on a screen by means of a suitable device such as a miscroscope or a magnifying lens. Thus extremely high specific luminous or caloric intensities are obtainable by concentrating emanations from several sources of energy and causing them to be projected. An apparatus such as this may be used as a marine searchlight or coast light, or as a projector for motion picture machines, automobile headlights, etc. The apparatus can also be used for concentrating heat radiations.

A Sound Operated Dog

(No. 1,279,831, issued to Christian Berger.)

When you clap your hands or whistle to this "pup" he jumps out

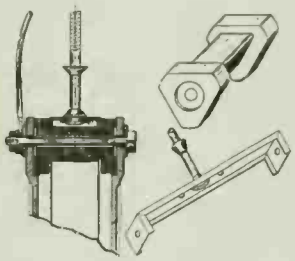


of his kennel in great delight. All because of a clever arrangement of a simple microphone and electromagnet which holds the trip retaining the dog within the kennel, until the sound produced by the clap of the hands or whistle strikes the microphone. At this instant the normal constant current thru the retaining electromagnet drops to a comparatively low value, thus releasing the powerful spring which kicks "Fido" out the door.

Primary Battery

(No. 1,276,754, issued to Walter Grothe.)

A novel arrangement for supporting the electrode elements within a

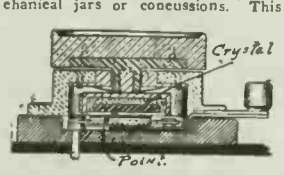


primary battery. The supporting member for the electrodes consists of a flanged yoke having depending ends, while a suspending bolt passes thru a hole in the yoke and is riveted therein. A spool of porcelain is arranged to be clamped against the yoke as shown. The shank and heads are preferably of triangular shape. A perforated container closed on all sides excepting the top, is adapted to be clamped between the depending ends of the yoke and the ends of the clip.

Crystal Detector

(No. 1,277,627, issued to Thomas B. Miller.)

A crystal detector for radio receivers which is claimed to be exceptionally rugged and reliable in design; also its operation is not likely to be interfered with by mechanical jars or concussions. This

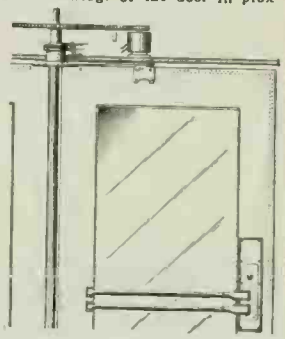


adjustable feature enables the contact member to be placed at any point upon the surface of the crystal desired, and the contact point and and crystal are both enclosed.

Motor-Driven Revolving Door

(No. 1,278,145, issued to Edward C. Haviland.)

Where a revolving door is continuously rotated, electric current is being continuously consumed regardless of the egress or ingress of people thru the door. The object of the present invention is to provide a means whereby a motor for revolving the door is only put in operation when a person is passing thru the door. This device comprises switches carried by the individual wings of the door in prox-

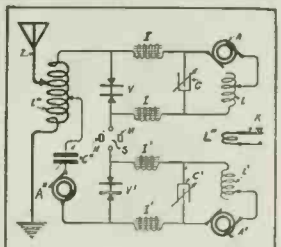


imity to the usual hand-rails, so that they may be either consciously or unconsciously actuated by the person passing thru the door. These switches establish electrical circuits to the actuating motor, but only for such time as is necessary for the person to pass in or out of the door.

Radio-Telegraph Transmitter

(No. 1,278,507, issued to Oscar C. Roos.)

A system in which the discharge of the oscillating circuit condenser may be readily controlled over a wide tone range. The operation is as follows: The high-frequency generator A cannot break down a larger gap than S and the arresters, therefore prevent the discharge of the condenser C" across the gap unless they are simultaneously broken down. They



will be simultaneously broken down $2(n-m)$ times a second where "n" and "m" represent the frequencies of the generators A, A" respectively, so that the tone produced in the receiving system will be the "beat frequency" of said generators. This tone, as will be obvious, may be widely varied by slightly altering the speed of one or both generators. This scheme will thus be seen to afford a very simple and flexible electrical substitute for various mechanical devices such as the "tone wheel," the rotating spark gap, etc.

www.americanradiohistory.com



Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light-toned ones. We pay $3.00 prize each month for the best photo. Address the Editor, "With the Amateurs" Dept.

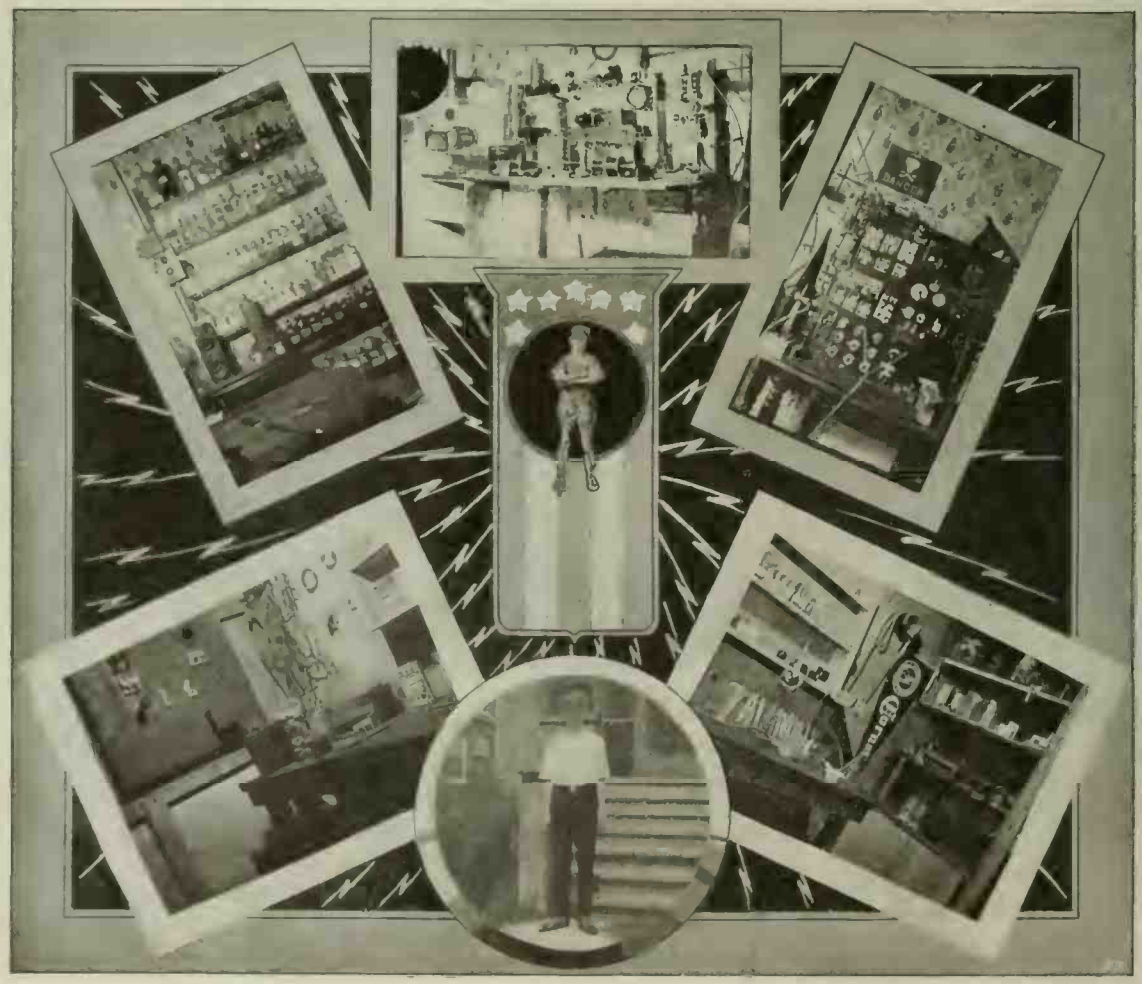
"Amateur Electrical Laboratory" Contest

THIS MONTH'S $3.00 PRIZE WINNER—ALFRED STACEY

HEREWITH are photographs of my laboratory. On the large table in the center of the room may be seen the radio outfit which was assembled in its original place to take this photograph. When set up it was used with an aerial one hundred and fifty feet high, one hundred feet long, with four stranded wires placed three feet apart. The transmitting set consists of a ½ K. W. transformer, condenser, rotary gap, oscillation transformer, aerial inductance, aerial condensers, and hot-wire meter, keys, etc., also a Poulsen arc and transmitter for radiotelephony. For receiving, I have receiving transformers, variable condensers, fixt condensers, audion, loading coils, Ferron, Galena, and Silicon detectors, two pairs of 'phones, etc. On the experimental table to the left of the radio table may be seen Tesla, audion, step-up and step-down transformers, meters, batteries of different types, motors, generators, telegraph and telephone instruments, condensers, measuring instruments and other electrical apparatus. To the right of this apparatus may be seen the two switch-boards containing circuit breakers, switches, and rheostats for controlling various instruments. To the right of the switch-board may be seen the work-bench for building and repairing instruments. To the right of work-bench, chemicals, elements, retorts, graduates, flasks, hydrometers, thermometers, *ad infinitum*. To the right of this bench will be seen another bench used for the manufacture of chemicals such as bromio, chlorin, etc. Next may be seen the stock-room and dark-room used for photo developing and printing. I have a book-shelf containing over one hundred and fifty chemical and electrical books. This laboratory is the result of ten years' hard work assisted by the famous "Electrical Experimenter" and "Modern Electrics."—ALFRED STACEY, Hamilton, Ontario, Canada.

HONORABLE MENTION (1 Year's Subscription to the "ELECTRICAL EXPERIMENTER") GERALD DITTMAN

I PRESENT herewith photograph of myself and two of my laboratory. I am eighteen years old and have had my laboratory for about a year. I have a great number of chemicals which I use for testing foods and for mixing up different solutions to see what effect they have on electricity. I have made an arc light which furnishes all my illumination. I use an ammeter to show how much current I am drawing and in that way save fuses, because when the pointer approaches ten amperes, I know a fuse will blow and I can shut it off in time. I also have a number of motors, a transformer, spark coils, condensers, Leyden jars and other instruments which I use for various experimental purposes.—GERALD DITTMAN, Chicago, Ill.

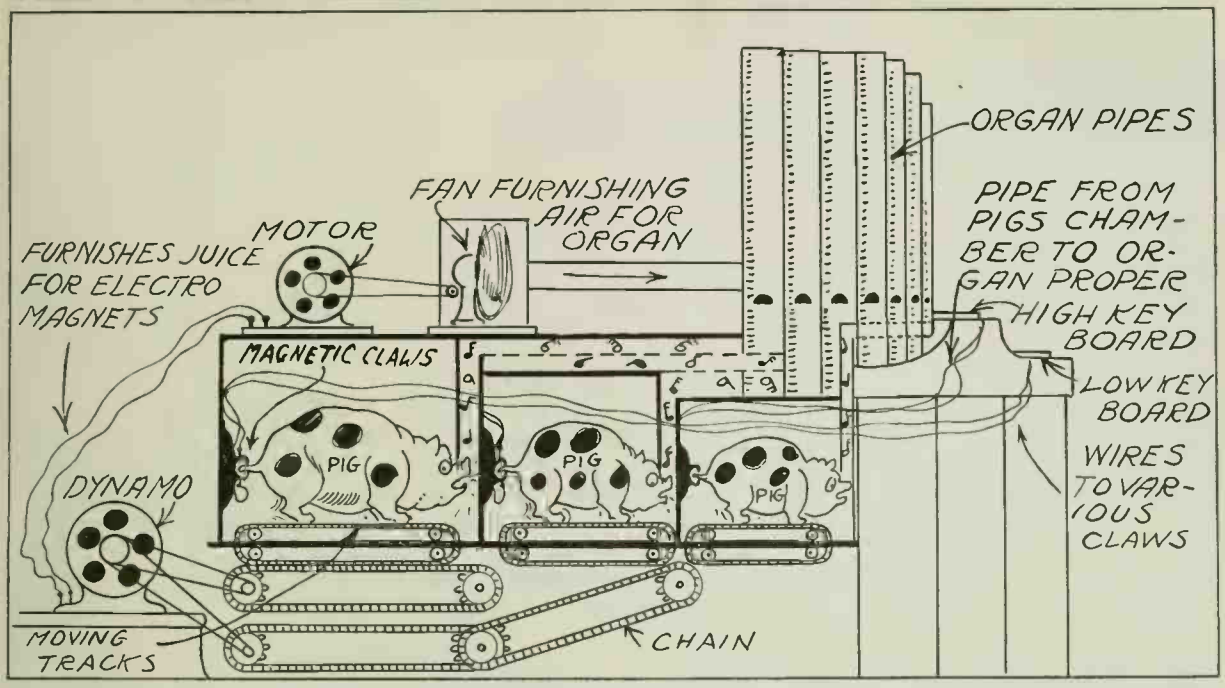


www.americanradiohistory.com

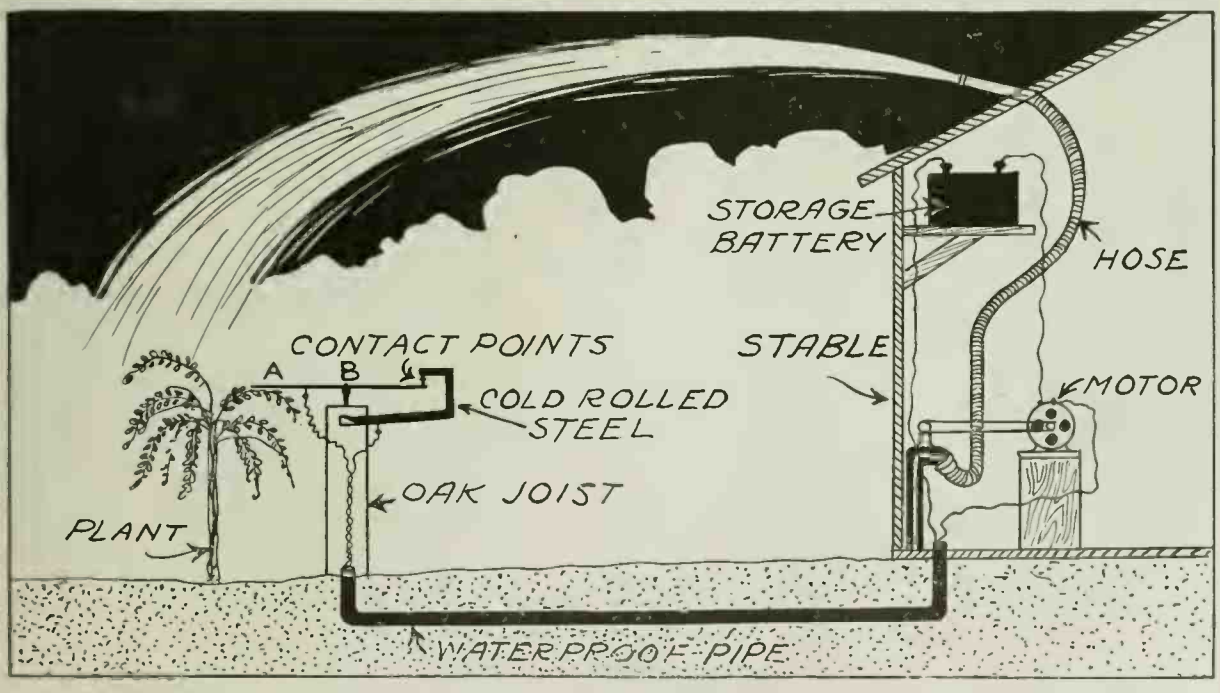
Phoney Patents

Under this heading are publisht electrical or mechanical ideas which our clever inventors, for reasons best known to themselves, have as yet not patented. We furthermore call attention to our celebrated Phoney Patent Office for the relief of all suffering daffy inventors in this country as well as for the entire universe.

We are revolutionizing the Patent business and OFFER YOU THREE DOLLARS ($3.00) FOR THE BEST PATENT. If you take your Phoney Patent to Washington, they charge you $20.00 for the initial fee and then you haven't a smell of a Patent yet. After they have allowed the Patent, you must pay another $20.00 as a final fee. That's $40.00! We PAY YOU $3.00 and grant you a Phoney Patent in the bargain, so you save $43.00!! When sending in your Phoney Patent application, be sure that it is as daffy as a lovesick hat. The daffier, the better. Simple sketches and short descriptions will help our staff of Phoney Patent Examiners to issue a Phoney Patent on your invention in a jiffy.

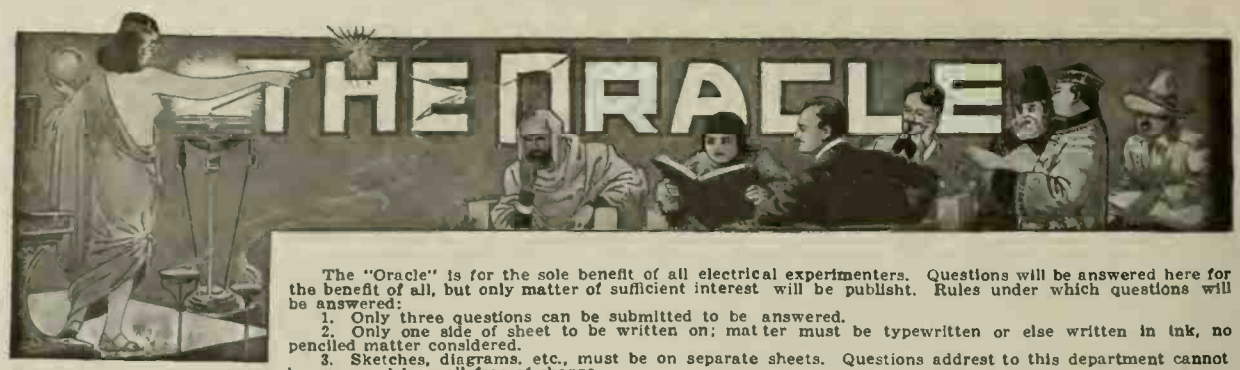


Prize Winner: WEEWEEEPIGORGAN. Take one gross pigs fresh and lusty, assort according to musical scale, put each in soundproof chamber, attach tails to electromagnetic claws operated by keyboard. Pigs run on endless belts furnishing power for organ. Depressing keys on keyboard pinches pigs' tails. Pig sings weee—weeeee—weee, as long as key is pressed. Don't use old sows. They sow discord. French airs go well on this organ due to the oui, oui!! Inventor: Paul Gaugewere, Bethlehem, Pa.



MIMOSA ELECTRICUS AUTOMATICUSS. Sun. More Sun. Heat. Dry. Draught. Plant. Droops. A, B, UP. Contacts. Kiss. Bliss. Juice. Motor. Battery. H_2O. Hose. Spurts. H_2O. Drops. Rain. Plant. Branches. Newlife. Upshego. A. B. Down. Contacts. DIVORCE. Rain. Nix. Simple. Fix. See? Oui. Ouii!! Inventor: Frank Truka, 280 Woolsey Ave., Astoria, L. I.

www.americanradiohistory.com



The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be publisht. Rules under which questions will be answered:

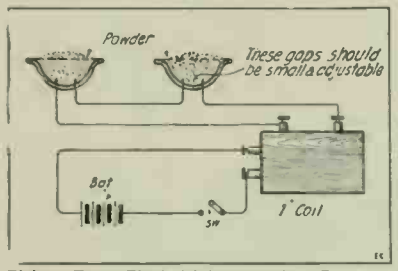
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addrest to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

FIRING TWO FLASH-LIGHT POWDER PANS SIMULTANEOUSLY.

(970) Fred Wheeler, Galt, Ont., Can., wants to know:

Q. 1. How to fire two or more flash-light pans simultaneously.

A. 1. For firing flash-light powder at two places simultaneously, we refer you to arrangement as per diagram. Use a spark coil and battery as indicated in diagram. Wire the two or more flash pans in series. Keep the spark gap in each pan small—1/16" gap is sufficient.



Firing Two Flash-Light Powder Pans at Once by Means of Spark Coil. Several Flashes May Be Ignited at Once.

HOW TO TELL DYNAMO POLARITY.

(971) Paul Miles, Chicago, Ill., inquires:

Q. 1. How can the positive terminal of a small D. C. dynamo be determined?

A. 1. Off-hand we cannot tell you which is the positive brush. However, we advise you to make the following test: In a 50% solution of salt water put two wires connected to the dynamo, and note from which wire the most bubbles come off. This is the negative wire.

A 4-volt dynamo will give about 3 amperes. However, much depends upon the condition of the brushes (contact, pressure, etc.), and the condition of the batteries. We would advise you to refer to "Lessons in Practical Electricity and Magnetism," by Swoope, which can be purchased thru our Book Department for $2.25, postpaid.

SPEED CONTROL OF A.C. MOTORS.

(972) Hugh McPherson, Borden, Sask., Can., asks:

Q. 1. How can I control the speed of a 30 H.P. A.C. 3-phase motor?

A. 1. The speed of the 30 H.P. A.C. 3-phase motor can be regulated in several ways, some of the best of which are as follows:

The voltage applied to the motor is varied by a transformer from which several taps are brought out to a controller, thereby varying the speed. Again, by means of an induction regulator which consists of a primary and secondary winding, having an iron core with one of the windings so arranged as to allow of being varied thru 180 magnetic degrees.

The above methods are really best for single-phase service, while the following method is very good for the three-phase service: In this method the speed can be varied by changing the number of poles of the motor connected in the circuit by means of suitable switches or by varying the current by a suitable rheostat connected in the respective legs of the wound rotor circuits. This last method also applies to the single-phase system, wherein the current is varied by means of a rheostat.

ODD PHOTOS WANTED AT $1.00 EACH!!!

Now is the time to make your Kodak pay for itself in a real practical way. We are after interesting photographs of out-of-the-ordinary electrical, radio and scientific subjects and are willing to pay $1.00 cash for every one we can use. Please bear in mind that for half-tone reproduction in a mogazine, a photograph should be particularly sharp and clear. Of course, if a subject happens to interest us particularly well, we can have the photo retouched. For the general run of subjects, however, it does not pay to go to such expense. Therefore, please take pains to properly focus and expose your pictures. It often happens that a really mediocre subject well photographed wins approval over an excellent subject poorly photographed. And don't send us plate or film "negatives"; send unmounted or mounted "prints", preferably a light and dark one.

As to what to photograph: Well, that's hard for us to say. We leave that up to you, and every reader now has the opportunity to become a reporter of the latest things in the realm of Electricity, Radio and Science. But, please remember—it's the "odd, novel or practical stunts" that we are interested in. Every photo submitted should be accompanied by a brief description of 100 to 150 words. Give the "facts"—don't worry about the style. We'll attend to that. Enclose stamps if photos are to be returned and place a piece of cardboard in the envelope with them to prevent mutilation. Look around your town and see what you can find that's interesting.

Address photos to—Editor "Odd Photos", ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York City.

LOOSE COUPLER AND DISTRIBUTED CAPACITY.

(973) C. W. Opert, Freeport, Ill., wishes to know:

Q. 1. Several points about making a loose coupler transformer for radio receiving circuits.

A. 1. In constructing a loose coupler, the best way to take the taps off is as follows: At the required part of the coil, punch a hole in the cardboard tube and bring about 18 inches of wire right thru this hole by looping the wire, and then pushing it thru. All that remains to be done now is to continue winding the coil until all the taps have been made.

We provide coils with dead-end switches in order to get rid of the *distributed capacity*. Distributed capacity is the capacity which exists between the turns of a helical coil, and for your benefit we refer you to an extensive article on this subject which was printed in the May, 1917, issue of this journal.

TESLA COIL FOR 2-INCH SPARK COIL.

(974) R. Conover, New York, N. Y., inquires of "The Oracle":

Q. 1. For data on a Tesla coil suitable for use on a 2-inch spark coil as an exciter.

A. 1. The ordinary Tesla coil, especially designed to work with a spark up to 2 inches on the primary side will do, and is briefly described as follows. The primary should consist of 14 turns No. 10 solid, rubber-covered copper wire in one layer on a spool 4½ inches in diameter, while the secondary consists of a coil 2¾ inches in diameter and 12 inches long, wound its full length with a layer No. 28 enamel wire.

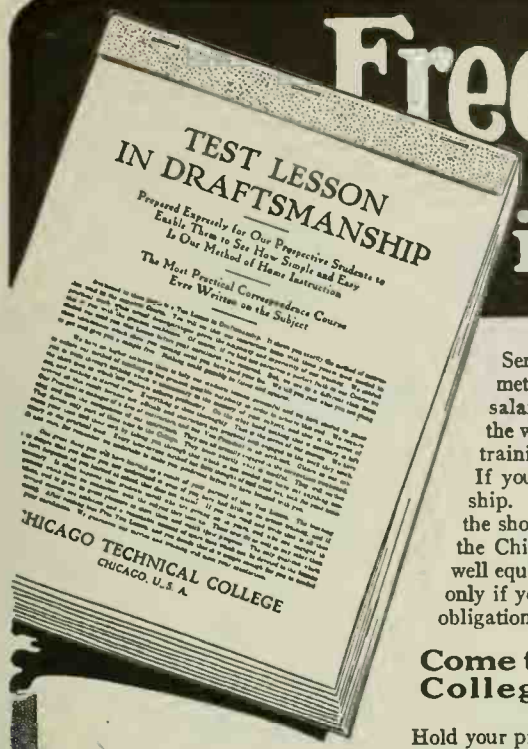
This size of Tesla coil can be furnished by the leading companies who advertise in our magazine. It is best to use two one-pint Leyden jars connected in parallel or a one-quart Leyden jar.

The construction for a glass plate condenser for the above Tesla coil is as follows: Procure five glass plates 6x7x1/16" and four pieces of tin-foil 5x6 inches. The tin-foil should be placed between the five plates so that two ends of the tin-foil protrude from the sides of the glass. The size of the spark obtained from the above Tesla coil will be about ¾ to 1 inch and can be taken thru the body without any harm.

(*Continued on page* 648)

www.americanradiohistory.com

Free Test Lesson in Draftsmanship



Send for this free lesson which explains the Chicago "Tech" method of teaching Draftsmanship by mail. Positions at big salaries are now waiting for competent men. The call of men to the war has left vacancies everywhere. Even draftsmen of limited training and experience are snapped up and paid good salaries. If you are dissatisfied with your opportunities, learn Draftsmanship. Chicago "Tech" will train you in the most practical way in the shortest time. Mail the coupon today and let us tell you about the Chicago "Tech" method. This free lesson will show you how well equipped you are to follow Draftsmanship. Enroll in the course only if you decide that you can take it up to advantage. No cost, no obligation on you to make this investigation.

Come to the College or Learn At Home

Hold your present position while training. Our experts will instruct you by mail. Only your spare time is required. You are directly under practical draftsmen and engineers. You are taught exactly the work required in the drafting rooms of big concerns. No time to put in on unnecessary studies. This means thorough instruction and early graduation.

$25.00 to $100.00 a Week

Draftsmen earn good salaries in normal times. They command extra high salaries now—and the tremendous work to be done after the war will bring a permanent and intensive demand for good men. Make your spare time count now for a higher salary and a better position.

Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Splendid opportunities open now.

Learn All This In Spare Time

Principles of the Automobile. Every point made clear about the basic principles of propulsion, power, transmission systems, etc., etc.

Gasoline Engines. All about the different types. A complete course in gas engine construction, operation and repair.

Power Plants and Transmissions. Application of power, by 4-6-8-12 cylinder engines. Types of clutches. Gears, Drives, Axles, etc.

Carburetors and Fuel Supply Systems. All methods demonstrated. Fuel values. How to test. Gasoline and air mixtures. Regulation, etc., etc., etc.

Lubrication and Cooling. All about oils and how to test them. Splash and circulating systems. Operation in different cars explained. Diagrams, etc., etc., etc.

Batteries. Electrical principles explained. Instructive diagrams of wiring and connections, etc., etc.

Magneto Ignition. Principles and practical operation of various types and systems with diagrams. Generation of current. Field, armature, high and low tension, all explained. Complete in every point.

Starting and Lighting Systems. All modern methods. Starters—spark, mechanical, air, acetylene, electric, battery—shown in detail with diagrams and full explanations. Charging. Motor and generator adjustments, etc., etc.

Know How to Fix Troubles

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men.

WRITE

Send the coupon and get catalog and all information—now.

Easy Payments

The fees for Chicago "Tech" Courses are very moderate—and you can pay on easy terms. And also—you obtain in a few months what it would take several years to acquire by ordinary methods. You can get an early start. You are soon ready to take a paying position and to quickly get back the cost of your course.

Send the Coupon

The sooner you are prepared the sooner you will be holding a job that pays a large salary and opens the way to advancement. Many executives, general managers and superintendents began as draftsmen.

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything.

The coupon will bring the Test Lesson, free. Also information about the profession of Draftsmanship and detailed facts about Chicago "Tech" methods, the fees, terms, etc. Mark with X the branch you are interested in—or if in doubt about which course to take, write a letter stating facts about yourself and asking our advice which will be freely given. Mail either the coupon or the letter today.

FREE Instruments

Every student of the Chicago "Tech" Course in Draftsmanship receives this set of instruments, or a cash credit in case he already has a set. These instruments are of the same make and sizes as used by high salaried experts in drafting rooms of factories, shops, railroads, etc. You use them while learning—then take them right into your practical work.



Chicago Technical College,
145 Chicago "Tech" Building, Chicago

Without obligation to me, please send me your FREE Test Lesson and other interesting literature covering the subject indicated below. Mark X opposite work in which you are specially interested.

[ ] Architectural Drafting	[ ] Plan Reading—Builders
[ ] Machine Drafting	[ ] Plan Reading—Shop Men
[ ] Electrical Drafting	[ ] Estimating
[ ] Structural Drafting	[ ] Surveying
[ ] Sheet Metal Drafting	[ ] Map Drafting
[ ] Builders' Course	[ ] Autos & Gas Engines

Name .....

Address .....

City ..... State .....

College or Home Study? State which.....

www.americanradiohistory.com

Mesco Telegraph Practice Set

For Learning Telegraph Codes



The Practice Set comprises a regular telegraph key, without circuit breaker, a special high pitch buzzer, one cell Red Seal Dry Battery, and four feet of green silk covered flexible cord.

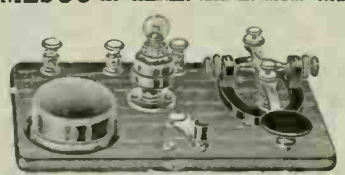
The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes.

List No.		Price
342	Telegraph Practice Set, with Battery and Cord	$3.24

Weighs 4 lbs. packed.

Price does not include postage.

MESCO Combination Practice Set for learning the Morse and Continental Visual and Audible Codes



This outfit is the only reliable instrument which will enable students to become proficient operators in the U. S. Naval Service, because it is equipped with a buzzer and miniature lamp enabling the user to master both the visual and audible signals quickly.

List No. 52—Practice Set with Red Seal Battery and Cord.....$4.05

Weighs 4 lbs. packed. Price does not include postage.

Send for the New Edition of Our Catalog W28

It is pocket size, contains 248 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephones and Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

Send for the Catalog Now

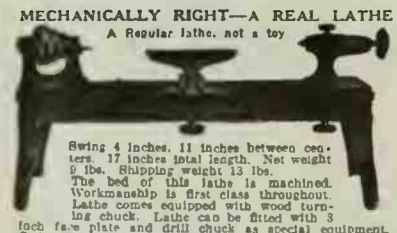
Manhattan Electrical Supply Co., Inc.

NEW YORK: 17 Park Place — CHICAGO: 114 S. Wells St. — ST. LOUIS: 1106 Pine St.

San Francisco Office: 604 Mission St.

MECHANICALLY RIGHT—A REAL LATHE

A Regular lathe, not a toy



Swing 4 inches. 11 inches between centers. 17 inches total length. Net weight 9 lbs. Shipping weight 13 lbs.

The bed of this lathe is machined. Workmanship is first class throughout.

Lathe comes equipped with wood turning chuck. Lathe can be fitted with 3 inch face plate and drill chuck as special equipment. Order one today. Price $4.50 cash with order.

SYPHER MFG. CO., DEPT. C., TOLEDO, OHIO

Feldman's "Geyser" Electric Water Heater

Instantaneous Hot Water

FELDMAN MFG. CO.

1500 Times Bldg. New York City

THE ORACLE.

(*Continued from page 646*)

RECORDING SPEECH ON A MOVING IRON WIRE.

(975) Miss Clara B. Griffin, Carthage, Ill., writes this Department:

Q. 1. Can an instrument known as the *Telegraphone* record speech?

A. 1. Relative to your inquiry regarding the *Telegraphone*, an instrument invented by Valdemar Poulsen of Denmark, we are pleased to state the following:

This instrument will record speech on a thin steel wire by recording the fluctuations of the magnetic lines of force set up thru a set of magnet coils. A full description of this machine was given by Samuel Cohen in the June, 1915, issue of this Journal; an article also appeared in a back issue describing iron disc type of Telegraphone designed as a dictating machine for business offices.

CHARGING LEYDEN JARS.

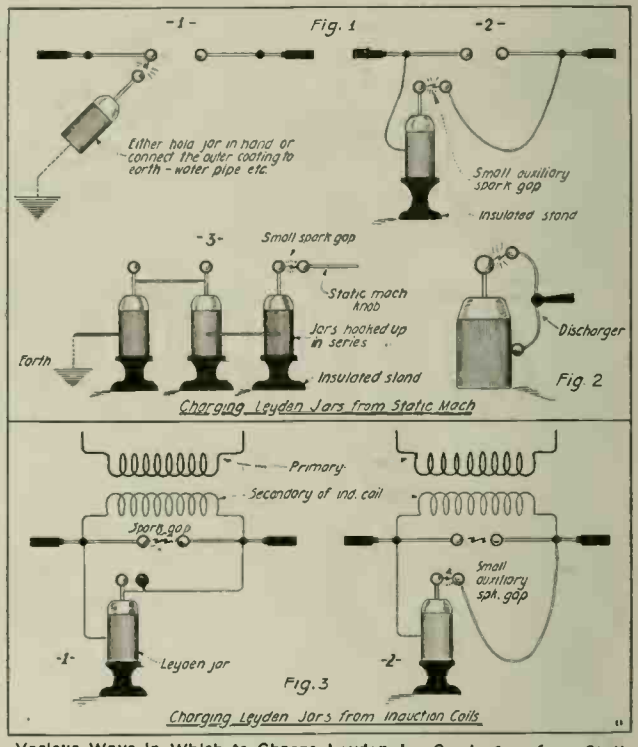
(976) Mr. B. Brewater, Dedham, Mass., asks:

Q. 1. Different ways to charge Leyden jars.

A. 1. We are giving a sketch herewith how to charge the ordinary Leyden jar by means of a static machine. The best way is to hold the jar in the hand and let sparks from one of the balls of the static machine jump over to the central ball of the Leyden jar. At first the sparks will jump fast, then as the jar becomes charged they will grow smaller and smaller, finally hardly any sparks will jump at all. This shows that the Leyden jar is fully charged. It can then be discharged by means of the ordinary discharger as shown in Fig. 2.

The important part to remember is that not every glass can be used for Leyden jars. Here is where many an experimenter is disappointed. Only *potash* glass can be charged—all the other varieties, such as *flint* and *lead* glass, "leak"—it being impossible to sustain a charge for even one second if such glass is used in the Leyden jar. If no *potash* glass is procurable, an ordinary phonograph disc coated on both sides with tinfoil will answer. Good results can also be had by using hard rubber sheeting. This material does not "leak."

It is not possible to charge Leyden jar by means of spark coils in the way the jars are charged with a static machine. In other words, the jars can never be fully charged and kept standing for a few seconds and subsequently discharged as if they had been charged with the static machine. The method to charge the jars with a spark coil is shown in our illustration, Fig. 3. In order to get the charge, it is necessary to hold the discharger as shown, and a continuous discharge will flow across the two knobs. The quality of the spark is the same whether charged by a static machine or Leyden jar, except that in the case of a static machine the spark will sometimes leap several inches, while the jar charged with a spark coil will only leap an eighth or one-quarter of an inch, and in extreme cases one-half inch.



Various Ways in Which to Charge Leyden Jar Condensers from Static Machines and Induction Coils.

DOES A PERSON WEIGH MORE AFTER EATING.

(977) Querist, New York City, inquires:

Q. 1. Does a person weigh more after drinking say, 25 glasses of beer, or eating 10 lbs. of beefsteak (as often happens at beefsteak eating contests), or will their weight remain the same? "A" says they will weigh the same; "B" says their weight will increase in exact accordance with the amount of food or drink taken into the stomach.

A. 1. This is an interesting question and one that has been asked hundreds, even thousands, of times. The Editor of this column recollects that the usual answer by the man in the street is to the effect that he will weigh exactly the same. He will, eventually, but—well, listen to the learned arguments put up by three well-known New York medical authorities.

Says the New York Medical Journal: In the case of eating, say, a pound of meat or drinking a pint of water, the weight of the human being is increased immediately after. In the course of two or three hours, however, the weight will return to normal, due to evaporation of moisture from the lungs and pores of the skin, also to digestion.

Dr. Sinclair Tousey, the well-known New York medical authority, says: Immediately after eating one pound of meat, the person in question would have *less* than one pound added to his weight. Owing to the increased evaporation of moisture from the

(*Continued on page 650*)

www.americanradiohistory.com

Learn Electricity



In the Great Shops of

COYNE

Trade and Engineering Schools
Dept. 21, 39-51 E. Illinois St., Chicago, Ill.

PRACTICAL INSTRUCTION

FINISH IN 3 MONTHS

Thousands of skilled Electricians are needed. The demand is becoming more urgent every day. The Government is employing every one they can get which is causing a great scarcity throughout the country and big salaries are being paid everywhere. Right now is *your* big opportunity. Make up your mind now to prepare for one of these big jobs and then get here as quick as you can for your training.

Earn $100.00 To $300.00 A Month

In the Electrical business. Come here where you will be trained in these great $100,000 shops. Experts show you everything and you learn right on the actual apparatus. You work on everything from the simple bell to the mighty motors, generators, electric locomotives, dynamos, switchboards, power plants, everything to make you a master electrician. We have thousands of successful graduates. Just as soon as you have finished we assist you to a good position. We now have more positions than we can fill. Think of it.

PREPARE TO SERVE YOUR COUNTRY

War Demands Have Taken Thousands of Men from this Profession. Men *Must* be Trained to Fill their Places. Prepare *Now* for a Big Paying Position.

These courses are thorough, short and practical. All instruction given on the actual equipment. Each man is trained individually and stays until thoroughly trained. Start any time—day and evening classes.

Our graduates are in great demand. We are continually receiving letters, telegrams, and telephone calls from contractors, manufacturing firms, etc., seeking our graduates to fill responsible positions. We have now more positions than we can fill and the demand is steadily growing. Every comfort is given our students while here. They live in comfortable homes in the most beautiful section of Chicago—on the lake.

The War is Over—Yes!

but the men "over there" will not be back for months—perhaps years, for their work "over there" isn't over. And so you, and thousands more must fill up the gap now that the absence of these brave workers has made in the ranks of skilled labor. Trained Electricians are needed more, perhaps, than any other class of men. The sudden ending of the war has caused the big industries to start up work sooner than any of us expected and in consequence the Manufacturers are Calling for Trained Men, and we are training men as fast as we can to meet these urgent calls. You are needed, Young Man, now! Don't wait. Don't put it off. Get in touch with us Today. Get ready to join the great "Peace Army" here at home.

Your country calls. Again we say, prepare to serve your country! We'll make a trained electrician of you in three months! Let's go!

LEARN DRAFTING

Skilled Draftsmen are always in demand. Our courses are thorough—short—practical, preparing a man fully to hold a position of responsibility. We have more positions than we can fill. We also have thorough practical courses in Plumbing and Heating, Motion Picture Operating and Bricklaying.

EARN YOUR WAY

Many students earn their living expenses by doing a little work in their spare time. Our employment dept. furnishes these positions without charge.

COYNE TRADE AND ENGINEERING SCHOOLS
Dept. 21, 39-51 E. Illinois St.
Chicago, Ill.

Please send at once your big Free Book—I am interested in
[ ] Electricity [ ] Drafting [ ] Plumbing
[ ] Motion Picture Operating [ ] Bricklaying
(Check trade interested in)

Name.....

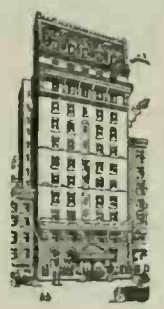
Address.....

MAIL COUPON FOR FREE BOOK NOW!

www.americanradiohistory.com

AK TABLETS
FOR
Grippe
Cold
in the
Head
Headaches
Neuralgias
Spanish Influenza
Women's Aches and Ills
Rheumatic and Sciatic Pains
Ask Your Druggist for A-K Tablets
Sold in Convenient Pocket Packages
Small Size 10c
Fac-Simile
Dozen Size 25c
See Monogram AK on the Genuine
The Antikamnia Remedy Company
St. Louis, Mo.

HOTEL ST. JAMES
Times Square, New York City
Just off Broadway at 109-113 West 45th St.
1½ Blocks from 45th Street Entrance to Grand Central Station.



Women will find here a home atmosphere and absence of objectionable features of ordinary hotel life.
40 Theatres, all principal shops, 5 to 6 minutes walk.
2 minutes of all subways, "L" roads, surface cars, bus lines.
An excellent Restaurant, at moderate prices.
Write for "What's Going On In New York"
All Outside Rooms
With adjoining bath - - from $1.50
With private bath - - from $2.00
Sitting room bedroom, bath, from $4.00
Furnished Apartments by the year, month or week, at special rates.
RAYMOND L. CARROLL, Pres. and Mgr.

Build Your Own PHONOGRAPH,
It's Easy With Our Help
A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fine profit building phonographs for your friends.
Write Today for Our Free Blue Print Offer. Agents wanted for our ready built Choraleone.
CHORALEON CO.
701 Meagw Bldg. Elkhart, Ind.



SAVE OVER HALF

"Electrical Worker's Friend"
An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting.
PRICE, ONLY $3.50
Write for full particulars
J. SMITH & SON
1524 Lowrie Street, N. S. Pittsburgh, Pa.

THE ORACLE.

(*Continued from page 648*)

pores of the skin, also from the lungs, this slight difference would occur immediately. But in two or three hours, due to the foregoing causes, also digestion, the weight will gradually decrease to normal.

Dr. William Benham Snow, of New York one of the leading American electrotherapeutists and medical men, states: The increase of weight in the human being after eating, say, one pound of meat varies greatly. In some instances there is no *increase* at all; while in others there is a *slight* (but never the full weight) increase, all depending upon the individual's respiratory and digestive organs. In the case of water, the full weight of the water is added to the person's weight, but within a very short time after the weight will rapidly decrease to normal.

It has been a widespread and popular idea that if a person were to lie on his back and hold his breath that he could be lifted with two fingers. This has been done by hypnotism, but not otherwise.

ELECTROLYTIC RECTIFIER.

(978) H. H. Mosehauer, Wortendyke, N. J., writes:

Q. 1. I have made a small Electrolytic Rectifier for charging storage batteries. This rectifier was built from instructions in the Scientific American Supplement No. 1644. According to the instructions, the liquid consists of one pound of crystalized sodium orthophosfate (per jar).

I am having great trouble getting this chemical. Some drug houses I have been to do not seem to know what it is at all. Could you advise me where I can get it? Or what other chemical I could use instead?

A. 1. Relative to your electrolytic rectifier, would advise that the majority of these rectifiers, even the larger sizes, are operated with a solution composed of sodium bicarbonat (baking soda) dissolved in water until the solution is saturated, i. e., until the water will not absorb any more of the bicarbonat. Another very good solution is composed of water in which there is mixed ammonium phosfate. A saturated solution of this is also employed.

The matter of the solution used is not a very important one, it being more important that a good, pure grade of aluminum is employed. Ordinary salt and water has been used in electrolytic rectifiers in emergency for that matter, and also wherever a solution seems to have too high a resistance or where a sufficient current is not obtained, a few drops of sulfuric acid may be added to the water to make it more conductive. If you have further trouble in getting the rectifier to operate, it is well to note that the aluminum plates have to be "formed" and this has sometimes to be accomplished by running the rectifier for five or ten minutes or so connected to a lamp bank so that this or similar resistances on the D. C. side can pass a fairly strong current thru the rectifier, and cause the necessary oxid to form on the aluminum electrodes.

2 K.W. "PIPE THAWING" TRANSFORMER.

(979) Mr. Wm. E. Newton, Ontario, Canada, writes the "Oracle" Dept.:

Q. 1. I would like to make a transformer for thawing ½-inch frozen water pipes and want a secondary current of 150 amperes at 10 or 12 volts, as I would only need to thaw about 10 or 12 feet at a time. The primary winding is to be supplied by 110 volts, 25 cycle alternating current. I have plenty of soft stove pipe iron at hand from which I could make the core, which, I suppose, would be of the closed core type. Please give dimensions of core, size, number of turns, and weight of wire required for primary. What kind, size, number of turns of wire required for secondary?

A. 1. We give below data for constructing the transformer in question:

Data for 2 K. W. 150 amp. 13.3 volt secondary "pipe thawing" transformer, for operation on 110 volt, 25 to 30 cycle A. C.

Core Data:—The sheet iron core should measure about 17½ inches in length by 8¾ inches in width ontside dimensions, its thickness and breadth should be 3 inches, or, in other words, 3 inches square. Both of the longer legs of the core should be thoroly insulated with five to six layers of oiled linen or Empire cloth, well shellacked.

Primary Winding:—This may consist of 244 turns of No. 9 B. & S. gage D. C. C. copper magnet wire wound in even layers on one of the long legs of the core. This will require about 2 pounds.

Secondary Winding:—The secondary coil to delivery 150 Amp. and 13.3 volts at full load may comprise 31 turns of No. 0, B. & S. gage D. C. C. copper magnet wire, or if this is not convenient, owing to its large size, you may wind on simultaneously two No. 3 B. & S. gage D. C. C. conductors side by side, or four No. 6 B. & S. gage D. C. C. conductors. The terminals of the separate wires, if a multiple winding is used, are joined together so as to connect all the wires on parallel.

The efficiency of this size of transformer is about 95 per cent with respect to the watts input at the primary and the watts output at the secondary

Knowing the size of the core you can readily compute the weight of wire for the windings by consulting any wire table. The circular mils area of the No. 9 B. & S. gage wire is 13,594 c.m., while the circular mils area of the No. 0 B. & S. gage conductor is 105,592 c.m.

A NEW TOGGLE SWITCH.

The toggle surface switch illustrated differs from the ordinary snap switch in that manipulation is by the throw of a lever or toggle, instead of by the turning of a



Showing Interior View of Single Pole Switch.



Appearance of New Toggle Switch.

key or button. Throwing the lever up makes the circuit; throwing it down breaks the circuit. The movement is positive—the make-and-break quick and snappy. The toggle switch has been used in Europe for a number of years, but was slow to find favor in America.

The advantages of the toggle movement in a surface switch are stated as three-fold—first, it permits making the switch more attractive and stronger than the ordinary switch; second, manipulation is much more convenient by means of the lever than by the turning of a key; third, the switch is self-indicating, the position of the lever showing at a glance whether the current is "on" or "off" without any marker or dial.

It combines in unusual degree the best mechanical and electrical features, with an appearance which makes quick appeal to those seeking the dignity of simplicity and richness.

www.americanradiohistory.com

RADIO-TELEPHONE GUIDED U. S. FLYERS MANY MILES AWAY.

(*Continued from page 629*)

require amplifying more than from ten to fifteen times.

Fig. 3 shows a new form of oxid filament tubular audion as supplied on U. S. Army and Navy sets. This bulb is provided with a special base, making it very convenient for attachment or replacement, and tests made with this bulb show the life to be about five thousand hours.

Fig. 4 shows an improved form of audion control panel. A number of new radio engineering features are incorporated in this apparatus, including deeply grooved, insulating terminal blocks which carry the binding posts. Integrating condenser switches are employed for regulating the capacity of the bridge and stopping condensers. The ammeter at the right of the panel indicates the filament current at all times. A special form of grafite potentiometer is mounted just below the filament

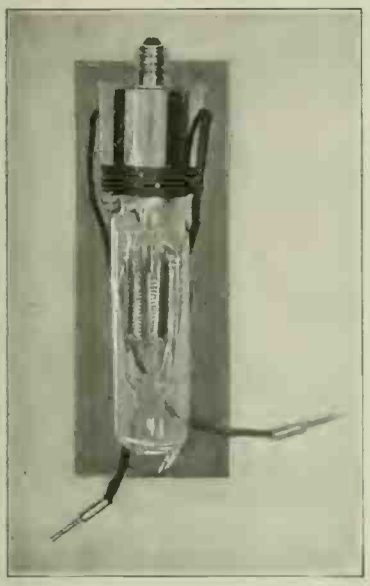
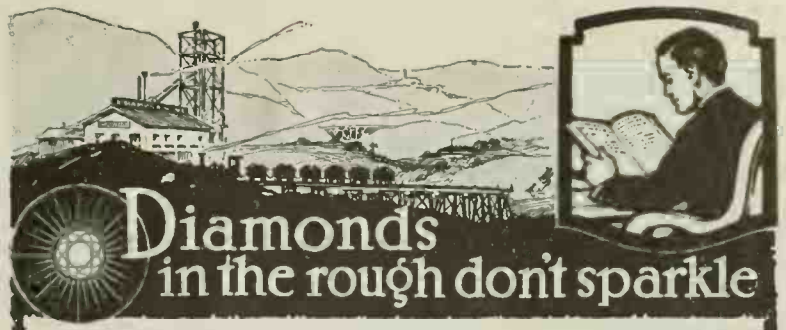


Fig. 3. New Form of Oxid Filament Audion as Supplied on U. S. Army and Navy Radio Sets.

ammeter to regulate the wing current.

Fig. 5 shows a large capacity oscillion bulb and control instruments mounted on a self-supporting panel for radio-telegraphic transmission. The bulb is mounted between upper and lower rings of heavy, rubber-covered wire. The loading coil switch for varying the antenna wave length is mounted in the upper left hand corner of the panel. Terminals for the Morse telegraph key are fitted at the bottom of the panel. A radiation hot-wire ammeter is seen at the left of the switchboard, while a three-pole switch controlling the filament and wing current appears at the right. The necessary condensers and auxiliary apparata are compactly mounted on the back of the panel.

A ½ K. W. oscillion is good for 150 miles radiophone transmission over water, or 250 miles radio-telegraph signalling over water. A 1 K. W. outfit has a range of 200 miles radiophone or 300 miles radio-telegraph over water. A 2 K. W. will talk 300 miles or telegraph 400 miles over water. These ranges can be greatly increased by the use of two to six stage audion amplifiers. The six stage audion amplifier has an amplifying factor of *one million* times.



WITHOUT training you are a diamond in the rough. You can't make the most of your **natural ability.** Your **real value** is hidden—always will be until you cut away the rough spots and **polish up** with **practical training.** That's all you have to do to put yourself in the position **where you want to be**—and where you rightly belong. There is no secret to success. It is just a question of mentally equipping yourself with practical training. You have the same chance as the "other fellow"—if you train. What are you going to do?

Why Not Get a Better Job?

What would it mean to you if your salary was doubled tomorrow? What would $5.00, $10.00 or $20.00 more a week enable you to do? It would mean a whole lot more pleasure in life—a lot more satisfaction, wouldn't it. **Then why not get it?** You can! It is not impossible or even a hard task. It is simply a matter of fitting yourself for the position and pay you want. Only by training can you capitalize on your **natural ability. If you can get what you are now earning without training,** think what you could make with it. You have a lifetime of work ahead of you—so why not put in your time in congenial, profitable work. Thousands of American School Students will tell you it **pays to train.** Let us send you some proof of what our training has done for others,

Wonderful Opportunities Await Trained Workers

If you are untrained, take a look into the future. Now that the war is won, there is a period of reconstruction coming which will mean unparalleled opportunity for men who can think and act for themselves—trained men. The war-torn countries of Europe must be reconstructed and America must do its share. America must also catch up with time lost in its own industrial activities. If you want to share in the prosperous times ahead **you can do it.** Get busy—now—and fit yourself with practical instruction that is guaranteed to satisfy you, and, therefore, guaranteed to make you make good.

Do Yourself a Favor

Make up your mind today to fit yourself for a more congenial position and bigger pay. You can do this—easy—if you will devote a part of your spare time to study. Keep on earning while you're learning. Check and mail the Coupon for Big Free Bulletin and details of Money-Back Guarantee.

SATISFACTION GUARANTEED — YOUR MONEY BACK IF YOU ARE NOT SATISFIED AFTER COMPLETING YOUR EXAMINATIONS

American School of Correspondence
Dept. C-7441
Chicago, U. S. A.

TRAINING THE KEY TO SUCCESS
PLEASE SEND ME BOOKLET AND TELL ME HOW I CAN FIT MYSELF FOR THE POSITION MARKED X
ASC

....High School Graduate	....Lawyer
....Electrical Engineer	.....Business Manager
....Elec. Light & Power Supt.	.....Certified Public Accountant
....Hydroelectric Engineer	....Accountant and Auditor
....Telephone Engineer	....Bookkeeper
....Telegraph Engineer	....Stenographer
....Wireless Operator	....Fire Insurance Expert
....Architect	....Sanitary Engineer
....Building Contractor	....Master Plumber
....Civil Engineer	....Heating and Vent. Engineer
....Structural Engineer	....Automobile Engineer
....Mechanical Engineer	....Automobile Repairman
....Shop Superintendent	....Airplane Mechanic
....Steam Engineer	....General Education Course
....Draftsman and Designer	....Common School Branches

Name .....

Address .....

www.americanradiohistory.com

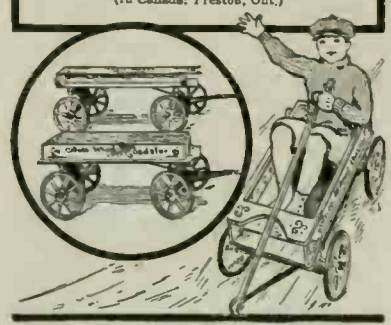
WHY DON'T YOU GET AN AUTO-WHEEL?

FELLOWS who know will tell you that the Auto-Wheel Coaster and the Auto-Wheel Convertible Roadster are the best wagons ever built for speed and stregth. Wheels have roller bearings, steel axles and tires, and the spokes are oval, like an auto.

Send For Free Felt Pennant

Write us names of three coaster wagon dealers and we'll send you a beautiful Felt Pennant FREE. We will also tell you how to organize a Coaster Club. It's great fun. Each member receives a cap and the captain a special cap. Write today.

BUFFALO SLED COMPANY
163 Schenck Street - N. Tonawanda, N. Y.
(In Canada: Preston, Ont.)



BOYS Build and Fly Your Own Training Plane



Train yourself in Aviation. Be an Amateur Aviator with an Aeroplane of your own. Learn how Aeroplanes are built; learn the principles of construction, operation and control. We sell IDEAL Accurate Scale Drawings, and Building and Flying Instructions which show you how to build a perfect Model Aeroplane, 3 ft. size, that will rise from the ground by its own power and fly like a big one. Send now for the Drawings and Instructions for the one you want to build.

Drawings and Instructions for
Curtiss Military Tractor
Bleriot Monoplane
Nieuport Monoplane
Tauba Monoplane
Curtiss Flying Boat
Wright Biplane
Cecli Paoli Racer

25c EACH

New Aeroplane Catalog 5 cents—None Free

Tells about Model Aeroplanes, Racing Aeroplanes, Flying Toys, and parts and supplies to build them with. 48 pages. Sent only upon receipt of 10 cents.

IDEAL AEROPLANE & SUPPLY COMPANY
78-82 West Broadway New York City

CHEAPEST WAY TO GO



Is on a bicycle — a dozen miles for a cent. That's why in Europe one every six persons rides a bicycle. All armies use them by thousands. It is the workman's street car, with the cost of the rides saved. A complete outdoor gymnasium that keeps you fit in mind and muscle.

Mead's Factory to Rider

Sales Plan Saves you $10 to $20 on all latest war approved Ranger models. 30 Days Free Trial and Free Delivery. TIRES Parts, Repairs at half usual prices. Don't buy until you get our Big Free Catalog describing all the wonderful new offers, liberal terms and low prices. Write a postal now.

MEAD CYCLE COMPANY
Department C-107 CHICAGO

15 PHONOGRAPH RECORDS $1
ALL GOOD TITLES



Sent PARCEL POST PREPAID anywhere in the United States. Enclose Money Order or Currency.

INDEPENDENT DRUG CO.
Dept. 100 204 S. Wabash Ave., Chicago

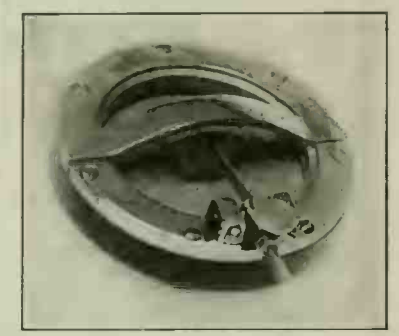
SALT FROM THE SEA BY ELECTRICITY.

A company is about to start the exploitation on a large scale of a method for extracting salt from sea water. The undertaking is being backed up by a number of men of exceptional standing. The process is due to Professor Helland Hansen, and the venture is backed by $5,000,000. It will in all probability be found expedient to erect several works along the coast of Norway as more electric energy becomes available. The comparatively large capital is principally necessary on account of the large plant needed, pumping stations, etc., absorbing the bulk of the power; the production of the salt itself only requires a small amount of energy and is consequently cheap. As to the location of the new factories, no definite decision has been arrived at, but Stavanger has been mentioned as a likely place for the first factory, and the Giaamfjord for the second.

A MELODIOUS PHONOGRAPHIC REPRODUCER.

By Frank C. Perkins.

The accompanying illustrations show the details of construction of a new phonographic reproducer, developed at Milwaukee, Wis., which it is said "Humanizes a Talking Machine". It is claimed that this reproducer plays perfectly all disc record selections, even the subtle tones of the instrumental accompaniments and prevents



Something New in Phonograph Reproducers. This Particular Type Has a Diaframm of Special Composition, and the Stylus Arm is Secured Thru a Bridge Arrangement, Similar to the Sounding Board of a Guitar. It Is Said to Give Excellent Reproduction.

clash and approaches the living voice, whether of soprano, contralto, tenor, baritone or bass, quite as natural as life. Even the resonance of the violin and the tone of the flute are marvelously perfect.

It is held that band records are reproduced with all the tone values of instruments, every overtone and undertone brought out harmoniously, without nerve-wrecking stridency, while orchestral combinations are greatly improved. The recordings of the great symphonies are revivified with all the original sublimity; reanimated in just the right volume for home enjoyment. The violins, cellos, oboes, clarinets, bassoons, saxophones, flutes, piccolos, horns, the "brasses" including the great tuba, the "percussion" containing drums, cymbals, bells, special effects as the imitations of birds, church chimes, are all as real as the record is made.

Any talking machine can be equipt with this reproducer in a moment, without tools. Either steel or fiber needles will work perfectly with the reproducer, whose weight is less than four ounces, so that records wear indefinitely if care is used.



EXPERIMENTAL STUDIES IN ELECTRICITY AND MAGNETISM, by Prof. Francis E. Nipher. Publisht by P. Blakiston's Son & Co., Philadelphia, Pa. 72 Pages, size 9½ x 6⅛ inches, illustrated, cloth bound. Price $1.25.

The student of electricity and magnetism will find many novel, new and decidedly interesting experiments described in this work. The author is well known in scientific circles and of very high standing. Furthermore, what he has to say to us in this presentation is of more than ordinary interest. Some very interesting photographs of sparks and spark shadows are given with some new theories as to their meaning; causes of local magnetic storms; the effect of "wind" on magnetism; and also the effect of "clouds" on the magnetic needle. These effects are indeed wonderful, and so new as to demand the attention of every earnest electrical student. Professor Nipher has performed some very interesting experiments in the laboratory and also in the field along these lines, and if you wish to read something refreshingly new in the realm of experimental electricity and magnetism, then you should by all means study this excellent and clearly written explanation of these little known scientific phonomena.

ALTERNATING CURRENT: THEORY, PRACTISE AND DIAGRAMS, by Horstmann and Tousley. Cloth covers, 296 pages, 173 illustrations, size 6½ x 4½ inches. Price $1.00. Publisht by Frederick J. Drake & Company, Chicago, Ill.

One of the well-known Horstmann and Tousley practical handbooks for electrical men, giving the theory and practice of this branch of electrical engineering so that the non-mathematical student can learn the exact meaning of the various terms used. The work starts with the generation of alternating currents and discusses inductance, capacity and resistance and their effect on the voltage and current in alternating current circuits. Next we find an interesting discussion on impedanee, wattless current, and skin effect.

Other interesting chapters treat on the calculation of power in A. C. circuits; transformers; the theory and construction of transformers and how they are connected in lighting and distribution circuits; alternating-current generators, their theory and construction; A. C. motors, including the synchronous motor and its characteristics; synchronous converters, their theoretical and practical operation; the split-pole and also inverted converters; A. C. to D. C. rectifiers of various types; including electrolytic and vibrating rectifiers; potential regulators; measuring instruments for A. C. work, including synchroscopes and power-factor meters, with numerous tables for the calculation of A. C. circuits for different frequencies and voltages. A clearly written handbook which explains in untechnical terms the principles and practise of alternating currents for the practical electrician and student.

GERMAN ENVOYS TOLD TO SURRENDER, VIA RADIO.

A wireless message sent to the German delegates from German headquarters authorized them to sign the armistice.

The German commissioners remained up all night waiting for final instructions. When the radio message arrived they hastened to a private train in which Marshal Foch was living, and which formed his headquarters. Marshal Foch was asleep at the time. He was aroused. He received formal word that the Germans had come to sign.

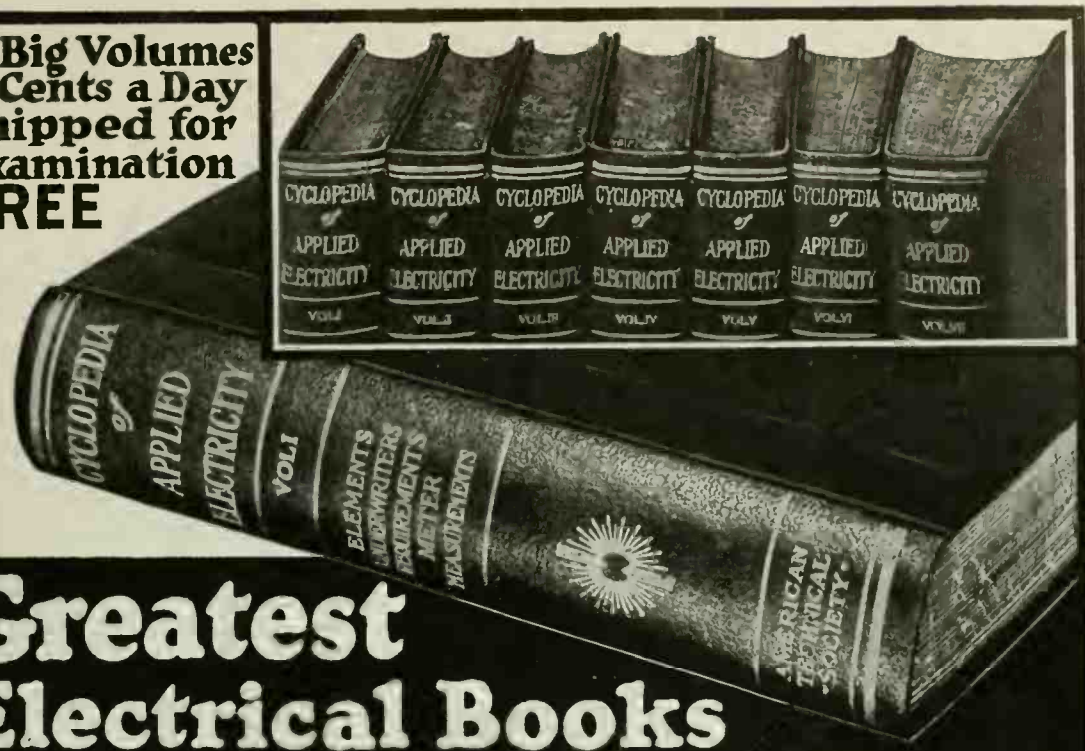
The first to affix his signature to the momentous document was Dr. Mathias Erzberger, civilian head of the commission. The other delegates followed.

As they signed, one by one, they saluted, Marshal Foch and his aide-de-camp responding courteously.

In the meantime, across the network of wires running from Marshal Foch's headquarters to the various battlefields, the order for cessation of hostilities at 11 o'clock, Nov. 11th, began to be flashed up and down the far-flung western front, while from Paris and London the news started on its joyous trip around the world.

www.americanradiohistory.com

7 Big Volumes 7 Cents a Day Shipped for Examination FREE



Greatest Electrical Books Now Brought to Your Home!

Partial Contents

Vol. I. *Elements of Electricity:* Magnets--Electromagnets. The Electric Current: Resistance--Underwriters Requirements--Power Stations and Equipments--Outside Wiring--High Tension--Special Installations--*Electrical Measurements:* Instruments--Measuring Methods: Resistance Insulation--Distribution Systems--Watt-Hour Meters: Construction, Installation, Testing.

Vol. II. *Dynamo Electric Machinery:* Magneto Electric Induction--Generators--Construction--Practical Design. *Types of Generators and Motors:* Direct and Alternating Generators and Motors. Motor Generators--Induction Motors.

Vol. III. *Direct Current Motors:* Efficiency--Torque--Speed--Power--Multi-Voltage Systems. *Management of Dynamos and Motors:* D. C. and A. C. Plants--*Lighting:* Incandescent Lamps--Tungsten Lamps--Nitrogen Filled and Mercury Vapor--Arc Lamps--Residence--Photometry.

Vol. IV. *Alternating Current Machinery:* Simple Alternator--Instruments--Polyphase Systems--Armature Windings--Transformers--Rectifiers--Motor Generators.

Vol. V. *Power Transmission:* Conductors--Distributing Systems--Voltage Regulation--Underground Construction--*Electric Railways:* Car Equipment--Maintenance--Power Plants--Signal Systems.

Vol. VI. *Power Stations:* Plant Location--Electrical Equipment--*Switchboards:* Wiring Diagrams of Connections--Switchboard Apparatus. *Storage Batteries:* Types--Charging and Discharging--Troubles and Remedies--Small Battery Installations. *Applied Electrochemistry:* Metal Refining and Plating--Chemicals--Electric Furnaces--High Tension Work.

Vol. VII. *Modern Land Telegraphy. Wireless Telegraphy and Telephony. Electric Elevators. Electric Heating. Welding.*

Note:--This is but a partial list of contents. The set contains every electrical subject known!

7 Big Volumes—Written by 27 Great Authorities—Yours for 7 Cents a Day

THE hardest way to learn Electricity is through your *own experience*. The *easiest* way to learn is through the experience that *others have paid for in time and money*. Here in practical, easy-to-understand form, you get the benefit of what *27 greatest electrical* authorities in America and all over the world have learned, and you get this vast fund of experience in convenient book form, so that you can read and study in your own home in your spare time.

This is the greatest opportunity of your life to become an electrical engineer, sub-station operator, dynamo tender, or to get any one of the other big-pay jobs in the electrical field. For less than you spend for tobacco or movies, you can train yourself to step up to the jobs paying $2,500 to $5,000 a year.

Shipped on Free Examination

No Money in Advance

Just glance at the partial list of contents of these 7 volumes in the panel at the left. Think how much there is for you in this great home-study library of electricity. Then write at once for the books themselves. Examine them in your own home for a week. Send them back if you are not satisfied. But if you decide to own this pay-raising set, send only $2 and then only $2 a month until the special half price is paid. Examine the books—see how they take you through every detail of each special branch of electricity. See how they give you all the necessary tables and formulas in simple, untechnical form. Note the frequent test questions which enable you to *examine yourself*. Note the 2,600 illustrations, full page plates, diagrams, etc. You be the judge of their value to you!

HALF PRICE—NOW

For a limited time we are offering this remarkable self instructor Electrical library at half price. Regular price $35—special price $19.80 on easy terms of only 7 cents a day. With each set we include a year's Consulting Service Membership free—worth $12. The 7 volumes contain 3,000 pages, each 7 x 10 inches, bound in American Morocco, Gold Stamped.

Mail Coupon—Send No Money

If you are interested in electricity you need these books. You will prize them for the new, up-to-date information they give you on every phase of electrical work. We ship the 7 volumes right to your home on your simple request. Send no money until you *are satisfied* after 7 days free examination. Put your name and address on the coupon now and send at once before this offer is withdrawn.

AMERICAN TECHNICAL SOCIETY
Dept. E3381, Chicago, U. S. A.

Mail This Coupon Now

AMERICAN TECHNICAL SOCIETY
Dept. E3381, Chicago, U. S. A.

Please send Cyclopedia of Applied Electricity for seven days' examination, I to pay shipping charges. I will send $2 within seven days and $2 a month until I have paid $19.80 or notify you and hold the books subject to your order. Title not to pass until fully paid.

Name .....

Address .....

Reference .....

www.americanradiohistory.com

AMATEURS!
Get Ready for the Opening Day

Complete text books written by leading experts. Up-to-date, describing all 1918 apparatus and practices. These books furnish all information required to enter the wireless and aviation services. Written to prepare you for active service in the shortest possible time. In use at all army and navy schools and camps, universities, colleges and technical schools. Each book is a practical home study course covering the entire subject and giving information not to be found in any other sources.

Practical Wireless Telegraphy
By Elmer E. Bucher, Director of Instruction Marconi Institute

The recognized standard wireless text book. Treats each topic separately and completely, and furnishes a progressive study from first principles to expert practice. Covers completely the entire field of wireless (fundamentals, construction and practical operation). More than 50,000 copies of this book have already been sold. Size 6 x 9 inches. 352 pages. 340 illustrations. Handsomely bound in full cloth with cover stamping in gold and black. Price, $1.75 postpaid.

Radio Telephony
By Alfred N. Goldsmith, Ph.D. Director of Radio Laboratory, College of the City of New York

Written in clear style to appeal to even the beginner. Treats all aspects of Radio Telephony including a description of Radio Telephony in practice for a distance of more than five thousand miles. Covers the subject of construction and operation thoroughly and will be found an invaluable aid to men who seek to improve their position in the wireless profession. Size 6 x 9 inches, 256 pages. 226 illustrations. Handsomely bound in full cloth stamped in gold. Price, $2.00 postpaid.

Vacuum Tubes in Wireless Communications
By Elmer E. Bucher

An elementary text book for experimenters, students and operators. Gives complete description and makes clear every fundamental operating principle of the vacuum tube. Graphic diagrams reveal at a glance the various uses of the vacuum tube. The only text book on the market devoted solely to the various applications of the oscillation valve. Shows over one hundred different circuits. Size 6 x 9 inches: 130 diagrams and illustrations. Handsomely bound in cloth. Price, $1.75 postpaid.

Practical Aviation
Including Construction and Operation
By J. Andrew White

An invaluable book for intensive study by men preparing to become aviators. Gives the complete working knowledge required for actual flying and air combat. The subjects covered include operation and care of aviation engines, reconnaissance, map reading, signaling and operation with military bodies, radio and its uses, meteorology, and night flying. Size 6 x 9 inches: hundreds of illustrations. Bound in full cloth. Price $1.75 postpaid.

These Text Books Have Been Used in Training Over 60,000 Men During the Past Year

THE WIRELESS AGE
The only American magazine devoted exclusively to the wireless art. Records all developments in the scientific, experimental and commercial fields. A magazine that keeps you posted on all the latest doings and gives you a broader working knowledge of the art of wireless than possible through any other sources. Live, up-to-date and newsy feature articles with vivid illustrations and practical suggestions for red-blooded Americans. Practical training courses by experts on wireless telegraphy, aviation, military signaling, etc., in each issue. Go to the nearest news-stand and secure your copy, or, we will mail postpaid upon receipt of price. 20c per copy, $2.00 per year.

SPECIAL OFFER The Wireless Age for one year and your choice of Practical Wireless Telegraphy, Vacuum Tubes or Practical Aviation for $2.75 or Radio Telephony for $3.00. Save money and subscribe now.

THE WIRELESS PRESS, Inc. 33 ELM STREET NEW YORK CITY

Attractive circular fully describing our complete line of books, sent free upon request. Ask for Circular E.

The House of Taylor

IN THE HEART OF THINGS



HOTEL MARTINIQUE
BROADWAY, 33D STREET, NEW YORK
One Block from Pennsylvania Station.

Equally Convenient for Amusements, Shopping or Business

157 Pleasant Rooms, with Private Bath, $2.50 PER DAY.

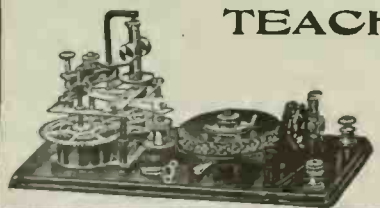
257 Excellent Rooms, with Private Bath, facing street, southern exposure, $3.00 PER DAY.

Also Attractive Rooms from $1.50.
The Restaurant Prices Are Most Moderate.

400 Baths
600 Rooms

"THERE'S MONEY IN IT"

AT HOME LEARN TELEGRAPHY AT HOME
MORSE AND WIRELESS



TEACH YOURSELF

In half the usual time, at trifling cost, with the wonderful Automatic Transmitter, THE OMNIGRAPH. Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would.

Adopted by U. S. Gov't. 4 styles. Catalogue free.

OMNIGRAPH MFG. CO.
39L Cortlandt St. New York



Monuments—Mausoleums—Statuary
No matter what your needs, we can serve you most advantageously. Estimates and designs submitted. Mail orders as carefully executed as though you had called in person. Write for particulars.

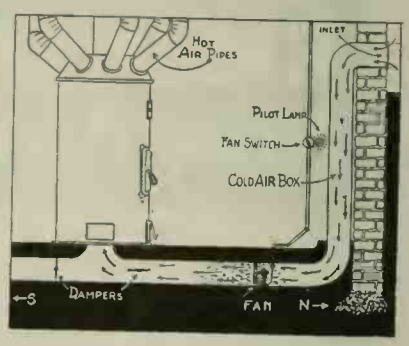
J. L. Wegenaar Co., 299A B'way, N. Y.
SPECIALISTS IN DESIGN AND CONSTRUCTION

WINTERTIME USES FOR THE ELECTRIC FAN.

(*Continued from page* 619)

be screwed down so as not to fall over and injure anyone.

Another illustration shows a very effective aid in the drying of milady's silk stockings, gloves and handkerchiefs. A funnel "B" can be easily constructed out of ordinary cardboard to fit the protective guard, and attached with wire. Or, it can be made a bit larger so as to slip a few inches over the protector, perforated at two or four places and tied at the back with string. Of course the width of the other end should be much narrower in order to produce the conical shape, as the sketch illustrates. A small piece of cardboard formed into a cylinder, and sewn or pasted together so as to exactly fit the end of the cone, is also fastened to it with wire. This is done by perforating both and sewing the wire from one hole to the other. The stocking is then slipt on and can be clamped down. (The clamps that are used on jam jars to make them air-tight would serve very nicely here.) Also small hooks made of wire (picture wire would do), invisible hairpins, etc., can be affixt to the end of the funnel, on which handkerchiefs, stockings and gloves can be fastened. In the latter case it is not necessary to make the small cardboard attachment. It is readily



To Improve the Cold Air Box Draft To Your Furnace, Install An Electric Fan In the Draft Passage After the Manner Illustrated. A "North" and "South" Cold Air Box, Fitted With Suitable Cut-Off Dampers, Makes a Very Dependable Furnace, No Matter Which Way the Wind Blows.

understood that the forced air thru this funnel dries the articles in no time. Should it be inconvenient for you to make this funnel, the handkerchiefs, stockings, et cetera, can be attached to the protector itself by pins or hairpins. With this method it will take slightly longer for them to dry. Care should be taken to attach the articles *before* you set the fan going. Take them off *after* you have *cut off* the current with the snap switch and the fan has fully stopt. *This precaution should be taken whenever the electric fan is handled in any way.*

Figure "B" shows a handy device that can quickly be affixt to or taken off the guard. A circle of tin is cut in the manner illustrated, allowance being made for small projections which are bent over and formed into hooks. It can be affixt to the protector guard with the projecting tabs. If the tin is not handy, cardboard will do just as well, except that the hooks must be made of wire or old hairpins. A good way to make these hooks is to thrust the hairpin thru the perforation, the two ends first, twisting them around at the other side of the perforation and then spreading them apart. About four cardboard tubes are inserted and sewn with wire as aforementioned to a piece of cardboard large enough to fit the wire cage pro-

www.americanradiohistory.com

tector or guard, to which it is in turn fastened. The use of hooks or rubber bands is also made here in securing the articles to the tubes.

Another use to which the electric fan can be put is the drying of photo negatives. The draft of air from the fan causes the water on the negative to evaporate, so that they will dry much sooner than under the ordinary process, which is to spread them on racks and allow them to dry by themselves. It proves of great help to the amateur as well as the commercial photographer, who particularly should make use of this method when business is rushed, or certain pictures are in special demand.

Nothing, perhaps, is more exasperating than to enter a public telephone booth and having to breathe the suffocating air, which is many times laden with the odor of stale tobacco. The electric fan might well be employed in all such instances.

Have you ever tried to look thru the window of a bakery or lunch room covered with frost, and dimly make out a few of the many delicacies therein? After the windows have been cleaned till they shine like mirrors, and a great deal of effort been expended to make the articles for sale most appealing, along comes Jack Frost and spoils it all. Some store-keepers have tried filling the window with warm air, but this is rather bothersome and expensive, as the cold window-pane cools it and a fresh supply of warm air must be employed. The most effective, least troublesome, and in the end the cheapest way, is—the electric fan. It circulates the air evenly, thus keeping a fixt temperature, with the result that no frost will form on the window.

One of the accompanying illustrations shows a very good use for an electric fan in the wintertime to help out the *cold air* circulating system to hot-air and other furnances. This suggestion was made by one of the Westinghouse engineers, and the sketch shows clearly how the fan is placed directly in the cold air duct. The fan may be placed anywhere in the duct, its function being to create a very strong draft or suction so as to act firstly as a forced draft for the furnace, and also to draw in a sufficient quantity of fresh air at all times thru the inlet in the cellar wall. Especially is this suggestion of value when the wind or air currents blow from the opposite side of the house in which the cold air intake is situated. In wiring up and installing such a fan arrangement, it is best to connect a small 4 c.p. pilot lamp on the motor side of the switch as a reminder to the furnace tender that the fan is operating, for it is not necessary to keep it going except at certain intervals, as for instance when a house is very cold or when the wind is blowing on the opposite side of the house.

A very good idea in this direction is to provide a two-way cold air box; one inlet being located in the *north* wall and the other in the *south* wall of the house. Suitable dampers should be used of course to cut off one or the other as the case may be, so that when the wind blows from the *north*, as the arrows show, then cold air can be taken from this inlet; while when the wind blows from the *south*, the cold air intake from that direction can be utilized by closing the north damper and opening the south damper. Great care must be taken in every instance to keep the cold air duct thoroly air-tight thruout its entire length, and it is often best to have a plumber or furnace man install the fan if you are not familiar with the work, as you may easily leave openings in the duct, thus creating a false draft and losing as much or more than what you at first set out to gain. Hot-air furnaces are widely used, but in some cases do not operate satisfactorily for sev-

How it Feels to Earn $1000 a Week

By a Young Man Who Four Years Ago Drew a $25 a Week Salary. Tells How He Accomplished It.

How does it feel to earn $1000 a week? How does it feel to have earned $200,000 in four years? How does it feel to be free from money worries? How does it feel to have everything one can want? These are questions I shall answer for the benefit of my reader out of my own personal experience. And I shall try to explain, simply and clearly the secret of what my friends call my phenomenal success.

Let me begin four years ago. At that time my wife and I and our two babies were living on my earnings of twenty-five dollars a week. We occupied a tiny flat, wore the simplest clothes, had to be satisfied with the cheapest entertainment—and dreamed sweet dreams of the time when I should be earning fifty dollars a week. That was the limit of my ambition. Indeed, it seemed to be the limit of my possibilities. For I was but an average man, without influential friends, without a liberal education, without a dominating personality, and without money.

With nothing to begin with, I have become the sole owner of a business which has paid me over $200,000 in clear profits during the past four years and which now pays me more than a thousand dollars a week. I did not gamble. I did not make my money in Wall Street. My business is not a war baby—on the contrary, many others in my line have failed since the war began.

In four years, the entire scheme of my life has changed. Instead of living in a two by four flat, we occupy our own home, built for us at a cost of over $60,000. We have three automobiles. Our children go to private schools. We have everything we want, and we want the best of everything. Instead of dreaming of fifty dollars a week I am dreaming in terms of a million dollars—with greater possibilities of my dream coming true than my former dream of earning fifty dollars a week.

What brought about this remarkable change? What transformed me, almost overnight, from a slow-going, easily-satisfied, average man—into a positive, quick-acting, determined individual who admits no defeat, who overcomes every obstacle and who completely dominates every situation? It all began with a question my wife asked me one evening after reading an article in a magazine about a great engineer who was said to earn a $50,000 salary.

"How do you suppose it feels to earn $1000 a week?" she asked. And without thinking, I replied "I haven't the slightest idea, my dear, so the only way to find out is to *earn it.*" We both laughed, and soon the question was apparently forgotten.

But that night, and for weeks afterward, the same question *and my reply* kept popping into my brain. I began to analyze the qualities of the successful men in our town. What is it that enables them to get everything they want? They are not better educated than I—indeed, some are far less intelligent. But they must have possessed some quality that I lacked. Perhaps it was their mental attitude; perhaps they look at things from an entirely different angle than I. Whatever it was, that "something" was the secret of their success. It was the one thing that placed them head and shoulders above me in money-earning ability. In all other ways we were the same.

Determined to find out what that vital spark of success was, I bought books on every subject that pertained to the mind. I followed one idea after another. But I didn't seem to get anywhere. Finally, when almost discouraged, I came across a copy of "Power of Will." Like a bolt out of a clear sky there flashed in my brain the secret I had been seeking. There was the real, fundamental principle of all success—Power of Will. There was the brain faculty I lacked, and which every successful man possesses.

"Power of Will" was written by Prof. Frank Channing Haddock, a scientist, whose name ranks with such leaders of thought as James, Bergson and Royce. After twenty years of research and study, he had completed the most thorough and constructive study of will power ever made. I was astonished to read his statement that, "The will is just as susceptible of development as the muscles of the body!" And Dr. Haddock had actually set down the very rules, lessons and exercises by which anyone could develop the will, making it a bigger, stronger force each day, simply through an easy, progressive course of training.

It is almost needless to say that I at once began to practice the exercises formulated by Dr. Haddock. And I need not recount the extraordinary results that I obtained almost from the first day. Shortly after that, I took hold of a business that for twelve years had been losing money. I started with $300 of borrowed capital. During my first year I made $30,000. My second year paid me $50,000. My third year netted me $70,000. Last year, due to increased costs of materials, my profits were only $50,000, though my volume of business increased. New plans which I am forcing through, will bring my profits for the present fiscal year up to $65,000.

Earning a thousand dollars a week makes me feel secure against want. It gives me the money with which to buy whatever will make my family happy. It enables me to take a chance on an investment that looks good, without worrying about losing the money. It frees my mind of financial worries. It has made me healthier, more contended, and keener minded. It is the greatest recipe I know for happiness.

Prof. Haddock's lessons, rules and exercises in will training have recently been compiled and published in book form by the Pelton Publishing Co., of Meriden, Conn. I am authorized to say that any reader who cares to examine the book may do so without sending any money in advance. In other words, if after five days' reading, you do not feel that the book is worth $3, the sum asked, return it and you will owe nothing. When you receive your copy for examination I suggest that you first read the articles on the law of great thinkiog; how to develop analytical power; how to perfectly concentrate on any subject; how to guard against errors in thought; how to drive from the mind unwelcome thoughts; how to develop fearlessness; how to use the mind in sickness; how to acquire a dominating personality.

Never before have business men and women needed this help so badly as in these trying times. Hundreds of real and imaginary obstacles confront us every day, and only those who are masters of themselves and who hold their heads up, will succeed. "Power of Will" as never before, is an absolute necessity—an investment in self-culture which no one can afford to deny himself.

Some few doubters will scoff at the idea of will power being the fountainhead of wealth, position and everything we are striving for. But the great mass of intelligent men and women will at least investigate for themselves by sending for the book at the publisher's risk. I am sure that any book that has done for me—and for thousands of others—what "Power of Will" has done—is well worth investigating. It is interesting to note that among the 250,000 owners of "Power of Will" are such prominent men as Supreme Court Justice Parker; Wu Ting Fang, Ex-U. S. Chinese Ambassador; Lieut.-Gov. McKelvie, of Nebraska; Assistant Postmaster General Britt; General Manager Christeson, of Wells-Fargo Express Co.; E. St. Elmo Lewis; Governor Arthur Capper of Kaosas, and thousands of others. In fact, today "Power of Will" is just as important and as necessary to a man's or woman's equipment for success, as a dictionary. To try to succeed without "Power of Will" is like trying to do business without a telephone.

As your first step in will training, I suggest immediate action in this matter before you. It is not even necessary to write a letter. Use the form below, if you prefer, addressing it to the Pelton Publishing Company, Wilcox Block, Meriden, Conn., and the book will come by return mail. This one act may mean the turning point of your life, as it has meant to me and to so many others.

The cost of paper, printing and binding has almost doubled during the past three years, in spite of which "Power of Will" has not been increased in price. The publisher feels that so great a work should be kept as low-priced as possible, but in view of the enormous increase in the cost of every manufacturing item, the present edition will be the last sold at the present price. The next edition will cost more. I urge you to send in the coupon now.

PELTON PUBLISHING COMPANY

30-A Wilcox Block, Meriden, Conn.

I will examine a copy of "Power of Will" at your risk. I agree to remit $3 or remail the Book in 5 days.

Name .....

Address .....

City .....*State*.....

www.americanradiohistory.com

The Gift of Gifts

FOR THOSE WHO LOVE GOOD MUSIC



THE ELLIS "MUSIC MASTER" REPRODUCER

is the ideal Christmas gift for anyone who owns a phonograph or talking machine using disc records. This wonderful little reproducer bears the same relation to the reproduction of records as does Stradivarius to the making of violins. Both are masters.

There is as much difference in the effect of the Ellis Reproducer and ordinary reproducers, as there is between a genuine Stradivarius and a cheap factory made violin. As one user said: "Mr. Ellis, your reproducer is soulful and inspiring. The overtones are remarkable and wonderful, and the tone shading very beautiful."

Ordinary reproducers, such as are supplied with all phonographs or talking machines, give a harsh, rasping, annoying sound and reproduce the human voice with a disagreeable nasal twang. The Ellis Music Master makes every note and tone as clear as a bell—and reproduces it in its true tone coloring. It is a marvelous little instrument that will please anyone who appreciates and can comprehend the difference between good and indifferent rendition of music. It is truly a "Music Master."

The Ellis "Music Master" is made for all machines using disc records. It is lighter than ordinary reproducers, therefore preserves and prolongs the life of records. The cost is little, but the satisfaction great.

Write today for circular E, which gives full details.

J. H. ELLIS, P. O. Box 882, Milwaukee, Wis.



Wireless Stations Will Shortly Re-open

Date, only, uncertain

Heed Our Advice *ORDER NOW*

As a matter of law Congress loses all control over wireless receiving stations and transmitting stations with a range within the borders of the state where located as soon as peace is declared. The Radio Inspector of this district has already asked our co-operation in printing in the next edition of our catalog the necessity of securing licenses for transmitting sets with a range beyond the borders of the state. No wireless manufacturer wants the stations to open tomorrow. They could not take care of the business. Order now and be prepared. We have a big stock of wireless instruments.

No. 11 is our latest catalog. No new price list.

Please do not write for catalog if you have No. 11. Paper costs three times as much as formerly. Let the amateur without a catalog secure one. Write for prices in advance. Just now we have no price list, because the changes have been so frequent. Will advise through this magazine when revised price list is ready, which will be as quickly as possible.

Send 8c in coin or stamps today for our big 300 page No. 11 Electrical and Wireless Catalog. Any wireless amateur will tell you it is the one catalog to have. You need no others. Our catalog contains most everything in wireless worth while, and is a guarantee that the goods are dependable.

THE WILLIAM B. DUCK CO., 230-232 Superior St., Toledo, Ohio

He Learned K·I· Shorthand in 5 evenings —You can!



AVAUGHN M. AMES, the young man in the picture, did it. So have legions of others. We guarantee you can learn the entire system in five evenings; than acquire speed. Become proficient in a tenth of the time it would take you with any of the old, complex systems. K. I. Shorthand is the new simplified stenography that experts consider the most concise and most legible shorthand in the world. Learn by mail.

Why go through months of drudgery and spend ten times as much money learning some troublesome system? K. I. students are found in every walk of life—among doctors, lawyers, teachers, electricians, engineers, and business-men, as well as stenographers and secretaries. Used in army and navy, and acknowledged by progressive commercial schools as the most practical of shorthand systems.

30 Days Approval K. I. Shorthand will be a big help to you in any vocation. You can afford to learn it because it is so easy and costs so little. Don't think K. I. Shorthand is meant only for stenographers. Learn this invaluable system so you can be more than a stenographer. It conserves your time, does your remembering for you. Hence promotes your efficiency and puts you in line for more rapid advancement. Valuable in your electrical or mechanical enterprises.

We teach you the entire course on approval for 30 days with the understanding that you need not pay one cent if you do not learn. Prove it for yourself by receiving two first lessons FREE.

More Than a Text Book! Do not compare our system with offers of text books on stenography. We give you personal mail tuition. Experts guide you in acquiring proficiency and accuracy in the shortest time. Free Lessons, testimonials and complete information sent on request.

KING INSTITUTE, Inc. Station F, (EH-300), New York, N. Y. or 2 S. Wabash Av., (EH-300), Chicago, Ill.

eral reasons. Among these are insufficient area of the cold air duct; furnace not located low enough in cellar bottom; or else hot air pipes rise at too low an angle. These should rise at a sharp angle, preferably not less than 45 degrees at the top of the furnace, and will always work better when kept close to this angle or approaching the vertical, than they will in the horizontal direction. In the majority of cases it is usually found that the wind blows from the north or some northerly direction more than any other. Therefore, where but one fan is available for this use, it should be installed in the *north* cold air box.

A large and airy but unfinished attic room in a building occupied by a school was suddenly needed in order to accommodate an extra class. It took only a few days to wire and plaster it but the time required for natural drying could not be spared and use of the common salamanders was inadvisable because of fire hazard. Three 16-inch electric fans were placed on boxes and turned so as to keep a continual circulation of air thruout the room. With windows poen and the fans running for a day and night, the fresh plaster dried quickly so that carpenters and decorators could finish the room shortly.

2 MEN MILE APART BURNED BY SAME ELECTRIC FLASH.

Recently two men, R. C. Deyo and Henry Nisson, both in the employ of the San Joaquin (Cal.) Light and Power Company, were working on the top of telephone poles for the company, 50 miles apart, when an unaccountable and unknown current of 10,000 volts went flashing over the wires and gave each man such a shock that it is a miracle that they escaped instant death. Both men were similarly burned about the hands, both were rendered unconscious, and only restored to consciousness by extraordinary efforts. The men are now recovering from burned hands and the electric shock at the San Joaquin hospital.

Deyo was at work on the top of a telephone pole about twenty miles west of Bakersfield, Cal. He was busy on what the electricians call the 60-phone line, when a shock came to him. He fell to the ground, a distance of 25 feet.

When, after an hour, Deyo came to his senses, he was put in an automobile and hurried to the San Joaquin hospital in this city. Dr. N. J. Brown was called for attendance. Both of Deyo's hands are burned to a crisp at the palms, and he is suffering from hurts he received in his fall from the top of the telephone pole.

At the same moment Henry Nisson, aged 28 years, was engaged in exactly the same sort of work for the San Joaquin Light and Power Company at Pond. He, also, was at the top of a telephone pole, and he was served the same as Mr. Deyo. He fell unconscious, and his companion rushed to Dr. Copeland's office for help. His hurts are the same as Mr. Deyo's, only he has not the bruises by the fall.

GAS VERSUS ELECTRIC RANGE.

The gas range is little better than half as efficient as the electric range. Recent tests show that the top surface of the electric range requires but 64 per cent of the energy necessary to do the same work on the top surface of the gas range. The electric range oven requires but 23 per cent of the energy necessary for the same work in a gas range oven. The electric range oven is much more efficient in proportion than the top surface as compared with the oven and top surface of the gas range. Under actual household conditions the electric range requires about 55 per cent of the energy used by the gas range to do the same work.

www.americanradiohistory.com

NIKOLA TESLA AND HIS INVENTIONS.

(*Continued from page* 615)

either a dreamer or, worse yet, crazy. The fact is the world does not understand you because you live in the next century. Moses was a great man, but the Bible teaches us that he was "heavy of tongue" and could not make himself understood. His brother therefore always spoke in his stead, announcing to his hearers what Moses had to say. Why not let the EXPERIMENTER be your brother? Why not let us translate your work into a language that the man in the street can readily understand? We have the knowledge and the technical training to do your inventions justice by means of graphic illustrations and wash drawings. The public does not want patent drawings or patent language. It wants pictures and plain English. You are a great inventor, but your 21st Century training prevents you from making yourself understood to a 20th Century public. My plan is to run one of your inventions every month, in plain English fully illustrated. That means that it will probably take over two years to deal with all of your more important inventions. At the end of this period the articles can be published in book form, a thing that does not exist at present. The plan is twofold. First, the world at large will at last understand the highly important work you have accomplished and will fully recognize you. Second, it will be of greatest benefit to Science, to whom your inventions will then not be the sealed book they are today."

Knowing that Tesla had in the past continuously refused similar offers of dozens of great publishers of this country as well as abroad, I was not at all sanguine of my own plan. Great was my surprise therefore, that he not only gave his consent, but he actually agreed to prepare each article personally with the Editors' collaboration.

Dr. Tesla wants it expressly understood that he is undertaking this great work chiefly to educate the young generation. He felt that he could not possibly reach such a large electrically trained young manhood, save thru the medium of the ELECTRICAL EXPERIMENTER. With its circulation above 100,000, all enthusiastic experimenters, Tesla feels that his greatest mission in life, namely, to assist our rising generation, will come near fulfillment.

Nikola Tesla's articles will therefore run serially every month in the ELECTRICAL EXPERIMENTER. The articles will be entitled: "My Inventions" —by Nikola Tesla. Every article will be entirely original; each will be illustrated with our own new illustrations and with such wash drawings as made this journal so successful. The first article will appear in our February number.

We wish to congratulate EXPERIMENTER readers for having obtained for them probably the greatest technical news feature of a generation. I caution you: *Expect much!*

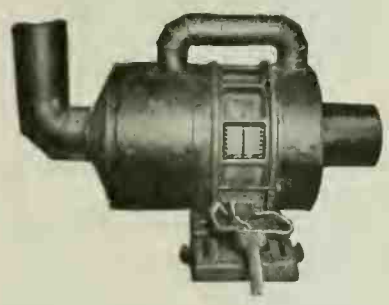
FARMERS AND ELECTRICITY.

Within the past three years the farmers of the United States have purchased one million automobiles and 100,000 tractors and innumerable pumping engines, and other devices run by electricity, according to widely publisht estimates. Farmers everywhere are rapidly advancing in the same direction, progress in labor-saving contrivances being phenomenal in this country. A motor does the churning; a motor runs the sewing machine and the washing machine. The rural telephone is invading country districts at the rate of many miles per day, and all farm machinery is being operated by the aid of tractors, which now haul the wagon and work the hay loader in the hay field. Next year, it is said, reapers and mowers in great numbers will be drawn by tractors.

DEVICE FOR PROTECTING ELECTRIC MOTORS.

A motor protection system which, it is claimed, does away with the trouble and expense of cleaning motors, has been devised and marketed. The usual type of installation, it is pointed out, in working out this system consists of casings which enclose each end of the motor and make it dust proof. A fan is attached to the end of the motor shaft, a dust separator, and an air intake pipe running to a clean air supply out of doors. When the motor is started, the fan draws in the cool, fresh air thru the dust separator and forces it against the rear end of the motor, thru the windings and out thru the laminations. Part of the air is forced thru a by-pass to the front hood so that the same action takes place on both sides of the motor.

As a result, it is pointed out that the motor is kept clean and has a large volume of cool, clean air constantly passing thru it which carries away the heat as fast as generated. Motor casings are provided with



Forced Air Cooling Apparatus Shown Installed on a Motor.

large doors to permit of a ready inspection of brushes, resistance, air-gap, bearings, and the like. The dust separator is also provided with doors so that the screens can be readily removed. The equipment can be applied to motors without moving them and requires a short time to install. Besides reducing the temperature and increasing the efficiency, the maker points out that the protection provided allows the carrying of a large overload without shortening the life of the motor and eliminates fire hazards.

DANIELS TELLS OF FOE RADIOS SCOUTS FOUND.

A telegram from Secretary of the Navy Daniels received by the Boy Scouts of America characterized them as "chivalrous young crusaders" because of their work during the war. It also disclosed that the Scouts, working on behalf of the Government, had discovered hundreds of illegal wireless plants.

Twenty-six of these plants were found in one day. A German alien, operating an underground radio station with a small New England river supplying the motive power, was taken into custody and interned. This plant was said to have been exchanging German Government messages between America and Berlin. Details of these scout activities are expected to be made public later.



"I Can Succeed!"

"What other men have done with the help of the International Correspondence Schools, I can do. If the I. C. S. have raised the salaries of other men, they can raise mine. If they have helped others to advance, they can help me. To me, I. C. S. means 'I CAN SUCCEED.'"

Make up your mind right now that not another day shall pass until you have made *your* start toward success.

For 27 years men in offices, stores, shops, factories, mines, railroads, and in the Army and Navy have been winning promotion and increased salaries through the I. C. S. More than 100,000 men and women are getting ready *right now* with I. C. S. help for the bigger jobs ahead.

No matter where you live, the I. C. S. will come to you. No matter what your handicaps, or how small your means, we have a plan to meet your circumstances. No matter what career you may choose, some one of the 280 I. C. S. Courses will surely suit your needs.

When everything has been made easy for you—when one hour a day spent with the I. C. S. in the quiet of your own home will bring you a bigger income, more comforts, more pleasures, all that success means—can you let another single priceless hour of spare time go to waste? Make your start right now! This is all we ask: Without cost, without obligating yourself in any way, put it up to us to prove how we can help you. Just mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6170, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ELECTRICAL ENGINEER
- Electric Lighting and Rys.
- Electric Wiring
- Telegraph Engineer
- Telephone Work
- MECHANICAL ENGINEER
- Mechanical Draftsman
- Machine Shop Practice
- Toolmaker
- Gas Engine Operating
- CIVIL ENGINEER
- Surveying and Mapping
- MINE FOREMAN or ENG'R
- STATIONARY ENGINEER
- Marine Engineer
- Ship Draftsman
- ARCHITECT
- Contractor and Builder
- Architectural Draftsman
- Concrete Builder
- Structural Engineer
- PLUMBING AND HEATING
- Sheet Metal Worker
- Textile Overseer or Supt.
- CHEMIST
- SALESMANSHIP
- ADVERTISING
- Window Trimmer
- Show Card Writer
- Sign Painter
- Railroad Trainman
- ILLUSTRATING
- Cartooning
- BOOKKEEPER
- Stenographer and Typist
- Cert. Pub. Accountant
- TRAFFIC MANAGER
- Railway Accountant
- Commercial Law
- GOOD ENGLISH
- Teacher
- Common School Subjects
- Mathematics
- CIVIL SERVICE
- Railway Mail Clerk
- AUTOMOBILE OPERATING
- Auto Repairing
- Navigation
- AGRICULTURE
- Poultry Raising
- Spanish
- French
- Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____

www.americanradiohistory.com

"THE SET UNCLE SAM USES"



"Uncle Sam" needs thousands of operators and is calling for more all the time. Here is your chance to become an expert telegrapher at a small cost. The practice outfit shown here is exactly the same as used by the United States Signal Corps and comprises the following:

A highly polished mahogany finished wood base, a real high frequency buzzer giving a high note, with nickel-plated case, regulation nickel-plated steel lever key. Also brass etched plate showing the three international codes mounted on the base for quick practice. A new feature not found on any other set. You simply cannot mislay this code.

This outfit quickly gives you speed, and enables you to learn telegraphy, Morse or wireless code in a short time. Special attention is called to the buzzer which gives a clear high note, not a rattling noise as many inferior outfits now on the market. IMMEDIATE DELIVERY. We ship the same day that order is received. Your money refunded if you are not satisfied.

Price as illustrated. Shipping weight 2 lbs. Size over all 6"x2"x1¼". **$2.80** Includes sufficient postage for mailing. Send for free illustrated folder.

THE TEWNO CO. 150 CHAMBERS ST., NEW YORK

The Breakers

Atlantic City's Newest Fire-Proof Hotel

Ocean Front. Unusually attractive during the Autumn and Winter seasons.

American and European Plans



Luxurious lobbies, spacious verandas and sun parlors overlooking the ocean. Charming afternoon musicales and evening concerts. A palatial residence for those seeking rest and recreation. Sea water baths. Fireproof garage. Illustrated booklet sent on request.

MAGNETIC RECTIFIER
Patented April 18, 1916



YOUR lights will shine and sparkle with delight, your horn will squawk raucously and your engine will turnover enthusiastically if you play godfather to your starting and lighting battery by giving it an

F-F BATTERY BOOSTER

A few minutes of your time once a month or so will rejuvenate your battery and prolong indefinitely its working life.

Write today for bulletin No. 12 and obtain a prescription for this battery panacea.

The France Manufacturing Company
10325 Beren Road, Cleveland, O.

Super-Sensitive Microphone Only $7.50



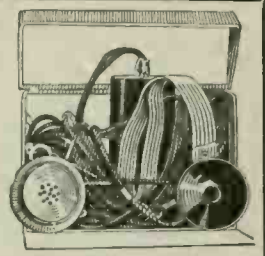
This instrument is offered at an extremely low price. It is excellent for building your own radio amplifier. Can also be used in many experiments where a sensitive microphone is required.

DETECTAGRAPH $15

This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25 ft. Black Cord, Receiver, Headband, Case and Battery.

Send for One Today and Convince Yourself

GASTON BOISSONNAULT
26 Cortlandt Street New York
Makers of Super-Sensitive Microphone Apparatus



DETECTAGRAPH $15

A WIRELESS OUTFIT FOR 20c

We at last have a low-priced wireless telegraph system. With this outfit you can receive and send messages to your friends and sweethearts or neighbors across the hall, etc. This outfit consists of two mechanical snapper sounders, one for each station; also two codes of Morse Alphabet, which, with practice, will enable you to operate any telegraph system. Complete, postpaid, for 20c in coin.

THE A. S. CO. 1305 Pearle St. CHICAGO

DEAFNESS IS MISERY



I know because I was Deaf and had Head Noises for over 30 years. My invisible Anti-septic Ear Drums restored my hearing and stopped Head Noises, and will do it for you. They are Tiny Megaphones. Cannot be seen when worn. Easy to put in, easy to take out. Are "Unseen Comforts." Inexpensive. Write for Booklet and my sworn statement of how I recovered my hearing. A. O. LEONARD
Suite 369 70 5th Ave., N. Y. City

THE EFFECT OF STATICS ON WIRELESS TRANSMISSION.

(*Continued from page 627*)

energy received, even if it could be collected in its totality, is infinitesimal and would not actuate the most sensitive instrument known were it magnified many million times. The fact is these waves have no perceptible influence on a receiver if situated at a much smaller distance. It should be remembered, moreover, that since the first attempts the wave lengths have been increased until those advocated by me were adopted, in which this form of radiation has been reduced to one-hillionth.

When a circuit, connected to ground and to an elevated capacity oscillates, two effects separate and distinct are produced; Hertz waves are radiated in a direction at right angles to the axis of symmetry of the conductor, *and simultaneously a current is passed through the earth.* The former propagates with the speed of light, the latter with a velocity proportionate to the cosecant of an angle which from the origin to the opposite point of the globe varies from zero to 180°. Expressed in words, at the start the speed is infinite and diminishes, first rapidly and then slowly until a quadrant is traversed when the current proceeds with the speed of light. From that region on the velocity gradually increases, becoming infinite at the opposite point of the globe. In a patent granted to me in April, 1905, I have summed up this law of propagation in the statement that the projections of all half waves on the axis of symmetry of movement are equal, which means that the successive half waves, tho of different length, cover exactly the same area. In the near future many wonderful results will be obtained by taking advantage of this fact.

There is a vast difference between these two forms of wave movement in their bearing on the transmission. The Hertz waves represent energy which is radiated and unrecoverable. The current energy, on the other hand, is preserved and can be recovered theoretically, at least, in its entirety. If the experts will free themselves from the illusions under which they are laboring, they will find that to overcome static disturbances all that is needed is a properly constructed transmitter and receiver without any additional devices or preventives. I have, however, devised several forms of apparatus eliminating statics even in the present defective wireless installations in which they are magnified many times. Such a form of instrument which I have used successfully is shown in the annexed photograph. These phenomena have been studied by me for a number of years and I have found that there are nine or ten different causes tending to intensify them, and in due course, I shall give a full description of the various improvements I have made, in the ELECTRICAL EXPERIMENTER. For the present I would only point out that in order to perfectly eliminate the static interference, it is indispensable to redesign the whole wireless apparatus as now employed. The sooner this is understood the better it will be for the further evolution of the Art.

A means of making use of the electric magnet under water has been devised in Japan, and it promises to be of great assistance in locating sunken vessels, to recover which salvage operations on a big scale are expected after the war.

With the aid of special oxygen masks airplane experts believe that air fighters will be able to carry on battles five miles above the earth.

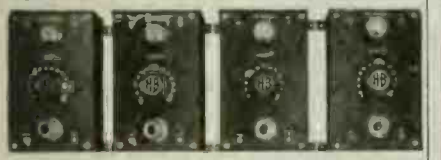
www.americanradiohistory.com

NEW BATTERY CHARGER SIMPLICITY ITSELF.

For the Garage Man going into Battery or Service work on an ample scale, or for the Garage that has outgrown its present equipment, an Ohio concern has brought out a new 32 battery capacity Charging Outfit shown herewith.

With this outfit batteries in all stages of charge can be handled by the four charging lines provided, caring for eight batteries in each line. Batteries requiring different charging rates can be handled according to their individual needs, due to the ample output of the machine. Different voltage batteries can also be charged in the same line, due to the automatic voltage control of the Generator.

With this outfit, battery charging work is claimed to be very profitable, and the makers state they have designed the outfit wholly with the idea of bringing the Garage the largest profits possible from this class of work.





Compact Battery Charging Outfit of capacity Ample for Average Public Garage and Service Station.

DO YOU ASSOCIATE COLORS WITH FIGURES?

The recent letter to *Science* from David Starr Jordan called to my attention a fact which I did not know before, says Arthur Bessey Smith, the well-known telephone engineer, in that journal. On mentioning it to my laboratory assistant, Mr. Herbert Edward Clapham, he said that he, too, associated colors with the letters of the alphabet, but not with all, and that figures were also associated with colors. At my request he wrote out the following list:

A gray	O black	1 white
B light red	P brown	2 red
C black	Q ———	3 light red
D pink	R ———	4 gray
E scarlet	S white	5 white
F pink	T red	6 white
G ———	U golden brown	7 golden
H yellow	V gray	8 brown
I white	W ———	9 red
J white	X ———	0 black
K ———	Y white	
L ———	Z red	
M olive green		
N olive green		

Altho I have never associated colors with letters or figures, from my earliest recollection I have always thought of letters and of figures arranged in certain relative positions. The origin of this I do not know. It might have been something in the presentation of these things by my first teacher, or the manner in which little wooden sticks were laid out on my desk in the first number work. These little sticks, each about 3 mm. in diameter and 20 mm. long, had been split out of pine for me by my father.

WANTED!

OFFICE MEN
Auditors, Accountants, Office Managers, Credit Men, Cashiers, Bookkeepers and Cost Clerks—$1,200 to $7,500.

FACTORY MEN
Electrical and Mechanical Engineers, Factory Managers, Superintendents, Foremen, Designers, Draftsmen—$1,500 to $12,000.

CONSTRUCTION MEN
Civil and Structural Engineers, Transitmen, Construction Superintendents and Foremen, Estimators, Designers and Draftsmen—$1,200 to $10,000.

TRADES—Machinists and Toolmakers, Auto Repairers, Electricians, Stationary Engineers, Firemen, Plumbers, Carpenters, etc.—$1,200 to $2,000.

All these positions were advertised in a single issue of a Chicago newspaper

Which Job Can You Fill?

Which one of them could *you* fill? If you haven't the knowledge necessary to break into the *big-pay class*, decide to *get that knowledge NOW!* Any of the books listed below will quickly fit you for a well-paid job—at home—in your spare time.

These books were written by experts in plain, everyday language. They are free from puzzling technical terms. Numerous illustrations, diagrams and tables make difficult points as simple as A-B-C. They are handsomely bound in half or full leather (except Law and Practice, which is bound in law buckram) and stamped in gold. Fill out the coupon.



Carpentry and Contracting
Five volumes, 2138 pages and more than 400 illustrations. Prepares for Contractor, Building Superintendent and Carpenter Foreman. Regular price, $25.00. Special price, $17.80.

Civil Engineering
Nine volumes, 3900 pages and 3000 illustrations, plates and diagrams. Prepares for Civil or Structural Engineer, Transitman, Estimator, Designer or Chief Draftsman. Regular price, $45.00. Special price, $29.80.

Telephony and Telegraphy
Four volumes, 1728 pages and 2000 illustrations, plates and diagrams. Prepares for Telephone Engineer, Wire Chief, Exchange Manager, Trouble Man or Telegrapher. Regular price, $20.00. Special price, $12.80.

Fire Prevention and Insurance
Four volumes, 1500 pages and 600 illustrations, diagrams, forms, etc. Prepares for Counterman, Rata Clerk, Inspector or Agent. Regular price, $20.00. Special price, $15.80.

Electrical Engineering
Seven volumes 3000 pages and 2600 illustrations, plates and diagrams. Prepares for Electrical Engineer, Power Plant Superintendent, Substation Operator or Electrician. Regular price, $35.00. Special price, $19.80.

Accountancy and Business Management
Ten volumes, 3680 pages and 1987 illustrations, forms, etc. Prepares for Certified Public Accountant, Auditor, Office Manager, Accountant, Credit Man or Bookkeeper. Regular price, $50.00. Special price, $24.80.

Automobile Engineering
Five volumes, 2100 pages and 2000 illustrations. Prepares for Garage Foreman, Automobile Mechanic or Chauffeur. Invaluable to car owners. Regular price, $25.00. Special price, $17.80.

Steam and Gas Engineering
Seven volumes, 3300 pages and 2500 illustrations, plates, diagrams, etc. Prepares for Stationary, Marine or Locomotive Engineer or Fireman. Regular price, $35.00. Special price, $21.80.

MachineShop Practice
Six volumes, 2300 pages and 2500 illustrations. Prepares for Machine Shop Superintendent or Foreman, Foundryman, Pattern Maker, Tool Designer or Tool Maker. Regular price, $30.00. Special price, $19.80.

Law and Practice
(with Reading Course in 25 bound pamphlets). Thirteen volumes, 6000 pages and 24 illustrations. Prepares for all Bar Examinations. A wonderful aid to business men. Regular price, $72.00. Special price, $39.80.

Sanitary, Heating and Ventilating Engin'ring
Four volumes, 1454 pages and more than 1400 illustrations, etc. Prepares for Sanitary Engineer, Heating and Ventilating Engineer, Master Plumber or Plumber. Regular price, $20.00. Special price, $13.80.

Practical Accounting
Four volumes, 1840 pages and 800 illustrations, plates and diagrams. C. P. A. questions and practical problems. Prepares for Accountant, Bookkeeper or Cost Clerk. Regular price, $20.00. Special price, $12.80.



One Week Free Trial

We'll gladly send you any set for seven days' examination. Don't send us a penny; just pay the small shipping charge when the books arrive. Examine them carefully—use them at your work for an entire week. At the end of that time, if you feel they aren't worth far more than we ask, return them *at our expense*. If you keep them, pay the bargain price on the easy terms explained below.

American Technical Society
Dept. X3389 Chicago, U. S. A.

50c A WEEK

Yes, if you decide to keep the set you have selected, send $2 within seven days and then $2 a month (*50c a week*) until the present low price has been paid. Have you ever heard of a more generous offer? Remember, you take no chances whatever—we send the books for examination and you are not obliged to keep them if you do not care to buy. Mail the coupon *now*—before you turn the page.

American Technical Society, Dept. X3389, Chicago, Ill.

Please send me set of ..... for 7 days' examination, shipping charges collect. I will examine the books thoroughly and, if satisfied, will send $2 within 7 days and $2 each month until I have paid the special price of ..... If I decide not to keep the books, I will return them by express at your expense. Title not to pass to me until the set is fully paid for.

Name .....

Address .....

Reference .....

www.americanradiohistory.com

?

DO YOU KNOW?

Do you know how to make chemical tricks?
Do you know how cloth is bleached?
Do you know how to test soil?
Do you want to make invisible ink?
Do you know how to test flour?
Do you know how Chlorine Smoke and Chlorine Gas (German War Gas), is made?
What do you know about chemistry in general?

These and hundred other interesting questions are answered and demonstrated with our Chemistry Laboratory which we present herewith.

CHEMISTRY!

We present herewith to our friends our new E. I. Co. Chemical Laboratory which contains real chemicals and apparata to perform real chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.



44 Chemicals
17 Apparata
1 Instruction Book with 100 Experiments

PRICE $5.00

Shipping Weight 10 lbs

CAN BE SHIPPED BY EXPRESS ONLY

The chemicals furnished are all technically pure and put up in appropriate wooden boxes and glass bottles, and there is a sufficient quantity to make dozens of experiments with each. The apparata are of standard laboratory size and quality.

Altho all chemicals have nearly doubled in price, we have decided not to raise the price for this outfit for the present.

Read the list of chemicals and apparata and look at the actual photograph of the outfit at your right.

And order one today!

THE E. I. Co. CHEMICAL LABORATORY

DESCRIPTION OF THE OUTFIT

It contains the following 44 chemicals:

Ammonium Chloride
Alum
Antimony
Boracic Acid
Charcoal
Sodium Nitrate
Sodium Carbonate
Sodium Borate
Sodium Sulphite
Manganese Dioxide
Oxalic Acid

Brimstone
Iron Oxide
Sulphate of Zinc
Magnesia Carbonate
Zinc, Metallic
Sodium Bicarbonate
Sodium Sulphate
Sodium Chloride
Calcium Sulphate
Barium Chloride
Lead Acetate

Ferrous Sulphate
Nickel Sulphate
Sodium Phosphate
Zinc Carbonate
Ammonium Sulphate
Ammonium Carbonate
Ammonium Aqua
Calcium Chloride
Chloride of Zinc
Copper Sulphate
Glycerol

Iron Chloride
Calcium Oxide
Stannous Chloride
Nickel Chloride
Hydrochloric Acid
Sulphuric Acid
Iodine
Mercury, Metallic
Tin, Metallic
Litmus Paper
Ferrous Sulphide

The following apparata are furnished:

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube

Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure

Glass Tubing
One book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

THE ELECTRO IMPORTING Co., NEW YORK, 231 FULTON STREET

SEE OUR FULL PAGE AD ON PAGE 679 FOR FREE CYCLOPEDIA

www.americanradiohistory.com

PATENT ADVICE





Edited by H. GERNSBACK

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries address to "Patent Advice" cannot be anwered by mail free of charge. Such inquiries are publisht here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

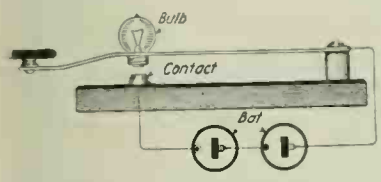
Readers' attention is called to the fact that due to the great amount of letters to this department it is quite impossible to answer them all thru these columns. The inquiries answered in this issue date as far back as July, and if readers wish speedy service they should carefully note the announcement appearing in the preceding paragraph.

Code Practise Instrument.

(289) Geo. R. Griffin, Troy, N. Y., writes: "I have noticed in the November number of the ELECTRICAL EXPERIMENTER an article by A. E. Kopp, New Middletown, Ind., called 'Code Practise Instrument' and the fault you had found with it. I have an idea which might be of value to Mr. Kopp's instrument, and am enclosing copy of same with the request to publish the device at your convenience."

Mr. Griffin suggests putting the lamp of the practise outfit right on the key lever as shown in our illustration. By this means the bulb is screwed in the socket made for that purpose on the lever of the key. This has a tendency to light the bulb on the downward stroke instead of the upward stroke.

A. This strikes us as a good solution of Mr. Kopp's idea, but of course in this case Mr. Griffin and Mr. Kopp should really be joint inventors in any future patent action. The solution seems satisfactory offhand.



Improved Code Practise Instrument.

Diving Mine.

(290) W. F. Ashe, Jacksonville, Fla., writes: "Has there been a patent issued for a 'diving mine'—power to be furnished by small motor or clockwork—one that will take in water on the surface of the sea, which will cause it to sink to let mine rakes pass by, and after it has gone down to about fifty feet, it will throw out water, and thus cause it to rise in time to blow a battleship up?"

A. To our knowledge there has never been anything of this kind invented before, and we have never seen any reference to it. We think a device of this kind is more or less impossible.

Safety Soap.

(291) W. L. McGowan, Holdenville, Okla., writes: "To your knowledge has there been any device patented for preventing soap from being stolen or destroyed from public places? Furthermore what do you think of such a device. The device which I speak of is composed of a flat steel which runs thru the center of the soap and is fastened by chain at one end and small lock on the other. Any information that you can give me concerning this matter will be greatly appreciated."

A. This is a very old idea, and one which we have seen in actual use in hotel and public washrooms years and years ago. There is nothing novel about this, and nearly all of these devices have been superseded by automatic soap dispensing machines, such as liquid soap, where you only have to press a button to get a thimblefull of liquid soap in your hand, or the other device whereby you turn a handle which puts soap shavings into your hand.

Invisible Periscope.

(292) Mr. Geo. Ulrich, Newark, N. J., submits an idea of what he calls "invisible periscope" scheme. The outside of the periscope tubing is to be surrounded with a heavy glass tube while the space between the periscope tube and glass tube is to be filled with sea water. The periscope tube is to be painted to match the sea water. Our advice is asked.

A. While an ingenious idea, this is not different from many other similar devices which have been suggested in the past. The trouble is that it is not the periscope itself which makes the trouble, but the V-shaped wake of churned, white water which is left behind as the submarine speeds thru the water. The periscope itself can be and has been camouflaged in the past in such a way as to render it almost invisible within a hundred yards. Of course, this is all right while the submarine is not moving, but once it starts moving, the periscope immediately leaves a telltale wake behind.

Ice-Cream Cone.

(293) Gardner S. Wyman, Pittsburgh, Pa., says: "I would like to submit a plan for a paper ice-cream cone that is to take the place of cake cones now in use, as I understand there is a shortage of the latter; the plan is to make a cone of the same shape as cake cones out of fairly heavy wax paper, the latter to unroll like a paper pencil as the cream is eaten away." Our advice is asked on this idea.

A. We are afraid that while it looks feasible on paper, it would not work out in practise for the reason that it would at best be a very messy operation to thus unroll the wax paper, which surely would splash melted cream over the eater.

U.S. PATENTS

SEND FOR THIS FORM

Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception," sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

LANCASTER & ALLWINE

255 OURAY BLDG., WASHINGTON, D. C.

PATENTS

INVENTORS. Send us a sketch, model, or photo and written description of your invention for advice regarding patent protection. No charge for this service.

Patents we secure advertised without charge in Popular Mechanics Magazine.

20 years' experience. Prompt personal service. Our experience and knowledge in patent matters often enables us to advise regarding patentability without expense to the inventor. Particulars Free. Write us today.

TALBERT & TALBERT, Patent Lawyers
4287 Talbert Bldg., Washington, D. C.

PATENTS

Inventors Invited to Write for Information and Particulars

Highest Refereoces. Best Results. Promptness Assured.

WATSON E. COLEMAN
Patent Lawyer
624 F Street N. W. Washington, D. C.

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE OF CONCEPTION". This should be signed and witnessed and returned to us together with model or sketch and description of the invention, and we will give our opinion as to its patentable nature.

Our Illustrated Guide Book, HOW TO OBTAIN A PATENT, sent Free on request. Contains full instructions regarding Patents, Trade-Marks, Foreign Patents, Our Methods, Terms and 100 Mechanical Movements illustrated and described. Articles on Patent Practice and Procedure, and Law Points for inventors.

An actual search of United States patents made in all cases before preparing application for patent.

Electrical Cases a Specialty Highest References Prompt Attention Reasonable Terms

FREE COUPON!

VICTOR J. EVANS & CO., Patent Attorneys

New York Offices: 1001 to 1007 Woolworth Bldg.
Pittsburgh Offices: 514 Empire Bldg.
Philadelphia Offices: 135 S. Broad St.
Main Offices: 779 Ninth Street, N. W., Washington, D.C.

Name *Address* .....

www.americanradiohistory.com

AMERICA NEEDS YOUR IDEAS

MILLIONS OF DOLLARS

are being spent NOW for new ideas of all kinds. Never before has the demand for good things PROTECTED BY OWEN PATENTS been so great—or profitable to the man who will but use his brains. Send for my four free books and find out what inventions are needed.

THESE ARE FREE! SUCCESSFUL PATENTS—a 72-page guide to success; STEPPING STONES—hundreds of hints of ideas wanted, truth about prizes for inventions; PATENT BUYERS—contains over 400 requests for OWEN PATENTS, with ideas desired; PATENT PROMOTION—tells how to sell your patent, etc.

I'll help without charge to sell your idea by advertising it and otherwise putting you in touch with prospective buyers. Send sketch or model for free opinion as to patentability, cost of patent, etc. Advice costs nothing. Write today for my books. A postal request will do.

RICHARD B. OWEN, Patent Lawyer

184 Owen Building 2276-8 Woolworth Bldg.
Washington, D. C. New York City

PATENTS and Trade Marks

Send sketch or model for actual search and report. Write for Booklet of instructions on patent practice and procedure. Prompt personal service. . . .

Geo. P. Kimmel
Patent Lawyer
88-M Oriental Bldg., Washington, D. C.

PATENTS

LACEY & LACEY

Attorneys-at-Law—Patent Practice Exclusively
Solicitors of
U. S. and Foreign Patents
Trade-Marks, Copyrights

642 F Street, N. W., Washington, D. C.

Write Us for Our Inventors' Book
PATENT-SENSE
ESTABLISHED 1869

U. S. PATENTS

Our facilities for securing patents enable us to give prompt and reliable service at reasonable rates. Inventors are invited to write to us regarding questions appertaining to securing patent protection. All matters receive prompt attention. Send sketch for preliminary examination. Books free on request.

A. M. BUCK & CO., Patent Attorneys.
205 Second Nat'l Bank Bldg., Washington, D. C.

Electric Radiator.

(294) Earl F. Hobbs, St. Louis, Mo., has an idea of a hot water radiator, electrically heated with expansion tank and built on wheels so it could be moved from one location to another and from room to room. It could be made out of ¾ inch pipe with about a 500 watt element made from nichrome wire. The radiator to have a medium and a low point.

A. There is nothing fundamentally new in electrically heated water radiators as our correspondent suggests in his letter. We have in the ELECTRICAL EXPERIMENTER often described numerous electrically heated radiators of this sort.

Poison Shell.

(295) Joseph Vierthaler, Philadelphia, Pa., submits description and device of a poison shell which comprises an ordinary shell with a hollow center. Poisoned gas is enclosed in the shell, the latter is put in the shell when manufactured. Our advice is asked.

A. There is nothing new at all about this, and the present gas shells as have been used by the Germans as well as all the Allies and the United States are made along precisely this plan.

Fan Guard.

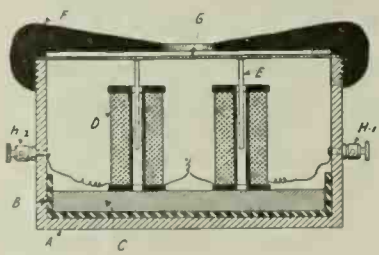
(296) Ladimir H. Svoboda, Cleveland, Ohio, writes: "As editor of the 'Patent Advice' I would appreciate your advice on the following: Would it be advisable to employ a guard for a small special electrical fan having blades but 3" long? The guard if employed must be dissectable. I have been advised to use a 'sand guard.' Could you give me details as to this or any other dissectable guard?"

A. We see nothing fundamentally difficult in making a detachable fan guard to work in conjunction with a small fan. It seems that any model shop or a clever experimenter ought to be able to devise such a guard, which seems a very simple undertaking. We do not know, however, what you mean by sand guard. We do not know to what this refers.

Telephone Receiver.

(297) Frank W. Harrington, Fulton, Ill., sends in a sketch of a telephone receiver which we reproduce herewith. The idea is to employ two bobbins having a central opening which are to pull in two soft iron needles 1/32 inch in diameter attached to the diafram as shown. We are asked if this design is good, whether the telephone is sensitive and whether the device has ever been tried before.

A. This is a similar idea to one described some time ago in these columns. Right here we want to say that any telephone receiver as a rule,—with very few exceptions,—which has its diafram weighed so as to interfere with the free vibration of the latter, usually is less sensitive than the diaframs which swing free. We are quite convinced that the construction shown by



Novel Idea in Telephone Receiver Design.

our correspondent would not prove very sensitive. The idea is of course not new, having been tried quite a number of times before.

Soldering Iron.

(298) K. Mowat, Atkins, Mich., writes: "Will you please tell me if an electric soldering iron which operates on six volts, six amperes is patentable. It has three holes bored in the iron in which is placed carbon of a certain size insulated by asbestos and connected together by copper strips, the whole being wrapped in asbestos which is held on by iron wire twisted at the ends.

A. Without knowing all the details of the construction, it is impossible to tell where this device would be patentable or not, and if it would work out in practise. We would advise our correspondent to first build a model and convince himself if it works satisfactorily before attempting to patent it.

NEW "GERMAN" ALARM CLOCK.

An electric alarm clock which awkens deaf sleepers by jarring their beds has been invented in Germany.

They should put one under the Kaiser's bed to awake him to the fact that the Potsdam Gang is *"spurlos versenkt!"*

NEW ELECTRIC FIRE DETECTOR AND ALARM.

The new quick alarm fire detector here shown supplements and supersedes watchmen. It is superhuman in responsiveness,



New Type of Electric Fire Detector and Alarm.

incessantly watching every part of the home or building. It operates the moment the air in close proximity to the ceiling becomes heated at the rate of 4 degrees Fahrenheit per minute. For example: A single newspaper on fire in a room having as much as 500 sq. ft. of floor space heats the air suddenly enough to cause a single detector to operate in 5 seconds.

This detector is radically different from common types of automatic alarms, thermostats and sprinklers which depend upon alloys, soft solder, bi-metallic compositions, dissimilar metal or mercury requiring a slow rise or fixt temperature of from 110 to 250 degrees. Before such systems operate, the fire gains tremendous headway, making it necessary to call the fire department to the scene, which means another delay of at least five minutes and inevitable damage. The inventor claims that this new fire detector enables one to locate the seat of the fire and to extinguish it single-handed, long before it gets hot enough to operate automatic sprinkler systems. The principle upon which it operates is simplicity itself. The very air heated by the incipient fire inflates a (non-metallic) diafram, joining two solid silver contact points, instantly closing the electric circuit. The detector is as sensitive below zero as above, but, by reason of its automatic compensating feature slow or local rises in temperature such as produced by hot water systems, furnaces, open grates, kitchen stoves or steam boilers cannot cause a false alarm. The automatic compensator insures that the air pressure under normal conditions is always the same inside the detector as that of the surrounding atmosphere.

The detector is very largely composed of a stone-hard insulating compound in which various elements have been permanently molded for permanent protection against wear and short-circuiting. It may be installed as easily as the ordinary household door bell or call bell systems, making use of bells, horns, signal lights, annunciators and batteries. It is compact, requires no assembling or adjusting, can easily be detached and removed from one building and again installed in another without the slightest damage.

CABLE BOX FIRE EXTINGUISHER.

To extinguish fires in electric cable boxes, where water might cause short circuiting, a device has been invented for injecting flame-smothering gases.

www.americanradiohistory.com

ONE READER'S EXPERIENCE WITH DR. ABRAMS' THOUGHT TRANSFERENCE THEORY.

As our reader's will recollect, we suggested in the September issue in connection with the article therein entitled "Popular Demonstration of Thought Transference and Other Phenomena," by Dr. Albert Abrams, that they write us as to what success they have attained in conducting any of the experiments outlined by Dr. Abrams in this little known realm of science, and we are pleased to give herewith the views of Mr. J. W. White of Brooklyn, N. Y., Mr. White having witnest a number of these tests as conducted by Dr. Abrams himself, when visiting San Francisco several years ago. Furthermore. Mr. White, who is in the electrical business in New York City, and a thoroly wide-awake student of electrical and allied matters, had the satisfaction of taking part in some of the experiments in Dr. Abrams' laboratory, and his views as given below are those of an unprejudiced and unbiased student.

Many people undoubtedly who have read the article in question have tried, unsuccessfully perhaps, to obtain results by *unipolar currents*, according to the theory of Dr. Abrams, such as for instance where the "percipient" or person interpreting the thought transference signal or message is connected to another person or body which forms the exciting point in the unipolar (single wire) circuit.

Here, for example, is what Mr. White experienced, and in this connection it is well to remember that the high professional standing of Dr. Abrams in the medical and scientific fields precludes all doubt of any fake or misrepresented reactions or phenomena, however little we may as yet know as to the exact mode in which such phenomena take place. First Dr. Abrams placed Mr. White in a separate laboratory room and gave him a permanent steel bar magnet, which as we all know has a *North* and *South* pole at the alternate ends. The Doctor instructed Mr. White to present either magnet pole as he might elect to the steam radiator in the room, when he would be able to tell in his instrument laboratory just which end of the magnet he had presented. According to the theory of Dr. Abrams, the action here was as follows: That the electronic discharge from the magnet, even when held a short distance from the radiator, charged the metal piping system, and this particular discharge past along thru the radiator and metal piping to the laboratory where an instrument or a human substitute for the instrument was connected by *one wire* to another radiator connected to the system. In this connection it is interesting to note that Dr. Abrams usually prefers to employ some delicate human reflex, such as the heart or stomach reflex, for indicating when one of these extremely minute electric currents arise, and which agents he claims are many *hundred thousand times* more sensitive to minute currents than are the most delicate scientific instruments such as galvanometers, etc. To sum up this experiment, Dr. Abrams was able to tell quickly just which magnet pole Mr. White had presented to the radiator, not making a single miss in twenty tests.

One of the most astounding phases of this particular experiment was when the Doctor informed Mr. White that it was not at all necessary that he present the magnet to the radiator, so as either to touch it or approach close up to it, but that he could determine which pole of the magnet the investigator was *thinking of* if he would but lay it on the floor and *concentrate his mind*

'Answer the call of Your Calling Now



IF you like electricity and are electrically inclined—there is where you will be most successful; for electricity is your calling. And the great field of electricity, with its superior advantages, opportunities and possibilities is calling to you *now*. Answer that call by obtaining the thorough, complete and practical electrical education, training and development this school offers. You will need ability because only electrical men with ability are chosen for the high electrical places. But don't just *work* at electricity, *learn* electricity. Don't just be *ambitious*. Be *determined* to succeed as one of the thorough efficient electrical men so anxiously sought. Enroll with this school now—don't wait and waste your time.

Become An Electrician In One Year Here Or Learn An Electrical Trade in 6 Months

THE courses here are practical, with the essential theory, mathematics, drafting, etc. You will have electrical appliances, tools, instruments, machines, motors, generators, etc., to work with while learning, to design, build, repair and operate—learning by actually doing as well as from classroom study and lectures. Also, there are fully equipped laboratories here—students performing 383 experiments a year. And you will obtain here in a short time the electrical knowledge and ability the electrical world requires, which you will need to succeed.

You Can Earn While You Learn

All your school periods here will be confined to morning or afternoon—with a half day free. And, if you choose, you can work one-half day at good pay in a position provided you by this school. And thus you can earn while you learn and help defray your school expenses—and obtain, as well, the valuable experience by working. Evening classes are likewise conducted and you can work all day and earn more money, if you prefer. Clip the coupon at the right here—get catalog and details of this school's courses, the "Earn While You Learn" plan and the many advantages here for you. Clip and mail the coupon.

Next Term Starts January 2

Department of Practical Electricity
SCHOOL OF ENGINEERING
An Electrical Technicians' Institute OF MILWAUKEE
73-373 Broadway, Milwaukee, Wisconsin.

Mail This Coupon

School of Engineering of Milwaukee
73-373 Broadway, Milwaukee, Wis.

I have checked the subjects I am interested in—please send complete details.

[ ] Electrician Course A. C. & D. C.—1 yr.
[ ] Electrical Engineering Course—3 years. 6 months Electrical Trade Courses
[ ] Electrical Trouble and Lineman.
[ ] Electrical Moterman.
[ ] Electrical Wireman.
[ ] Electrical Motor and Generator Repairman.
[ ] Telephone Trouble and Repairman.
[ ] Draftsman.
[ ] Earn While You Learn Plan.

Name.....
Address.....
City..... State.....
Age..... Education.....

LEARN TO FLY

We are NOW enrolling Student Aviators for our SPRING CLASS which starts March 1st.

Modern type, high speed biplane used for training. Students continue training until Pilot's license is obtained from AERO CLUB OF AMERICA.

The opportunities for Licensed Aviators are greater than ever, for the Aeroplane is now the means of fast transportation of mail, passengers and light express goods.

Our Flying Course, also includes 6 weeks training in care and operation of engines, airplanes, use of instruments, map reading, navigation of the air, etc.

Write for our Illustrated Booklet "H"—"A Message to You on Aviation."

at AMERICA'S PIONEER AVIATION SCHOOL under Former Aviator Officers Back from the Front.

(Members of Aeronautical Society of America)

EAGLE AVIATION SCHOOL

Telephone Bryant 9078
110-114 West 42d Street, New York

ACTIVE SERVICE



$1.25 **Dependable for a life time. Made right to write right. Long or short—Red or Black.** Absolute necessity to any business man or woman. Unequalled for general writing, billing, ruling and manifolding. Made of pure vulcanized rubber with non-corrosive, durable writing point. Lock-Cap prevents leaking. Extra size, 8 in., black only, $1.50. Your name in gold inlay 35c. FREE: Liberal supply of ink with retail orders. Agents wanted. Good profits. $1.25
J. R. ULLRICH & CO., 27 Thames St., New York

www.americanradiohistory.com

Learn Telegraphy-Wireless

Right In Your Own Home, in your spare time

Remarkable opportunities are offered experienced wireless operators and telegraphers. The demand is greater than the supply—steady positions at increased pay and rapid advancement are assured.

DEPENDABLE KNAPP ELECTRIC SPECIALTIES

Combination Wireless-Telegraphy Outfit



will soon make you an accomplished operator. Teaches Light and Sound Signals, both Radio and Morse. Outfit consists of exceptionally fine Telegraph Key, Buzzer, 3 Binding Posts, Lamp, Lamp Socket and Control Switch—all mounted on a highly finished base. Two outfits can be operated at considerable distance apart for sending and receiving practice.

$3.00

This Same Outfit Without Lamp $2.50

Or your dealer can secure it for you. Order to-day. Descriptive circular and catalog of celebrated Knapp Motors and Electrical Specialties from 10c up mailed free on request.

Knapp Electric & Novelty Co., 523 W. 51st St., N. Y.

BECAUSE OF THE

SHORTAGE of CRUDE RUBBER

You can SAVE $10.00 on our Standard

VIOLET-RAY MACHINE

Being afraid that we could not get delivery on hard rubber used for the outside casing of the Violetta machine, we made 250 of these in wood. Now these machines are exactly alike in construction mechanism and workmanship as our latest model standard machine which costs $25.00.

The only difference being that instead of using hard rubber for the casing, wood is used, but it is finished in a beautiful black piano finish, and the difference is hardly noticeable.

Now, we cannot send these out as standard machines so are placing them in a special lot at

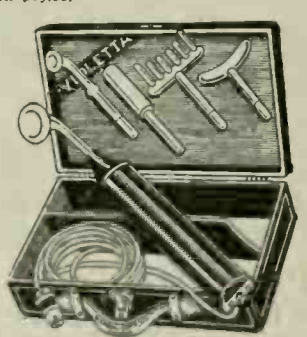
$15.00

an actual saving to you of $10.00. Besides we guarantee these machines to be new. The Outfit includes the generator, one general electrode and a handsome carrying case.

How to secure one of these machines:

Send only one dollar to pay express charges and we shall send you one of these instruments by express for your examination. This amount will be deducted from total cost of machine. You need not accept if not satisfactory.

Send at once for this is the only lot we shall have of these machines and prices on the standard machine will advance in 30 days.



BLEADON-DUN CO.

DEPT. 2 B 11-17 SO. DESPLAINES ST., CHICAGO

What 15c will bring You from the Nation's Capital

Washington, the home of the Pathfinder, is the nerve center of civilization; history is being made of this world capitol. The Pathfinder's illustrated weekly review gives you a clear, impartial and correct diagnosis of public affairs during these strenuous, epoch-making days.

The little matter of 15c in stamps or coin will bring you the Pathfinder 13 weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth and only the truth; now in its 26th year. This paper fills the bill without emptying the purse; it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you would appreciate a paper which puts everything clearly, fairly, briefly—here it is. Send 15c to show that you might like such a paper, and we will send the Pathfinder on probation 13 weeks. The 15c does not repay us, but we are glad to love us to new friends. **The Pathfinder, Box 70, Washington, D.C.**



TYPEWRITER SENSATION

PROMPT SHIPMENT.

$4.00 per month buys a beautifully reconstructed, latest model visible typewriter, with back spacer, decimal tabulator, two-color ribbon, etc. Every late style feature and modern operating device. Sent on approval. Catalogue and special prices free.

Harry A. Smith, 738, 218 N. Wells St., Chicago, Ill.

on one of the poles. This experiment was checked up by a considerable number of tests, and Dr. Abrams was able to tell the pole concentrated on in Mr. White's mind each time.

One of the experiments which will interest our readers very greatly, especially those who read the article referred to in the September issue, was that where Mr. White became the "percipient." To show the effect of the electric currents in the body, Dr. Abrams had a strong man placed in a separate laboratory, several rooms away from where Mr. White was located, and both this man and Mr. White were connected by a *single* copper wire. A number of heavy weights were placed in the room with the strong man. The percipient—Mr. White—had attached to one of his fingers a pulse detector of these minute electronic currents, as devised by Dr. Abrams, comprising a small rubber tube strapt to the finger; this tube being connected by means of a rubber tube with a small pneumatic chamber attached to a pivoted arm, the free end of which carried an electric contact for opening and closing a signal circuit. The contacts on this instrument were conected with a battery and an electric signaling bell. This pulse indicator was connected and acted in the same way, upon the receipt of each electronic wave or current, as the straw pulse needle indicator described in the article referred to.

This is what happened every time the strong man lifted the weights in the distant part of the laboratory buildings: An electronic current apparently shot along the wire and acted to cause a heart reflex in the percipient's (Mr. White's) body, which manifested itself at the pulse, and in turn this action repeated itself thru the rubber tube attached to the finger, thus causing the pneumatic diafram chamber to vibrate and move the pivot arm attached to it, which in turn caused the electric signal bell to ring each time a weight was lifted by the "agent."

Probably some of the most remarkable tests which Mr. White personally saw performed by Dr. Abrams were those where he was enabled to differentiate between different disease germs, and in some cases even the disease affecting a patient over a telephone or other wire. For some of these and other tests Dr. Abrams has devised a very interesting instrument to take the place of the stomach reflex, thus doing away with the necessity of a "live" percipient. This instrument comprises an aluminum cylinder covered at one end with a tightly stretched diafram of goldbeater's skin. The metallic bell or rather shell of this instrument is connected to the single unipolar terminal used in this arrangement, instead of connecting the wire to a human percipient or interpreter, and whenever an electronic current was received over the wire, the tone of the bell, as produced by striking the diafram with a small hammer, is caused to be either resonant or full, or else dull, according to the reaction taking place. Moreover, disease germs such as tuberculosis, cancer, and pneumonja have their own vibration period or wave length, according to his most remarkable work, "New Concepts in Diagnosis and Treatment." He outlines forms of wireless tuning aparatus comprising condensers, tuning coils, etc., for the purpose of measuring the exact wave length or vibration index of these electronic currents as they are received over a telephone or other wire and interpreted by the instrument just described, or by recourse to a human percipient employing the stomach or other reflex. The stomach reflex is one in which the percussion sound given by the stomach when struck with the fingers over that portion of the body is dulled when an electronic current is received.

www.americanradiohistory.com

THE WIRELESS SITUATION.

(*Continued on page 625*)

ness of all companies having been suspended, and their operators having made an instant show of patriotism by joining the Navy in the earliest days of the war, it is believed that most of the companies owning radio stations would be glad at this time to sell their stations to the Government at a fair price, which is provided for in the bill; especially so, since all who have made a study of conditions under which radio communication is held must realize that it is only a question of time when Congress will enact some measure similar to this.

At this time, when most of the world is to be made over, when the United States is fostering the beginnings of a great merchant marine, whose servant radio-telegraphy is, and when the American news and American viewpoint are to be disseminated throughout the nations, it is submitted that the greatest good to the people of the United States as a whole will accrue to them from well-regulated communications with their ships at sea and with foreign nations at reasonable rates without interference from a variety of rival interests within our own borders, utilizing the system of stations which is absolutely necessary for the control of the Fleet. There is no such thing as successful naval operations these days without efficient radio communication, and this must be provided by stations running smoothly and efficiently in the hands of the Government long before hostilities actually commence.

The Navy Department has the confidence of Congress and of the people of the United States, and deserves the confidence which would be placed in it through the enactment of this very necessary measure.

THE FATAL BILL.

H. R. 13159. 65th CONGRESS. 2d Session.

IN THE HOUSE OF REPRESENTATIVES.

November 21, 1918.

Mr. Alexander introduced the following bill; which was referred to the Committee on the Merchant Marine and Fisheries and ordered to be printed.

A BILL.

To further regulate radio communication.

BE IT ENACTED BY THE SENATE AND HOUSE OF REPRESENTATIVES OF THE UNITED STATES OF AMERICA IN CONGRESS ASSEMBLED, That when used in this Act—

The term "signals" means the signals used in communication by any electrical system or method without the aid of a wire or other conducting connections;

The term "radio station" means any place, vessel, or vehicle containing apparatus used, or capable of being used, for transmitting or receiving signals;

The term "experiment station" means a radio station actually used for conducting experiments for the development of the science of radio communication or the apparatus appertaining thereto, and used for no other purpose except as a technical and training school station;

The term "technical and training school station" means a station actually used for purposes of instruction in radio communication and of training operators, and used for no other purpose except as an experiment station;

The term "person" includes partnerships, corporations, and associations.

Sec. 2. That the President shall requisition and take permanent possession of, for the use of the Government, every radio station on land or on a permanently moored vessel, now in existence within the jurisdiction of the United States or any of its possessions, other than experiment stations, technical and training school stations, and stations belonging to the United States or the Government of the Philippine Islands.

Sec. 3. That no person shall maintain or operate, on land or on a permanently moored vessel, (first) within any State any radio station capable of being used, (a) for the transmission of signals, the effect of which extends beyond the jurisdiction of such State or causes interference with the transmission or receipt of signals to or from any place beyond the jurisdiction of such State, or (b) for the receipt of signals which originate outside such State, or (second) any radio station within any Territory, district, or possession of the United States. This section shall not apply to experiment stations and technical training school stations duly licensed, as provided by the Act to regulate radio communication, approved August thirteenth, nineteen hundred and twelve, and stations belonging to the United States or the Government of the Philippine Islands. Whoever violates this section shall be punished by a fine of not more than $600 for the first offense, and by a fine of not more than $1,000 or imprisonment for not more than one year, or both, for each subsequent offense; and any radio apparatus operated in violation of this section shall be forfeited to the United States.

Sec. 4. That from the date of the passage of this Act the Secretary of the Navy shall be charged with the execution of the provisions of the Act approved July twenty-third, nineteen hundred and twelve, amending section one of an Act entitled "An Act to require apparatus and operators for radio communication on certain ocean steamers," approved June twenty-fourth, nineteen hundred and ten, with the Act entitled "An Act to regulate radio communication," approved August thirteenth, nineteen hundred and twelve, and any amendments to the said Acts, and the provisions of the International Radiotelegraphic Convention, signed in London in nineteen hundred and twelve and proclaimed by the President July eighth, nineteen hundred and thirteen, and future international radiotelegraphic conventions which may be ratified by the United States, except in so far as the provisions of the above-mentioned Acts, conventions, or treaties apply to stations operated by other departments of the Government of the United States or by the government of the Philippine Islands.

Sec. 5. That the Secretary of the Navy may issue special licenses, subject to such conditions and restrictions, and for such periods, as he deems proper, for the establishment and operation of stations for special emergency use in cases where no other rapid means of communication are available. Any violation of such conditions and restrictions shall constitute cause for revocation of the license without compensation therefor, and the owners of such station shall be punished by a fine of not more than $500 or by imprisonment for not more than one year, or both.

Sec. 6. That when the United States is at war or when war is threatened, or during any war in which the United States is a neutral nation, or during any national emergency, such fact being evidenced by the proclamation of the President—

(a) The President may issue regulations for the conduct and censorship of all radio stations and radio apparatus within the jurisdiction of the United States or of any of its possessions. Whoever knowingly violates any such regulation shall be punished by a fine of not more than $10,000 or by imprisonment for not more than three years, or both, and in case of any violation the radio station or apparatus shall be forfeited to the United States; and

(b) The President may cause the closing of any radio station on land or on a permanently moored vessel within the jurisdiction of the United States or any of its possessions and the removal therefrom of any radio apparatus, or may authorize the use of the station or its apparatus by the United States.

The regulations for the conduct and censorship of radio stations, the closing of a radio station, and the removal of apparatus therefrom shall continue no longer than the duration of such war or emergency. The fact that the war or emergency has ended shall be evidenced by the proclamation of the President.

Sec. 7. That if, in the opinion of the Secretary of the Navy, the operation of any radio station would interfere with the receipt of signals by radio stations belonging to the United States or the government of the Philippine Islands, or by radio stations on shipboard, or would be otherwise prejudicial to the interests of the United States, no license under the Act entitled "An Act to regulate radio communication," approved August thirteenth, nineteen hundred and twelve, shall be issued to such station, and any such license already issued to such station shall be revoked or suspended for such time as the Secretary of the Navy may prescribe.

Sec. 8. That when any radio station is requisitioned, taken possession of temporarily or permanently, or closed, or its license revoked or suspended, the United States shall pay to the persons interested therein just compensation for the property or interest so taken, provided that a claim for such compensation is made on the Secretary of the Navy, within two years after the date of passage of this Act. In case of disagreement as to such just compensation, the Secretary of the Navy shall make an offer, and if such offer is not accepted there shall immediately be paid to the person interested three-quarters of the amount offered. The person interested shall be entitled to sue the United States to recover the balance justly due, in the manner provided by section twenty-four, paragraph twenty, and section one hundred and forty-five of the Judicial Code. An amount sufficient to pay such just compensation is hereby permanently appropriated out of any money in the Treasury not otherwise appropriated.

Sec. 9. That all radio stations taken possession of by the President shall be operated under the direction of the Secretary of the Navy.

Sec. 10. That the Secretary of the Navy shall, so far as may be consistent with the transactions of Government business, open naval radio stations to general public business under regulations prescribed by him and shall fix the rates for such service. He shall establish special rates for the handling of press dispatches by transoceanic or other special stations. The receipts from such services, less an amount not to exceed twenty-five per centum per annum for expenses, shall be turned into the Treasury as miscellaneous receipts.

BROWNING GUN SUCCESSFUL IN AIRPLANE PROPELLER TEST.

The Browning machine gun has successfully undergone a test to determine its value for use with aircraft. This is one of three types of machine guns with which the rate of fire can be so synchronized that the gun can be fired by the pilot of a combat plane thru the revolving blades. Firing in that fashion, it is necessary to aim the machine gun by steering the plane directly at the target. The direction of the plane gives direction to the fire and the pilot can fire the machine gun while controlling the plane.

Airplane propellers revolve at from 800 to 2,000 revolutions per minute. The machine gun is connected with the airplane engine by a mechanical, hydraulic or electrical device, and impulses from the crank shaft are transmitted to the machine gun. The rate of fire of the machine gun is constant, and its fire is synchronized with the revolving propeller blades by "wasting" a certain percentage of the impulses it receives from the airplane engine and by having the remaining impulses trip or pull the trigger, so that the gun fires just at the fraction of the second when the propeller blades are clear of the line of fire.

The pilot operates the gun by means of a lever which controls the circuit and allows the impulses to trip the trigger. It has occurred in practise that as many as 15 shots have hit the propeller without putting the plane out of commission.

A FAKE ELECTRIC PISTOL TO SCARE THIEVES.

A new electric flashlight pistol of French invention for scaring criminals not only displays a bright light when the trigger is pulled, but also makes a noise like a real weapon as well.

BOYS



Learn Drafting

The United States Government and employers everywhere are looking for skilled draftsmen. They are offering splendid salaries, and still good positions are always open, because thousands of draftsmen have gone into the service. Others must take their places and carry on their work.

No line offers greater opportunity for advancement. Drafting itself not only commands good pay, but it is the first step toward success in Mechanical or Structural Engineering or Architecture. And drafting is just the kind of work a boy likes to do. There is an easy delightful way in which you can learn right at home in spare time. For 27 years the International Correspondence Schools have been giving boys just the training they need for success in Drafting and more than 200 other subjects. Thousands of boys have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon, then mark and mail it. This doesn't obligate you in the least and will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6171, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

☐ MECHANICAL DRAFTING	☐ SALESMANSHIP
☐ STRUCTURAL DRAFTING	☐ ADVERTISING
☐ SHIP DRAFTING	☐ Show Card Writer
☐ ELECTRICAL DRAFTING	☐ Sign Painter
☐ ARCHITECTURAL DRAFTING	☐ ILLUSTRATING
☐ SHEET METAL DRAFTING	☐ Cartooning
☐ BOILERMAKER DRAFTING	☐ BOOKKEEPER
☐ BRIDGE DRAFTING	☐ Stenographer and Typist
☐ MACHINE DESIGN	☐ Cert. Public Accountant
☐ ELECTRICAL ENGINEER	☐ TRAFFIC MANAGER
☐ Electric Lighting and Railways	☐ Railway Accountant
☐ Electric Wiring	☐ GOOD ENGLISH
☐ Telegraph Engineer	☐ Teacher
☐ Telephone Work	☐ Common School Subjects
☐ MECHANICAL ENGINEER	☐ Mathematics
☐ Machine Shop Practice	☐ CIVIL SERVICE
☐ Gas Engine Operating	☐ Railway Mail Clerk
☐ CIVIL ENGINEER	☐ AUTOMOBILE OPERATG
☐ Surveying and Mapping	☐ Auto Repairing
☐ STATIONARY ENGINEER	☐ PLUMBING AND HEATING
☐ Marine Engineer	☐ Textile Overseer or Supt.
☐ ARCHITECT	☐ CHEMIST
☐ Contractor and Builder	☐ Navigation ☐ Spanish
☐ Concrete Builder	☐ AGRICULTURE ☐ French
☐ Structural Engineer	☐ Poultry Raising ☐ Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____

TELEGRAPHY AND RADIO

Day and Evening Classes in Radio for Army, Navy and Merchant Marine. Women in special "Radio Corps". Similar classes in TELEGRAPHY for men and women. Prepares for all branches of telegraph work.

EASTERN RADIO INSTITUTE
899B Boylston St. Boston, Mass.

www.americanradiohistory.com

BE AN ARTIST

HAW HAW HAW HAW

CHECK FROM MAGAZINE



DRAWN BY 14-YEAR-OLD BOY

The above cartoon was drawn by Master Bob Brennan of the Washington School of Art. Bob writes that he is selling his work and that he is cartoonist on a small paper in Evansville, Ind. He is but one of our many students and graduates who are making money as cartoonists, illustrators and designers.

Learn By Mail at Home!

By our new method of teaching drawing by mail you can learn in your own home, in a short time. Get into this fascinating work yourself and earn $50 to $100 or more per week!
The study is fascinating. Only a few minutes a day! Have your own studio or secure high-salaried position. Or work in spare time. Many students earn while they are learning.

FREE! BOOK AND ARTISTS' OUTFIT WRITE TODAY

A complete Outfit free to all students. Includes everything required to produce hundreds of dollars' worth of pictures. Write today. Special terms to a limited number of new students. Mail postal or letter for beautiful Booklet, "How to Become an Artist." Filled with drawings and full particulars of our extraordinary offer. Do it now—before you forget.

WASHINGTON SCHOOL OF ART, Inc.
1391 H Street, N. W. Washington, D. C.

"I Would Not Part with it for $10,000"

So writes an enthusiastic, grateful customer. In like manner testify over 100,000 people who have worn it. Conserve your body and life *first*.



The Natural Body Brace

Overcomes WEAKNESS and ORGANIC AILMENTS of WOMEN AND MEN. Develops erect, graceful figure.

Brings restful relief, comfort, ability to do things, health and strength.

Wear It 30 Days Free at Our Expense

For Children Also

Does away with the strain and pain of standing and walking; replaces and supports misplaced internal organs; reduces enlarged abdomen; straightens and strengthens the back; corrects stooping shoulders; develops lungs, chest and bust; relieves backache, curvatures, nervousness, ruptures, constipation. Comfortable and easy to wear.

Keep Yourself Fit

Write today for illustrated booklet, measurement blank, etc., and read our very liberal proposition.

HOWARD C. RASH, Pres. Natural Body Brace Co.
286 Rash Building SALINA, KANSAS

Don't Wear a Truss



BROOKS' APPLIANCE, the modern scientific invention, the wonderful new discovery that relieves rupture will be sent on trial. No obnoxious springs or pads. Has automatic Air Cushions. Binds and draws the broken parts together as you would a broken limb. No salves. No lies. Durable, cheap.

Send on trial is proves it. Protected by U. S. Patents.

Catalogue and measure blanks mailed free. Send name and address today.

C. E. BROOKS, 203B State Street, Marshall, Mich.

STAMMERERS

You can be cured quickly, permanently and privately. Write me personally for free booklet, "How to Stop Stammering."
Samuel O. Robbins, Pres., Boston Stammerers' Institute, 248 Huntington Ave., Boston, Mass.

PHILA. TO BE BIGGEST ELECTRICAL CENTER.

Philadelphia is to be made the largest electrical center in the world after the declaration of peace, according to plans now being perfected by the Westinghouse engineers.

The largest of forty-one plants under the Westinghouse management will be located on the Tinicum township tract near Lester, in buildings now devoted to war purposes. Twenty-five thousand men will be employed at the plant. All goods will be shipt from piers to be erected on the tract.

Experimental Chemistry

(*Continued from page* 639)

Chemical Properties.

1. *Yellow phosphorous* possesses great affinity for many of the elements, uniting with all directly, except nitrogen and Carbon. With Bromin and Sulfur it reacts violently. Characteristic is its affinity for Oxygen. When exposed to the air at 40° C. or at a lower temperature, if in a finely divided state, ignition takes place, burning to Phosphoric oxid, according to the supply of oxygen present.

2. It is luminiscent in the dark, even the minute particles adhering to the fingers on handling matches.

3. Because of its great affinity for oxygen, phosphorous is an energetic reducing agent. Sulfuric acid is reduced to Sulfur dioxid. Nitric Acid is deoxidized with explosive violence, salts of the metals are reduced to their metals and phosfides, thus silver nitrat is reduced to Silver and Ag_3P, Copper sulfate to Cu_3P_2.

Red Phosphorous. Properties. 1. This is an *allotropic* modification, and possesses properties essentially different from the yellow variety. It forms a dark red to reddish-brown powder, which is insoluble in carbon disulfid and all other solvents. It does not Phosphoresce, and is stable in the air. It does not fuse at red heat, but when quickly heated above 260° C. the vapors change to those of yellow phosphorous. This variety is prepared by heating the yellow variety to 300° C. in closed air-tight vessels, and after the conversion, the product is then treated with carbon disulfid to remove any of the unchanged phosphorous. If a little iodin be added, this change will take place below 200° C.

Scarlet Phosphorous. Properties. This is another modification, being obtained by boiling a solution of yellow phosphorous in phosphorous tribromid. It resembles the red variety except that it is more active, reducing salts of the metals, and with the alkalies, it yields *phosphin* [PH_3] and a hyposulfite.

Metallic Phosphorous. Properties. This form is obtained by heating the yellow variety in a sealed tube free from air to 530° C. It thus forms black metallic shining crystals, which are less active than the red variety.

Luminescence or Phosphorescence.

If a match is scratched in a dark room, a faint line of light may be observed as the minute particles of phosphorous which are left glow and oxidize. The same thing occurs if the element is exposed in darkness, and the phenomenon is called PHOSPHORESCENCE. It is due to slow combustion [or oxidation]. Substances rubbed with phosphorous give the same effect.

Many other minerals and chemical compounds have the power to emit light in darkness, and some of these form the basis of the so-called luminous paints. The sulfides of Barium, BaS, BaS_2, BaS_3, etc., are examples.

Some animals, as fireflies, glowworms, et cetera, emit a light from a certain part of the body, without heat above that of the rest of the body. In Cuba, a species of luminiscent insect is bottled up and used sometimes for lighting purposes, about *forty* of these equalling *one candle-power*. The light is apparently due to an oxidation of animal tissue which is under the control of the insect. To produce the same light by the oxidation of gas or oil, we have a temperature of about 2,000° F. and 99% of the energy of the flame is lost, while these creatures utilize possibly 100% of the energy of oxidation, without any apparent rise in temperature. The animal supplies its own light.

Uses.

Phosphorous is used mostly in the manufacture of matches. A kilogram (2.2 lbs.) of it will tip about *two million matches* It is also used to some extent for medicinal purposes.

Matches.

The making of matches after the splints are prepared includes two processes. First, one end is dipt into melted sulfur, some of which adheres to the wood. Second, it is tipt with a paste consisting of a mixture of phosphorous, an oxidizing agent, and glue. A little coloring matter is quite frequently added. The oxidizing agent may be Potassium chlorat [in which case the match snaps and burns vigorously on being scratched], potassium nitrat, Manganese dioxid, or red lead [Pb_3O_4]. This result is accomplisht by pressing the end on a slate slab covered with the paste. Sulfur is necessary, as the heat liberated in the burning of phosphorous is not enough to set the wood on fire, and a coating of P_2O_5 forms over it. Sometimes paraffin is utilized in place of the sulfur. The well-known Swedish [or Safety] match head does not contain phosphorous, but consists of a mixture of potassium chlorat and dichromat with red oxid of lead and antimony sulfid. They are ignited by scratching them on the prepared surface of the box, which is essentially a mixture of red phosphorous, antimony sulfid and powdered silica. A machine has been constructed to cut the splints, tip the matches, and dry and pack them in boxes, all four processes being automatic and continuous, besides eliminating the poisonous fumes.

A Burning Match.

Whenever one ignites so simple and common a thing as an ordinary match, little does he realize that he is performing one of the most wonderful and complicated of chemical experiments. The mere fact that fire could be obtained by simply scratching the end of a stick was regarded less than three-quarters of a century ago, as a truly remarkable triumph of science.

Friction on the end of a match over a rough surface liberates heat enough to cause the phosphorous to unite with the oxygen of the oxidizing agent in the paste, and produce combustion, the main product of which is P_2O_5. If the oxidizer is potassium

www.americanradiohistory.com

chlorat, then potassium chlorid is left. The heat of the burning phosphorous is enough to set fire to the sulfur, which unites with the oxygen of the air to form sulfur dioxid, and this in turn sets the wood on fire.

The reactions of a *burning match* are many. Try and complete the following and explain from what each comes, then the next time you strike a match you will probably stop to think of the complicated change which takes place. This only goes to illustrate that many seemingly unimportant operations made during our daily routines may, if carefully analized, show the complicated changes which take place unobserved.

1. $KClO_3 = ?$
2. $2P + 5O = ?$
3. $2P + 3O = ?$
4. $P_2O_5 + H_2O = ?$
5. $P_2O_5 + 3H_2O = ?$
6. $P_2O_5 + H_2O = ?$
7. $P_2O_5 + 3H_2O = ?$
8. $S + 2O = ?$
9. $SO_3 + H_2O = ?$
10. $C + O = ?$
11. $C + 2O = ?$
12. $CO_2 + H_2O = ?$
13. $2H + O = ?$

Phosphates.

Wheat contains compounds of phospborous, and most food plants in order to come to fruitage must take phosfates from the soil in which they grow. The phosfates must be soluble, so that, as the rain dissolves it, it can be absorbed by the roots and circulated in the sap of the plant. Soils have to be renewed or fertilized, and fertilizers contain, among other things, the soluble phosfate $H_4Ca[PO_4]_2$, made according to the first step in reducing the element. This is absorbed, transformed, and assimilated by the plant, especially the fruit.

Animals eat the fruit, and thus the compounds of phosphorous are again transposed, circulated in the system, and deposited wherever needed, as in the bones and nervous tissues, and especially in the brain. Man feeds upon either plant or animal, *and thus obtains his phosphorous. From the human system it is excreted by means of the blood and kidneys, as phosfates and microcosmic salt* $[HNaNH_4PO_4]$. *When the brain is hard worked, more than usual is excreted;*—in fact, there seems to be a *direct ratio between the amount excreted* and the *vigor of brain action*, as tho each intellectual effort was attended by the combustion of phosphorous. A simple test of the urine will demonstrate this. At the start of the day the urine will, under normal conditions, appear clear yellow. Examine a sample of urine from the same subject taken after a hard day's brain work, and you will be surprised to see many little white specks floating about. This represents the phosphates, and while the laboring man may show but little, if any, of these suspended phosphates in the urine at the end of a working day, the brain worker will invariably manifest this condition regularly. To clear the urine in order to test it for any solids or sediment, add a little nitric acid. It will clear up perfectly if the urine is normal.

Experiment No. 147.

Place about 12 heads of ordinary (not safety) matches in a flask, as shown in Fig. 155. Have this flask (1) about half filled with water. Proceed to distill the same by applying the Bunsen burner under the flask, taking care that the action does not become too violent.

If this experiment is performed in a darkened room a ring of greenish light appears at the level of the water in the condenser, where the steam condenses. After a short time little colorless spheres of a waxy solid collect under the water in the second flask, which acts as a receiver for the drippings from the condenser. If the water is poured away, this solid begins to give off a white smoke, and is luminous in the dark.

(To be continued)

Learn to Treat Disease This Way



This is a small reproduction of one of 22 magnificent charts all of which we want to send you ABSOLUTELY FREE, just to show you how easily you can master Chiropractic and how successfully you can treat disease by this modern drugless healing method. These charts show the different pain and nerve areas of the body. The science of Chiropractic is based upon the well known principle that when there is bone pressure on a trunk nerve where it leaves the spinal column there will be pain in the area it controls; and that by relieving the pressure the pain is banished. Chiropractic teaches you how to locate nerve pressure at any point along the spinal column and how to relieve it.

BE A DOCTOR OF CHIROPRACTIC

Advanced Science of Spinal Adjustment

The great profession that within the past few years has taken the longest forward strides ever known in the history of drugless healing. It has called to its ranks thousands of ambitious men and women from every walk of life. Today it is calling more insistently than ever because the tide has turned strongly in favor of drugless healing. Right now the demand for Doctors of Chiropractic is far greater than the supply.

Learn at Home In Spare Time The American University method of teaching enables you to study by mail or in class and obtain a complete mastery of Chiropractic in the shortest time consistent with thoroughness, while you hold your position. You can pay on easy terms. From the day you enroll your instruction will be under the personal direction of a splendid faculty of Chiropractic experts. Our one aim will be to make you successful. We will work whole-heartedly with you to advance your interests so that in a short time you, like thousands of Chiropractors, can earn a good income.

$3000 to $5000 a Year

There are many instances of Chiropractors earning from $3000 to $5000 a year. Some upwards of $10,000. Dr. M. D. Moore, of Kentucky, reports an income of $9,000 a year. Dr. L. H. Roche, New Jersey, $5,000; Dr. Hanna, of Kentucky, over $5,000 yearly.

The success of Chiropractors in many cases has come so quickly as to be almost startling. And yet, it is not to be wondered at when you consider the constantly increasing number of intelligent, thinking people who are now convinced that Chiropractic is the common-sense and really scientific way to relieve pain and disease and who, therefore, demand the services of Chiropractors.

NOW—Your Great Opportunity

Why not qualify now for this splendid profession that offers such remarkable possibilities for making you prosperous and independent? If you are ambitious to make money, increase your social standing and be "somebody," our course in Chiropractic will point the way. No special preliminary study required. You graduate with the degree of D. C. (Doctor of Chiropractic), receive handsome diploma, FREE, and are ready at once to open your office.

Get Free Charts offer at once. Regular value of the 22 magnificent charts is $30.50. Many of these charts are handsomely lithographed in life-like colors. Mail coupon and get all the facts. We will send you our beautiful new illustrated book, full particulars regarding course, easy terms, together with free charts offer immediately. Don't put it off—mail coupon or send your name on a postal card—today.

AMERICAN UNIVERSITY
Manierre Bldg., Dept. 372 Chicago, Ill.

AMERICAN UNIVERSITY
Manierre Bldg., Dept. 372 Chicago, Ill.

Without cost or obligation send me by mail, your new illustrated, 72-page book and your Free Charts offer.

Name.....

Street No. or R.F.D.....

City..... State.....

1/4 H.P., 110 volts, A.C. 60 cycle, single phase, 1750 R.P.M. MOTORS



We have 1000 NEW WASHING MACHINE MOTORS. These are of standard manufacture and carry the regular factory guarantee. Shipped in original boxes. Complete as cut.

Bought from Bankruptcy Stock

Suitable for operating Coffee Grinders, Cream Seperators, Bottle Washers, Air Compressors, Small Lathes, Etc.

Mail $3.00 cash or Money Order. We will send C.O.D. subject to full examination. MONEY BACK GUARANTEE

$18.50 EACH Special Quantity Prices Regular Value $34

MANUFACTURERS' DISTRIBUTER

BARGAINS in Small Motors and Generators. Write for Catalogue

CHAS. H. JOHNSTON - West End - Pittsburgh, Pa.

www.americanradiohistory.com

HEL-MET THE KAISER



Send one to your boy in camp; all the boys will want them. Anyone against the Kaiser or Germany should wear this pin. Same size as picture. Handsome metal, black letters. Will wear for years. Men and women wear them — causes laughter wherever seen.

Price 10 Cents



Voice Thrower 10c

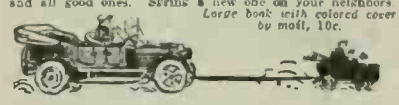
Learn to throw your voice into a TRUNK, under the bed, out in the hall or anywhere. Lots of FUN fooling the Teacher, Janitor, Policeman, Parents, Neighbors, or Friends.

THE VENTRILO

is a little instrument that fits into the mouth out of sight. BOYS or GIRLS can use it. NEVER FAILS! A 32-page book on Ventriloquism sent with the VENTRILO for TEN Cents.

NEW FORD JOKE BOOK 1919

All the latest jokes on the Ford auto. Hundreds of them, and all good ones. Springs a new one on your neighbors. *Large book with colored cover by mail, 10c.*



Devil Resigns to the Kaiser



Everyone who reads this book is wild over it. Contains the following:— The Kaiser's Dream, A Letter from the Devil to the Kaiser, Kaiser's Prayer, How Satan Resigns to the King of Devils, The Kaiser, etc. any other stories, jokes, etc., about the German Emperor. Book mailed 10 cents, postage 2 cents extra.

ROGEN X-RAY



Price 10 Cents

HERE, BOYS, is just what you want. With this instrument you can apparently see through clothes, see the bones in your fingers. Think of the fun you can have with it! Sample, by mail, TEN CENTS.



SKULL RING

Here is a handsome, up-to-date Ring, representing a Skull and Cross-bones. Has stones in the eyes and looks something frightful. Women won't like it, but for men or boys it is a great novelty. Sample, by mail, 15c.



Gee! What a Wad!

This is STAGE MONEY

Looks like the GENUINE STUFF. Some Green backs and some Yellow backs. Create a BIG sensation among your friends. The girls will all be after you when they see the wad. BIG roll of 15 pieces by mail. 10 cents.



Boys Own Toy Maker

and Nine Other Books for 10c

Tells how to make a Telephone, Magic Lantern, Kites, Sail Boat, Stilts, Electric Telegraph, Pop Gun, Red Fire, Galvanic Battery and many other things. This book, with nine other interesting books, mailed for 10c.



ENCHANTED BARREL

The Most Wonderful Pocket Trick Made

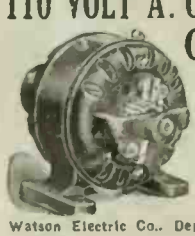
CHANGE A CENT INTO A DIME

Ask your friend to drop a dime in the barrel. When he takes it out, Behold! It is a CENT. You make 9 cents every time you fool them. Never fails. They cannot get on to it. Sample barrel, with directions, only.... 10c

Any three of the above articles for 25c or any six for 50c

Royal Novelty Co. 250 EAST AVENUE SOUTH NORWALK, CONN

110 VOLT A. C. GENERATORS ONLY $5.00!



Holtzer-Cabot hand generators, while stock lasts, $5.00. Order today.

Battery chargers, 6 v. 6amp. $10.00; 7 v. 11 amp. (like cut) $27.00; Hydro-Electric Generator complete, giving up to 25 v. 3½ amp. D.C. $25.00. Immediate shipment while stock lasts. Order from this ad.

Watson Electric Co., Dept. 11, Gas Bldg., Chicago

POPULAR ASTRONOMY.

(*Continued from page 621*)

There is the possibility that forms of life may exist on these satellites of Jupiter, tho they may, on the other hand, be barren, lifeless worlds, such as Mercury and the Moon. Their great distance from the earth, never less than three hundred and sixty-eight million miles, makes observations of their surface markings very difficult.

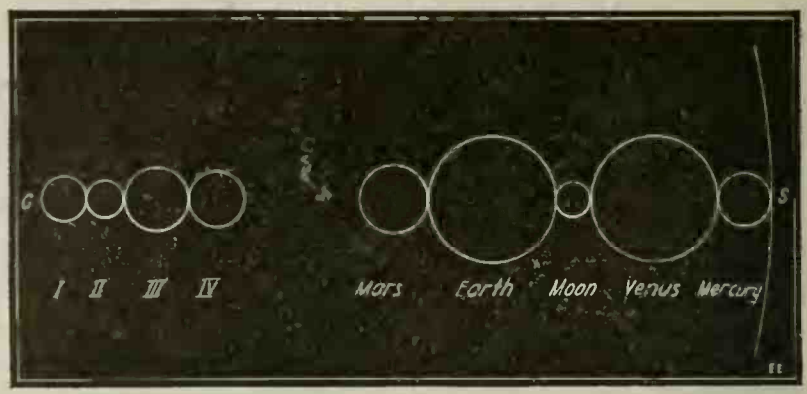


Diagram I.—Showing the Relative Sizes of the Four Moons of Jupiter, Io, Europa, Ganymede and Callisto, or Satellites I, II, III and IV Respectively, and the Moon and Terrestrial Planets Mercury, Venus, Earth and Mars. The Distance from C to S Is the Distance from the "Center" to the "Surface" of Jupiter. So If All the Satellites of the Planet and the Terrestrial Planets and Moon Were Placed Side by Side Their Combined Diameters Would Fall Short of the Surface of the Planet by a Distance About Equal to the Diameter of the Earth.

How beautiful beyond description must the heavens appear as viewed from the satellites of Jupiter! From the nearest of these, Io, or Satellite I, the mighty planet Jupiter presents a spectacle such as the eye of man has never been privileged to behold. The huge flattened globe, ninety thousand miles in equatorial diameter, equal in mass to *three hundred planets such as our own* and in volume to nearly *fourteen hundred*, fills a space in the heavens nearly twenty degrees in extent as viewed from this satellite. Fifteen hundred of our own full moons would hardly fill the same space. Whirling on its axis with frightful speed in a period of less than ten hours, the huge ball glides rapidly but majestically onward thru the sky. A far distant sun shrunk to but one-fifth the diameter of the full moon throws light and shade across the rapidly changing surface of the planet, rich in the reds, browns and yellows and all the gorgeous shades and tints of its dense, seething, gaseous envelope. The phases of the moon on a greatly enlarged scale rapidly succeed each other on Jupiter as the satellite views it from all positions with reference to the sun. The cause of the belts of Jupiter, that lie parellel to the planet's equator and are constantly changing in number, width and shade, as well as of all the peculiar splashes of color and intensely white flecks that come and go in the dense atmosphere of the planet, could doubtless be explained were it possible to view the great planet from its nearest satellite, which is about as far from the surface of Jupiter as the moon is from the earth. It is uncertain whether the planet is entirely gaseous thruout or has a central core of solid or liquid matter. Its density is only one and one-quarter that of water and slightly less than that of the sun, showing that it is composed largely, if not entirely, of matter in a gaseous state. Jupiter is a world as different from our own as it is possible to imagine. There is no visible surface crust and there are no permanent markings. Different spots on the planet's disk give different periods of rotation showing that atmospheric phenomena are observed. All is constant flux and change. Dense vapors arise from a highly heated interior and spread out into belts parallel to the equator and in the direction of the planet's rotation. From its nearest satellite all the interesting changes of color and form that constantly take place in the atmosphere of this great globe could be observed in great detail. The high percentage of light and heat that Jupiter reflects from the sun to its nearer satellites would make it a secondary sun to them of tremendous size but feeble strength. As seen from the nearest moon the other three major moons of Jupiter present all the phases of our own moon in rapid succession, due to their constantly changing positions with refcrence to the sun. The five small moons, discovered in modern times, are so minute that they are simply star-like points of light even when viewed from the other moons of Jupiter.

When nearest each other some of the moons appear even larger than our own moon does to us, but when approaching opposite sides of the planet their disks rapidly diminish in size tho they never appear as small as the far distant sun nearly five hundred million miles away whose apparent diameter is less than one-fifth that of the full moon.

To keep track of the rapidly changing positions and various phases of the moons of Jupiter as seen from any one of them,



Diagram II.—Orbits of the Four Old Satellites of Jupiter, and Satellite V, the First to Be Discovered of the New Moons. Satellites VI and VII Are Nearly Seven Times More Distant and Satellites VIII and IX Nearly Fourteen Times More Distant Than Satellite IV. The Period of Revolution of Satellite V Is 12 hours and of Satellite IX 3 Years. Scale .5 Cm. = 200,000 Miles.

www.americanradiohistory.com

NEW SCIENTIFIC WONDER
"X-RAY" CURIO
PRICE 12½C. SILVER ONLY
BOYS BIG FUN
You apparently see thru Clothes, Wood, Stone, any object. See Bones in Flesh.
A Magic Trick Novelty given FREE with each X-Ray.
MARVEL MFG. CO., Dept. 52, New Haven, Conn.

$500 REWARD
A Year To Pay
We will pay $500.00 reward to anyone who can permanently dim the brilliancy of the RAJAH im. diamond without destroying it. The RAJAH Im. Diamonds stone. They stand all diamond tests—fire, acid, file and glass cutting. Their brilliancy is eternal. Guaranteed for a lifetime. Set in solid gold, and sent 30 DAYS' FREE TRIAL to you on If you can tell it from a real diamond return it. Send today for our beautiful, FREE illustrated jewelry catalog in colors. Write now.
KRAUTH & REED, 159 N. State St., Dept. 200. CHICAGO, ILL.

You Can Secure a Motor-Cycle at Little Cost
by mounting a STEFFEY motor on your bicycle.
They are best made, most reliable and best hill climbers. We sell you the complete attachment at a low manufacturer's price, or we can supply the finished parts from which you can assemble the motor yourself. Instructions and full size blueprints of drawings, 25c.
STEFFEY MFG. CO., 5028 W. Brown St., Phila., Pa.

110 V. TRANSFORMER
8 Volts Secondary ONLY $1.00
A reliable transformer for all experimental work, ringing bells, etc. Consumes so little power it will not move ordinary meter. $1.00, postpaid. Cord and plug, 50c extra.
Transformer No. 10, giving 8, 12 and 18 volts secondary, with plug, $2.00 postpaid. Order from this ad.
EMPIRE TRANSFORMER CO.
Dept. 11 2214 Sedgwick St., CHICAGO

Be an Accountant—
Step Into the Job Higher Up Through Accountancy
Our Free Book, "Stories of Success" shows how the I.A.S. intensive home-study course prepared many for the bigger job and how they got it. Low tuition; easy terms; quick results; simple, efficient method.
International Accountants Society
624 So. Michigan Ave. Dept 39-A Chicago Ill.

EVERY INVENTOR
should have this book. "PATENTS AND PATENT POSSIBILITIES." It is chock full of ideas and practical advice, telling what to invent and where to sell. Write for your copy today. IT IS FREE.
I have requests for patents upon sound inventions of all kinds. Can you help supply the demand?
My service is individual, prompt and efficient (14 years experience). Every expedient is employed to secure patents at least possible cost.
H. S. HILL, 804 McLachlen Bldg., Washington, D. C.

STAMPS
50 diff. Belgium (large bi-color) China, Jamaica, Portugal, Venezuela, etc., 10c; 1,000 well mixed, 40c; 100 var. U. S., 50c; 1,000 hinges, 10c; Agts. wanted, 50%. List free. I buy stamps. L. B. Dover, Overland, Mo.

INDEX TO
ELECTRICAL EXPERIMENTER SCIENCE & INVENTION
FOR VOLUME 1, 2, 3, 4, 5
This index contains 24 pages and shows every article of interest that has been published since the inception of the magazine up to and including April, 1918.
It is absolutely indispensible to everybody interested in any kind of electrical research work. With it everything of importance in the advancement of electrical science during the last five years can be readily found.
Price 15c. Postpaid
EXPERIMENTER PUBLISHING CO.
Book Dept. 231 Fulton St., N.Y.

as well as the rapid apparent motion of the planet thru the sky due to the revolutions of the satellite itself, would be a troublesome task for an astronomer stationed on one of these far distant worlds. It would be a common sight to see in the sky at one time the huge planet, the sun itself, and one, two or three moons. Seen from the moons of Jupiter the contellations would appear as they do to us on earth for such a slight change in position as five hundred million miles, more or less, is trivial when one is measuring the relative distances of the stars. Observations of the stars from the nearest moon of Jupiter would be attended with difficulties at times, however, since reflected sunlight from a body nearly twenty degrees in diameter would be extremely troublesome, especially were the phases of the planet near that of the full moon. Even from the fourth or most distant of the major satellites the planet would subtend an angle of nearly five degrees. Occultations of the stars would be many and frequent as the huge planet globe glides swiftly thru the heavens. Many a moonlight night would appear almost as day owing to the presence of the enormous brilliantly reflecting ball of light and occasionally two or three moons in addition. Only the brightest stars would be seen under such circumstances. When, however, the small worlds pass into the shadow of the great mother planet and not only the light of the sun but also the reflected light of Jupiter disappears for many minutes the stars shine forth in all their glory there as here. In the sky would appear, possibly, some of the larger moons feebly shining by the reflected light of the far distant sun. Saturn also might be visible, but beautiful Venus and ruddy Mars would fail to appear. Tiny bodies, mere specks of light at this distance, they are lost to view in the glare of the sun.

(The next Installment will appear in an early issue.)

ELECTRIC DEATH TRAPS IN HUN'S RETREAT.

(Continued from page 608)

to blow the cave to pieces, and which was connected up with an electric device to the time-clock also. Thus did the Boches not only hope to gas their victims, but to kill them as well, one way or the other.

The daily press had considerable to say in the later months of the war concerning the many devilish and ingenious *delayed time-fuse bombs* which were left behind in many of the towns and cities of northern France as the Hun army was being driven toward the Rhine by General Foch's victorious armies. One of the simple devices of this nature, which was used to blow up buildings, etc., a considerable length of time after the Huns had retreated from a certain locality, is shown in Fig. 10. It comprised nothing more than a float tank similar to those used on all modern plumbing for flushing purposes. As soon as it started to rain, such weather being frequent in northern France, the tank filled up and caused the float to rise. When the float ball reached its uppermost position it closed an electric circuit, connected by wires running inside the building, to a heavy charge of explosive, with results that can be better imagined than described. These cowardly and dastardly tricks sound quite tame and harmless when you read them "Over Here," —but imagine what havoc and untold death they have spread "Over There," where it often happened that troops had occupied a town for several days before some of these delayed time fuses functioned at unexpected moments!

NEW LIFE!
Health-Strength-Beauty
You can have bodily vigor, success-attaining energy—attractive healthful beauty! All yours at *practically no cost*—the great benefits of the famous VIOLET RAY TREATMENTS heretofore only procurable at big expense from Physicians and Beauty Specialists. TREAT YOURSELF at home with
Renulife Violet Ray
HIGH FREQUENCY GENERATOR
transforms electricity into the most powerful, effective, purifying Health and Beauty giving agency known to science, yet gentle, soothing, perfectly safe—no shock nor pain. Eradicates disease from blood, flesh, bone and nerves; tones and restores. While relieving pains and aches and the manifest results of disorders, it removes the deep seated cause. Saturates the system with invigorating, life-laden violet rays bringing back normal functioning.
TREATS Successfully
Rheumatism
Neuritis
Lumbago
Chest Pains
Catarrh
Headache
Ear Diseases
Hardening of Arteries
Wrinkles
Skin Diseases
Falling Hair
Etc., Etc.

Treatment forgeneral debility, nervousness etc.

Quick relief for rheumatism

Inhaling ozone. For Catarrh, throat and lungs. Marvelous local results with general tonic effect
Painless Electricity
Science has modified electricity that the weakest may stand its force without fear or pain. Every tissue and fibre is saturated, patient experiencing only a sensation of relief, as if standing in a ray of sunshine. *Violet Ray high frequency* has no comparison with old, crude, electrical batteries and shocking current. Every jar and shock is removed. The effects are marvelously rapid.
Lowest Priced—Most Effective
Violet Ray
For Home Use
Every person would be wonderfully benefited by a few minutes' daily use. Its astonishing low price places it within the reach of all. Write at once for full information regarding uses, benefits, price, etc.
Liberal *Trial Plan* Proves Value


GET FREE BOOK telling the whole marvelous story of the Violet Ray. Its wonderful successes—its many uses—specified by physicians for rheumatism, neuritis, headache, catarrh, wrinkles, blemishes, falling hair and 100 other bodily ailments and beauty defects, chronic and acute. Get this valuable book by return mail.

RENULIFE ELECTRIC CO.
532 Marquette Bldg. Detroit
Wanted: Representatives to demonstrate to physicians and individuals. Fine money making opportunity.

www.americanradiohistory.com



Strongfort
The Perfect Man

STOP SNUFFLING!

Sneezing, hawking, spitting and coughing. Why do you have catarrh anyway? You were not born with catarrh—you contracted it. This offensive, unwholesome, disagreeable complaint fastened itself upon you and grew. Nature is trying to prevent more serious consequences due to the congestion in your body, finds an outlet for the accumulated waste, by way of catarrh. You cannot get rid of it the way you are going—sprays, lotions, snuffing powders, drugs and medicines won't stop it. You know catarrh leads to other troubles—serious ones — throat, lungs, stomach, intestines—all become affected. You can never enjoy good health if you have catarrh; you won't be efficient in anything as long as you have catarrh, and it detracts from your personality to be hawking and snuffling around others.

Build Yourself Up

Be Clean—Wholesome—Healthy—Virile. Go at it the right way. Nature's way: no drugs, no medicines, and you banish catarrh from your system. Let me show you how, by my method of health building, body developing called

STRONGFORTISM

Its practice never fails—it builds new tissue, gives brawn and muscle, it invigorates heart action, strengthens kidneys, and makes the bowels move by their own natural strength. It makes every organ in your body pulsate to health. Under this kind of influence, catarrh quits for good, so will constipation, indigestion, nervousness, palpitation, rupture, rheumatism, weak heart, poor memory, physical weakness, vital losses, short wind, and all sorts and kinds of ailments and disorders.

If you are too stout or too thin, flat chested, or round shouldered—Strongfortism will alter it. It will make you grow in vigor and virility—and nervous energy—it will restore your vitality and keep your forces vital. No matter what your condition is now, or what habits you contracted or indulged in—I will show that you can renew yourself. You want to be strong, healthy—a virile man—you want to be all that a man ought to be and I can and will show you how to make yourself the man that is desirable from every standpoint.

Tell me your ailment and send three 2-cent stamps to cover mailing expenses, and I will send you my book, "PROMOTION AND CONSERVATION OF HEALTH, STRENGTH AND MENTAL ENERGY," written for your interest and welfare.

LIONEL STRONGFORT
Physical and Health Specialist
735 Park Bldg. Newark, N. J.



Skinderviken Transmitter Button

Nothing like it on the market. Will make an old transmitter better than new. Adjusted in a jiffy. Supersensitive. Talks at all scales. See our ad in the December or coming February number for innumerable uses to which it can be put.

Price $1.00 each. Discount in quantities.

Send us One Dollar, for which we will mail one button prepaid under our money-back guarantee.

Booklet No. 3 free for the asking

Skinderviken Telephone Equipment Co.
For your convenience in writing us, address
STECO 2134 Clark St., Chicago, Ill.



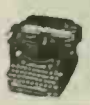
EARLE E LIEDERMAN
Why not look as healthy and be as strong as I am?

DO YOU WANT A
Wonderful Muscular Development,
with perfect health, abundance of vitality and great strength?

You can get all the above, if you want them, and I can show you how. The results of my system are shown on my own person, and that is recommendation enough.

I have prepared a booklet, illustrated with photographs of myself, which will tell you how you can obtain a development the same as I did. The name of it is "Muscular Development" GET IT—it will interest and benefit you. A copy of this instructive and illustrated booklet will be sent you upon receipt of 10c—stamps or coin.

EARLE LIEDERMAN, Dept. 204, 203 Broadway, New York City



TYPEWRITERS

ALL MAKES. SAVE $25 TO $50
on rebuilt by the well-known "Young Process." Sold for low cash-instalment or rented. Rental applies on purchase price. Write for full details and guarantee. Free trial.
Young Typewriter Co., Dept. 659, Chicago

EXPERIMENTAL MECHANICS.

(*Continued from page* 638)

secured to the saddle. The circle should be marked with a sharp *scriber* where the boring is to be done, also its final diameter. By bringing the work forward to the sharp point of the scriber which is attached to the boring rod, and slowly revolving said boring rod, the scriber making the proper mark, this will aid in boring the hole to the proper diameter. At the same time you can see whether the work is secured to the saddle with respect to the central line of the cutting tool, also live and dead centers. The cutting tool is held on block T. H., or tool holder, and is secured to the boring rod by a set screw. The boring rod is run between the centers and firmly attached to the *live* spindle by means of a *lathe dog* D to the face plate.

The novice can construct a very simple form of boring cutter, such as that shown in Fig. 4 This consists of the usual boring rod, B. R., which may be of any desired length, depending on the character of the work. The rod should be made of tool steel, heavy enough to prevent its springing or bending when used in boring. The longer the rod, the greater the chance of springing. It is therefore advisable to make the rod as short as possible. A one-half inch hole is made in the center of the boring rod, which is used to secure the cutting tool. This is about the size cutting tool that the novice will need in his work. Another hole is drilled at right angles to this one with a one-quarter inch drill and tapt for No. 18-5/16 inch thread. A headless set screw is threaded in, a saw cut being made on the outer end in order that it may be screwed in with a screw driver. The cutting tool should be made of the highest grade, self-hardening tool steel. Its length should not exceed one-half inch, the diameter of the boring rod. The cutting side of the tool is ground as indicated in Fig. 4, its bottom edge being slightly rounded, so that it will be prevented from chipping or breaking.

In boring a hole in cast iron, it will be found advisable to start with a heavy cut. This is done so that the sand or other silica particles that may have adhered to the cast iron when taken from the mould are immediately removed.

In the forthcoming issue the subject of "Taper Cutting" will be considered.

(*To be continued*)

Madrid gets its electricity for lighting and power from a hydro-electric plant 120 miles from the city.

A company in Japan has begun the production of soda by an electrical process.

Electrically operated cash carriers for stores have been invented, the motors of which are supplied with current thru the wires on which they run.

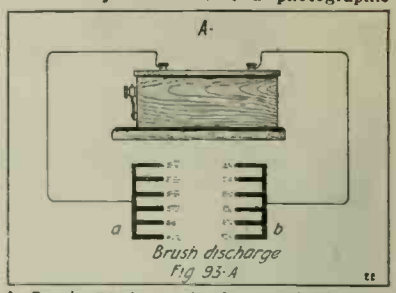
EXPERIMENTAL PHYSICS.

(*Continued from page* 626)

sisted of negatively charged particles, remembering that an electric current is an *electric charge in motion*, and that an electric current tends to move in an electric field in a direction given by the three-finger motor rule (see Lesson 16). Hence, our present belief *that the cathode rays are negatively charged electrons.* The fact that these rays give a negative charge to bodies on which they fall douhly strengthens the theory. The deflectibility of the cathode rays in magnetic and electric fields furnishes us with the necessary data for computing the size, weight, and speed of the electron. The size and weight is extremely small, the speed tremendously large (about 100,000 miles per second).

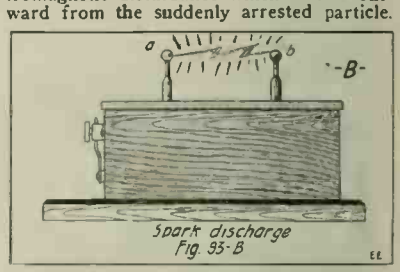
Experiment 108.

In 1895, Roentgen while working with cathode rays found that a photographic



A Brush Discharge Is Composed of Many Fine Sparks, Forming an Effluve.

plate which he happened to have near the cathode ray tube *blackened* on development. just as if it had been exposed to light. On investigating, he found that a *radiation* outside the tube always accompanies the production of cathode rays. These radiations differ in many ways from cathode rays and are called *Roentgen* (or *Röntgen*) *rays* after their discoverer, also *X-rays*, the name given to them by their discoverer. These rays result from the sudden stopping of the cathode ray. The kinetic energy of the cathode ray when suddenly stopt by encountering an obstruction produces an electromagnetic disturbance which travels outward from the suddenly arrested particle.



A Simple Spark Discharge from an Induction Coil.

The velocity of the X-ray is found to be the same as that of light. For the production of concentrated X-rays, a special form (the focus tube) of cathode ray tube is used (see Fig. 97a). Cathode rays coming from the concave spherical surface *c* converge and strike platinum plate P, where X-rays are generated which radiate in a hemisphere as illustrated in diagram.

By moving a zinc sulfid screen around the tube, we find that the X-rays cause fluorescence. If the hand or some other object is placed on a photographic plate and X-rays are allowed to strike the plate, a short exposure will give an X-ray photograph (see Fig. 97b), because of the ability of X-rays to penetrate many substances *opaque* to light. This makes possible the photographing of interior parts of the human body for diagnosis. X-rays are similar to cathode rays in that they cannot he re-

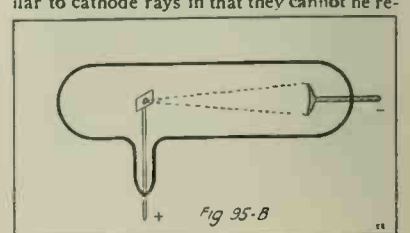


Fig. 95-B. The Cathode Is Concave and Spherical. The Anode Consists of a Small Piece of Very Thin Platinum. The Cathode Rays Are Converged, Focus on the Platinum and Are Therefore very Concentrated. The Platinum Incandesces, Thus Showing the "Heating Effect" of the Cathode Rays.

www.americanradiohistory.com

flected or refracted as light can, but they are different in many important respects. X-rays penetrate many substances which cathode rays cannot (X-rays pass right thru glass, whereas the cathode rays do not). X-rays cannot be deflected by electric or magnetic fields and hence cannot, like cathode rays, consist of electrically charged particles. The real nature of X-rays is still unknown. Lead seems to be the most difficult substance for X-rays to penetrate. Hence, lead is used as a screen to shield objects from X-ray action. Care should be taken in experimenting with X-rays as their penetrating power results in serious flesh burns under either protracted or oft repeated exposure to them.

(To be continued)

THE MANUFACTURE OF VACUUM DETECTORS.

(Continued from page 630)

than the filament when the tube is jarred.

After adjustment on the plate and grid has been made, the assembly is inserted into the prepared tubes and the end seals made. A short length of small diameter tubing is attached to the seal at one end of the tube, this being for connection to the pump manifold. The tube is then carefully annealed and is ready for exhaustion.

A number of tubes are sealed on the manifold in the oven and the temperature is gradually increased to 900 degrees Fahrenheit (480° C.) at which point the pumps are started. The tubes are heated in this manner before the pumps are started so that the air contained in the tubes may conduct the heat to the central elements and drive off the occluded gases (i.e., gases held in the molecular interstices of the wing, filament and grid structure). When the pumps have produced a vacuum of one micron, the temperature of the tubes is very gradually increased to 1000 degrees (540° C.). At this point they must be watched very closely as the melting point of this glass varies greatly and should the walls of the tubes become soft, the vacuum would cause collapse. From one micron, the vacuum slowly increases, and after about five hours of continuous pumping the tubes are sealed off at the manifold and allowed to cool in the oven.

McLeod gages are used in the measurement of vacua but I have found that a much more accurate vacuum comparison can be made using a large induction coil. For this purpose an electrode is sealed to the manifold or at some point in the vacuum line. One terminal of the coil is connected to this electrode and the other coil terminal is connected to the low vacuum pump. A calibrated spark gap is used on the coil and when the vacua is high enough and the residual gases are properly pumped from the tube a spark will jump the gap *without a glow in the vacuum line or tubes.* The vacuum used in the tubular detector will permit a five inch (12.5 cm.) spark between needle points in air.

Prof. Richardson has shown that when new metals are heated to incandescence they emit positive ions, probably because of the impurities or gases in the metal. I have found that this positive discharge must be eliminated to obtain maximum sensitiveness of the tubular detector, and this is accomplisht during the manufacturing stage by burning the filament on alternating current for about two hours. Tubes that have not been treated in this manner are found to be less sensitive than those in which the positive ionization has been destroyed.

A VERTICAL CABINET TYPE COUPLER.

(Continued from page 631)

ENDS FOR THE COILS

It is necessary now to cut a base end to fit the five inch primary coil and two for the four and one-half inch or secondary coil, from three-eighths inch wood (white pine may be used, as it is quite soft and easy to handle). When thus cut they are placed on top of each other and two one-eighth inch holes drilled about one and one-half inches apart and toward one end. They must, of course, be in alignment, as they are for the slider rods. The center must also be free as in one of the four and one-half inch covers fifteen holes are to be drilled for the fifteen secondary taps. The respective taps of the secondary are drawn thru in order and the ends nailed to the coil with brass nails. Care must be taken to get the openings for the sliders directly under each other. The completed secondary is shown at Fig. 4, and also the sliders and their arrangement. The sliders are made from No. 8 copper wire which is stretched taut by screws at the top of the cabinet. A screw eye is inserted into the top for varying the coupling, as will be described presently, and the primary is screwed in place (see Fig. 4).

THE CABINET

Very little need be said about the material for the cabinet, perhaps, as the building of this depends entirely upon the ways and means of the Amateur, so only the measurements will be given. The cabinet is made like a box except that the top and back are not put into place until the apparatus is mounted. The front panel is one-half inch thick, twenty-six inches high and eight and one-half inches wide (¼ inch Bakelite makes an excellent job); the sides are six inches wide.

SWITCHES, SWITCHPOINTS AND METHOD OF VARYING THE COUPLING

The switches were made at a cost of eight cents each, using also such odds and ends as are found in any laboratory. The knobs



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle massage. Can be used with or without electric current.

All users of the **Lek-Tro-Shav** speak well of it.

A barber says—"Have shaved for years and have never used any shaving device near its equal."
A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."
No. 1 Made for use from Light Socket.
No. 2 Made for use from Dry Battery.
Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.

VIBRATING ELECTRIC RAZOR CO
Dept. 122. Omaha, Nebr.

WIRELESS
OPERATORS WANTED
If you are ambitious and wish to better yourself this is your opportunity.

America's new Merchant Marine needs trained wireless operators. Good pay and splendid chance to see the world and help in the reconstruction of Europe. Our classes have supplied hundreds of expert Wireless and Land Line Operators.

Write for illustrated booklet giving full particulars. "The Best Radio School in New York City."

Y. M. C. A.
East Side Branch
Lenox 6051
86th St. and Lexington Ave.
New York

Learn Mechanical Drawing

Thousands of Draftsmen Wanted — Salaries $35-$100 Per Week



ARE you earning more than the average man? If not, my offer will interest you. I offer you the best service that my school affords. I offer you my personal instruction in mechanical drawing. I offer to teach you expert draftsmanship in your own home. I offer to fit you for the high-paying position of draftsman in one of the United States government departments or one of the great machine shops of America. I offer to do all this at a reasonable expense to you, and in a comparatively short time.

The drafting field is not crowded. It never was. It probably never will be. You cannot make a mistake by taking up draftsmanship. I do not know of any single profession open to men today which offers better opportunities. As I have said at the beginning of this article, draftsmen are earning $35 to $100 per week.

There is a demand for men who complete my course. I cannot supply graduates fast enough. Many of them are taken even before they complete their course. This unusual demand is explained by the fact that my students enter on actual drawing work the day they enroll with me. They spend no time with preparation and useless theory.

ONE OF THE FINEST AND BEST EQUIPPED INSTITUTIONS IN AMERICA TEACHES YOU MECHANICAL DRAWING AT YOUR HOME.

With the ending of the war, the day of big opportunities for trained men is here. Especially is this true in the case of draftsmen, on whom the mechanical industries of America depend. On no one profession does the reconstruction of Europe so nearly center.

Columbia School of Drafting
ROY C. CLAFLIN, Pres.
Dept. 868, 14th & T Sts., N.W., Washington, D. C.

ROY C. CLAFLIN, President
COLUMBIA SCHOOL OF DRAFTING

Free drawing instruments—Each of our students is presented at the beginning with a set of professional drawing instruments.

A valuable book sent without charge—Merely fill in the coupon below for a valuable book on drawing, and complete information in regard to our course.

COLUMBIA SCHOOL OF DRAFTING
Dept. 868, 14th and T Sts., N.W., Washington, D. C.
Without obligation to me, please send me your illustrated book on Drafting and tell how I may secure your complete Home Study Course, the DRAWING OUTFIT FREE, and your help in securing a position as Draftsman.

Name.....
Address.....
City..... State.....

www.americanradiohistory.com



GET "CHEMCRAFT" for Christmas! Perform all kinds of wonderful chemical experiments and tricks that will amaze and puzzle your friends. Learn the principles of Chemistry and have real fun at the same time. Get your outfit now!

Chemcraft No. 1—$1.25
West of Mississippi River and in Canada—$1.50
Chemcraft No. 2—$2.50
West of Mississippi River and in Canada—$3.00
Chemcraft No. 3—$5.00
West of Mississippi River and in Canada—$6.00

Be sure you get "CHEMCRAFT," the original and most complete and scientific chemical outfit. Ask for it by name at your Toy Store, or send price and we will deliver direct prepaid.

The Porter Chemical Company
Industrial Bldg., W. Washington St.
Hagerstown Maryland

35 MILES PER HOUR
Is Record Of This Car



Built by a boy from Junior parts furnished by us. Any boy can build this car. Parts very cheap. Send 25 cents for blue prints and price list of parts showing how to build this speedy little car.

SIPHER MFG. CO.
156 Warren Street
TOLEDO, OHIO.

FREE
$20



Violin, Hawaiian Guitar
Ukulele, Guitar, Mandolin, Cornet or Banjo

Wonderful new system of teaching note music by mail. To first pupils in each locality, we'll give a $20 superb Violin, Mandolin, Ukulele, Guitar, Hawaiian Guitar, Cornet or Banjo absolutely free. Very small charge for lessons only expense. We guarantee success or no charge. Complete outfit free. Write at once—no obligation.
SLINGERLAND SCHOOL OF MUSIC, Dept 422, CHICAGO, ILL.



ZIP
Patented Sept. 3, 1918

BOYS! We have received scores of letters like this W. A. ROTHWELL, M.D., Kendrick, Idaho
Automatic Rubber Co., Columbia, S. C.
Gentlemen: Enclosed find personal check for $1. Kindly oblige me by forwarding two Zip-Zips: the last I ordered were perfect in every way. Yours sincerely, W. A. Rothwell, M.D.
The doctor says they are O. K., boys. Order from us or your Sporting Goods Store. Zip-Zip complete only..... 50c
AUTOMATIC RUBBER CO., COLUMBIA, S. C.

TELEGRAPH PICTURES

This picture of Wilson received over Leishman Picture Telegraphy Machines. Will transmit pictures, maps, drawings and handwriting. Send for descriptive folder.

L. J. Leishman, Dept. T
Ogden, Utah





FREE BOOK ON AVIATION
Learn of the great opportunities in this new $1,000,000,000 industry. Thousands of men needed. Learn by mail—free book tells how. Write at once.
NATIONAL AERO INSTITUTE, Dept 7441 Merchants Bldg., Chicago

were purchased from a hardware store. These are glass drawer knobs and have a brass shell into which the glass knob is cemented; also a screw is fitted into the end. Five of these are needed. The switch blade is cut from a piece of springy brass or nickel. Cut two pieces three inches long and taper down one end (see Fig. 5). The other end must be made to fit the knob. A hole is drilled into this end and the blade is soldered to the brass cup; bend the contact end as shown. Also cut two pieces one and one-half inches long for the secondary switches and fasten in the same way and to the fifth knob solder the hand of a clock.

The switch points are common upholsterer's nails with the brass tops and small washers to fit the under side. After the wire has been drawn thru a hole drilled in the cabinet for it, it is twisted around the nail and the loop thus formed pushed far down into the hollow of the cup of the nail. A small amount of flux and a piece of solder about one-quarter the size of a split pea is placed into the cup which is held hollow upward. A hot iron is now touched to the nail, and the solder will melt flush and make an excellent connection. The washer is now slipt over the nail and the nail driven in place. The washers are not essential but make the heads of the switch point protrude more. (Fig. 5.)

The method of varying the coupling is by a cable and drum arrangement. Rack and pinion methods need accurate workmanship for them to operate correctly, so this novel home-made method was devised. After the clock hand has been soldered to No. 5 knob, a twenty-four inch (circumference) wooden wheel is fastened to the screw of this knob. This wheel is locked in place and a hearing is made to fit the other end of the screw, so that there will be a fairly good axle and bearings formed, one bearing being the front panel. A bent piece of brass will answer for the other end. A piece of leather is fastened in such a way as to cause friction against the wooden wheel. A piece of cord is nailed to the wheel and wound around the groove; the cord passing over a small pulley and secured to the screw-eye on the upper end of the secondary (see Fig. 4).

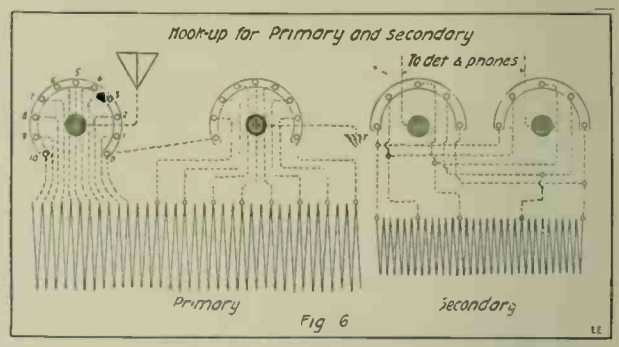
ASSEMBLY

Along the mid-line of the panel and four and eight inches up from the bottom, respectively, drill two holes to fit the screws of the switches. Above each of these drill two smaller holes for wires which will go to antenna and ground. Draw the flexible wires thru; solder to switch blade (Fig. 5) and put switch in place. Place a spring on the under side of switch to keep it tight. Describe an arc with each switch and using about two-thirds of a complete circle for the arrangement of switch points, divide them equally into the area thus allowed. Drill holes for the wires of the switch points, solder to switch points as already described and hammer into place. Then seventeen inches from the bottom and two inches from the mid-line each way, drill holes for the switches of the secondary. Mount the sixteen switch points in place as per diagram for connections.

Put the top on the cabinet with the bolts (eye-bolts) for slider rods and tighten the rods; finally put on back. The diagram of the assembled coil is shown in Fig. 7.

There are many advantages of this type cabinet, as it is both compact, inexpensive and neat. It does not allow dust to settle between the windings and prevents the entrance of other foreign matter. One complete turn of the coupling knob will change the coupling completely. Accurate tuning of the primary is worked out to a very fine extent and the novel arrangement of the secondary tuning will be seen to have many merits, as any portion of the coil may be used and the direction of current may also be reversed. Often the coupling will not have to be changed in order to vary the secondary, as both switches may be moved and so bring another portion of the coil into play.

With a galena detector stand and using a "radiocite" crystal, this outfit cannot be beaten and other stations were brought in that never were heard before. This may have been due to the excellency of the crystal, but the coil has something to do with it, in my estimation.



Hook-Up of Primary and Secondary Windings On Vertical Coupler. Note That Secondary Switching Circuit Permits of Reversing the Polarity of the Circuit.

SOLAR ENGINE USES SUN'S ENERGY.

(Continued from page 607)

Messrs. Shuman, Boys, and Ackerman, engineered and built a large solar energy plant at Meadi on the Nile, Egypt. This plant developed 100 h.p. The total area of sunshine collected was 13,269 square feet. The maximum pounds of steam generated was 12 pounds per 100 square feet of sunshine, or the equivalent, to *183 square feet per brake horsepower*. The best hour's run developed, at atmospheric pressure, 1,442 pounds of steam. Hence (allowing 22 pounds steam per brake horsepower) the maximum output for an hour was 55.5 horsepower (about ten times better than any previous results). This means *63 brake horsepower per acre of land occupied by the plant*. Moreover, no marked reduction in the horsepower produced was noticeable in the early hours of the morning or in the late hours of the afternoon.

The temperature of the sun, as aforementioned, has been calculated to be about 6,000 degrees centigrade. Several authorities point out that this terrific heat therefore precludes any possibility of the sun being a molten mass in the process of combustion. It has been thought recently by many to be a great mass of matter possessing to a remarkable degree radio-activity akin to radium. Helmholtz proposed that the sun could keep on producing energy at its present rate by accounting for same on the basis of a slight annual shrinkage in its size. From observations and measurements

www.americanradiohistory.com

of this heavenly body made from year to year it has been computed that the age of the sun would, on the shrinkage basis, be 17,000,000 years.

The radiant energy received from the sun at the outer surface of the earth's atmosphere is equivalent to *7,300 horsepower per acre.* Of this about 70 per cent. or, roughly speaking, 5,000 horsepower per acre, is transmitted thru the atmosphere to the land surface proper of the earth, at noon on a clear day. Lesser amounts, of course, are received in the early morning and late afternoon, owing to the greater thickness thru which the energy must pass.

Relative to the basis upon which solar energy is calculated for the earth's surface, this is generally made, it may be said, on the "solar constant," as it is termed, ascertained from 696 tests conducted by the Smithsonian Institute of Washington, in various parts of the world, which resulted in accepting 1.93 calories per square centimeter per minute, equal to *7.12 British thermal units per square foot per minute.* This is an average value, all things considered.

Only about three-fifths of the solar radiation produce any impression on the earth, and it is only the radiant energy which falls on some material body that is converted into heat. The best body for this conversion having been ascertained to be a dead black one.

"ODD PHOTO" CONTEST.

(*Continued from page* 616)

as to work the strings. Fourthly, it was indoors on a cloudy day. I simply guest at the time—about 25 seconds for each exposure (double exposure) and let 'er go at that. The streaks are the strings; the lenses were between the two strings. I didn't expect it to be any good at all. So if you have any extra dollars flying around, send one out to Iowa. Fred Wagner,
Burlington, Iowa.

NOVEL PHOTO OF CITY AND LIGHTNING AT NIGHT.

The photo I submit is a picture of a city at night, taken from a high mountain nearby. The object of taking the picture was to "snap" the lightning.

Rob't Sullivan, Canon City, Colo.

AT LAST—A PHOTO OF "BALL LIGHTNING."

Speaking of "Odd Photos" or something for the "bug" to worry about, I think I have it here, in the form of two actual photographs, either of which contain any kind of lightning one would want, i.e., *chain, ribbon* or *ball.*

These photos were taken about six months ago (Pardon the selfishness) on the same night and about five minutes apart, during a very damaging electrical disturbance in this locality.

I may be wrong in my conception of the impression on the right side of photo No. 1 (the upper left photo) being *ball lightning,* but would suppose it to be such. This picture is an exposure of 30 seconds. There was no artificial light of any kind in front of the camera. This phenomenon was not perceptible to the eye—or at least was not observed.

If this be ball lightning we then know that ball lightning is of an oscillating or pulsating nature, as is evident from the path taken by the ball. Possibly this is a potential of one sign seeking its affinity or opposite potential sign, in order that it may neutralize. Following the path of the ball it comes in at the base of the ribbon discharge at the left, whence it travels straight across, almost parallel to the wires in the background, then it comes to rest in the upper right hand corner. It now slowly follows an irregular path with a few stops and makes its exit into the heavens, no doubt to join its patiently waiting other half.

Photo No. 2 (lower center) is a 3 minute exposure, during which time the camera was moved once but very slightly, as you see from the double print of the chimneys in the background. In this picture will be seen innumerable paths of the light ball where it has traveled at various speeds.

L. E. Church, Bailesville, Okla.

EXPERIMENTS IN RADIO-ACTIVITY.

(*Continued from page* 636)

radio-active study. It is thought unnecessary here to give further experiments in this phase of the subject as they will suggest themselves to the reader. It is an intensely interesting subject and the reader will derive both beneficial knowledge and pleasure from his experiments. There are many other properties of these substances besides their ionizing power which will be taken up in later articles.

(*To be continued*)

BUILDING A 3-INCH SPARK STATIC MACHINE.

(*Continued from page* 633)

should reach the comb and thus prevent the escape of the electricity before it reaches the metal points.

An iron ring placed on the conductor heightens its capacity. This consists of an iron wire bent in a circle and then well insulated with paper, which is later varnished with shellac.

If the handle of the machine is turned towards the combs, electric sparks can be drawn from the small ball attached to the end of the brass wire holding the comb.

It is unnecessary to explain the uses of Leyden jars and other apparatus which can be used in connection with this machine, as any "Physics book," under the heading of "Electricity," describes a number of them.

THE CITY OF SPLENDID NIGHT.

(*Continued from page* 623)

footed torch-bearers led the way. None of them, proud souls, ever saw their doorways in fullest beauty, the beauty that is electric, that softens rude prominences while it throws a lustrous, enchanting glow over fine design and decoration.

The "City of Splendid Night" forever calls me to fresh delights. I go the way of a side street at the beckon of a light and, anon, find myself before the stately pile of a church, mirrored against the sky by the guardian pillar of radiance that stands before it. Later I come upon a green park bordered with electric jewels. Here I seat myself and watch the trees play tag with beams of electric brilliance.

Big Money for Boys!



Learn ELECTRICITY

There is a wonderful opportunity right now for boys who like electricity. Thousands of men from the electrical industry have gone into the service and others are going every day. Boys who are ambitious and will train themselves in spare time can step into good positions and play a real part in winning the war by carrying on their work. Good salaries are offered with rapid promotion.

For 27 years the International Correspondence Schools have been training boys for success in electricity and over 200 other subjects. They will help you prepare right at home for a position in the line of electrical work you like best—or in any other work that appeals to you. Thousands of boys, through I. C. S. training, have stepped into fine jobs, but never were opportunities so great as now.

Let the I. C. S. help *you.* Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least, and it will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now.*

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6172, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

☐ ELECTRICAL ENGINEER
☐ Electrician
☐ Electric Wiring
☐ Electric Lighting
☐ Electric Car Running
☐ Heavy Electric Traction
☐ Electrical Draftsman
☐ Electric Machine Designer
☐ Telegraph Expert
☐ Practical Telephony
☐ MECHANICAL ENGINEER
☐ Mechanical Draftsman
☐ Ship Draftsman
☐ Machine Shop Practice
☐ Toolmaker
☐ Gas Engineer
☐ CIVIL ENGINEER
☐ Surveying and Mapping
☐ MINE FOREMAN OR ENG'R
☐ ARCHITECT
☐ Architectural Draftsman
☐ PLUMBING AND HEATING
☐ Sheet Metal Worker
☐ CHEMICAL ENGINEER
☐ SALESMANSHIP
☐ ADVERTISING MAN
☐ Window Trimmer
☐ Show Card Writer
☐ Outdoor Sign Painter
☐ RAILROADER
☐ ILLUSTRATOR
☐ DESIGNER
☐ BOOKKEEPER
☐ Stenographer and Typist
☐ Cert. Pub. Accountant
☐ Traffic Management
☐ Commercial Law
☐ GOOD ENGLISH
☐ STATIONARY ENGINEER
☐ CIVIL SERVICE
☐ Railway Mail Clerk
☐ Textile Overseer or Supt.
☐ AGRICULTURE
☐ Navigator
☐ Poultry Raising
☐ Automobiles
☐ Spanish
☐ French
☐ Italian

Name
Present Occupation
Street and No.
City State

YOU CAN MAKE BIG PROFITS WITH HB BATTERY CHARGER



Others are making $100 to $150 a month extra profit. So can you. No experience necessary. Write for full particulars or send $15 with this ad. to put this money-making HB 500 watt Charger in your garage on trial order. Balance in 9 monthly payments of $20 each. No risk. Absolute money-back guarantee. Delay means lost profits. Order today.
Hobart Bros. Co. Box 1E, Troy, Ohio

Bliss Electrical School
ELECTRICAL ENGINEERING
Condensed Course—Complete in One Year. Sound, scientific, practical—without frills. For young men of energy and character. 26th year opens September 25th. Write for new catalogue.
260 Takoma Avenue, Washington, D. C.



FREE BOOK ON AVIATION
Learn of the great opportunities in this new $1,000,000,000 industry. Thousands of men needed. Learn by mail—free book tells how. Write at once.
NATIONAL AERO INSTITUTE, Dept. 741 Marion Bldg., Chicago

www.americanradiohistory.com

LEARN Chiropractic OF US (DRUGLESS HEALING)



You can easily and quickly get your Doctor's degree and receive University Diploma from the well-known educational institution, Chicago University of American Sciences, and enter a modern profession paying others $5,000 and more a year, simply by taking our true PERSONAL SERVICE INSTRUCTIONS in Chiropractic during spare time at home. ONLY course offered by a legally organized school that Guarantees Satisfaction or Refunds Money

My students today have big incomes. Thousands helped to success and riches. Let us help YOU. Write for proof and special offer of a 12 volume Reference Library FREE for a few days.

Dr. D.E. WOOD, 17 N. State, Suite E 1 Chicago.



THE MIDGET SLIDE RULE will add, subtract, multiply, divide; solve problems involving even and uneven roots and powers. Also gives the logarithms of numbers and the Sines and Cosines, Tangents and Cotangents of all angles. Its operation is very simple; quickly solves any mathematical problem. Durably made of metal. Adapted for shop and office use. Fits the pocket. 3¼ inches diameter. Price with instructions, $1.00 Your money back if you are not satisfied. Gilson Slide Rule Co., Niles Mich.



SMALL ENGINES

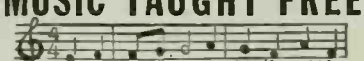
Perfected Gasoline Engines—½, 1 and 1½ h. p.—for Farm and Shop use. Price $27.50 and up. Also WASHING MACHINES

We ship on trial. Send for Booklet and Special Offer.

SIEVERKROPP ENGINE CO. 1401—19th St., Racine, Wis.

STARTER for FORD CARS

MUSIC TAUGHT FREE



You can read Music like this quickly

In Your Home. Write today for our booklet. It tells how to learn to play Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced pupils.

American School of Music 57 Lakeside Bldg., Chicago

Build Your Own PHONOGRAPH

PARTS FOR ANY STYLE MACHINE

Build your own cabinets

We show you how

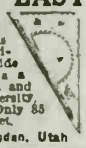
Circulars and instructions 10c.

Motors, Reproducers, etc. sold

Electro Mechanical Parts Co.

Dept. E 160 No. Wells St., Chicago, Ill

MATHEMATICS MADE EASY



The Arcascope—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 85 cents Postpaid. Order today before you forget.

Dept. 8. L. J. LEISHMAN CO., Ogden, Utah



SAVE 25% to 60%

on like new used GRAFLEX-KODAKS

Cameras and Lenses of every description. Equal to new. Save money. Write now for Free Bargain Book and Catalog

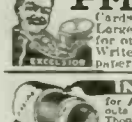
Lists hundreds of money saving bargains in slightly used and new cameras and supplies. All goods sold on 10 days' Free Trial. Money back if not satisfied. You take no chances dealing with us. We have been in the photographic business over 18 years. Write Now

CENTRAL CAMERA CO., Dept. 171 124 So. Wabash Ave., Chicago

WHY "FLUNK"?

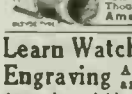
in Latin, Students? "CAESAR"-FIRST 8 BOOKS-"CICERO", "OR VIRGIL"-and others-, translated, word for word into ENGLISH. Complete, clothbound, $2.00 each, postpaid.

MONONGAHELA NOVELTY CO., BOX 299, MONONGAHELA, PA.



Printing Cheap

Cards, circulars, labels, book, paper. Press $8. Larger $20. Job press $60. Save money. Print for others, big profit. All easy, rules sent. Write factory for press catalog. TYPE, cards, paper. THE PRESS CO. D-47 Meriden, Conn.



INSYDE TYRES Inner Armor

for Auto Tires. Double mileage, prevent blowouts and punctures. Easily applied in any tire. Thousands sold. Details free. Agents wanted. Amer. Accessories Co., Dept. 23, Cincinnati

Learn Watchwork, Jewelrywork and Engraving A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL Department, Bradley Institute, Peoria, Ill. for our latest catalog

You may know the white lights of the night, so do I, but I also know where are to be found those more precious sights of the city, made possible by night and electricity. And so I wander lovingly thru the "City of Splendid Night," and visit its shimmering shrines.

The Park at Night

WHEN next you walk abroad at night, choose Central Park, and preferably that part of it which ranges south of Seventieth Street. Enter to the left of General Sherman and follow the friendly bypath that skirts the Japanese Lake, where the swan boats ride at anchor. I call it the "Japanese Lake" because the first sight of it, thru certain trees bent and burdened with weird charm, suggests a Japanese print, wherein the towering Plaza becomes Fujiyama. The while you stand the lake gathers lustre from many sources, taking toll of light until its tiny, radiant body seems a great, luminous tear, dropt from the eye of God.

You can't know Central Park until you see it at night, and then it is no more the park than the city surrounding it that thralls you. Each season has its own particular charms; but it is best to consult your almanac prior to making the excursion, for no moon is wanted at such a time. The lights of Manhattan should not be disturbed, or marred, and a cloudy night, tho with rain yet a long way off, is to be especially desired.

In truth some of the rarest charms of this great enclosure are the vantage points it offers for viewing the glowing city. From each hill and hollow and rustic bridge you see sights that make you feel Nature has prepared a wonderful gallery in which you may stand and see the thousand pictures painted by Night and Electricity.

And the wonder of the lighting. Never have pictures been hung for exhibition with more rare understanding of the art of presentation. Never has favored critic at private view found color and arrangement, composition and subject, more effectively displayed than finds he who will be guest of Central Park as he stands witness to the glory of Manhattan.

Off to the South and West flare great electric signs surmounting high buildings. Warm and colorful they hang in the sky; aerie, detached beacons of fantastic shape, winking at the night and rippling thru darkness. Rows of lighted windows speak cheerfully of life. From the summit of a tiny hill streaking traffic is visible in its shooting rays of warning speed.

Within the sylvan solitude the voice of the city speaks faintly, and its sparkling eyes are veiled with the romance of contrast, that ever comes when Nature spreads her green mantle in the midst of man's activities.

Oh, the wonder of the city from the park; and then the wonder of the park within the city. Here Robin Hood might dwell and Peter Pan feel a charm as luring as his finest scenes in Kensington Gardens.

If you would really see all the spirits of the wood gathered together in carnival, then stand at the Northern limits of the Mall and, half closing your eyes and rising on tiptoe, look down its length. Fill yourself with the full beauty of the fairy court. It is precisely lighted with soft, glowing globes. Here and there stand set pieces of statuary, grotesquely gigantic, forever trying in their rigid way to cast strange shadows for each competing light that falls on them from either side and from across the Mall's milky way.

As sure as you believe in fairies, they are here. Some lurking behind these statues, snuggled in the robust curves of back and base. All waiting in thrilling expectancy their turns to dance and frolic in the silvery glow. The scene will surely enchant you. Earth-weight passes, the senses are ethereally acute, you feel the pulse of Beauty, and the heart within you takes fire.

So lives the radiant poetry of Central Park. It is there for all of you who will go with vision for its picturing. It is the great gallery exhibiting the Light of Manhattan.

New York in the Rain.

BLOT out the stars. Draw a leaden mantle of cloud across the heavens. Let the skies open every pore, until earth rejects the surfeiting torrents. Fields are sodden, woods sullen, villages sordid, and all the open country a sticky mass of morbid moisture.

But old New Amsterdam is glorious!

So fare you forth and witness the wonders of this city of cities in the rain. The perfect time is during the first silent hours of the morning. Then you may surprise it in the full splendor of its bath. The buildings stand stark, dripping, and in great masses rise triumphant thru the drenching.

The gutters are long panels of flowing mirrors which break and shatter into ten million fractions in reflections, where treacherous corner grills suck them into roaring depths. About each light that punctuates the avenues and streets there is a hazy glow. Here sparkle the jewels thrown overboard by the clouds in an effort to lighten their ballast.

As tho hoisting themselves on the liquid ladder of the storm, the ascending mingled lights of the city burnish the grey vault above with golden copper, as the hearth-flames picture themselves in the kettle swinging from the crane.

The romance of *Masonry* and *Electricity* is before you. It is a drama done in pouring pantomime. The scenery is made of steel and stone, with all the city on the stage. Footlights and spotlights get their life from giant dynamos and turbines swiftly milling greater light than Nero made when sacrificing Rome.

Now pause, while the clouds are discharging their cargoes; if you will halt between tall buildings and bear your face to the rain for a full upward glance you will know somewhat of the feeling of the mountain traveller when he stands in the spray of some vast waterfall. Deep down in the cañon he pauses while the rays of an unseen sun paint a rainbow on the struggling torrent at the spot where the unleashed waters hurl themselves from the cold embrace of the rocky heights.

Again you stand before great arches opening into the halls of commerce and mark the silent sentinels picking luminous arcs out of the night and rain and sending many-colored reflections into the shadowed recesses as fire-brands challenge the darkness of some echoing cave.

So we see the many-sided city at its bath. The city that has been the sweetheart of an endless procession of goodly men. The city of which O. Henry sang so sweetly and of which he wrote so understandingly. Great is Diana of the Madison Square Campanile. Great is the Lady of Liberty Light. But greater still is the city over which they reign.

When storm breaks at night Manhattan blooms: she blossoms gorgeously in the downpour, and bathes majestically. And so, when drenching clouds cut off our view of the campfires of the guardsmen of the heavens, we feel an increased thrill in the shining of our faithful keepers of the curb, the stars of the street.

www.americanradiohistory.com

MAGAZINES GOING UP!



Further Increases Coming!

NOW IS YOUR CHANCE!

With this issue, the price of the EXPERIMENTER, as announced on another page, goes to $2.00 a year. With the paper market in chaos and soaring prices, printers demanding another large wage increase, engravings going up 90%, we feel sure that before spring ALL magazines will go much higher than now.
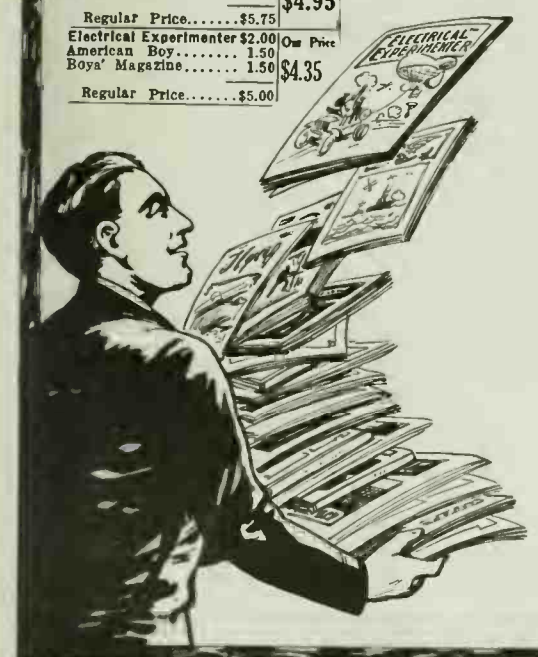
By subscribing now for from one to five years, YOU POSITIVELY WILL SAVE BIG MONEY.

The prices below are unquestionably the lowest for standard magazines that it is possible to obtain anywhere. Only by a special arrangement with the publishers are these prices possible and they are good only until December 15th, after which date all prices as given on this page are withdrawn. Make up your list at once—do not delay. If you are already a subscriber and your subscription to the EXPERIMENTER runs for a long time, you may subscribe for any other magazines by deducting the price of the EXPERIMENTER from the clubs at the rate of $1.85 (the special price allowed in clubbing with other magazines). Thus you can make up any club yourself of as many magazines as you wish from the list below.

The Publishers Will Mail the Magazine Direct From Their Own Office to You

All prices quoted are for subscribers in U. S. only. Canadian and foreign subscriptions require additional postage.

Electrical Experimenter $2.00 Popular Science..... 2.00 Illustrated World, (Technical World).. 2.00 Regular Price.....$6.00	Our Price	$5.50
Electrical Experimenter $2.00 Scientific American.... 5.00 Regular Price.....$7.00	Our Price	$6.50
Electrical Experimenter $2.00 Popular Astronomy... 3.50 Regular Price.....$5.50	Our Price	$5.15
Electrical Experimenter $2.00 Wireless Age..... 2.00 Etude ..... 1.75 Regular Price.....$5.75	Our Price	$4.95
Electrical Experimenter $2.00 American Boy..... 1.50 Boys' Magazine..... 1.50 Regular Price.....$5.00	Our Price	$4.35
Electrical Experimenter $2.00 American Boy..... 1.50 St. Nicholas..... 3.00 Youth's Companion.... 2.00 Regular Price.....$8.50	Our Price	$7.85
Electrical Experimenter $2.00 Today's Housewife.... .75 McCall's Magazine.... .75 Regular Price.....$3.50	Our Price	$3.00
Electrical Experimenter $2.00 Collier's Weekly..... 2.50 Literary Digest..... 4.00 Regular Price.....$8.50	Our Price	$8.00
Electrical Experimenter $2.00 Etude ..... 1.75 Regular Price.....$3.75	Our Price	$3.20
Electrical Experimenter $2.00 Boys' Magazine..... 1.50 Regular Price.....$3.50	Our Price	$3.00
Electrical Experimenter $2.00 Everybody's Magazine. 2.00 Delineator (all to one address) ..... 2.00 Regular Price.....$6.00	Our Price	$5.35
Electrical Experimenter $2.00 Motion Picture Magazine ..... 2.00 Regular Price.....$4.00	Our Price	$3.60
Electrical Experimenter $2.00 Everybody's ..... 2.00 American Magazine... 2.00 Regular Price.....$6.00	Our Price	$5.50
Electrical Experimenter $2.00 World's Work..... 4.00 Regular Price.....$6.00	Our Price	$4.85
Electrical Experimenter $2.00 Smart Set..... 3.00 Regular Price.....$5.00	Our Price	$4.10
Electrical Experimenter $2.00 Parisienne ..... 2.00 Regular Price.....$4.00	Our Price	$3.50
Electrical Experimenter $2.00 Youth's Companion... 2.00 Review of Reviewa.... 3.00 Regular Price.....$7.00	Our Price	$6.10
Electrical Experimenter $2.00 Pictorial Review..... 2.00 McClure's Magazine... 1.50 Regular Price.....$5.50	Our Price	$5.00



Special Clubbing Prices of Electrical Experimenter WITH

	Regular Price	Our Rate Per Year
Adventure	$5.00	$4.70
American Boy	3.50	3.00
American Magazine	4.00	3.85
Black Cat	3.50	3.00
Blue Book	4.00	3.75
Boys' World	2.50	2.25
Century	6.00	5.30
Christian Herald	4.00	3.60
Collier's	4.50	4.25
New Country Life	7.00	6.65
Delineator	4.00	3.60
Etude	3.75	3.20
Everybody's	4.00	3.60
Field & Stream	4.00	3.50
Film Fun	3.50	3.25
Orit	4.00	3.60
Illustrated World (Technical World)	4.00	3.50
Judge (Weekly)	7.00	6.75
Leslie's Weekly	7.00	6.75
Literary Digest	$6.00	$5.70
McClure's Magazine	3.50	3.00
Metropolitan	5.00	4.75
Modern Priscilla	3.50	3.25
Nation	6.00	5.35
Outing	5.00	4.75
Outlook	6.00	5.75
Pearson's Magazine	4.00	3.50
Popular Science Monthly	4.00	3.75
Red Book	4.00	3.75
Review of Reviews	5.00	4.00
St. Nicholas	5.00	4.75
Scientific American	7.00	6.50
Scribner's Magazine	6.00	5.35
Smart Set	5.00	4.10
Wireless Age	4.00	3.50
Woman's Home Companion	4.00	3.75
World's Work	6.00	4.85
Youth's Companion	4.00	3.75

Write for Special Prices on ANY Publication not listed here

We will save you money

SEND ALL ORDERS TO "CIRCULATION DEPARTMENT"

EXPERIMENTER PUBLISHING CO., Inc.

233 Fulton Street, New York City, N. Y.

SEND FOR OUR FREE SUBSCRIPTION CATALOG

Scores of Publishers are increasing their prices overnight. Protect yourself by subscribing NOW

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms and dealers from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section seven cents a word for each insertion. No advertisement for less than 50c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by accredited advertising agency.

Ten per cent discount for 6 issues, 20 per cent discount for 12 issues from above rate. Objectionable or misleading advertisements not accepted. Advertisements for the February issue should reach us not later than December 22.

SPECIAL NOTICE Owing to the large increase in circulation the classified advertising rate beginning with the February issue will be 7c per word. However, all orders or reservations for a period not to exceed one year, which are received not later than December 20, will be accepted at the old rate of 6c per word.

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Automobile Accessories

More Power, Less Fuel, No Carbon. No mystery, plain facts, results guaranteed. Write for booklet. S. O. Automobile Accessories Co., Baltimore, Md.

Fords Start Easy in Cold Weather with our new 1919 carburetors. 34 miles per gallon. Use cheapest gasoline or half kerosene. Increased power. Styles for any motor. Very slow on high. Attach it yourself. Big profits to agents. Money back guarantee. Thirty days' trial. Air-Friction Carburetor Co., 270 Madison, Dayton, Ohio.

Lubricant Carbon Remover Solves the Carbon Problem. When your motor loses power, when it knocks, bucks and overheats, don't monkey with the carburetor. Send for a can of Lubricant Carbon Remover. Every can guaranteed. Price $1 prepaid. Agents wanted. W. A. Engelke, 3257 Bishop St., Cincinnati, Ohio.

Kwik-Fix Rubber Compound. Better than anything you have ever used. Repairs auto tires, innertubes, ignition wires, leaky auto tops, cuts and thin spots in rubbers, rubber boots, hot water bottles. At your garage or by mail 35c. Merriman, Freehold, N. J., Dept. E.

Motorcycles

Motorcycles from $25 up—New and second-hand. Easy terms, large list to choose from, all makes. Send 4c stamps for Bulletin "A." Peerless Motorcycle Co., Watertown, Mass.

Agents Wanted

Insyde Tyres, inner armor for automobile tires, double mileage and prevent punctures and blow-outs. Quickly applied. Costs little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, O.

Hel-Met The Kaiser Pin—Latest war novelty. Biggest hit out, every patriotic citizen wants one. Sample 10c. Wedge Mfg. Co., "KM," Binghamton, N. Y.

$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Ave. D, Decatur, Ill.

Hindoo Magical Secrets. Wonderful book, 1919 edition limited, 25c. Sample 12c. $2 per 100. Better order quick. Dept. X, Lindhorst Magic Shop, St. Louis, Mo.

Sterling Fibre Brooms: Outwear five corn brooms, guaranteed one year, $1.25 postpaid; agents wanted. Keystone Fibre Broom Co., 618 Duquesne Way, Pittsburgh, Pa.

Help Wanted

Men Wanted to make Toy Soldiers, Army, Navy and other toys. Homeworkers on small scale, manufacturers on large scale. Greatest chance for industrious people for independent business. Enormous demand and future in "American-made toys". This new American work stands out conspicuously. Factories have been established, people trained, machinery made with energy and success. Dealers don't want to handle any others except "American-made". We buy these goods all year, paying fixed prices. Experience or tools not necessary. Hundred and more made complete per hour. Casting form outfits $3 up. Booklet and information free. Toy Soldier Manufacturing Co., 32 Union Square, New York.

To Ascertain the Vocation for which you are best: adapted send for Zancig's Revised Horoscope. Send date of your birth and 25c. Prof. Zancig, 109 West 87th St., New York.

Monthly income paid those writing lists of names for us at home, spare time; no supplies to purchase, no investment, expense or other work required; postal brings particulars. National Exchange, Box 1001, New York.

Phonographs

Build Your Own Phonographs and manufacture them for profit. Drawing instructions, Parts, Price List, Blue Prints, etc., complete, sent free upon request. Write today. Associated Phonograph Co., Dept. E-1, Cincinnati, Ohio.

Phonographs—Continued

Build Your Phonograph. "Perfection" high-quality spring and electric Motors. Tone Arms, Reproducers, Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Indiana.

Charlotte, N. C.
Oct. 4, 1918.

Electrical Experimenter Pub. Co.,
233 Fulton St., New York.

Dear Sirs:

It certainly was SOME RESULTS.
I've almost worn out a good typewriter.
Just about exhausted myself writing.
Used all the paper in this part of America.
And about "Gone Busted" buying postage stamps.

Now, I'm a-goina quit, and will never do it again, or at least I won't promise to answer all the letters I received from an Ad that I put in the "E. E."

The letters are still coming in.—The apparatus advertised has long since been sold. Every piece of it. The letters are from all over the United States, AND ELSEWHERE. Received one today from Shanghai, China. Can you beat that. I'm enclosing the letter from China.

It's a great life, if you don't weaken.

I wish to THANK the "E. E."—Some circulation.

Very Respectfully,
G. R. SMATHERS,
403 N. Brevard St., Charlotte, N. C.

Miscellaneous

Tobacco or Snuff Habit Cured or no pay. $1.00 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

Catch Fish. Descriptive folder containing valuable information mailed for stamp. George Julian, Albany Building, Boston.

Wanted—Small Gasoline and Steam Engines. Cash paid for 1 to 4 cylinder light weight Motors. ¼ to 10 H.P. Johnston, West End, Pittsburgh, Pa.

Your Technical Troubles can be solved. We handle all technical problems pertaining to design, calculation, installation, etc., promptly and correctly for $1 and up. We invite your correspondence. E. Duskis, Technical Advice Bureau, 1760 Bergen St., Brooklyn, N. Y.

Cigarette, pipe or chewing habit conquered. Nature's method. Guaranteed. Write for free brochure. Edw. J. Woods, TA-300, Station F, New York.

Fountain Pen Free with a $1.75 order of ink. Eighteen packages, each package contains enough material to make twenty cents' worth of blue-black ink. Trial package ten cts., three for 25 cts. Kralovec & Co., 2344 Altgeld St., Chicago, Ill.

"Quick Process Duplicators." Makes 100 copies in 10 minutes. Remarkable time-savers. Thousands in use. Write for free illustrated circular. Heyer Duplicator Co., 160-EE, N. Wells St., Chicago.

Pyorrhea—H. E. Kelty, D. D. S., M. D., pyorrhea specialist for 15 years, has developed a successful home treatment for pyorrhea. Purifying, healing, preventative. Full month's treatment and booklet, $1. Circular free. Dr. H. E. Kelty, Glenwood & Woodland Aves., Leonia, N. J.

We Have a limited number of beautiful art pictures on hand of Nikola Tesla and Dr. Lee De Forest. These make a handsome decoration for any laboratory or workshop and should be prominently displayed. Price for both, prepaid, 10c. Experimenter Pub. Co., 233 Fulton St., New York City.

"Opportunity Ad-Lets" bring quick results. Over 100,000 circulation, net. Other firms are making money—so can you. For proof address Classified Department, Electrical Experimenter, 233 Fulton St., New York City.

Business Opportunities

I made $20,000 here past four years making burial vaults. Will start you in same permanent business without capital. Absolutely no selling. Stamp brings details. Charles Murphy, Dept. 3, Bloomington, Ind.

Enter a New Business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks, at small expense; no further capital required; no goods to buy; job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston, Mass.

I Made $30 a Week, easy money, evenings home. Free Booklet explains. Mail Order Business. Send stamp. Alec. Scott, Cohoes, New York.

Make Die-Castings. Sketch, Sample, Booklet, and Proposition, 12c. R. Byrd, Box 227, Erie, Pa.

"Quick-Action Advertising—How it is Building Business for the Progressive Advertisers of America"; A little story of RESULTS, told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet, which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th Street, New York.

Build up an Income in Oil—Others are doing it—Why not you? Today is the opportunity. Join our easy monthly payment plan NOW—it may mean hundreds in profits. Write for information. National Oil Drilling Co., Dept. K, Houston, Texas.

WANTED—Specialties for mail order house. What have you to offer. Stone Specialty Co., 11 Broadway, N. Y.

Manufacturers: Advertising and Toy novelty with an unlimited field. Protected. 3166 Third Ave., New York City.

Amazing profits manufacturing backyards Fuel Briquettes, cheapest fuel known. Stamp. California Products Company, San Mateo, California.

You can letter Automobiles, Windows, Trunks, etc., without previous experience, by Transfer Process. Make $27.50 on $2.50 outfit. Auto Monogram Supply Co., 87 Niagara Building, Newark, N. J.

Incorporate your business under the common law. No organization tax; no franchise tax; no federal corporation tax; certificates not taxable; stockholders exempt from company debts; do business anywhere; directors reside where you wish; lowest cost organization possible. Common Law Organization Co., 4 Randolph, Detroit, Mich.

Dollars Yearly in Your Backyard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. Metz, 313 East 89, New York.

Business Worthwhile. I Start You silvering mirrors, Plating tableware; Plans Free. Clarence Sprinkle, Dept. 48, Marion, Indiana.

$30 a Week, Evenings. I made it with a small mail order business—continued my regular job daytimes. Free booklet tells how, 2c postage. Alex. W. Scott, Cohoes, N. Y.

Auctions

Auctioneers make from $10 to $50 a day. Free catalog. Missouri Auction School, Kansas City.

Postcards

Twenty Pretty Assorted Postcards 10c. 45—20c. Castle Co., N. Locust, Hagerstown, Md.

www.americanradiohistory.com

Wireless

Bargains—10,000 ¼" Wireless Coils complete, guaranteed, 90c, send postage. Also, 25,000 Wireless Coils without vibrators, 45c, send postage. A. Dubs, 1534 Pitkin Ave., Brooklyn, N. Y.

Best Radio Hook-ups for Damped and Undamped Waves, Amplifiers, etc. Blueprinted with full instructions, 60 cents postpaid. Luther Reiner, Bexley, Ohio.

Better stock up now on switches and switch points for that new set. Circular describing the most perfect on the market sent free. Eureka Secondary Co., 6939 S. May St. Chicago, Ill.

Morehead All-Purpose Vacuum Tubes: Last 50% longer; require less hi-voltage; eliminate STATIC; SUPER-sensitive! Have one ready Avoid the RUSH later! Satisfaction GUARANTEED; absoTIVELY. $6.50 each—FIVE for $25.00! Somerville Radio Laboratory, Eastern Agents, 102 Heath, Somerville, Mass.

Electrical Supplies and Appliances

Recharge 2 dry cells for five cents. Directions 10c. Gilbert, 8 Chestnut, Binghamton, N. Y.

Tungsten Steel Magnets U type. Have a number of these magnets weighing 2 lbs. each and will lift 6 or more times their own weight. $1.75 while they last. Henry Althaus, Bluffton, Ohio.

Blueprints for building of Spark Coils from ½" to 12" with instructions. 50c. each. Also for Wimshurst Machines, etc. Also repairs made and parts machined, after sketch. The B. & H. Electric Laboratory, City Hall Station, General Delivery, N. Y.

Electricians. Send $1.50 for 16 blue prints of Motor Windings. 10 A. C. Single, two and three-phase, and 6 D. C. or set of 20 A. C., 6 D. C., and 6 Rotary Converter Drawings for $2.25. Connecting and Winding made easy. Superior Electric Company, Lock Box, 1372, Pittsburgh, Pa.

Electricians and garagemen: You need the blueprint for building the E102 test and trouble finder and directions for making tests. Locates shorts, grounds, opens in armatures; Oil or water soaked secondary cables on ignition units; Traces any power or lighting circuit; Hundreds of tests can be made with it. Send 25c for blueprint and directions. The Data Exchange, P. O. Box 1018, 7th Floor, U. B. Bldg., Dayton, Ohio.

Formulas

160 Formulas, resilvering mirrors, renewing dry batteries, luminous paints, mechanics' soap 25c, lists 2c. "Bestovall," Box 543-E, Chicago.

Formulas for Every Purpose. H. Krause, 2746 So. Karlow, Chicago.

For Inventors

Inventors—Market and secure your inventions through National Institute of Inventors, World Bldg., New York City. Membership co-operative organization.

Legal advice on any subject, Mfg., commercial, trade information In Re. inventions—patents. Hanlon, 1201-Arch, Philadelphia.

Inventors! Attention! I have valuable information how you can protect your inventions for two years before patenting it without expense or risk, full instructions, 25c. H. B. Lambert, 55 Willow Ave., North Pelham, N. Y.

Tricks, Puzzles and Games

1000 stage tricks with 500 illustrations. Catalogue 10c, small catalogue FREE. Hornmann Magic Co., Sta. 6, 470 Eighth Avenue, New York.

Tricks, Puzzles, Jokes, Toys, Games, Novelties, Doll and Cane Racks, Plays, Wigs, Stage Supplies, Escapes and Illusions. Large 1917 catalog free. Oakes Magical Co., Dept. 549, Oshkosh, Wis.

Black Art Hindoo Experiments, copyright 1919 Edition, 25c. Invisible Ink. Free Trick. Catalog each order. Lindhorst Magic X Shop, St. Louis.

Stamps and Coins

Stamps—61 all different free. Postage, 3c. Mention paper. Quaker Stamp Co., Toledo, Ohio.

California Gold, Quarter size, 27c; Half-dollar size, 53c; Dollar size, $1.10; Large cent, 1820, and catalogue, 10c. Norman Shultz, Kings City, Mo.

500 Finely Mixed United States or Foreign Stamps, 12c. Philatelic Star, Madison, N. Y.

225 Different Stamps 25c. Fred Onken, 546 Carlton Avenue, Brooklyn, New York.

We buy and Sell Old Money. $2 to $500 each paid for hundreds of coins dated before 1895. Keep all Old Money. Send 10 cents for new illustrated Coin Value Book, 4x7. You may have valuable Coins, get posted. Clarke Coin Company, Box 110, Le Roy, N. Y.

200 all different really fine Postage Stamps, 23c. Dayton, East Foxboro, Mass.

Scenery for Hire

Collapsible Scenery for all Plays. Amelia Grain, Philadelphia, Pennsylvania.

For Inventors

Inventions Commercialized. Cash or royalty. Adam Fisher Mfg. Co., 205 St. Louis, Mo.

For Advertisers

20 Word Ad. in 100 Pulling magazines, $1.00. About 75,000 readers. Send copy now. Lindhorst Magic Shop, St. Louis.

Advisory Correspondence free. Profitable letters, folders, booklets, follow-ups, plans. Reasonable charges. Pontifex, 62 Frank Street, Ottawa, Canada.

"Quick-Action Advertising—How it is Building Business for the Progressive Advertisers of America"; A little story of RESULTS told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 **West 39th St., New York.**

Printing

100 Bond Noteheads, 4 lines and 100 envelopes, prepaid, $1.00. Southwestern, 1413-H Berendo, Los Angeles.

50 Bond Letterheads, 50 linen cards, 50 envelopes, 3 lines, $1.00. Shamrock Press, 86 Mithoff, Columbus, Ohio.

Calling Cards. Your name on 25 high-grade, pasted bristol cards together with a famous Brown cardcase, 25c. The Barker Press, 17 Gibson St., Medford, Mass.

Song Poems Wanted

Write the Words for a Song. We write music and guarantee publisher's acceptance. Submit poems on war, love, or any subject. Chester Music Co., 538 S. Dearborn St., Suite 265, Chicago.

Chemicals

80 Chemicals $5. Chemical outfits as previously advertised containing 80 chemicals now again for sale at $5. Swimmer Chemical Co., 1849 Park Place, Brooklyn, N. Y.

Novelties

Genuine Indian Baskets—Wholesale and Retail. Catalogue. Gilham, Highland Springs, California.

News Correspondents

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Motors, Engines and Dynamos

Small Motors and Generators: 1000 New Motors and Generators from Bankruptcy Stock, ¼ H. P. A. C., $18.50 each; ½ H. P., $30.00. **Battery Charging Sets**—Robbins & Myers new outfits, all sizes, $30.00 each and up. Charging Lighting and Moving Picture Arc Generators, $10.00 each and up. Motors for all phases of current. Immediate delivery. Less than ½ regular prices. Write for late bulletin. Johnston, West End, Pittsburgh, Penna.

Boilers, Engines and Machinery. Werner Extract Company, Mechanicville, New York.

For the Hair

I Was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have good hair-growing results. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E. 32nd St., BA-300, New York.

Photo Developing

Mail Us 15c with any size Film for development and 6 velvet prints. Or send 6 negatives any size and 15c for 6 prints, 8 x 10" mounted enlargements 35c. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke, Va.

Kodakers: How would you like to get a 9 x 11 enlargement of your best negatives free? Drop us a card right now asking about it. Films developed at 10c per roll, prints 3c, 4 and 5c each. Satisfaction guaranteed. Ford's Foto Studio, Ellensburg, Washington.

Telegraphy

Telegraphy and Railway Accounting taught thoroughly and quickly. Unprecedented demand for both sexes at Big Salaries. Oldest and largest school—Est. 45 years. Catalog free. Dodges Institute, Seventh St., Valparaiso, Ind.

Patent Attorneys

Patents — Without advance attorney's fees. Not due until patent allowed. Send sketch for free report. Books free. Frank Fuller, Washington, D. C.

Inventions Wanted! Manufacturers constantly writing us for patents. List of inventions actually requested and book "How to Obtain a Patent" sent free. Send rough sketch for free report regarding patentability. Special assistance given our clients in selling patents. Write for details of interest to every inventor. Chandlee & Chandlee, Patent Attorneys, Est. 21 years. 551 7th St., Washington, D. C.

Patent Your Own Inventions. Save attorney's fees; we prepare applications; furnish full instructions and give satisfaction. Free information. Carl Larsen Co., Park Row Building, New York City.

Millions Spent Annually for Ideas! Hundreds now wanted! Patent yours and profit. Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. 212 Patent Dept., American Industries, Inc., Washington, D. C.

M. F. Miller, Ouray Building, Washington, D. C., Patent Attorney, Mechanical and Electrical Expert. Best quality of work and results. Moderate charges. Advice free.

Your Idea Wanted. Patent Your Invention. I'll help you market it. Send for 4 free books, list of patent buyers, hundreds of ideas wanted, etc. Advice free. Patents advertised free. Richard B. Owen, Patent Lawyer, 130 Owen Bldg., Washington, D. C., or 2278T Woolworth Bldg., New York.

Dogs, Birds, Pets

Ideal Xmas Gifts: Collier, Fox terrier, B. & Tan, Pekingese, Pomeranian, Boston, Canaries, Angora Kittens. Send 3c for bargain list. Shadydell Kennels, Work, Pa.

Books

Free—$5,000 worth of valuable books as premiums. Write for more information and catalogue; it's free. I have many books on Natural healing, personal magnetism, Clairvoyance, Seership, Hypnotism, Mesmerism, concentration, character reading, mind power, etc. Tell me your wants. A. W. Martens, JX8, Burlington, Iowa.

Electricity Made Simple, 233 pages, 108 illustration, $1 each prepaid, or send for circulars. Satisfaction guaranteed. M. E. Kraybill, Jr., Boiling Springs, Pa.

Blueprinted Charts. Send 25c for "15 Experiments in Chemistry" and circular of other new things. Royal Publishing Co., Box 1054, St. John, N. B., Canada.

Books for Real Live People. Lists free. J. E. Sheridan, 417 E. 151st St., New York.

Money saving magazine offers. Send for free catalogue. F. C. Johnson, 1620 East 68th Street, Chicago, Ill.

Bookkeepers and Business Men—Something different in Bookkeeping. Perfection Business Summary. Makes business 100% more interesting and satisfactory. 800 in 4 cities. John Capehart, Frankfort, Ky.

World-Romic System, Masterkey to All Languages. Six Textbooks, $1.44. French Chart, 37c; Spanish, 37c; Aviation Dictionary, $1.50. French-English Aviation Dictionary, 61c. Languages, 143 West 47th, New York.

Learn to Become an Acrobat—Our 10 lesson course teaches you. Send 75c for Lesson No. 1, or circular free. Only course in America on acrobatics. Royal Publishing Co., Box 1054, St. John, N. B., Canada.

How to Locate Oil, Minerals and Valuable Substances by Wireless; Scientific Book, $3 postpaid. Astral Child Publishing Co., Corpus Christi, Texas.

To Get Better Pictures: Read the Amateur Photographer's Weekly; illustrated; weekly prize competitions; print criticisms; many unique features; $1.50 per year; three months' trial subscription 25c. Abel Publishing Compaoy, 401 Caxton Bldg., Cleveland, Ohio.

Old E. E. Back Numbers: We have some valuable old E. E. back numbers on hand as follows: 1915—Jan., March, April, June, July, Aug., Sept., Oct., Nov., Dec., price each 35c. 1916—Jan., Feb., March, May, June, August, Sept., Oct., Nov., Dec., price each 35c. 1917—Jan., Feb., March, Apr., May, June, July, Aug., Sept., Oct., Nov., Dec., each 35c. 1918—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec., each 20c. We can fill orders at once upon receipt of your remittance, and if you have not these numbers already, now is your chance to get them, as they probably will be snapped up very quickly. Experimenter Publishing Co., 233 Fulton St., New York City.

A Binder for The Electrical Experimenter will preserve your copies for all time. Price, 50c. Postage on 3 lbs. is extra. Send for one today. Experimenter Publishing Co., 233 Fulton Street, New York City.

www.americanradiohistory.com

Scientific Exchange Columns

THE quickest medium in the country for buying what you need or disposing of anything for which you have no further use. Read these ads. each month—you'll not find bigger bargains anywhere.

NOTICE of CHANGE

Effective with February, 1919, Issue.

Beginning next month, these exchange ads. will be run in the regular opportunity ad-let columns under a separate sub-heading, "scientific exchange ads." This will give exchange ads. a better position and insure their being seen by every reader of the magazine. The rate will be the same as for all other classified ads.—7c **per word**, with a discount of 10% for six consecutive insertions and 20% for twelve.

Advertisements for the February issue must reach us not later than Dec. 22.

EXPERIMENTER PUBLISHING CO., 233 Fulton St., New York City

For Sale—6 H.P. 4 cylinder Universal Engine and 55 amp. 60 volt D.C. Generator, $250. Will take typewriter or wireless as part payment. Herbert Lauber. Geneva, Nebr.

Swap—Electrical apparata or small camera for field glasses or telescope or what you have. Lloyd Solomon, Cordele, Ga.

First Twenty Dollars takes Goodell-Pratt bench lathe. Same as new, been in use only one month. Am buying large engine lathe so must sell. C. C. Cole, Whittier, Cal.

Trade—Movie Machine and Seneca Camera for wireless goods. Frank Gaede, Winamac, Ind.

Blacksmith Post Drill, $5. 1918-9 Volume Machine Shop Library, $9. Bosch Magneto Twin Indian Motor less carburetor, $15. A. Ryder, Box 58, Argo, Ill.

Exchange—Winchester .22 Repeating for .22 Automatic. Good condition. Panaro, 1478 First Ave., New York City.

Swap—Two $5 Erectors, books and magazines for phonograph or offer. Beaver, 556 West 184th St., New York City.

Exchange—2a Ansco Camera with leather carrying case. Mecanno Set 4; 29 Test tubes 1x6. Want good wireless instruments; receiving preferred. Letters answered. Kenneth Cook, Trenton, Mo.

Sell—New $25 Electric Train, $10. Harold Tinker. 3448 Aldrich, So., Minneapolis, Minn.

Edison Exhibition Motion Picture Machine to Exchange—Want chemicals, chemical apparatus, motorcycle, or typewriter. Valuation, $85. H. E. Robinson, 126 S. Stewart, Sedalia, Mo.

Swap—Electrical goods. Want half to two K.W. Transformer and Rotary spark gap. Warwick, 2535 10th Ave. So., Minneapolis, Minn.

Wanted — Wireless transformers, ammeters, quenched gap, etc. Sell or trade Automatic Photo Button Machine, cost $150; also Automatic Stereopticon, capacity eighteen slides. Prefer Wireless goods. Radio Amateur, Marion, Ill.

Wanted—Screw-cutting Bench Lathe. W. T. Gravely, Danville, Va.

For Sale—¼ H.P. turbine with flash boiler and condenser. Want omnigraph. Joe Martin, Hopkinsville, Ky.

Wanted—Wireless goods, describe fully. Will pay cash. Merle Hawkins, 1015 Prescott, Canon City, Colo.

Wanted—Round Audion, 1 K.W. Oscillation Transformer, Aerial Switch, Rotary Gap. Eugene Beckley, Milton, Pa.

Sell—13 dial omnigraph and other things. Hersee, Burlington, Ontario.

Electrical Laboratory for Sale. Send for list of apparatus and parts. Ray Wengel, 29 W. Doty St., Madison, Wis.

Will Buy—No reasonable offer refused. Tubular Audions, other makes also, variable condensers mounted and unmounted, Blitzen preferred; Blitzen amplifying transformer. Audion impedance coils. Sell now, give description and time used. State lowest price. Aubrey Tholin, 1339 5th Ave., Rockford, Illinois.

Wanted—A few old hand stereoscope views, 50c each for certain kinds. Write for information. John Murray, Remington Hotel, Eddystone, Pa.

For Sale—**Hydroplane.** Length sixteen feet, beam 5 feet. Electric lights including searchlight. Automobile Steering Wheel and controls. Name: Sea Gull. Double cylinder Gray two cycle, high speed, twelve horsepower motor. Speed 20 miles per hour. Decks and bulkhead mahogany finished and varnished. Double waterproof hatches. Fastest boat of her class on Indian River. Winner of many races. In perfect condition; just painted. Don't wait until someone beats you to it. Shipped for first $200 check. Atlee Gulledge, c/o Coast Guard Station 206, Fort Pierce, Fla.

For Sale—One set E. I. Co. S. P. 2000 ohm Phones, new, $2.50. One 120 Egg Electric Incubator, 110 volts, $18. One 3 pole 75A Knife Switch, $2. One Small Moving Picture Machine with 100 w. 110 v. lamp (without reels), $2. One large Electric Bell, $1. One Boy's Mechanic Vol. 2, $1. One 2 cap. 110 v. Electric Stove, $8. Edwin L. Murrill, Lewisburg, W. Va.

Will Exchange complete motorcycle engine for Johnson skates. W. A. Schoenheider, 5431 So. Ashland Ave., Chicago.

Amateurs—Bugs—Send stamp for my list of Radio Apparatus, Electrical Goods, Ancient and Modern Coins, Swords, Arrowheads, Chemical Laboratory, Rifle, Movie Projector Lens, etc. Luther Reiner, Bexley, Ohio.

Marionettes, miniature people who walk, talk, sing and dance. Five professional figures. Will sell for cash or exchange for Smith Motor Wheel or similar outfit. The Wallaces, Baraboo, Wis.

Bargains—New $25 Stewart Speedometer, $15. Book and others. Write Worth Bailey, Park Ave., Johnstown Pa.

CARNOTITE

(Radium Mineral.) The American Pitchblende found in Colorado, from which *Radium* is extracted.

A generous piece, enough to conduct experiments, such as affecting photographic plates thru opaque material (similar to X-Ray pictures), first made by Sir W. Crookes and Mme. Curie, is furnished in neat, wooden box.

URANIUM ORE

(Radio-Active)

Containing about 35% of pure Uranium; also Radium and Vanadium. One of the most rare and interesting minerals. Twenty milligrams are furnished in glass vial protected by lead cover.

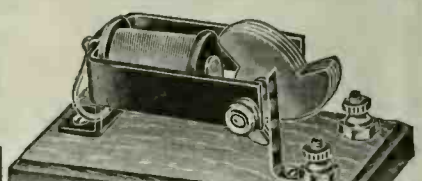
One box of *Carnotite* and one vial of *Uranium Ore* as described above sent prepaid. **50c.**

SIDNEY SPECIALTY CO.
233 Fulton St., New York City

BOYS, LOOK!

A REAL Electric MOTOR 50c

Some bummer. Develops wonderful power. Will run your Erectors, Meccanos, etc. Works on 1 to 6 dry cells, storage battery or A. C. transformer. Mounted on hardwood base. Has ¼ in. grooved pulley. On two cells you can hardly stop it with your finger. Runs all kinds of toys. Has nickeled steel frame and copper armature. Put 50 cents in stamps in an envelope.



FREE A 3½ volt tungsten flashlight lamp if you order at once.

Use Coupon Below. *Return mail will bring you Motor.*

C. D. WOOD ELECTRIC CO., Dept. 60, 441 Broadway, New York City.
SIRS: Send me a MONOCOIL Motor. Enclosed find 50 cents.

Name .....

Address .....

CORE WIRE

We have been fortunate in securing thru auction several tons of guaranteed pure, double annealed Norway Iron Core Wire and are selling this wire to "Experimenter" readers

AT PRE-WAR PRICES 20cts LB.

This wire is just the thing for spark coils, transformers, etc., and it is, of course, a very much more superior product than the usual iron wire. We absolutely guarantee the quality.

If you ever thought of building a spark coil, transformer, or similar apparatus, now is the chance to get the right material for it. As far as we know this is the only lot of Iron Norway Core Wire in the hands of any dealer at the present time, and none can be gotten until after the war.

We have only two sizes left:

26 INCHES **36 INCHES**

Thickness about No. 21 B and S

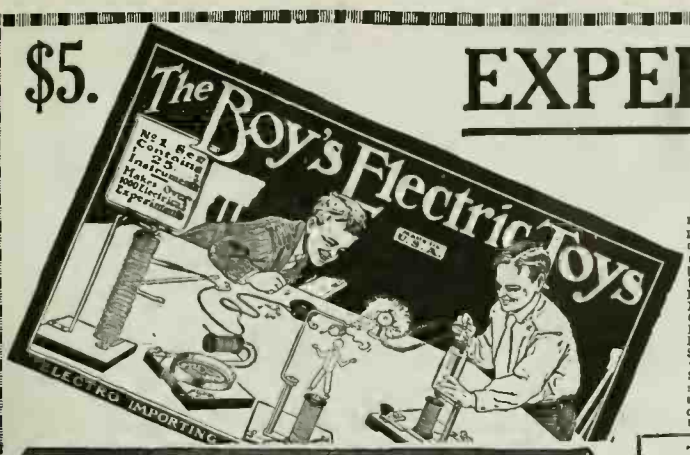
If either of these sizes should be too long we advise cutting the wire down yourself by means of shears. It will pay you to do so as real Norway Iron Wire, sold by a few dealers last year, brought from 40c to 50c a pound. American core wire now sells for from 30c upwards per pound.

As long as the supply lasts we offer this wire as described above to our customers at the very low price of 20c a pound. Order at once.

ELECTRO IMPORTING CO., 231 Fulton St., N. Y. C.

www.americanradiohistory.com

$5. EXPERIMENTERS!





No. EX2002

"THE BOY'S ELECTRIC TOYS" contains enough material TO MAKE AND COMPLETE OVER TWENTY-FIVE DIFFERENT ELECTRICAL APPARATUS without any other tools, except a screw-driver furnished with the outfit. The box contains the following complete instruments and apparatus which are already assembled:

Student's chromic plunge battery, compass-galvanometer, solenoid, telephone receiver, electric lamp. Enough various parts, wire, etc., are furnished to make the following apparatus:

Electromagnet, electric cannon, magnetic pictures, dancing spiral, electric hammer, galvanometer, voltmeter, hook for telephone receiver, condenser, sensitive microphone, short distance wireless telephone, test storage battery, shocking coil, complete telegraph set, electric riveting machine, electric buzzer, dancing fishes, singing telephone, mysterious dancing man, electric jumping jack, magnetic geometric figures, rheostat, erratic pendulum, electric butterfly, thermo electric motor, visual telegraph, etc., etc.

This does not by any means exhaust the list, but a great many more apparatus can be built actually and effectually.

With the instruction book which we furnish, one hundred experiments that can be made with this outfit are listed, nearly all of these being illustrated with superb illustrations. No other materials, goods or supplies are necessary to perform any of the one hundred experiments or to make any of the 25 apparatus. Everything can be constructed and accomplished by means of this outfit, two hands, and a screw-driver.

The outfit contains 114 separate pieces of material and 24 pieces of finished articles ready to use at once.

Among the finished material the following parts are included: Chromic salts for battery, lamp socket, bottle of mercury, core wire (two different lengths), a bottle of iron filings, three spools of wire, carbons, a quantity of machine screws, flexible cord, two wood bases, glass plate, paraffine paper, binding posts, screw-driver, etc., etc. The instruction book is so clear that anyone can make the apparatus without trouble, and besides a section of the instruction book is taken up with the fundamentals of electricity to acquaint the layman with all important facts in electricity in a simple manner.

We guarantee satisfaction.

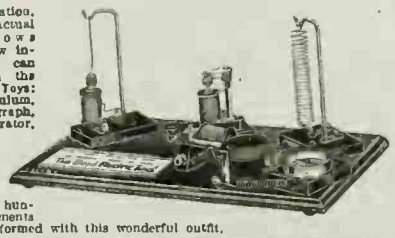
The size over all of the outfit is 14 x 9 x 2¾. Shipping weight, 8 lbs. **$5.00**

No. EX2002 "The Boy's Electric Toys," outfit as described.....

IMMEDIATE SHIPMENTS

ELECTRO IMPORTING CO., 231 Fulton St. NEW YORK

A Sample of What You Can Do With This Outfit



This illustration, made from an actual photograph, shows only a very few instruments that can be made with the Boy's Electric Toys: Electric Pendulum, Electric Telegraph, Current Generator, Electric Dancing Spiral, Galvanometer. Space does not permit us to show the hundreds of experiments that can be performed with this wonderful outfit.

The "Electro" Radiotone

HIGH FREQUENCY SILENT TEST BUZZER



This instrument gives a wonderful high pitched MUSICAL NOTE in the receivers, impossible to obtain with the ordinary test buzzer. The RADIOTONE is built along entirely new lines; it is NOT an ordinary buzzer, reconstructed in some manner. The RADIOTONE has a single fine steel reed vibrating at a remarkably high speed, adjusted to its most efficient frequency at the factory. Hard silver contacts are used to make the instrument last practically forever.

Yes, the RADIOTONE is SILENT. In fact, it is so silent that you must place your ear on top of it to hear its beautiful musical note.

You will be astounded at the wonderfully clear, 500 cycle note, sounding sharply in your receivers. **To learn the codes, there is absolutely nothing like it.** With the radiotone, a key and one dry cell and ANY telephone, a fine learner's set is had. Two or more such sets in series will afford no end of pleasure for intercommunication work. Shipping Weight 1 lb.

Radiotone as described.....each **$.90**

IMMEDIATE SHIPMENTS

The "Electro" Telegraph



is not a toy, but a practical, honestly built telegraph outfit, which not only sounds but works like the big commercial instruments. By studying the code for 30 days you can become a first-class telegraph operator. Such operators are in big demand now. Outfit consists of TWO complete telegraph instruments each measuring 3½ x 2½ x 2¾. All metal parts are highly nickel plated, including key lever. Note hard rubber knob. Telegraph Code Chart, telegraph blanks and connecting wire comes with set, but no batteries. Outfit works on 2 dry cells (one cell for each instrument). The "Electro" is the ONLY outfit that works both ways, each station can call; no switches, no extras. Nothing to get out of order. Guaranteed to please you or money back. Price Complete as illustrated (TWO INSTRUMENTS).. **$1.25**

Shipping Weight, 2 lbs.

IMMEDIATE SHIPMENTS

The "Electro" Codophone (*Patents Pending*)

$1.50



What this remarkable instrument is and does.

The "Electro" Codophone is positively the only instrument made that will imitate a 500 cycle note exactly as heard in a Wireless receiver. The loud-talking receiver equipped with a horn, talks so loud that you can hear the sound all over the room, even if there is a lot of other noise.

THAT'S NOT ALL. By lessening or tightening the receiver cap, a tone from the lowest, softest quality, up to the loudest and highest screaming sound can be had in a few seconds.

FOR INTERCOMMUNICATION. Using two dry cells for each instrument, two Codophones when connected with one wire and return ground, can be used for intercommunication between two houses one-half mile apart.

One outfit alone replaces the old-fashioned learner's telegraph set, consisting of key and sounder.

The "Electro" Codophone is a handsome, well made instrument, fool proof, and built for hard work. Contacts are of hard silver ⅛ inch in diameter, that will outlast the instrument.

There is also a neat code chart and full directions enabling any intelligent young man or girl to learn the codes within 30 days, practising one-half hour a day.

Size: 6¾ x 3 x 2¾". Shipping weight, 2 lbs. The "Electro" Codophone as described, complete..... **$1.50**

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 19 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 228 Big Pages, 600 illustrations, 500 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy." 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 19 measures 7x5⅛". Weight ½ lb. Beautiful stiff covers.



ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

I enclose herewith 6 cents in stamps or coin for which please send me your latest Cyclopedia Catalog No. 19 as described.

NAME .....

ADDRESS .....

STATE ..... E.E. 1-19

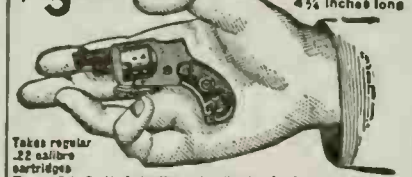
www.americanradiohistory.com

"The Baby" Double Action Hammerless Revolver

A HANDSOME AND MOST EFFECTIVE WEAPON

$5.50

Measures but 4¾ inches long



Takes regular .22 calibre cartridges

The new Baby Double Action Hammerless Revolver has been produced to meet the ever increasing demand for a revolver that would combine small size and light weight with the essential features of Efficiency and Practicability. It is small in size, yet is just as effective and reliable as the more expensive weapon you can buy. Every lady should have a revolver and should know how to use it, and there is no safer or better one made than this. A great feature is its safety action that guards against accidental discharge, making it quite safe for young men and ladies. The illustration gives an idea of its appearance, but it must be seen and used to be thoroughly appreciated. The ammunition used is the standard .22-calibre (short) cartridge obtainable anywhere, or you may obtain the cartridges from us (cartridges can be shipped only by express). The revolver is fine six shots in one loading. The operation of the charging mechanism is extremely rapid and absolutely reliable; all well aimed shots can be fired in as many seconds. The revolver is very well constructed, with finest nickel plated fluted barrel of cylinder, and it weighs only 4½ ounces. **The Price of the Baby Revolver is only $5.50, sent by mail postpaid to any address.** JOHNSON SMITH & CO.

The Border Bandit Books

Thrilling Adventures and Daring Deeds of Notorious Outlaws



PRICE ONLY 25 CENTS OR THE FULL SERIES OF 19 BOOKS FOR $4.00 POST PAID

This series of books contains thrilling accounts of the adventures and daring deeds of notorious outlaws. Each book has full page illustrations. The subjects of these books cannot be any thing but beneficial upon the characters of the most youthful readers. They do not glorify the sensational exploits of crimes, rascals and detectives; on the contrary, there is an obvious moral to be drawn from every story that cannot fail to have a wholesome effect. **Price of these books is 25 cents each copy, by mail, postpaid.**

B 1. Tracy the Outlaw, King of the Bandits, by Harry Hawkeye.
B 2. The Dalton Boys and Their Gang of Desperadoes, by Harry Hawkeye.
B 3. Buffalo Bill, King of the Scouts, by Harry Hawkeye.
B 4. Rube Burrow, the Outlaw, by Harry Hawkeye.
B 5. James Brothers (Life of the James Boys), by J. W. Buel.
B 6. Younger Brothers (The Border Outlaws and Companions of Frank and Jesse James), by J. W. Buel.
B 7. Cowboys of the Wild West. Life on the Texas Plains, by Harry Hawkeye.
B 8. Lives and Exploits of Frank and Jesse James, by Bladdeus Thorndike.
B 9. Jesse James (new) The Story of His Adventures.
B 10. James Boys and Their Daring Deeds, James Edgar.
B 11. The Allen Outlaws. Their Career and Crime of the Blue Ridge Mountains Moonshiners, by James Edgar.
B 12. The Auto Bandits of Paris. Most Amazing True Story of Crime.
B 13. Buffalo Bill and His Thrilling Adventures in the Wild West, by Nebraska Ned.
B 14. Northfield Bank Robbery, by Cole Younger and Convict Life in Minnesota State Prison.
B 15. James Boys, The Missouri Bandits, by Edgar James.
B 16. Daring Exploits of Jesse James and His Band of Border Train and Bank Robbers, by Lige Mitchell.
B 17. Frank James and His Brother Jesse, The Daring Leaders of the Fearsome Border Bandits, by Harry Hawkeye.
B 18. Auto Bandits of Chicago. A Correct Account of the Greatest Detective Work in the History of Chicago Police Force, by Jas. Allen Durbin.
B 19. The Great Beattie Murder Case. A Thrilling Story of a Man's Double Life of Henry Clay Beattie, Jr. The Sensational Story of Buelah Binford, the Woman in the Case.

JOHNSON SMITH & CO., Dept. E2 54 W. Lake St., CHICAGO

Trim Your Own Hair With the Utility Safety Hair Cutter



Cuts the Hair Any Length, Short or Long—Saves Its Cost First Time Used.

PRICE ONLY 35c POSTPAID. EXTRA BLADES 35c EACH.



If you can COMB your hair you can TRIM your own hair with this marvelous invention. The UTILITY TRIMMER will cut hair any length you desire, short or long, finish the job as nicely as any barber and in one-fourth the time before your own mirror. The ladies can cut the children's hair at home in a jiffy, or can be used as an ordinary razor to shave the face or finish around the temples and neck. Sharpened like any razor; can be carried in the vest pocket ready for instant use and will last a lifetime.

To use it, stand in front of a mirror, if necessary, and use the UTILITY TRIMMER like you would a comb. Push it through the hair, downward, in the direction the hair lies, but Never Upward.

To cut long hair, first moisten the hair and comb it, so it will be close to the head, then start cutting with downward cuts as high as you desire, evenly all around the head. Shave the neck and temples with a square cut, like a barber.

To cut very close, push the blade until the "cut steps" in your hair with this device, as the handle guard guides the cutter blade evenly over the scalp.

To cut very close, push the blade until the cutting edge is even with the guard teeth.

To shave the face or neck it can be used as an ordinary razor by reversing the blade in the holder, the cutting edge being to the back of the holder, exposing the entire blade, except each corner.

To hone, place the blade in the holder, with the cutting edge to the back, moving the blade out until the cutting edge is clear of the back of the holder. Then hone in the usual manner, the same as with an ordinary razor.

JOHNSON SMITH & CO., Dept. E2 54 W. Lake St., CHICAGO

The CONJURER'S CASKET

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment

ANYONE CAN DO THEM. PRICE 50c POSTPAID

Get this Conjurer's Cabinet. It contains the apparatus for seven first-rate tricks, including The Disappearing Rose, that, when placed on the lapel of your coat, vanishes from sight at will; the Magic Vase and Ball Trick in Wooden Ball is placed inside, and upon replacing the ball has disappeared and is found in someone else's pocket; The Magic Nail with which you can apparently cut your finger almost in two; the Wonderful Card Trick in card is placed in an envelope, and when opened an entirely different card altogether is found; The Disappearing Coin Box in coin is placed in the little wooden barrel and when opened again, is found to have vanished entirely or can be made to change into a coin of another denomination; The Famous Mesmerized Penny test defies the law of gravitation suspends from the palm of the hand, nose, cheek, wall, clothing etc.; The Genii Goblet and Vanishing Coin Trick (a coin is dropped into a glass of water, and when the water is poured out the coin has vanished). Full printed instructions for performing each trick. Besides the tricks contained in the Casket, there are twenty-five other tests and illusions fully explained with full printed instructions, for which you can easily make or procure the necessary apparatus. We also send the secret of performing five wonderful stage tricks



50c

JOHNSON SMITH & CO., Dept. E2 54 W. Lake St., CHICAGO

THE EXPO WATCH CAMERA

The most wonderful and ingenious Camera made



It is but little larger than a watch, which it closely resembles. You can carry the Expo about in your pocket and take pictures without any one being the wiser.

Price $2.50

One Cent a Picture

The Expo loads in daylight with 25 Exposure Films, costing but one cent per picture taken, plus a small sum of 25c—One cent a picture. 10 Exposure Films also obtainable. It is so simply built to operate. Takes pictures through the stereo, where the Rapid Fire Lens is located. The photos (5/8 x 7/8) may be enlarged to any size.

QUICK AS A FLASH Time and instantaneous shutters; weighs but 8 ounces; nickel plated. Endorsed by amateurs and professionals the world over. Thoroughly practicable printing and developing of films just the same as ordinary cameras—in daily use by the police, newspaper reporters, detectives, and the secret service. Important deals have been secured with the Watch Camera by enterprising reporters. Produces clear, sharp negatives indoors or outdoors equal to any camera on the market, size of picture 1¾ x 1 inches.

Expo Watch Camera Postage 10c Anywhere $2.50 FILMS, 10 Exposures 15c, 25 Exposures, 25c Leather Pocket Carrying Case, 35c

JOHNSON SMITH & CO., Dept. E2 54 W. Lake St., CHICAGO

7-in-1 Combination Bill Book 50c

With Name Stamped In 23-Karat Gold Letters



23 KARAT GOLD NAME

With a view of getting our name still more widely known, as well as to secure new customers, we make this REMARKABLE OFFER of a handsome Leather Combination Bill Fold, as illustrated, with the owner's name stamped in 23 karat Gold Lettering, for ONLY 50 cents, postpaid. Here is an all 'round useful combination that serves NO LESS THAN SEVEN DISTINCT PURPOSES. There is (1) a large pocket for storing bills in. (2) another pocket for cards or tickets. (3) still another for checks. (4) a fourth for miscellaneous papers and memorandums. there is (5) a short center pocket with clasp for postage stamps, (6) an identification card with room for your name and your one's photograph, and (7) removable calendar by months. The Identification Card and Calendar are protected by a transparent covering, the whole folding up into a compact space of 3x4½ inches. Price 50c with name in gold, 25c less for each additional line. Also obtainable in very superior quality, $1.00 p. pd.

Johnson Smith & Co., Dept. E2 54 W. Lake St., Chicago

ELECTRIC INSOLES

Comforting to the Feet and Healthful

You will never suffer from Cold Feet while you wear these Electric Insoles. Any size. Comfortable even in a tight shoe. Alternate plates of copper and zinc generate a mild and pleasant form of electric energy that promotes the circulation of the blood and thus tones up the entire system. Positively Prevents and Cures Rheumatism, Relieves you from Colds and Chills and dispel Rheumatic Pains. Having obtained a large stock we are able to reduce the price to 25c per pair or better quality, 50c postpaid.

JOHNSON SMITH & CO., Dept. E2, 54 W. Lake Street CHICAGO

NEW BOOK ON ROPE SPLICING

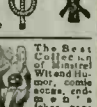
USEFUL KNOTS, HITCHES, SPLICES, ETC.

How Different Knots Are Made and What They Are Used For. Knots to Use and Knots to Avoid.

PRICE 20c



A most practical handbook giving complete and simple direction for making all the most useful knots, hitches, rigging, splices, etc. Over 100 illustrations. All about wire rope attachments, lashing, blocks, tackles, etc. Heraldic Knots illustrated. Of great value to mechanics, riggers, campers, boatmen. Price 20c p. pd.



Johnson Smith & Co., Dept. E2 54 W. Lake St., Chicago

INVISIBLE INK



The most confidential messages can be written with this ink, for the writing MARKS NO MARK. Cannot be seen unless you know the secret. Invaluable for many reasons. Keep your pockets and other articles from embarrassing exposure from prying eyes. Great fun for playing practical jokes. Only 15c a Bottle

JOHNSON SMITH & CO., Dept. E2 54 W. Lake St., CHICAGO

LUMINOUS INK

writing can be READ ONLY IN A DARK ROOM; writing shines like fire. Quite invisible at daytime. Very remarkable. 15c bottle; 3 for 40c postpaid.

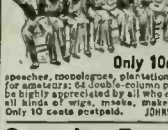
THE FIGHTING DREADNAUGHT

Sensationally Realistic! Exact Model of Modern Warship



The great test toy sensation of the day. The Fighting Dreadnaught is an exact model of Uncle Sam's latest fighting monster. It carries eight big guns, each of which flashes, at correct intervals, from twelve to twenty times. Extra ammunition always obtainable. Absolutely harmless. Can be operated indoors or out. Now, here! Here's your chance to wage battleship action, and the best of it is you can OWN the ship and command the firing yourself! By having two or more Battleships, you can arrange EXCITING NAVAL BATTLES in your own home. **Price of Warship and ammunition, 16c, three for 40c, or a fleet of 12 ships for $1.50 postpaid. Extra Ammunition, 5 cents per pkg.**

THE MINSTREL SHOW



The Best Collection of Minstrel Wit and Humor, comic songs, end-men's jokes, gags and repartees, farce, darky drama, darky dialogues, stump speeches, monologues, plantation sketches, interlodes and farces. The very book for amateurs; 64 double-column pages of genuine burnt-cork comicalities that will be highly appreciated by all who enjoy a good laugh. PRICE, including catalog of all kinds of wigs, whiskers, make-up goods, grease paints, etc., for masquers. Only 10 cents postpaid.

Only 10c Postpaid

JOHNSON SMITH & CO., Dept. E2 54 W. Lake St., CHICAGO

New Vamping Card



PIANO PLAYING MADE EASY

No Teacher Needed Surprisingly Simple System

Persons having neglected their Musical Education need not despair, for with the aid of our new VAMPING CARD (placing the card upright over the piano keys), you can at once Vamp any of Songs, Ballads, Waltzes, Rag Time, etc., etc., equal to a Professional Musician. No knowledge of music is required. After using it a few times, you will be able to vamp with the best of them. The Card entirely Only 10 cts. p. pd. Johnson Smith & Co., Dept. E2 54 W. Lake St., Chicago

Sneezing Powder



Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real source, but think they have caught it some from the other. Between the laughing and sneezing you yourself will be having the time of your parties, political meetings, car rides, or any place at all where there is a gathering of people. It is the greatest joke out. Price 12c or 3 for 30c.

JOHNSON SMITH & CO.

STAGE MONEY



With a bunch of these bills, it is easy for each person to have a roll to appear prosperous. By flashing a roll of these bills at the proper time and getting off a genuine bill or two from the outside of the roll, the effect created will be found to be of the most splendid. Prices, postpaid: 15 Bills 10c, 50 Bills 25c, 125 for 50c, or $3.50 thousand.

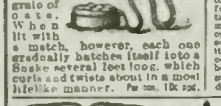
Serpent's Eggs



Each box contains 12 eggs, which are no larger than a grain of oats. When lit with a match, however, each one gradually hatches itself into a Snake several feet long. Which curls and twists about in a most lifelike manner. Per box, 10c ppd.

Mystic Skeleton

10c ppd.



A jointed figure of a skeleton, which in its height, will dance to music and perform various gyrations and movements while the operator may be some distance from it. Simply place on a chair or table it will seemingly become endowed with life and begin to move. At command of operator will lie down, stand up, dance, etc. J. S. & CO.

MUSICAL KAZOO



With the Musical Kazoo you can, without previous practice whatsoever, play any tune right off, imitate any bird or animal, operate snare drum, Punch and Judy, etc. No holes to finger. It is simplicity itself. Produces a perfect music, but you do not blow into it, but sing, speak, laugh or make any desired imitation. Used with genius while the operator is seemingly playing a comb, in church entertainments, dances, serenades, picnics, outings, excursions. Just the thing for choruses and shows, bicycle and marching clubs, etc. Excellent for vocal or instrumental accompaniments, either with or without other musical instruments. Price 15c. pd.

MAGIC FLUTE



Wonderfully Sweet Toned and Musical

A marvelous musical instrument. No other instrument produces sweeter music. Whether it be the joyous notes of a quickstep or the solemn strains of a church hymn—in fact, any class of music can be played upon the Humanatone without practice, as it is almost a self-playing instrument. When played with a piano accompaniment, or any other musical instrument, the effect is charming. Full printed instructions for playing sent with each instrument.

Post Paid 15c

A Great Curiosity

Midget Illustrated Bible

The Smallest Bible in the World



The Midget Bible is a perfect gem, and a work of art. It is about the size of a postage stamp and contains TWO HUNDRED AND FIFTY PAGES of the NEW TESTAMENT, profusely illustrated. This little Bible is a wonder. It is said to bring good luck to the owner. Must be seen to be appreciated. Price, only 15 cents, three Bibles for 30 cents; one dozen Bibles for $1.00 or 100 for $8.00. Good money can be made selling these Midget Bibles among retail trade, church organizations. Sunday schools, etc. Send for wholesale terms and trial offer.

JOHNSON SMITH & CO., Dept. E2 54 W. Lake St., CHICAGO

CIGARETTE ROLLER



Very neat and handy. Weighs less than a quarter of an ounce. It makes better cigarettes than you can buy and makes them really and quickly. You can use all the tobacco you prefer and thus have nicer "smokes" than ready-made, and more of them, besides saving about half of your money. Just try one and make your cigarettes just to your own liking. Price only 10c or 3 for 25c postpaid, with full instructions for use.

JOHNSON SMITH & CO., Dept. E2, 54 W. Lake St., CHICAGO

Thumb Brander



NEW & NOVEL JOKE

to play on your friends. Place on your thumb, and "brand" your victims as you shake hands. Great fun. Won't wash off very easily, either. Any of these choice symbols: Owl, fool, ass, grouch, baby, lightning, hot air, bull. Safety Fluid. Complete with pad and ink, 15c (post 2c). Any other brand made to order 25c.

INKLESS PEN



WRITES with WATER 600 words every time you dip. Makes its own ink. Writes fashionable violet color. Better and cheaper than fountain pens. Writes a fine letter with one dip in plain water. No trouble—no bother—no mess. A pleasure to use. With Nickel Plated Reversible Holder 10 CENTS. 3 for 25c postpaid. Extra Points 5c, 6 for 25c.

Latest Novelty: Aerial Balloon



Flies gracefully in or outdoors. VERY LATEST SENSATION IN BALLOONS. A brightly colored balloon that measures sixteen inches long is blown up in the usual way, and, when released, the air escaping sends the balloon SOARING UPWARD, the 8½-inch propeller SPINNING AROUND AT A LIVELY RATE. The effect is startling. It is a graceful flier that makes the possessors WILD WITH JOY. May be used repeatedly indoors or outdoors. An immensely interesting toy. Price 10c each, 2 for 25c pd. Johnson Smith & Co., Dept. E2 54 W. Lake St., Chicago

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night

The very latest discovery in the scientific world. Hitherto, practically unobtainable except at an exorbitant price, we have at last succeeded in producing this remarkable LUMINOUS PAINT, which, obtained from the surface of any article, emits rays of white light, rendering it partially visible in the dark. THE DARKER THE NIGHT, THE MORE BRILLIANT IT SHINES. Quite simple to use. Anyone—you can do it. A little applied to the dial of your watch or clock will enable you to tell the time by the light. You can locate the push buttons or switch plates of your electric lights, match boxes, and innumerable other articles; make your own Luminous Signs, Luminous Numbers, Luminous Rosaries, etc. Quite enough sufficient to cover several small articles. Price 25c. Larger sizes 50c and $1 postpaid. Johnson Smith & Co., Dept. E2 54 W. Lake St., Chicago

All the Latest Surprising and Joke Novelties

Pharo's Serpents Eggs, box	10c	Mesmerized Penny (defies the law of gravity)	20c
Sensation Cigarettes	15c	Mysterious Tumbler and Vanishing Coin Trick	25c
Cleopatra's Snake (very lifelike)	15c	Magic Mirror (take one peep)	10c
Puff Matches (fool your friends)	5c	Magic Photo Lifter	20c
Puss Mustache (fool your friends)	15c	Imitation Gold Teeth	8 for 10c
Cord Auto Puzzle (tax)	10c	Great Burglar Puzzle	10c
Mysterious Ghost, shines at night	20c	Wire Puzzles, 10c, 12 different, $1.00
Rubber Dagger (sensational)	20c	"Elec-Trick" Push Button	10c
Window Smashers (great joke)	25c	Inkless Pen (writes with water)	10c
Lookbackwoscope (see behind you)	15c	Invisible Red Ruler	10c
Great Mind Reading Mystery Cds.	10c	Squirt Ring	20c
Thurston's Mysterious Trick Cds.	10c	Trick Bill Book	10c
Fighting Roosters, pair	10c	Acquaintance Cards (witty and amusing)	10c
Cover the Spot Trick, a scien. cov.	10c	Glass Watch	25c
X Ray Novelty	10c	Medicine Billiard Ball Trick	25c
Trick Pencil	10c		
Rubber Tacks (a good joke)	10c		

JOHNSON SMITH & CO., Dept. E2 54 W. Lake St., CHICAGO

www.americanradiohistory.com

Every Electrical Man Wants These Books and we ship them for your inspection FREE





Flexible Covers — Handy Pocket-Size Volumes

10 Volumes — 3500 Pages — 4700 Pictures

$1 Per Volume

$1 Per Month

Just what you need to know to succeed in ELECTRICITY

EVERY electrician, every engineer, every mechanic should know about these wonderfully helpful instructive books, which give in plain words a complete working knowledge of electrical engineering in all its phases.

You run into some new electrical problem almost every day. The information you need to help you in your every day work is in

HAWKINS ELECTRICAL GUIDES

These books place electricity at your finger ends. They cover every imaginable subject, principle, theory, problem, trouble, and way of doing things electrically. Every subject is indexed so that you can turn right to it. They are a study course and a reference guide in one, written in plain every day language—no wasted words—only what you need to know—chock full of up-to-the-minute electrical knowledge. The guides are a complete course in electrical engineering. They will help you in every detail of the day's electrical work. You can't ask an electrical question that Hawkins Guides can't answer.

What Electrical Men Say

Helped Him Make Good

"It is only right for me to recommend highly the Hawkins Guides, for they have been of the greatest assistance to me in placing me in my present position as Superintendent of Construction Department of one of Ohio's largest Electrical Companies. I would like to see every man have a set of Hawkins Guides."
Geo. Knecht. Columbus, Ohio.

In the Naval Electrical Dept.

"The Hawkins Guides are great help to me in the Naval Electrical Department, which they cover very thoroughly."
C. J. Cornell.
U. S. Receiving Ship, Brooklyn, N. Y.

Superintendent

"I am now superintendent of the Dunnville Hydro-Electric Systems, and Hawkins Guides were a great help to me in holding down a responsible position."
W. E. Swartz, Dunnville, Ontario.

Wireless Operators

"I have worked wireless for ten years—but I wish I had these books years ago, as they have saved me a great deal of trouble." H. Marshall.
Steamer M & B No. 2.
Walkerville, Ont.

Pocket-Size Flexible Covers

The books are small enough to slip into your coat pocket—handsomely bound in flexible black covers.

You can carry each volume with you until you have mastered its contents. 3,500 pages of actual information and 4,700 illustrations. Once you see these books and put them into actual use you will never again want to be without them. Try it at our expense.

SEND NO MONEY

It will cost you nothing to receive these books—to look them over—ask them all the questions you can think of—use them in your work—study them—pick up some information that will increase your earning ability. We will ship you the entire set of 10 volumes entirely FREE.

This is a sign of our confidence in the guides. Pure gold does not object to being tested. Keep them for seven days and if you do not decide that you can't get along without them, return them to us and owe us nothing.

When you decide to keep them you only have to pay $1.00 down and remit the balance of $9.00 on the easy payment of $1.00 a month till paid for.

Use this coupon to get the books. It will pay you many times over.

THEO. AUDEL & CO.
72 Fifth Ave. New York, N. Y.

SEND NO MONEY - USE THE COUPON

READ THIS PARTIAL LIST OF CONTENTS

No. 1 Contains 348 pages, 388 illustrations. Electrical signs and symbols—static and current electricity—primary cells—conductors and insulators—resistance and conductivity—magnetism—induction coils—dynamo principles—classes of dynamos—armatures—windings—commutation—brushes, etc.

No. 2 Contains 342 pages, 394 illustrations. Motor principles—armature reaction—motor starting—calculations—brake horsepower—selection and installation of dynamos and motors—galvanometers—standard cells—current measurement—resistance measurement—voltmeters—wattmeters—watt hour meters—operation of dynamos—operation of motors, etc.

No. 3 Contains 300 pages, 423 illustrations. Distribution systems—wires and wire calculations—inside, outside and underground wiring—sign flashers—lightning protection—rectifiers—storage battery systems, etc.

No. 4 Contains 270 pages, 379 illustrations. Alternating current principles—alternating current diagrams—the power factor—alternator principles—alternator construction—windings, etc.

No. 5 Contains 320 pages, 614 illustrations. A. C. Motors—synchronous and induction motor principles—A. C. commutator motors—induction motors, transformers: losses, construction, connections, tests—converters—rectifiers, etc.

No. 6 Contains 298 pages, 472 illustrations. Alternating current systems—switching devices—circuit breakers—relays—lightning protector apparatus—regulating devices—synchronous condensers—indicating devices—meters—power factor indicators—wave form measurement—switch boards, etc.

No. 7 Contains 316 pages, 379 illustrations. Alternating current, wiring power stations—turbines; management, selection, location, erection, testing, running, care and repair—telephones, etc.

No. 8 Contains 332 pages, 436 illustrations. Telegraph—simultaneous telegraphy and telephony—wireless—electric bells—electric lighting—photometry, etc.

No. 9 Contains 322 pages, 627 illustrations. Electric railways—electric locomotives—car lighting—trolley car operation—miscellaneous applications—motion pictures—gas engine ignition—automobile self-starters and lighting systems, electric vehicles, etc.

No. 10 Contains 513 pages, 599 illustrations. Elevators—cranes—pumps—air compressors—electric heating—electric welding—soldering and brazing—industrial electrolysis—electro plating—electro-therapeutic—X-rays, etc.

Also a complete 126-page ready reference index of the complete library. This index has been planned to render easily accessible all the vast information contained in the 10 electrical guides. There are over 13,500 cross references. You find what you want to know instantly.

THEO. AUDEL & CO.
72 Fifth Avenue
New York, N. Y.

Please submit me for examination Hawkins Electrical Guides (price $1 each). Ship at once. Prepaid, the 10 numbers. If satisfactory I agree to send you $1 within seven days and to further mail you $1 each month until paid.

Signature .....
Occupation .....
Business Address .....
Residence .....
Reference .....E.E. Jan.

www.americanradiohistory.com



These Are The Hours That Count

MOST of your time is mortgaged to work, meals and sleep. But the hours after supper are *yours*, and your whole future depends on how you spend them. You can fritter them away on profitless pleasure, or you can make those hours bring you position, money, power, *real success* in life. Thousands of splendid, good-paying positions are waiting in every field of work for men *trained to fill them*. There is a big job waiting for *you*—in your present work or any line you choose. Get ready for it! You can do it without losing a minute from work or a wink of sleep, without hurrying a single meal, and with plenty of time left for recreation. You can do it in one hour after supper each night, right at home, through the International Correspondence Schools.

Yes—You Can Win Success In an Hour a Day

Hundreds of thousands have proved it. The designer of the Packard Twin Six and hundreds of other Engineers, climbed to success through I.C.S. help. The builder of the great Equitable Building, and hundreds of Architects and Contractors, won their way to the top through I.C.S. spare-time study. Many of this country's foremost Advertising and Sales Managers prepared for their present positions in spare hours under I.C.S. instruction.

For 26 years men in offices, stores, shops, factories, mines, railroads—in every line of technical and commercial work—have been winning promotion and increased salaries through the I.C.S. Over 100,000 men are getting ready *right now* in the I.C.S. way for the bigger jobs ahead.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 6169, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

☐ ADVERTISING	☐ ELECTRICAL ENGINEER	☐ MECHANICAL ENGINEER
☐ SALESMANSHIP	☐ Electrician	☐ Mechanical Draftsman
☐ Traffic Management	☐ Electric Wiring	☐ Machine Designer
☐ BUSINESS (Complete)	☐ Electric Lighting	☐ Machine Shop Practice
☐ Commercial Law	☐ Electric Car Running	☐ Boilermaker or Designer
☐ Certified Public Accountant	☐ Heavy Electric Traction	☐ Patternmaker
☐ Higher Accounting	☐ Electrical Draftsman	☐ Toolmaker
☐ Railway Accountant	☐ Electric Machine Designer	☐ Foundry Work
☐ BOOKKEEPER	☐ Telegraph Engineer	☐ Blacksmith
☐ Stenographer & Typist	☐ Telephone Work	☐ Sheet-Metal Worker
☐ Good English	☐ ARCHITECT	☐ STEAM ENGINEER
☐ Window Trimmer	☐ Architectural Draftsman	☐ Stationary Fireman
☐ Show-Card Writer	☐ Contractor and Builder	☐ MARINE ENGINEER
☐ Sign Painter	☐ Building Foreman	☐ GAS ENGINE OPERATING
☐ CIVIL SERVICE	☐ Carpenter	☐ Refrigeration Engineer
☐ Railway Mail Clerk	☐ Concrete Builder	☐ CIVIL ENGINEER
☐ Mail Carrier	☐ PLUMBER & STEAM FITTER	☐ Surveying and Mapping
☐ CARTOONIST	☐ Heating and Ventilation	☐ R. R. Constructing
☐ Illustrator	☐ Plumbing Inspector	☐ Bridge Engineer
☐ Perspective Drawing	☐ Foreman Plumber	☐ MINE DRAFTSMAN
☐ Carpet Designer	☐ CHEMIST	☐ Structural Draftsman
☐ Wallpaper Designer	☐ Analytical Chemist	☐ Structural Engineer
☐ Bookkeeper Designer	☐ MINE FOREMAN OR ENGINEER	☐ Municipal Engineer
☐ TEACHER	☐ Coal Mining	☐ NAVIGATION ☐ Spanish
☐ Common School Subjects	☐ Metal Mining	☐ Motor Boat Engr'g ☐ French
☐ High School Subjects	☐ Metallurgist or Prospector	☐ AGRICULTURE ☐ Italian
☐ Mathematics	☐ Assayer	☐ Fruit Growing
☐ AUTOMOBILE OPERATING	☐ TEXTILE OVERSEER OR SUPT.	☐ Vegetable Growing
☐ Automobile Repairing	☐ Cotton Manufacturing	☐ Live Stock and Dairying
☐ Auto. Electrical Work	☐ Woolen Manufacturing	☐ POULTRY RAISING

Name _____

Occupation _____ Employer _____

Street and No. _____

City _____ State _____

Canadians may send this Coupon to International Correspondence Schools, Montreal, Can.

Your Chance Is Here!

No matter where you live, the I.C.S. will come to *you*. No matter what your handicaps, or how small your means, we have a plan to meet your circumstances. No matter how limited your previous education, the simply written, wonderfully illustrated I.C.S. textbooks make it easy to learn. No matter what career you may choose, some one of the 280 I.C.S. Courses will surely suit your needs.

Make Your Start Now!

When everything has been made easy for you—when one hour a day spent with the I.C.S. in the quiet of your own home will bring you a bigger income, more comforts, more pleasures, all that success means, can you afford to let another single priceless hour of spare time go to waste? Make your start right now! This is all we ask: Without cost, without obligating yourself in any way, put it up to us to prove how we can help you.

Just Mark and Mail This Coupon

THE CAREY PRINTING CO. INC. NEW YORK

www.americanradiohistory.com

Beginning: "My Inventions," by Nikola Tesla

TK
7800
E54
V.6
no.2-12

FEB.
1919
20 CTS.

ELECTRICAL EXPERIMENTER

SCIENCE AND INVENTION

OVER
175
ILLUST.

REG. U.S. PAT. OFF.

THE TESLA WIRELESS LIGHT

SEE PAGE 692



LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION

www.americanradiohistory.com

MEN WANTED AS CERTIFICATED ELECTRICIANS

This is the Electrical Age, and this wonderful new profession is calling you. The demand for expert Electricians is greater every year and the salaries higher. Electricity is truly the greatest motive power in the world, to-day, and now is the time to enter this profession.

YOU CAN DO THIS



AFTER HOME STUDY

$36.00 TO $100.00 A WEEK

You can earn $36 to $100 a week and more as an Expert Electrician. If you have a common school education I can train you in a few months at home. Big lighting and power companies, municipalities, and manufacturers are always seeking trained men to handle their Electrical problems.

SPECIAL OFFER: Owing to the big demand for trained Electricians in the Government Service I am making a wonderful offer for those who enroll during October.

I Guarantee Satisfaction

Every student receives our Sealed Guarantee Bond, which guarantees to return every penny of his money if he is not entirely satisfied. No other school has made this wonderful offer, but I know the success I have brought to hundreds of my students, and I know what I can do for any ambitious young man who will give me a little of his spare time each day.

FREE ELECTRICAL OUTFIT

For the next 30 days I am giving each student an Outfit of Electrical Testing Instruments, Tools, Electrical materials, and Motor absolutely Free. My instruction is by practical methods and this outfit is used in working out the lessons. Practical training with the theory makes perfect. I am Chief Engineer of the Chicago Engineering Works, and I can give you the training that will land the big jobs and hold them.

This is the only Correspondence School in America that has fully equipped Electrical Shops where students may come for special instruction.

If you are in real earnest I want to send you my Book—"How to Become an Electrical Expert." It's free. No matter how many other schools you write to I want you to have my book—It's different because it's practical—Write today.

MAIL THIS COUPON

CHIEF ENGINEER L. L. Cooke Chicago Engineering Works
Dept. 22, 441 Cass Street, Chicago, Ill.

CHIEF ENGINEER L. L. COOKE
CHICAGO ENGINEERING WORKS
Dept. 22 - - 441 CASS STREET, CHICAGO, ILL.

www.americanradiohistory.com

Bigger Pay for YOU

"See them first--pay afterwards"

Small Monthly Payments if you're satisfied

You Can Now Know ELECTRICITY As Experts Know It

When we observe the ever-increasing applications and usages of electricity, we wonder if all the present openings and the newly created positions in the electrical world can ever be filled.

The ending of the war lends a new and mighty impetus to the electrical end of American industries. Salaries are soaring. There is practically no limit to the earning power of the man who educates himself in the finer points of electrical work.

Actual working facts

With the advent of the new Library of Practical Electricity, by Terrell Croft, a new era is marked in the production of self educational electrical literature. This library satisfies a demand never heretofore met—the demand for a home study course which would bring out in detail the actual working facts. This great undertaking has been accomplished. It is a seven-year task completed.

No previous electrical training necessary

Three thousand pages, with twenty-one hundred of the learest illustrations ever put into book form. Each of the eight volumes is indexed so that everything you want to know about electricity is at the finger's end. And when you find what you want, there is not merely a short question and a short answer. You are told everything you want to know. The explanation is clear to you, regardless of whether you have had a previous knowledge of electricity or not.



8 Vols.

Flexible binding

Pocket size

3000 pages

2100 illustrations

Know electricity as the highest paid engineers know it

When you are studying the Croft Library of Practical Electricity, you are studying electricity as experts know it. You are acquainting yourself with the methods employed by the highest paid electrical workers and engineers in America.

This Library of eight volumes sent to you FREE for 10 days' trial

So positive are we that you will be pleased with the Croft Library of Practical Electricity that we offer to send the entire ten volumes for ten days' free use. All you need do in order to have the books sent, charges prepaid, is to fill out the attached coupon and return to us. Keep the books ten full days. Then if you are not satisfied, return them at our expense. On the other hand, if you find that they will help you, as they are helping thousands of others, send us the small sum of $2 per month for eight months.

A letter that means something to every man in America who is interested in electricity

McGraw-Hill Book Company, Inc.
239 West 39th Street, New York, N. Y.
Gentlemen: In an attempt to express myself about CROFT'S NEW LIBRARY OF PRACTICAL ELECTRICITY, I have never seen and do not believe there was ever printed in the English language, a more comprehensive set of books. It is a library that is just as valuable to the novice as to the expert, because it is all practice.
Respectfully,
GUY H. PEIFER.
Chief, Doplon Silk Corporation, Hazleton, Pa.

McGraw-Hill Book Co., Inc.
239 West 39th Street, New York, N.Y.

ACT NOW

FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc.
239 W. 39th St.
NEW YORK

Gentlemen:
Please send me the Library of Practical Electricity (shipping charges prepaid) for 10 days' free examination. If satisfactory, I will send $2 in ten days and $2 per month until $16 has been paid. If not wanted I will write you for return shipping instructions.

Name.....
Home Address.....
City and State.....
Name of Employer.....
His Address.....
Your Position.....

LIBRARY SEP 2 8 1999 UNIVERSITY OF TORONTO

www.americanradiohistory.com

Electrical Experimenter

233 FULTON STREET, NEW YORK

Publisht by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer;) 233 Fulton Street, New York

Vol. VI Whole No. 70 FEBRUARY. 1919 No. 10

NIKOLA TESLA AND HIS WIRELESS LIGHT.....Front Cover
From a painting by George Wall.
TIDAL POWER PROBLEM SOLVED AT LAST..... 685
PRODUCING RAIN BY ELECTRICITY AND X-RAYS..... 687
MOVING PLATFORM FOR NEW YORK'S CROSSTOWN SUBWAY.....By H. Winfield Secor 688
THE UNKNOWN PURPLE.....By Dorothy Kant 690
ZEPPELIN FLIES FROM BULGARIA TO KHARTOUM AND RETURN WITHOUT STOPPING..... 691
FAMOUS SCIENTIFIC ILLUSIONS.....By Dr. Nikola Tesla 692
SOLDIERS' ILLS CURED BY ELECTRICITY..... 695
MY INVENTIONS—NO. 1 OF A SERIES
By Dr. Nikola Tesla. Exclusive Feature. 696
SUBWAYS OF DOWN-TOWN NEW YORK
From a painting by George Wall. 699
POPULAR ASTRONOMY—THE MILKY WAY
By Isabel M. Lewis, of the U. S. Naval Observatory 700
WOMEN NOW TRAINED AS METER READERS..... 702
LARGEST ELECTRIC CRANE LIFTS COMPLETE TUG BOAT... 703
SELLING ELECTRICITY BY THE "CAN..... 704
LATEST ELECTRICAL APPARATUS AND NOVELTIES..... 705
WIRELESS LEGISLATION NEWS..... 706
RADIO DEPARTMENT—PRESIDENT WILSON IN TOUCH WITH AMERICA ON LAND OR SEA—VIA RADIO..... 708
VACUUM VALVE ACTION AND THE ELECTRIC CURRENT
By K. G. Ormiston, Instructor in Radio 710
THE VORTEX RING THEORY OF THE ELECTRON
By F. W. Russell and J. L. Clifford 712
"BALL LIGHTNING" EXPERIMENTS..By Samuel S. Weisiger, Jr. 714
A USEFUL ELECTRICAL LABORATORY SWITCH-BOARD
By H. Danner 715
EXPERIMENTS IN RADIO-ACTIVITY
By Ivan Crawford. Part II.—Ionization 716
EXPERIMENTAL MECHANICS—LESSON X..By Samuel D. Cohen 717
EXPERIMENTAL CHEMISTRY—THIRTY-THIRD LESSON
By Albert W. Wilsdon 718
HOW-TO-MAKE-IT DEPARTMENT—PRIZE CONTEST..... 719
WRINKLES, RECIPES AND FORMULAS...Edited by S. Gernsback 720
LATEST PATENTS DIGEST..... 721
WITH THE AMATEURS—LABORATORY PHOTO CONTEST.... 722
PHONEY PATENT CONTEST..... 723

EDITORIAL

The New Wireless

IT will come as a profound shock to all wireless enthusiasts, scientific and amateur alike, that their present-day notions on wireless are totally erroneous and not based upon actual facts. For years we clung to the theory that a wireless message radiates from the aerial wires of the sending station and speeds over the surface of the earth thru the ether towards the receiving station. We thought that we were sending out pure Hertzian waves from our transmitters. We thought that we received these waves over the aerial wires of our receiving station. All of these theories are wrong and will be relegated shortly into the past along with the early notion that the earth stood still, while sun, moon and stars revolved around it.

Remain only the physical facts that we did send and did receive messages without wires—but they are not sent by means of pure Hertz waves, nor do they go by way of the ether as radiations.

In a highly illuminating article printed elsewhere in this issue, Nikola Tesla explodes all of our present orthodox views as to wireless propagation and makes it clear that the earth is the sole medium thru which our wireless impulses travel, in the form of true conduction. Particularly does this hold true for long distance messages: Here we are sending out a compound impulse three quarters of which is a galvanic current, traveling thru the conducting earth, the other quarter or less is in the form of Hertz waves, going by way of the ether. This explains why we can send signals to airplanes and vice versa; but even here we probably have to do not with pure Hertz waves it is almost certain that we have capacity-inductive effects as well.

Tesla maintaining that there can be no long distance effects by radiations transmitted thru the ether, but rather only by currents thru the earth, it follows that in his opinion all our radio apparatus is designed and operated faultily. Indeed, this is not a brand new idea of the famous inventor. He has been preaching it ever since he took out his first patents and described his system in 1893—long before Marconi thought of wireless But he was preaching to a stone deaf scientific world.

But how simple it all becomes when we stop to apply a little reason and logic to Tesla's claims. For instance, we can send radio impulses three to five times as far over salt water as over land. Why? Simply because the impulses go *thru* the water, which is a much better conductor than earth alone. If we were sending pure Hertzian waves, why do we connect one wire at both sending and receiving station to the ground? Hertz never dreamt of such a thing. If you are still unconvinced that the earth is the chief medium of transmission, disconnect your ground wires entirely and try to send and receive. Now you may work with Hertz waves, but the distances you can bridge will be pitifully small.

Already Tesla's logic is filtering into our radio scientists' minds. *All the big stations are beginning to scrap their towers and aerial wires, at least for receiving. They now bury their "aerial" wires in the ground,* and lo! they can receive signals twice as far as before. Incredible, but it is being done every day. And—wonders upon wonders—how we will laugh at our present and past blindness—*the static interference is practically gone* the minute we pull our aerial wires down and bury them! Static Electricity? There never was a reason for having the bugaboo, for there is no "static" in the ground.

But Tesla goes much farther. In time he will show the world wireless power transmission effected *not by ether waves but by currents thru the earth,* which is a first rate conductor. Like all big things, the problem is simple. At some point on the globe he will erect a station powerful enough to charge the whole earth with electricity—and keep it charged. To do this we need about 10,000 kilowatts. Then at *any* point on the globe the current can be tapt by means of suitable apparatus. Like a bell ringing transformer, *connected* to your supply line, no current is consumed unless you close the secondary circuit. Tesla's world wireless works just that way. *No current is consumed till it is tapt at the distant receiving station.*

H. GERNSBACK.

The ELECTRICAL EXPERIMENTER is publisht on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions, Canada and foreign countries, $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 20 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. A green wrapper indicates expiration. No copies sent after expiration.

All communications and contributions to this journal should be address to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

ELECTRICAL EXPERIMENTER. Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered U. S. Patent Office.

Copyright, 1919, by E. P. Co., Inc., New York. The Contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.

The ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris.

www.americanradiohistory.com



El Paso, Texas, Oct. 1, 1917.

MR. CHARLES F. HAANEL, St. Louis, Mo.
In Re "The Master Key"

My Dear Mr. Haanel: The value of an idea is determined by its application. Pragmatism has long since spread beyond the confines of Missouri. The world insists on being shown.

The lash of circumstances and the logic of events are, more than ever, impelling men to think. Whether an idea be a new process for picking cabbages, or an old process (Kaiserism, for instance) for preserving kings, we are from Missouri.

A philosophy of life having as its base blind optimism; a religion that won't work seven days a week, or a proposition that isn't practical, appeals to the intelligent not at all. It is results that we want and the acid test is: will it work?

The Master Key qualifies. It is the most lucidly scientific statement of "Truth" that I have seen. It reconciles rationalism and religion; illumines economic determinism and the materialistic conception of history, and is an infallible guide to understanding. It contains in condensed form the substance of an entire library on science. Its teaching, if consistently applied, will make a man healthy, wealthy and wise. Its distribution is super-missionary work in excelsis. Those who wish to think intelligently will find it invaluable.

Intelligence rules. Desire, intelligently directed, is a creative force which automatically causes its object to manifest on a material plane. It is the law. Let him that hath an ear to hear, hear.

Yours truly,
CHAS. A. HEARD.

May 15, 1918.

Dear Mr. Haanel: Ever since I have been old enough to read, I have been reading occult and metaphysical literature. I have waded ears deep through the books from all ages, all lands, all schools.

I have rejected tons of lies, oceans of misconceptions, an entire universe of false deductions.

I have found grains of truth in mines of folly, and worlds of truth in a single grain. The pursuit was interesting in itself, and I do not regret the time spent upon it. But it was a genuine surprise to read your Master Key System and find within, the essence of all that I had read, with much more added thereto.

In this extraordinary system you have sifted the true from the false; you have given in concrete form all that is worth while in many schools of philosophy.

You have placed arcane truths into the hands of the uninitiated as weapons they can learn to use without danger to themselves. I congratulate you. You are doing mankind a service.

Yours very sincerely,
CHARLES F. OURSLER.
501 Fifth Avenue, New York City, N. Y.

THE LOWE OBSERVATORY
Edgar Lucien Larkin, Director
Los Angeles, Cal., Dec. 6, 1916.

MR. CHAS. F. HAANEL, St. Louis, Mo.

Dear Sir: Your booklet, Master Key, ought to be expanded into a book. Its teachings that Mind is the all-dominating creative force is precisely in line with the wonders of the most recent psychology. All persons having desks should have this pamphlet thereon. And it would be a fitting pocket companion.

EDGAR LUCIEN LARKIN.

Detroit, Mich, May 28, 1917.

Dear Sir: The words, "Your world will change as if by magic, the moment you realize the marvelous power within your control," page 6, I have underlined. They state a fact, a real live fact; and to me this is the most wonderful, the most important fact of all—that one may put this knowledge to an immediate test, that one may, after learning of this power, proceed to apply it with a definite knowledge as to results.

W. M. HOWE.

which can throw wide the doors which seem to bar men from the Treasure House of Nature. This may seem "too good to be true," but remember that within a few years science has placed almost infinite resources at the disposal of man, is it not possible that there are other laws containing still greater possibilities? Get the Master Key and find out for yourself how the invisible forces of Faith and Desire are converted into actual, tangible, concrete facts in the objective world.

Chattanooga, Tenn., Feb. 22, 1918.

The Master Key is wonderful, it has brought about a most remarkable change in my environment, attitude toward life, mental and physical condition. I am an entirely new person and improving daily, discouragement, lack of ambition, physical ills, mental distress, and fear are things of the past.

I cannot find words that express my gratitude for all that the Master Key has done for me. With heartfelt thanks to you, I am,

Yours sincerely,
R. J. ARNOLD.

---

160 Claremont Avenue, New York
New York, Nov. 18, 1916.

I have made a thorough examination of the little booklet which you so appreciatively have called the Master Key, and can unhesitatingly endorse it and its teachings.

In this pamphlet of only a few pages you have led a hungry world to the threshold and placed in their hands a "key" with which the understanding ones may unlock the door and enter "The Secret Places of the Most High," and enjoy the abundance of all good to be found therein. With best wishes,

AGNES MAE GLASGOW.

HOME LIFE INSURANCE CO. OF N. Y.
James Lee Bost, General Agent
Washington, D. C., Dec. 29, 1916.

Dear Sir: Your little booklet, entitled "The Master Key," has been received and I had great pleasure in studying it carefully. It is a very clear and concise, yet forceful presentation of the big subject handled, and shows a very wide study of the absolute teachings and deep understandings of the same.

Very truly yours,
JAMES LEE BOST.

"I am able to extract from this system all that can be made known by the finite mind relative to origin, evolution, destiny and the much-mooted riddle of the Universe."

"I can hardly grasp the full significance of the facts. The vastness of this subject is so overwhelming it seems a life-time of effort could never fathom all its possibilities."

"You have given a wonderful analysis of the power that is the creative force by which the master mind controls his destiny."

"The Master Key is too modest a title for such a stupendous revelation."

"I have found the Key and with it each day am opening the store-house of wisdom and success, of which for many years I was utterly ignorant."

FREE! There is no charge for the MASTER KEY. It is FREE!

CHARLES F. HAANEL, 423 Granite Bldg., St. Louis, Mo.

Send me the Master Key without cost or obligation of any kind.

Name .....

Address .....

Post Office ..... *State* .....



NOTE—*Tomorrow; today* will be *yesterday*. Get your Master Key TODAY! NOW!

www.americanradiohistory.com



Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Oldest and Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 5,000 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Let us explain this course to you in person. If you can't call, send now for 64-page book—it's FREE to you

New York Electrical School
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

..... (NAME)

..... (ADDRESS)

New York Electrical School
29 West 17th Street, New York

You Incent by mentioning the "Electrical Experimenter" when writing to advertise s

www.americanradiohistory.com

Electrical Experimenter

H. GERNSBACK - EDITOR
J. W. SECOR - ASSOCIATE EDITOR

Vol. VI. Whole No. 70 | FEBRUARY, 1919 | Number 10

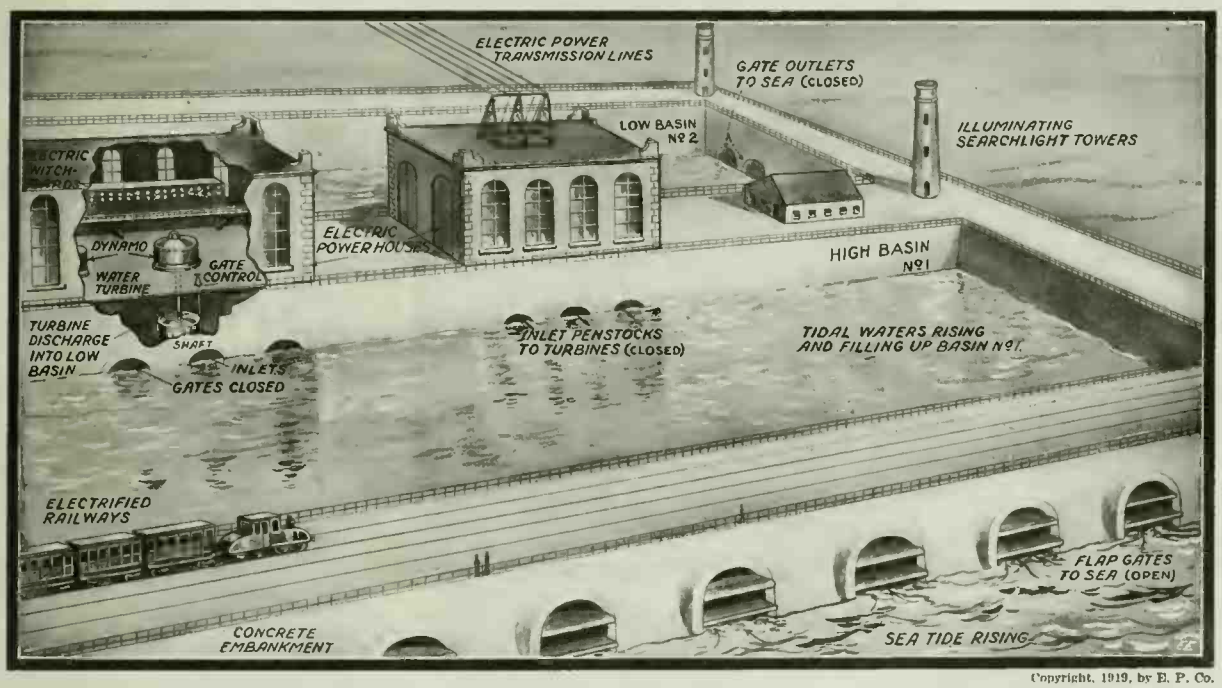
Tidal Power Problem Solved at Last

TIDAL power is one of those long dreamed of possibilities in engineering which has occupied the minds of great philosophers for generations. Why not,—for who can stand down by the ocean shore, or even by any large river having an appreciable tidal rise and fall, and fail to be imprest with the gigantic natural power here spread out before us, and let go to waste for all these years. Think of it—tens of thousands, yes, millions, of horse-power dissipating itself on our coastal and river shores every day in the year. To realize this fact fully we need but reflect for a moment. If the tide brings us a rise of several acres (many thousand cubic feet) of water, why let it fall again, *uselessly?* Allow the water to flow, without friction, into huge basins at high tide; trap it, and when the tide falls, permit the imprisoned water to escape, *but thru turbines*, back to the tidal level.

That is the idea several engineers have had, but an English engineer seems to have solved the problem successfully with his specially designed tidal turbines and triple basins. His name is J. O. Boving, and his scheme is so practical that it has been proposed for the development of electric power from the tide water at the mouth of the River Dee. Mr. Boving's description of the tidal power plant is as follows:

Altho the (English) Government a few months ago took a very wise and necessary step in appointing a committee to inquire into the possibilities of water power development in the British Isles, there is one aspect of the question which does not seem to have attracted adequate attention, and that is the utilization of *tidal power*. The rise and fall of the tides around the English coasts vary greatly, from a maximum of nearly *fifty feet* in some places on the west coast to only a few feet at others. Generally speaking, the differences on the east coast are small, but on the west coast there are many river estuaries and other inlets which offer abundant possibilities for obtaining power from the tides.

Some years ago I had an opportunity of examining the possibilities of developing a tidal water power on the estuary of the River Dee, where the tidal differences are roughly *thirty-five feet* at *highest* Spring tide and *thirteen feet* at *lowest* neap tide. The scheme put forward was to form a railway embankment across the mouth of the estuary so as to connect up the Welsh railway system with Birkenhead and Liverpool. The area of the impounded water behind this dam was to be *forty-four square miles*. On account of local conditions it was not difficult to divide this basin into two equal parts, and to arrange these two inner basins, the sea forming the third, in



Copyright, 1919, by E. P. Co.

The Proposed River Dee Tidal Power Development As Designed By a Famous English Engineer—J. O. Boving. This View Shows His Two Basin Proposal Where the Area of the Impounded Water Would Amount To Forty-Four Square Miles. The Maximum Tidal Difference Is In This Case About Thirty-Five Feet. A Large Railway Embankment Is a Part of the Scheme, This Railway to Connect Up the Welsh Railway System With Birkenhead and Liverpool.

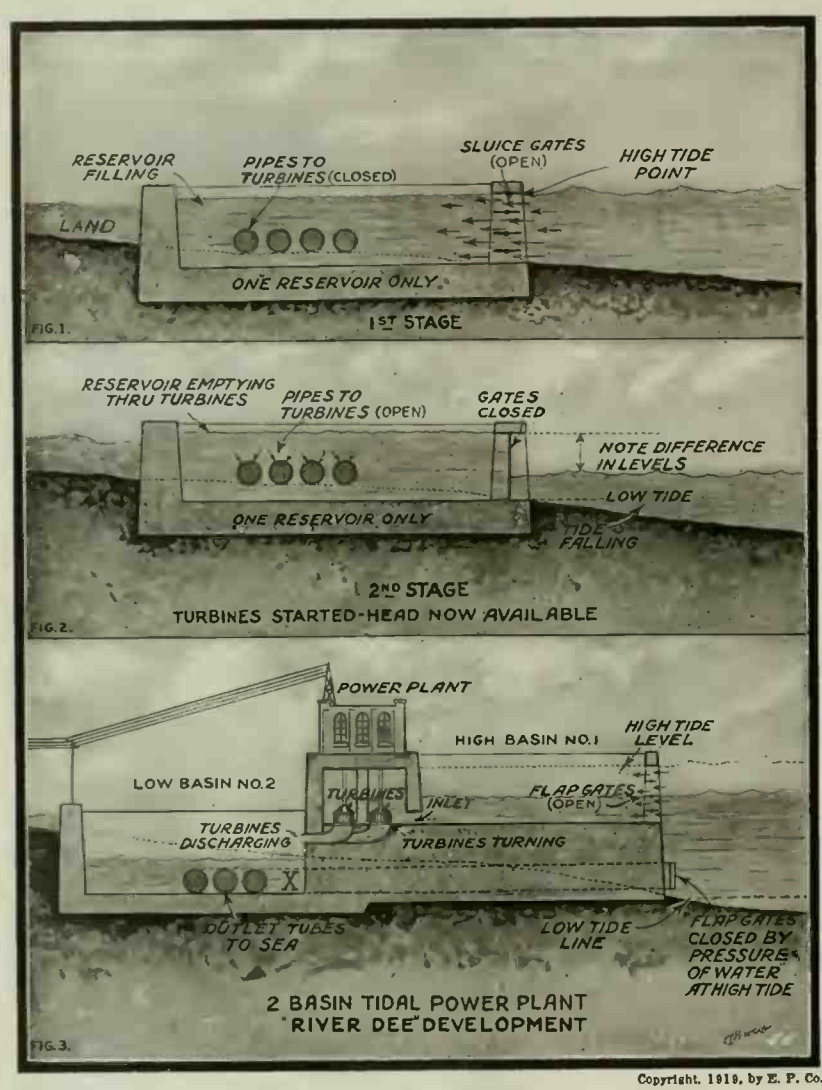
www.americanradiohistory.com

such a way that a power station could be worked *continuously* under constant head and with constant output. The plan was roughly as follows:

Supposing that we start with high tide, the flap gates leading from the sea to the high basin would be open, and the water would flow in and pass thru turbines into the lower basin, the automatic flap gates to this basin being closed by the water pressure outside. This flow would continue until the level in the sea equaled that in the high basin, when the flap valves to this would slowly close. *In the meantime the level in the high basin would slowly SINK as water was consumed, and the level in the low basin would INCREASE until the moment when the water level in the sea had fallen to such a point that the gates of the lower basin would open and discharge the water in it completely.* On the rising tide a similar sequence would be followed, and a continuous development of power would thus be maintained.

There are a great number of cases along the coast where it would be easy to create a reservoir at a considerable height adjacent to the tidal power station, or at least within a distance which would make electric transmission easy. In such cases the surplus power might be used during the periods when it is available for pumping up water to such reservoirs, while during the intervals, when power is required, it could be obtained thru high-pressure turbines driven by the stored-up water supplied.

It will perhaps be argued that this is a very elaborate and costly arrangement which would not pay. The problem in fact resolves itself to this: Assuming (1) that an ordinary water power in a river was developed and used for commercial purposes during twelve hours out of the twenty-four and that it was a good commercial scheme under these conditions; and (2) that a high pressure power development could be obtained by using stored water for twelve hours of the twenty-four, and that this also was a commercially good undertaking in itself; then it must be equally sound commercially to link the two together and produce power around the twenty-four hours. In the tidal scheme the only things added to the arrangement described above are pumps, which are a negligible factor in the general costs (they would correspond to something like $3.75 per h. p.). The pipes thru which the water is pumped up are, of course, the same as those which return the water from the high pressure plant. Everything else is in common.



Copyright, 1919, by E. P. Co.

Progressive Illustration Showing How the Tidal Power Plant Works. First Figure Shows How the Rising Tide Fills the Large Basin Or Reservoir With Water. At Full Tide the Sea Gates Are Closed and After the Tide Has Fallen a Few Feet, a Working "Head" Becomes Available As Fig. 2 Shows. The Impounded Water Discharges Thru Turbines Back to the Sea. Fig. 3 Shows a "Two Basin" Plant Which Discharges the Impounded Water In Two Stages, Giving Steadier Power Development.

The calculation for such a scheme is simple, and in the case referred to, assuming that in any case a bank was needed across the Dee mouth, for railway purposes, there is no doubt that this power development would pay well. In cases where two tidal plants of similar size are close together the necessary conditions could be realized by connecting them. There would be nothing novel in such plans; the turbines would be of standard design, the variation in the head would be only such as would be allowable for in ordinary turbine plants, and there would be no need to bridge over any periods when the power developed fell much below the average power.

However, in most cases it would be impossible to develop the three-basin idea, and it would be necessary to rely only on one inner reservoir and the sea. Obviously under such conditions the engineer has to contend with very great variations in head and power. The great differences that occur in the tidal ranges at various times compel him to calculate his turbines for the average head derived from neap tides.

The general idea of a one-reservoir tidal scheme is as follows: At the beginning of high tide the sluices are open fully and the water rushes into the inner reservoir, filling it up as quickly as possible. Then the gates are shut for a certain time, *until the water level outside has fallen to give a desired difference in level between the reservoir and the sea.* (See detailed illustration of one reservoir scheme herewith.) The turbines are now started and kept in operation under virtually constant head, while the level in the reservoir falls at the same time as the tide. Some time before the lowest level of the tide the turbines are shut off, the gates opened, and the remaining water in the reservoir allowed to rush out with the lowest tide. Then the gates are closed, the tide rises outside until the difference in level between the sea and the reservoir has again reached the agreed amount, the turbines are started, and the same procedure is gone thru for the rising tide as just described for the falling. Thus for certain definite periods power is obtained at a nearly constant rate, but in the intervals no power is produced.

Up until now we have been satisfied to mine and burn coal, prospect for oil gushers, and, in fact, have tried out about every expensive source of power we could think of. This comes of prosperity. America is rich, and the keynote of the hour is "speed." Design, develop, build,—do all these things—say our great philosophers and educators, but do them FAST. Speed is a fine thing—in its place; but there is bound to be a big bill to pay, some day. Why not live and work efficiently; not necessarily in a slow, plodding, unenlightened way, but in an economical manner. Coal and oil will not last forever. If you have ever visited Holland, you have undoubtedly been imprest with the simplicity of things, and those windmills. There is a fine bit of antique engineering. The Hollander is using an untaxable, free, and powerful source of natural power—the wind. Besides these you will find in all parts of Europe the ever-present water wheel and turbine. Excellent, steady power, untaxed in most cases; but do the American farmers and developers put the *free* wind and water power to work? Yes, they do NOT. They would rather spend a thousand dollars or so for a gasoline engine and then work their heads off for the rest of their lives buying gasoline and oil to run it with. You can see hundreds of windmills and waterwheels rusting to pieces all over the country. A great pity and a prodigious waste.

Sweden, which is rich in water power, sends electricity across the sound to Denmark.

www.americanradiohistory.com

Producing Rain by Electricity and X-Rays

FROM time to time in the world's history, there have been schemes promulgated for and attempts made at producing rain by artificial means under the control of man. One of the most promising of the recent schemes for producing rain-fall at any desired time, providing there happened to be aqueous particles contained in the atmosphere, is that due to an Australian scientist, John Graeme Balsillie. He has taken out patents on his system of producing rain-fall electrically, and one of his latest American patents is here pictured and described.

The illustration shows how Mr. Balsillie proposes to send up a series of balloons or large box kites of sufficient size to carry an extra large X-ray tube, and also capable of supporting two thin electric wires of considerable length. As the inventor states in his patent, his invention "consists in electrical means for assisting and promoting under suitable meteorological conditions the formation of aqueous particles in the atmosphere and assisting in promoting the deposition of water particles (rain-fall) from the atmosphere, and further to provide suitable apparatus for producing the necessary electrical conditions for that purpose." This balloon may be controlled from a motor truck which can speed over the country to various points wherever it may be desired, and a portable gasoline engine and dynamo outfit on the truck may supply the necessary current for operating the powerful X-ray tube carried by the balloon, as shown in the illustration, and also for developing the high potential current, about 350,000 volts, which is employed for *charging the metallized surface of the balloon.*

As has been pointed out in previous articles on similar inventions in this Journal, —and as substantiated by the opinion of several well-known scientists, included Dr. Henryt Arctowsky, the Arctic explorer, of New York,—the inventor informs us in his patent that his discovery is susceptible to practical use *only* when the cooling of aqueous vapor resulting from its expansion in elevated regions of the atmosphere and other natural influences brings the vapor *above the saturation point,* so that *condensation* becomes possible.

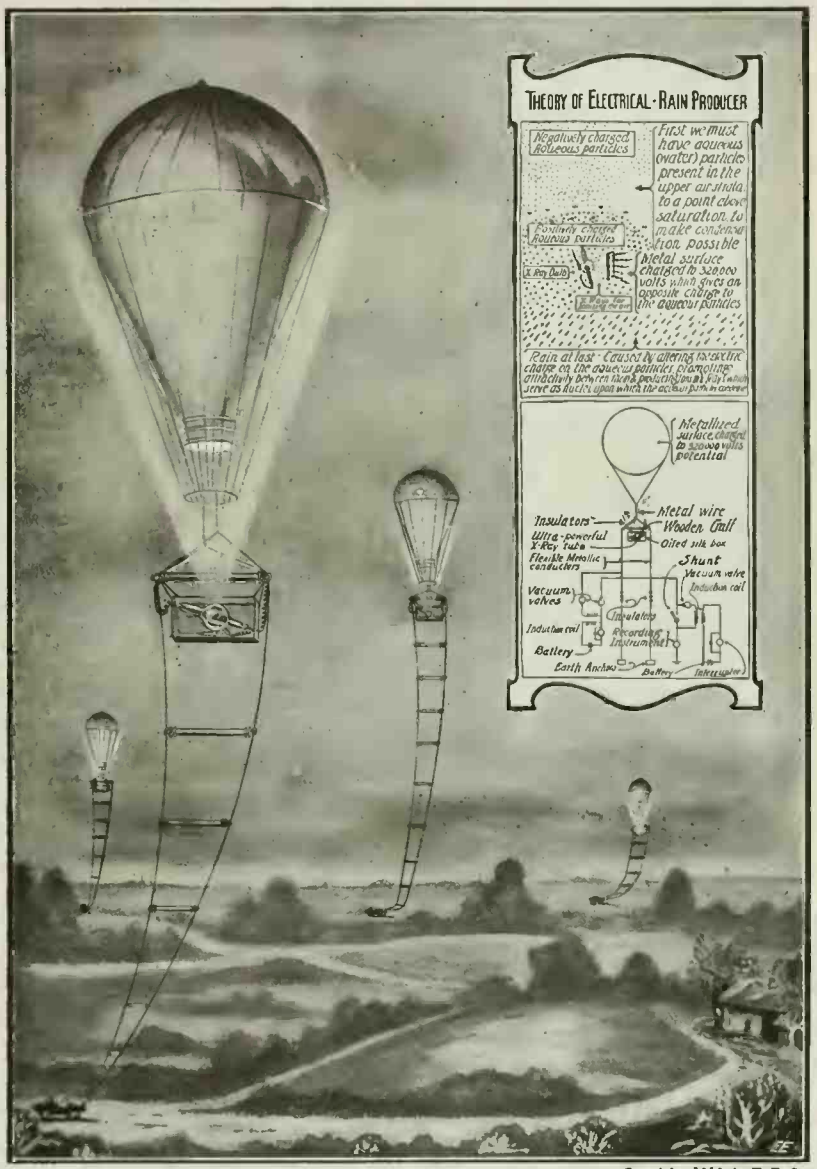
It has been ascertained that ions, produced in this case by Mr. Balsillie by the powerful X-rays, which ionize the atmosphere in the vicinity of the balloon, may act as nuclei, upon which, under certain conditions, water vapor will condense. Aqueous particles comprising cloud, fog or mist are invariably electrified by natural causes, and altho their electrification is of one sign, the potential or voltage distribution thruout the mass is uneven. Aqueous particles of approximately equal dimensions and potential will therefore naturally repel each other, and no condensation will result. However, nuclei, upon which water condensation may take place, can be created by ionizing the atmosphere, such as by powerful X-rays, and further if under normal conditions, a *mutual repulsivity* of charge of the aqueous particles is altered to a condition of *mutual attractivity,* then coalescence of such aqueous particles will be assisted, and rain caused to fall.

As the accompanying detail illustration shows, if a metal plate (or the metallized surface of the balloon) is charged at a very high potential of say several hundred thousand volts, then this electrified body serves to give an opposite charge to the aqueous particles floating in the atmosphere.

The aqueous particles thus become possest of a charge of *opposite sign* to that which they originally had. This charge of opposite sign, however, is not and cannot be communicated instantaneously to all the particles in said zone. The particles in close proximity to the source of electrification are rapidly charged by electrostatic induction with a charge of opposite sign to that which they originally possest. This inversion of sign of charge is gradually communicated to all the particles in said zone in an ever-expanding circle, about the source of electrification as a center. At the perimeter of the circle of imprest electrification, at any instant, a condition exists whereby particles in close proximity to each other are possest of electrical charges of opposite sign. Such particles consequently attract each other, coalesce, and then fall as rain, under the influence of gravity.

The apparatus used for producing the high potential uni-directional current for charging the metallized balloon surface is produced by a transformer and interrupter supplied from a dynamo or other source on the ground. The secondary circuit of the induction coil is equipt with rectifying valves in order to rectify the current. Similar appratus, also provided with vacuum

(*Continued on page* 749)



Copyright, 1919, by E. P. Co

Man Is Slowly But Surely Learning the How and Why of Nature's Secrets. Rain and How It Forms Has Particularly Interested An Australian Scientist—John Graeme Balsillie, and His Method of Ionizing and Charging the Aqueous Particles Is Here Illustrated and Described. Ionization Is Accomplisht By Large X-Ray Bulbs Suspended From Balloons.

www.americanradiohistory.com

Moving Platform for New York's Cross-Town Subway

By H. WINFIELD SECOR

SUBWAY commuters and others who use New York's great underground transportation systems daily, have been much provoked and harast in the past several months by the various difficulties occasioned by the change in the two principal North and South arteries of subway travel. In other words, the subway system was changed over a few months ago from the old familiar "Z" system to the new so-called "H" system, which gives a continuous east-side and west-side subway express route, the—bar of the "H" connecting at the present time by shuttle trains running under 42nd Street between the Grand Central Station and the Times Square Station. The Grand Central Station is located at Park Avenue and East 42nd Street, while the Times Square Station is located on the west side at the juncture of 7th Avenue, Broadway and 42nd Street.

For several reasons the shuttle train service seems apparently not to be the best solution of the problem confronting the subway engineers in smoothly and quickly transferring the cross current of traffic between these two stations, and therefore Public Service Commissioner Travis H. Whitney has proposed that a *continuous moving platform* such as here illustrated be installed in the space now occupied by two of the four shuttle tracks. Mr. Whitney's original idea called for the installation of this continuous moving platform on the two northerly tracks of the shuttle system, leaving the two southerly tracks for train service, which might be necessitated whenever the moving platform might for instance get out of order, when the shuttle train service could be put in use. Also these two tracks could be used for the extension of the Queensboro Subway system, which is another proposal in the minds of the Public Service Commission engineers, so that eventually the Queensboro trains which now end their westward run at the Grand Central Subway Station, two levels underground as here illustrated, will terminate at Times Square.

In a recent interview with Mr. M. Everhart Smith, consulting engineer of the construction concern which will build this gigantic moving platform, six thousand feet in length and capable of carrying ten thousand people at one time, a different suggestion was made concerning the location of this proposed continuous moving platform. Instead of having it occupy the space over which the two northerly tracks now run, Mr. Smith pointed out that it is much more feasible and practical in every way to have it occupy the present position of the extreme northerly and southerly tracks, leaving two tracks in the center for emergency shuttle train service or for the extension of the Queensboro system to Times Square. This modification of the design and layout of the moving platform system is a very important one and practically necessitated, for the reason that if the return loop of the platform past along in the position now occupied by one of the inside tracks, then passengers could not alight at any point desired, excepting at the terminal stations at either Grand Central or Times Square.

As is pointed out there should be not less than three moving platforms in any case, each moving at a different speed, the outer one say at three miles, the intermediate at six miles, and the inner platfrom carrying the seats, at nine miles per hour. Therefore, as Mr. Smith suggested, in discussing Mr. Whitney's original idea, it would not be possible for passengers traveling *east* to attempt to cross a high speed (9-mile per hour) platform moving *west*. To give the greatest service, and to enable passengers to alight from or board the moving platform at any point along the entire route, the moving platform system should occupy the space now used by the two center or the two outside tracks. In other words the two moving platforms would have to have adjacent to them a stationary platform provided with suitable exits and entrances.

If the present shuttle train service should be extended to connect with other subways on avenues farther west than 7th Avenue at Times Square, the trains, Mr. Smith explained, would not conflict with the moving platforms, because the latter would operate only between two of the train stations. In this case the moving platform would be used merely for the collection and distribution of passengers within the area of Times Square and east and west of it.

Concerning the initial cost of this great moving platform it is estimated that it would approximate $1,000,000.00, and that it would take six months to build and install. At the present time the engineers of the Public Service Commission and the subway staff, as well as the experts of the moving platform concern, are busy trying to find a satisfactory space for the platform return loops at the station ends at Times Square and Grand Central; these loops being quite an extensive affair, the minimum diameter of the loop being about 130 feet.

The moving platform idea is not so entirely new or untried, as it might appear at first. They have been built and used at different times quite a number of years ago, both abroad and in the United States. The same concern which is now designing the one for installation under 42nd Street, had one in successful operation at the World's Fair in Chicago, 4,400 feet in length. Visitors to that Fair will undoubtedly remember the great attraction, the platform of which was operated by electric motors to the total of 150 horsepower, which had a carrying capacity of 6,000 passengers. On "Chicago Day," 185,000 passengers—twice the daily traffic of the Brooklyn Bridge—were carried without any inconvenience. The total live and dead weight was 900 tons. As aforementioned, the new platform proposal for 42nd Street, New York City, is approximately 6,000 feet in length, with a capacity of 10,000 passengers, and will require electric motors distributed along its length to a total of about 250 horsepower.

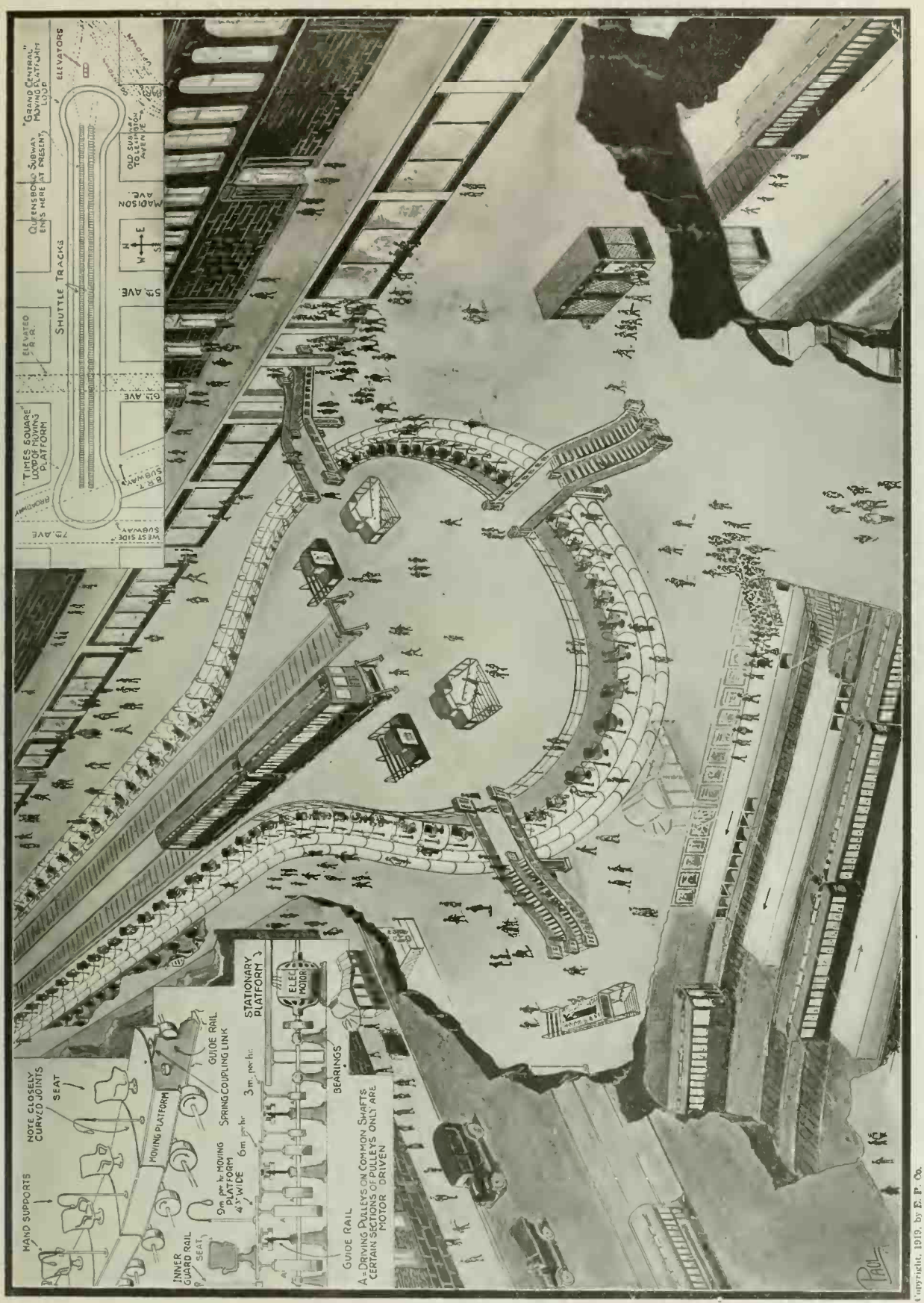
Undoubtedly some of our readers will be interested in some of the more or less obvious technical details and just how the various parts are to operate. Thru the courtesy of Mr. M. Everhart Smith, we are pleased to give several details here, which have seemed of paramount interest to the editors. First, the three moving platforms, moving at three gradually increasing velocities in order to allow a person to board it without being thrown over or requiring acrobatics, will not be exactly on the same level, but each platform will slightly overlap the next succeeding platform, this practise having been found the best from past experience. The detailed drawings in the accompanying illustrations show clearly how the platform is made in a large number of jointed sections, each of which is provided with a flexible coupling so as to easily negotiate the curves at the station loops. Under the whole moving platform there is installed a stationary series of wheels or pulleys mounted on axles. The depending rails of the various platforms rest on the respective pulleys or wheels belonging to that particular platform in each case, as the drawing indicates. At about every eighth or tenth pulley there will be located a small electric motor connected by driving chains to several of the pulley shafts. All together about 250 horsepower in electric motors will be required, which is quite small indeed compared to the two thousand horse-power in electric motors necessary for the operation of a ten-car subway train.

The matter of seats on the third or high-speed platform is a very flexible one, and at first most probably but one row of seats will be installed, as the illustration shows, but more seats can readily be added at any time. It will only require a few minutes to go from Grand Central to the Times Square Station or vice versa on the moving platform, and the seats would probably only be used by women, as Mr. Smith pointed out. Another feature at this point is that those in a hurry can walk along any one of the moving platforms and gain time; for instance, if a man walks at the rate of four miles per hour on the nine mile per hour platform, he will actually be moving in that particular direction at the rate of thirteen miles per hour. In addition to the advantages of constantly moving platforms with no waits for shuttle trains, and with entrances and exits at every cross-street, such as at Madison, Fifth and Sixth Avenues, an immense income could be derived from the stores and large advertising spaces along the platforms.

Referring once more to the platform and its operation, it will be seen how the motor-driven wheels under the rails of the platform sections will cause these sections to be propelled forward in a direction depending upon the rotation of the wheels. The endwise juncture between the sections and the moving platforms is on an even level, and they are closely curved on the order of a knuckle-joint so that no gap occurs between them. The rails of each section are so designed as to correspond both at front and back, and thus this unique design permits of the section moving around the loop curves in a smooth manner. Light steel posts, containing straps for the use of the "strap hangers' brigade," without which metropolitan life would lose a large part of its vim and pep, will be provided, as the illustration shows. Of course the chaps on the way home from the club will have to "mind their step," as the English say, or—well—WELL, by that time the Nation will be dry anyway, so we should worry!! And besides the late home-comers using the platform during the "G. M. hours" will most probably be lucky enough to find it pretty well deserted in the event that they may have drunk one too many glasses of near-beer or cherry flip.

Regarding the heating of this long tunnel, Mr. Smith has suggested that during severe cold weather the tunnel system, in which the moving platform was installed, could be steam-heated at regular intervals, and also special ventilating fans and baffle walls could easily be provided at the various stations, as well as at the terminals, so as to ensure the proper ventilation and heating of the passageway.

www.americanradiohistory.com



Copyright, 1919, by E. P. Co.

New York City Will Soon Have Something New To Interest Out-of-Town Visitors If This Recently Proposed Moving Platform Is Installed Under Forty-second Street to Connect the "Grand Central" and "Times Square" Subway Stations. There Are Three Moving Platforms, the One Carrying the Seats Traveling at 9 Miles Per Hour, and the Outer Two At 3 and 6 Miles Per Hour, Respectively. The Platform Required Would Measure 6,000 Feet or About 1¼ Miles, Have a Carrying Capacity of 10,000 Passengers, and Be Propelled By a Total of 250 Horsepower In Electric Motors. The Shuttle Trains May Be Retained for Emergency Use.

(For full description see opposite page)

www.americanradiohistory.com

The Unknown Purple

By DOROTHY KANT

WHAT would you do if you had the power to make yourself invisible—not by means of Aladdin's wonderful lamp, but by an actual scientific invention? Ask Dad, he knows! Thus, for instance, it certainly would be a boon to some delicately balanced husband, homeward bound, to escape the shark eye of his better half, not to mention the rolling pin; to some suspicious wife, etc., etc., *ad infinitum*. Then think what a shock it would be to a Hun general, after the blimp observers had spied an advancing American Army, with the guns ready to be set off, when whisto! the American army wasn't there at all! In other words Grimms' Fairy Tales in real life.

That other minds have peeped into the bright future of this wonderful invisible "source," which would make radium cheap by comparison, is well exemplified in the fact that not so long ago in the March and April, 1918, numbers of the ELECTRICAL EXPERIMENTER, in a story entitled "At War With the Invisible" the underlying idea of up-to-date scientific invisibility was shown. Here we had a young and handsome lady of the year 2011 who possest a bracelet of bells encircling her wrist, which bracelet was concealed to the human eye, or rather invisible to it, due to an optical invention of a certain scientist. . . .

The author of the "Unknown Purple" evidently thought along the same lines, for here we have a plot with almost the same underlying principle, wherein a certain scientist discovers and perfects a substance by which he can make himself invisible merely by holding that substance in his hand. But let us delve a little deeper into a play that seems to have so big a success with New York's critical audiences.

The scientist in this play who is incidentally our hero uses his invention to wreak vengeance upon his unfaithful wife and her paramour by making himself invisible and by playing pranks with the fortunes of both wife and lover.

But how does he do it and at the same time raise the tension of the audience to such a height that you can hear a "dew" drop?

One of our ingenious readers not so long ago wrote, jocularly, suggesting that we run a perfectly blank cover on the magazine under the caption *"Camouflaged Ship on the Ocean"*. The joke was supposed to be that the ship was so well camouflaged that you could not see it at all—hence the blank cover page! The authors of the "Unknown Purple" evidently used a similar line of reasoning on which they built up their play.

The problem was how to show a man walking across the stage who is supposed to be invisible. The answer is simplicity itself: don't show him at all, but make the audience believe that he is really there. This is certainly simplicity reduced *ad absurdum*. But in order to show that the man was really there,—altho, of course he wasn't,—something had to be done, else the audience would not be sufficiently imprest and would take the hero's "absent treatment" as a joke. So the authors simply have a purple spot light arranged overhead, which light travels at a slow gait across the stage, and the lighting effects are so cleverly arranged that the audience obtains the impression that the invisible man is really concealed within the purple shaft of light.

For some reason or other the authors seem to think that to make oneself invisible, such action should be electric and accompanied by a purple light, in order to heighten the tension and to give the mysterious touch that is particularly impressive on a lay audience. So, in addition, whenever the purple light appeared, and when our invisible hero was on the stage, the effect was still further heightened by a certain low buzz produced by a spark coil vibrator or the like and which buzz was supposed to emanate from the substance in the hero's hand which created the invisibility. Needless to say it had the desired effect and many a young damsel felt purple gooseskin take the place of her natural one, and becoming the recipient of creeps and thrills such as never were hers before.



Three Exciting Scenes from "The Unknown Purple." Left, the Invisible Hero Goading the Husband to Kill His Wife by Whispering into His Ear. Center, the Invisible Hero Once More in the Act of Foiling the Detectives. Right, Working on the Villain's Imagination by Talking to Him, the Hero of Course Being Invisible.

Of course, the usual stage tricks were resorted to, as for instance when our noble hero stealthily and invisibly opens the safe to abstract certain important papers. We thus see the purple spot or ray centered on the safe, amidst the mysterious buzzing sound—then the click of the combination as it is turned—the opening of the safe door slowly and mysteriously. Yes, you guest it, the safe was opened by invisible threads or strings, as no hands or anyone were visible. A similar trick was used whenever the hero entered the stage by means of the door. The door, of course, opened without any visible mechanical means and the solution in this case too obviously was strings or threads. There was only one scene that was staged elaborately and that was in the

(*Continued on page* 748)

www.americanradiohistory.com

Zeppelin Flew 4,130 Miles Round Trip from Bulgaria to Khartoum

A RECENT wireless dispatch from a Berlin correspondent contains some most interesting news concerning Teutonic developments in giant aircraft. It is said that the Germans are busy constructing a mammoth airplane intended to cross the Atlantic Ocean. This huge aërial craft, now under construction, is stated to have a wing spread of 198 feet, and it is to be engined by 3,000 horse-power in petrol motors.

The Teuton aërial flight experts are said to be busy constructing a gigantic Zeppelin craft at Friedrichshafen, which is to be propelled by nine engines and eight propellers. It will have a carrying capacity of one hundred passengers, and it is hoped that the international situation will clear up so that the first trans-oceanic flight may take place this coming July. The voyage across the Atlantic from a point in Germany to New York City is expected to take about forty hours.

But coming down to cold facts and past performances, the accompanying illustration shows one of the most remarkable aërial trips accomplisht during the great war, in which a giant Zeppelin flew from Jamboli, in Bulgaria, to a point over Khartoum, on the river Nile in Africa, a distance as the crow flies of 2,065 miles, and a distance of *4,130 miles for the non-stop return trip*. The Zeppelin carried a crew of twenty-two men besides twenty-five tons of ammunitions and medicines for the Teuton army in German East Africa. The great craft glided from its hangar at Jamboli at eight o'clock on the morning of November 21st, 1917. On the night of November 22nd-23rd, the monster airship had arrived over Khartoum, when it picked up a wireless message from the German radio station at Nauen, ordering it to return at once, as the Government at Berlin had ascertained in the meantime that the majority of Gen. von Lettou-Worbeck's troops had surrendered to the Allies.

Consequently the air-ship turned about in mid-air *without making a landing* and arrived at Jamboli at eight o'clock in the morning on November 25th. The technical director of the factory where this aërial craft was built has stated that a ship of this type was easily capable of flying from Berlin to New York and returning *without a stop*. The air-line distance from Berlin to New York City is approximately 3,930 miles, and the round trip distance would be 7,860 miles, or nearly eight thousand miles.

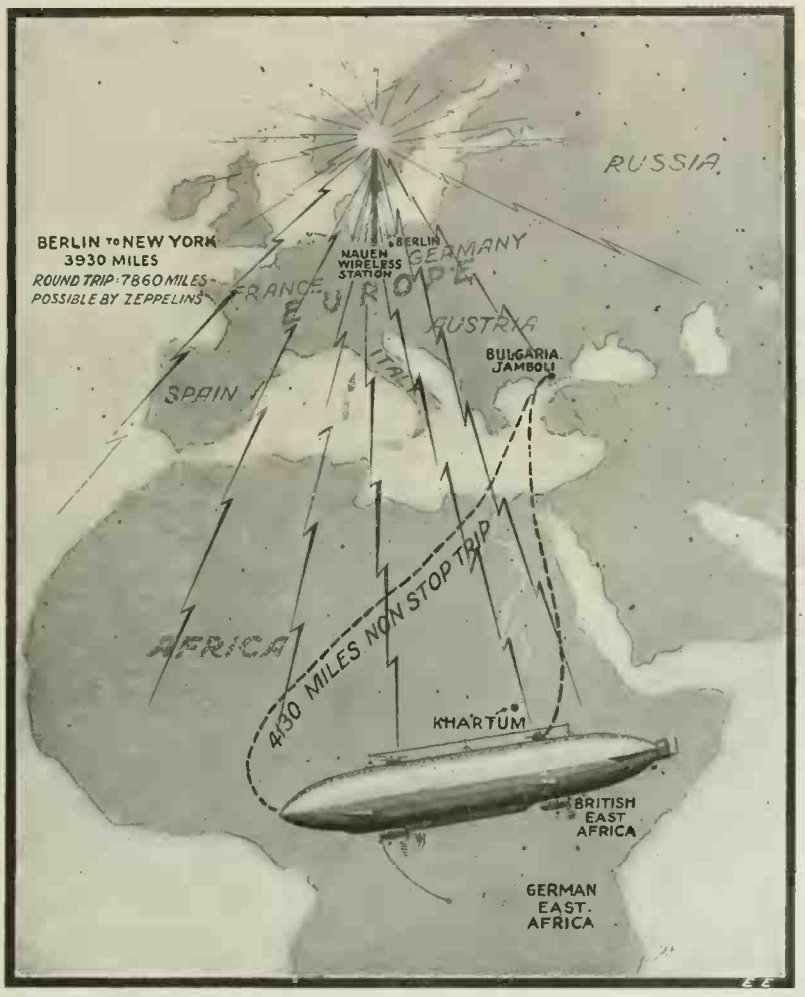
Talking of dirigible gas-bag types of aircraft, the U. S. Navy Department has just announced a remarkable new gas, which is available by a new process. Discovery of this new inert, non-inflammable gas for balloons, dirigibles and other lighter-than-air craft was revealed by the Navy Department on December 9th in a statement explaining expenditures for its production now being made jointly with the army.

The department states that the use of this new element, officially termed "argon," will eliminate the hazard of fire and explosion that always has accompanied balloon operations where "hydrogen" has been used to inflate the gas bags.

The gas from which "argon" is obtained comes from the wells at Petrolia, Tex., owned by the Lone Star Gas Company, the statement said, and a ten-inch pipe line to cost $1,050,000 is being laid for a distance of ninety-four miles from the wells to a plant at North Fort Worth, where the gas will be comprest into cylinders for shipment to the balloon fields.

High proof gasoline is obtained in a ratio of about five gallons per 1,000 cubic feet of gas, it was said, and after the 1 per cent of "argon" is removed, by agreement with the oil company, the remainder of the gas is turned into the city mains of Fort Worth and Dallas.

The Department estimates that the plant at North Fort Worth, designed by the Navy Bureau of Yards and Docks, and which will cost $900,000 will be completed by April 1.



Copyright, 1919, by E. P. Co.

One of the Great Scientific Feats of the World-War Was the Non-Stop Flight of a German Zeppelin Over the Route Here Illustrated—a Distance of 4,130 Miles. Such a Craft Could Fly Easily From Europe to New York, and the Engineers That Built the Airship Claim That It Is Capable of Flying From Berlin to New York and Return, Without Stopping.

INJURING THE EYES BY PHOTOGRAPHY.

When one sees so many veteran photographic workers, in both amateur and professional ranks, suffering from astigmatism, one wonders what is the actual cause of this distressing optical defect. On inquiry, it will be found that in many cases the eyes were strained during the early days of dryplate-photography, when the plates—then coated with a very slow emulsion—were handled, and examined during development, by the light of a deep ruby oil-lamp. Amateurs at first used advisedly a small pocket-lamp, and undoubtedly incurred serious injury to the sight. Later—thank goodness—light of greater volume was employed, ruby light being also superseded by orange light; preferably fabric instead of glass being used to expose the dryplates sparingly to the rays of this brighter light. Now the photographer confronts the danger of ruining his eyes from exposure to the electric arc when used for printing-purposes. To look at the bare arc is obviously injurious to the sight. Arc-rays reflected from the surface of the negatives are also bad for the eyes. A good plan is to use a printing-lamp in which only reflected light reaches the negatives, or to use a printing-cabinet in which the arc is enclosed, care being taken to cover up empty spaces with pieces of cardboard so that the arc or its reflections do not reach the printer's eyes.

www.americanradiohistory.com

Famous Scientific Illusions

By NIKOLA TESLA

Written specially for the Electrical Experimenter

In this original and revolutionizing discussion, Nikola Tesla gives us something really new to think about. First—Does the moon rotate on its axis? Second—Is the Franklin pointed lightning rod correct in theory and operation? Third—Do wireless signals fly thru space by means of so-called Hertzian waves in the ether, or are they propagated thru the earth at prodigious velocity by means of earth-bound oscillations? World-famous conundrums these—questions which have been answered in many ways by some of the greatest scientists. Dr. Tesla explains these three predominant scientific fallacies in a masterly way, so that everyone can understand them.

THE human brain, with all its wonderful capabilities and power, is far from being a faultless apparatus. Most of its parts may be in perfect working order, but some are atrophied, undeveloped or missing altogether. Great men of all classes and professions—scientists, inventors, and hard-headed financiers—have placed themselves on record with impossible theories, inoperative devices, and unrealizable schemes. It is doubtful that there could be found a single work of any one individual free of error. There is no such thing as an infallible brain. Invariably, some cells or fibers are wanting or unresponsive, with the result of impairing judgment, sense of proportion, or some other faculty. A man of genius eminently practical, whose name is a household word, has wasted the best years of his life in a visionary undertaking. A celebrated physicist was incapable of tracing the direction of an electric current according to a childishly simple rule. The writer, who was known to recite entire volumes by heart, has never been able to retain in memory and recapitulate in their proper order the words designating the colors of the rainbow, and can only ascertain them after long and laborious thought, strange as it may seem.

Our organs of reception, too, are deficient and deceptive. As a semblance of life is produced by a rapid succession of inanimate pictures, so many of our perceptions are but trickery of the senses, devoid of reality. The greatest triumphs of man were those in which his mind had to free itself from the influence of delusive appearances. Such was the revelation of Buddha that self is an illusion caused by the persistence and continuity of mental images; the discovery of Copernicus that, contrary to all observation, this planet rotates around the sun; the recognition of Descartes that the human being is an automaton, governed by external influence and the idea that the earth is spherical, which led Columbus to the finding of this continent. And tho the minds of individuals supplement one another and science and experience are continually eliminating fallacies and misconceptions, much of our present knowledge is still incomplete and unreliable. We have sophisms in mathematics which cannot be disproved. Even in pure reasoning, free of the shortcomings of symbolic processes, we are often arrested by doubt which the strong-

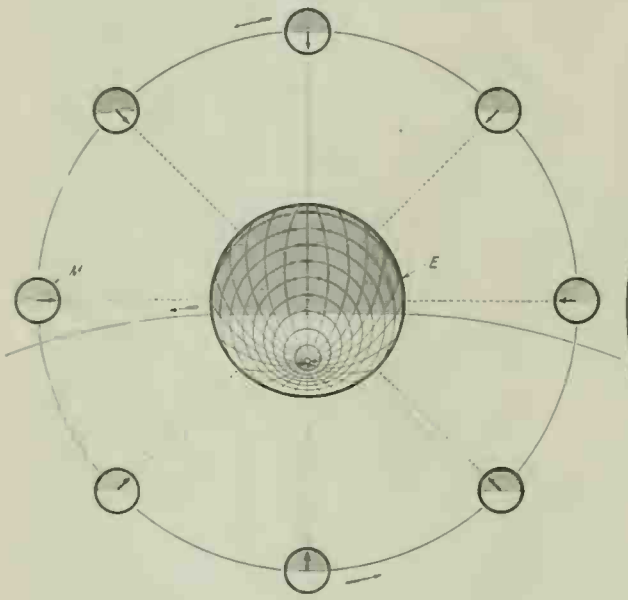


Fig. 1

It Is Well Known That the Moon, M., Always Turns the Same Face Toward the Earth, E, as the Black Arrows Indicate. The Parallel Rays From the Sun Illuminate the Moon in Its Successive Orbital Positions as the Unshaded Semi-circles Indicate. Bearing This in Mind, Do You Believe That the Moon Rotates on Its Own Axis?

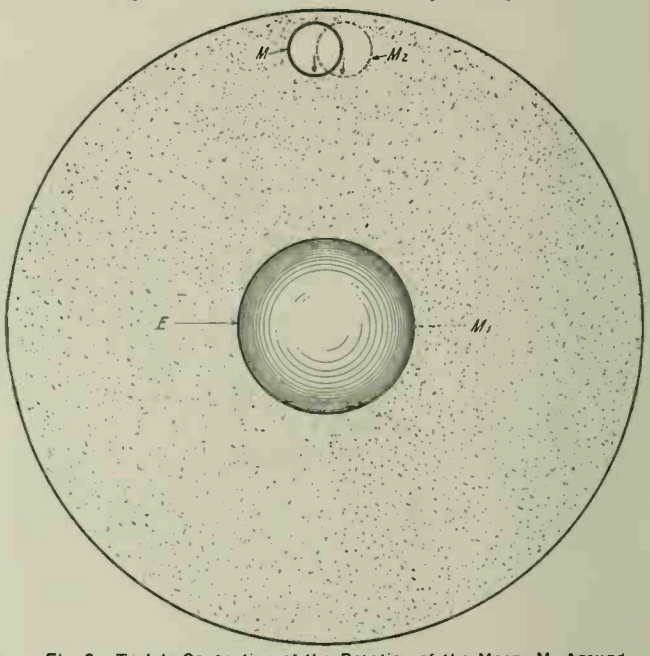


Fig. 2.—Tesla's Conception of the Rotation of the Moon, M, Around the Earth, E; the Moon, In This Demonstration Hypothesis, Being Considered as Embedded In a Solid Mass, M_1. If, As Commonly Believed, the Moon Rotates, This Would Be Equally True For a Portion of the Mass M_2, and the Part Common to Both Bodies Would Turn Simultaneously In "Opposite" Directions.

FOR over a century and a half the whole world, educated and otherwise, thought that the moon revolved around its axis. Nikola Tesla in the present highly instructive article disproves that theory and will convince scientists and all others alike that the moon does no such thing.

For thousands of years it was thought that the sun and stars revolved around the earth and all kinds of experimental proofs were furnished to substantiate this theory. The illustrious Galileo thought different, and everyone today knows that the earth revolves around the sun.

So it is with Tesla's discovery. Tesla also, in the second part of the present paper, shows us that the ancient and time-worn theory advanced by Benjamin Franklin as to the lightning conductor is not substantially correct as viewed by latter day science. It will come as a shock even to our professors that the lightning rod actually aids the lightning in hitting the building. The reason is that the lightning rod helps in ionizing (making conductive) the surrounding air.

Mr. Tesla has devised a lightning conductor with no points, and there is no doubt whatsoever that his theory is right. Scientists the world over will acknowledge this very shortly.

In a third section of the same paper Tesla explodes still another popular delusion, viz., that wireless waves follow the curvature of the earth when messages are transmitted, let us say from a point in the United States to a point in Europe. In his revolutionary arguments, supported by facts as well as by logic, Tesla shows why the currents do not travel around the earth but directly thru it. In other words, Tesla maintains that wireless communication is accomplished ONLY thru the medium of the earth itself. His contention seems very sound. If it were not so, let every wireless station, commercial or otherwise, do away with its ground connection. None could then operate as is well known, except perhaps over very limited distances.

Mr. Tesla's present article will arouse world-wide comment due to the revolutionary philosophy contained therein. We are sure our readers will appreciate Mr. Tesla's most timely and illuminating article on this but little understood subject.

Copyright, 1919, by E. P Co. All rights reserved.

www.americanradiohistory.com

est intelligences have been unable to dispel. Experimental science itself, most positive of all, is not unfailing.

In the following I shall consider three exceptionally interesting errors in the interpretation and application of physical phenomena which have for years dominated the minds of experts and men of science.

I. The Illusion of the Axial Rotation of the Moon.

It is well known since the discovery of Galileo that the moon, in travelling thru space, always turns the same face towards the earth. This is explained by stating that, while passing once around its mother-planet the lunar globe performs just one revolution on its axis. The spinning motion of a heavenly body must necessarily undergo modifications in the course of time, being either retarded by resistances internal or external, or accelerated owing to shrinkage and other causes. An unalterable rotational velocity thru all phases of planetary evolution is manifestly impossible. What wonder, then, that at this very instant of its long existence our satellite should revolve exactly so, and not faster or slower. But many astronomers have accepted as a physical fact that such rotation takes place. It does not, but only appears so; it is an illusion, a most surprising one, too.

I will endeavor to make this clear by reference to Fig. 1, in which E represents the earth and M the moon. The movement thru space is such that the arrow, firmly attached to the latter, always occupies the position indicated with reference to the earth. If one imagines himself as looking down on the orbital plane and follows the motion he will become convinced that the moon *does* turn on its axis as it travels around. But in this very act the observer will have deceived himself. To make the delusion complete let him take a washer similarly marked and supporting it rotatably in the center, carry it around a stationary object, constantly keeping the arrow pointing towards the latter. Tho to his bodily vision the disk will revolve on its axis, such movement does not exist. He can dispel the illusion at once by holding the washer fixedly while going around. He will now readily see that the supposed axial rotation is only apparent, the impression being produced by successive changes of position in space.

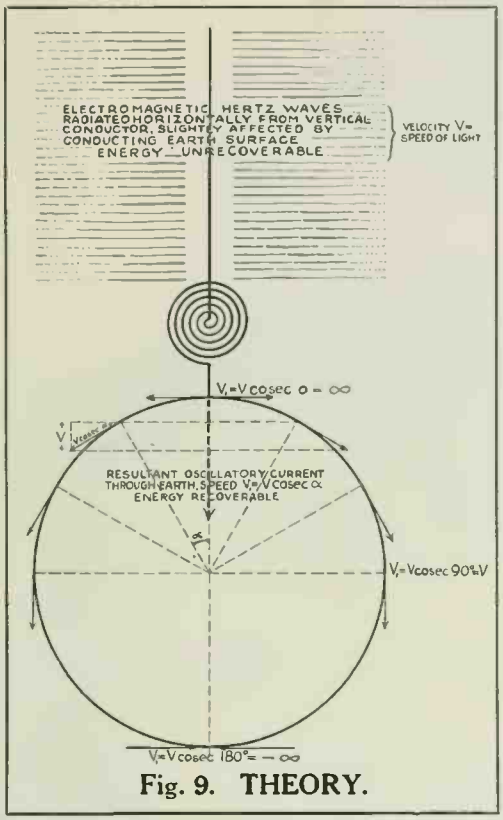
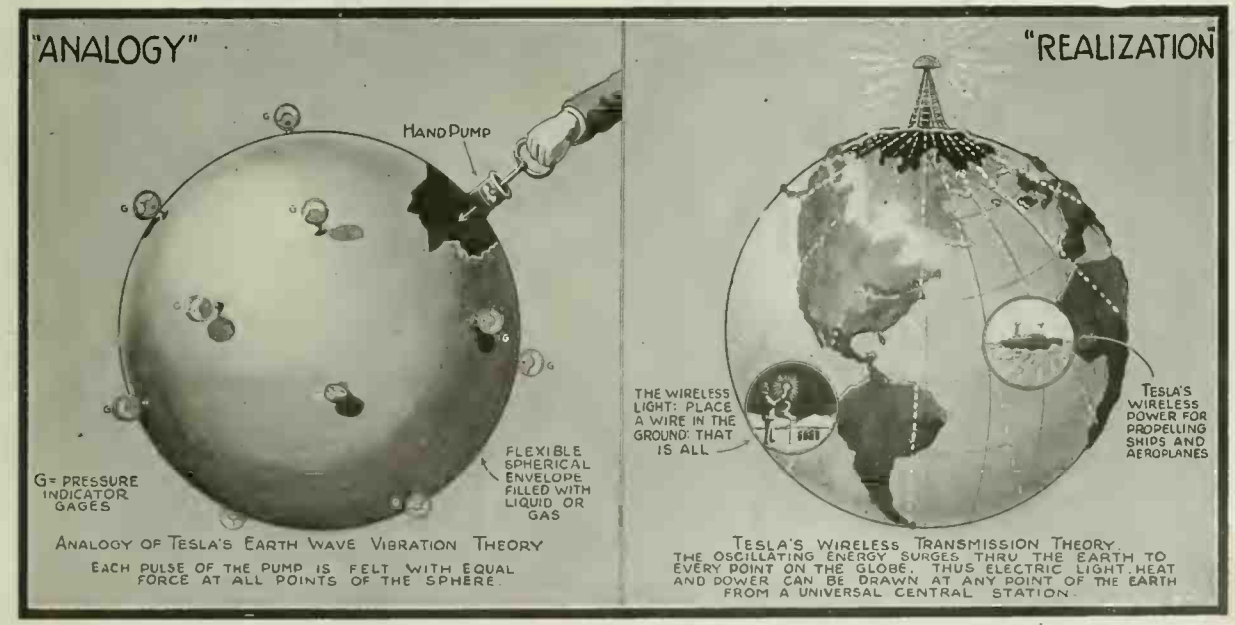


Fig. 9. THEORY.

But more convincing proofs can be given that the moon does not, and cannot revolve on its axis. With this object in view attention is called to Fig. 2, in which both the satellite, M, and earth, E, are shown embedded in a solid mass, M_1 (indicated by stippling) and supposed to rotate so as to impart to the moon its normal translatory velocity. Evidently, if the lunar globe could rotate as commonly believed, this would be equally true of any other portion of mass M_1, as the sphere M_2, shown in dotted lines, and then the part common to both bodies would have to turn *simultaneously in opposite directions*. This can be experimentally illustrated in the manner suggested by using instead of one, two overlapping rotatable washers, as may be conveniently represented by circles M and M_2, and carrying them around a center as E, so that the plain and dotted arrows are always pointing towards the same center. No further argument is needed to demonstrate that the two gyrations cannot co-exist or even be pictured in the imagination and reconciled in a purely abstract sense.

The truth is, the so-called "axial rotation" of the moon is a phenomenon deceptive alike to the eye and mind and devoid of physical meaning. It has nothing in common with real mass revolution characterized by effects positive and unmistakable. Volumes have been written on the subject and many erroneous arguments advanced in support of the notion. Thus, it is reasoned, that if the planet did *not* turn on its axis it would expose the whole surface to terrestrial view; as only one-half is visible, it *must* revolve. The first statement is true but the logic of the second is defective, for it admits of only one alternative. The conclusion is not justified as the same appearance can also be produced in another way. The moon does rotate, not on its own, but about an axis passing thru the center of the earth, the true and only one.

The unfailing test of the spinning of a mass is, however, the existence of



Tesla's World-Wide Wireless Transmission of Electrical Signals, As Well As Light and Power, Is Here Illustrated In Theory, Analogy and Realization. Tesla's Experiments With 100 Foot Discharges At Potentials of Millions of Volts Have Demonstrated That the Hertz Waves Are Infinitesimal In Effect and Unrecoverable; the Recoverable Ground Waves of Tesla Fly "Thru the Earth". Radio Engineers Are Gradually Beginning to See the Light and That the Laws of Propagation Laid Down by Tesla Over a Quarter of a Century Ago Form the Real and True Basis of All Wireless Transmission To-Day.

www.americanradiohistory.com

energy of motion. The moon is not possest of such energy. If it were the case then a revolving body as M₁ would contain mechanical energy other than that of which we have experimental evidence. Irrespective of this so exact a coincidence between the axial and orbital periods is, in itself, immensely improbable for this is not the permanent condition towards which the system is tending. Any axial rotation of a mass left to itself, retarded by forces external or internal, must cease. Even admitting its perfect control by tides the coincidence would still be miraculous. But when we remember that most of the satellites exhibit this peculiarity, the probability becomes infinitesimal.

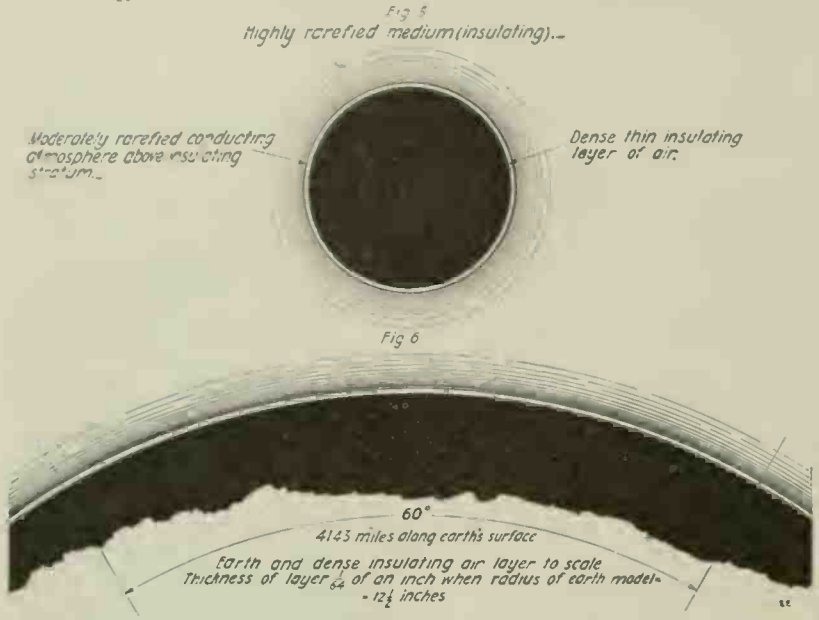
Three theories have been advanced for the origin of the moon. According to the oldest suggested by the great German philosopher Kant, and developed by Laplace in his monumental treatise "Mécanique Céleste", the planets have been thrown off from larger central masses by centrifugal force. Nearly forty years ago Prof. George H. Darwin in a masterful essay on tidal friction furnished mathematical proofs, deemed unrefutable, that the moon had separated from the earth. Recently this established theory has been attacked by Prof. T. J. J. See in a remarkable work on the "Evolution of the Stellar Systems", in which he propounds the view that centrifugal force was altogether inadequate to bring about the separation and that all planets, including the moon, have come from the depths of space and have been captured. Still a third hypothesis of unknown origin exists which has been examined and commented upon by Prof. W. H. Pickering in "Popular Astronomy of 1907", and according to which the moon was torn from the earth when the later was partially solidified, this accounting for the continents which might not have been formed otherwise.

Undoubtedly planets and satellites have originated in both ways and, in my opinion, it is not difficult to ascertain the character of their birth. The following conclusions can be safely drawn:

1. A heavenly body thrown off from a larger one cannot rotate on its axis. The mass, rendered fluid by the combined action of heat and pressure, upon the reduction of the latter immediately stiffens, being at the same time deformed by gravitational pull. The shape becomes permanent upon cooling and solidification and the smaller mass continues to move about the larger one as tho it were rigidly connected to it except for pendular swings or librations due to varying orbital velocity. Such motion precludes the possibility of axial rotation in the strictly physical sense. The moon has never spun around as is well demonstrated by the fact that the most precise measurements have failed to show any measurable flattening in form.

2. If a planetary body in its orbital movement turns the same side towards the central mass this is a positive proof that it has been separated from the latter and is a true satellite.

3. A planet revolving on its axis in its passage around another cannot have been thrown off from the same but must have been captured.



A Section of the Earth and Its Atmospheric Envelope Drawn to Scale. It Is Obvious That the Hertzian Rays Cannot Traverse So Thin a Crack Between Two Conducting Surfaces For Any Considerable Distance, Without Being Absorbed, Says Dr. Tesla, In Discussing the Ether Space Wave Theory.

II. The Fallacy of Franklin's Pointed Lightning-Rod.

The display of atmospheric electricity has since ages been one of the most marvelous spectacles afforded to the sight of man. Its grandeur and power filled him with fear and superstition. For centuries he attributed lightning to agents god-like and supernatural and its purpose in the scheme of this universe remained unknown to him. Now we have learned that the waters of the ocean are raised by the sun and maintained in the atmosphere delicately suspended, that they are wafted to distant regions of the globe where electric forces assert themselves in upsetting the sensitive balance and causing precipitation, thus sustaining all organic life. There is every reason to hope that man will soon be able to control this life-giving flow of water and thereby solve many pressing problems of his existence.

Atmospheric electricity became of special scientific interest in Franklin's time. Faraday had not yet announced his epochal discoveries in magnetic induction but static frictional machines were already generally used in physical laboratories. Franklin's powerful mind at once leaped to the conclusion that frictional and atmospheric electricity were identical. To our present view this inference appears obvious, but in his time the mere thought of it was little short of blasphemy. He investigated the phenomena and argued that if they were of the same nature then the clouds could be drained of their charge exactly as the ball of a static machine, and in 1749 he indicated in a publisht memoir how this could be done by the use of pointed metal rods.

(*Continued on page 728*)

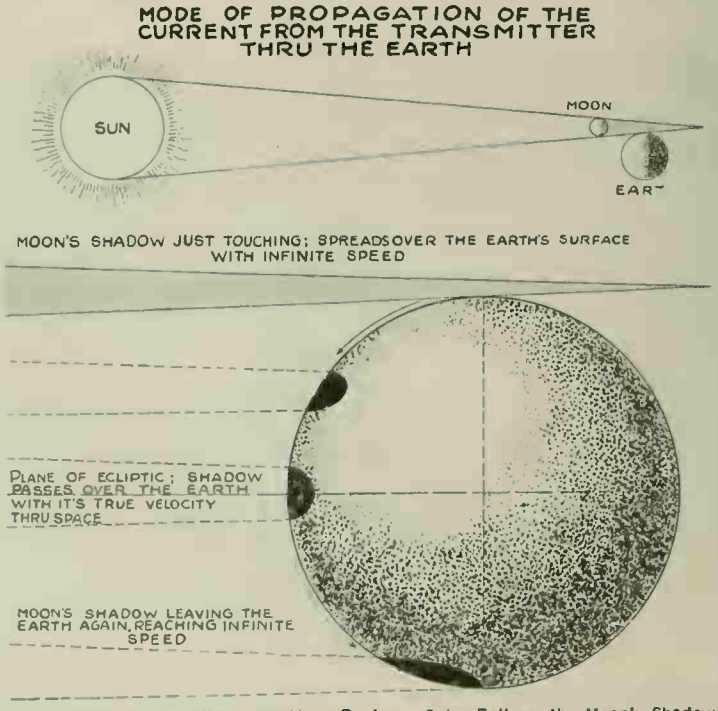


Fig. 8.—This Diagram Illustrates How, During a Solar Eclipse, the Moon's Shadow Passes Over the Earth With Changing Velocity, and Should Be Studied In Connection With Fig. 9. The Shadow Moves Downward With Infinite Velocity at First, Then With Its True Velocity Thru Space, and Finally With Infinite Velocity Again.

www.americanradiohistory.com

Curing Soldiers' Ills with Electricity

By PAULINE BERGINS

ELECTRICITY is playing no mean rôle in the vast reconstruction work now being carried on in the great Red Cross as well as Army and Navy hospitals thruout the country. Not only has the electric current been cleverly employed in many diversified ways to treat the many ills and maladies with which the soldiers and sailors have been afflicted in this country, but thousands of these appliances have been and are being used every day in the field hospitals in France, and in other lands which were not many months ago raging battlefields. Portable yet powerful X-ray ambulances sped over the battlefields but a few miles behind the front line trenches, ever ready to loan a helping hand in the merciful work of the medical corps. And not only do we find in these shell-torn regions the invaluable





Three Interesting Views Showing Electricity's Role In the Reconstruction Work of the Army Hospitals. Above: Fig. 2, Soldier Patient Receiving Electric Arm Bath Treatment For Rheumatism, at the American Red Cross War Hospital at Paignton, Devon, France. Fig. 1, Below, Shows American Soldier Being Treated in the Bergonié Electric Chair, Extensively Used for Shell Shock Treatment, at Fort MacPherson, Ga. Fig. 3, at Left, Illustrates the Electric Light Bath Cabinet in Use. A Wounded Marine Is Enjoying the Glowing Warmth Produced By This Electrotherapeutic Apparatus For Treating Sore and Stiffened Muscles.

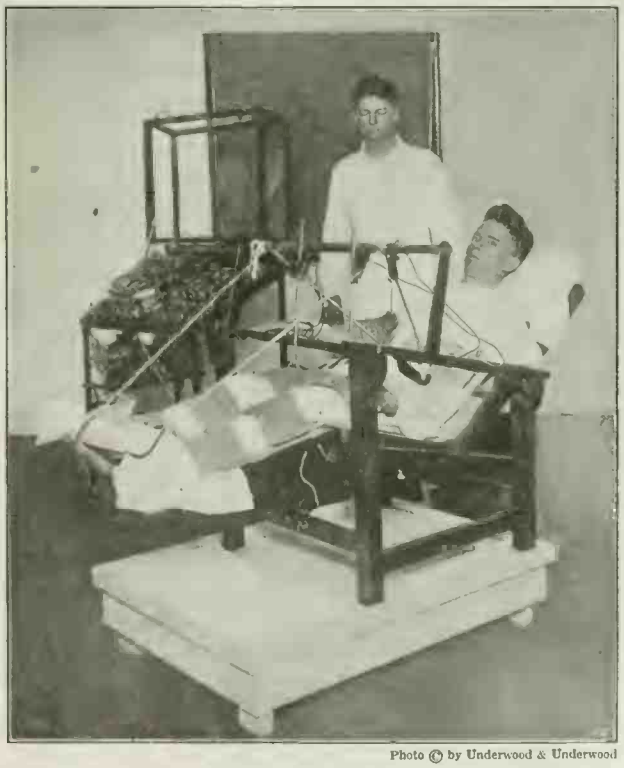


Photo © by Underwood & Underwood

X-ray machines, but many other appliances such as electric heating devices for the treatment of "trench feet", electric sterilizers and cauterizers, Faradic outfits for the treatment of lameness and rheumatism, electric light baths, etc.

The accompanying photographs show several very interesting and practical applications of the electric current for the treatment of war ills. The photograph, Fig. 1, showing an American soldier seated in the large reclining chair, was taken at Fort MacPherson, Ga. This curious and complicated looking electric outfit comprises one of the most wonderful electro-medical devices ever invented—the "Bergonié" Electric Chair. The Bergonié invention involves the application of low voltage electric currents of peculiar wave form to the patient's body while seated in the chair here shown, the body being weighted with a number of sand bags. The switch-board in the background contains a number of regulating rheostats and motor-driven interrupters as well as measuring instruments, such as a voltmeter and milliampere meter for indicating the strength of the current applied to the patient. The Bergonié chair treatment produces rythmic pulsations in the nerves and muscles and has been found very efficacious for shell-shock victims as well as for treating severe nervous cases caused by excessive fatigue, and for over-strained muscles and cords.

There are more shell-shock victims from this great World War than there have been in any other. And therefore, the fact that the Bergonié electric chair will help to alleviate and cure these cases, is indeed a great blessing.

It might be said that the majority of shell-shock victims lose a part or all of their mental faculties, and to all appearances cannot use their reason at all. They have all sorts of delusions as to whom their folks are, or where their home is. Practically everyone has heard of, or has been in contact with, one or more cases of shell-shock, and so it is not necessary to expatiate further on this important phase of the problem of reconstruction, except to say that the various hospitals and sanitariums engaged in this work are doing wonders over night, literally as well as metaphorically, for some of these cases of shell-shock are cured suddenly and instantly by the most peculiar incident or happening. In a large French hospital just prior to the signing of the armistice there

(*Continued on page* 748)

www.americanradiohistory.com

My Inventions

By Nikola Tesla

1. MY EARLY LIFE

THE progressive development of man is vitally dependent on invention. It is the most important product of his creative brain. Its ultimate purpose is the complete mastery of mind over the material world, the harnessing of the forces of nature to human needs. This is the difficult task of the inventor who is often misunderstood and unrewarded. But he finds ample compensation in the pleasing exercises of his powers and in the knowledge of being one of that exceptionally privileged class without whom the race would have long ago perished in the bitter struggle against pitiless elements.

Speaking for myself, I have already had more than my full measure of this exquisite enjoyment, so much that for many years my life was little short of continuous rapture. I am credited with being one of the hardest workers and perhaps I am, if thought is the equivalent of labor, for I have devoted to it almost all of my waking hours. But if work is interpreted to be a definite performance in a specified time according to a rigid rule, then I may be the worst of idlers. Every effort under compulsion demands a sacrifice of life-energy. I never paid such a price. On the contrary, I have thrived on my thoughts.

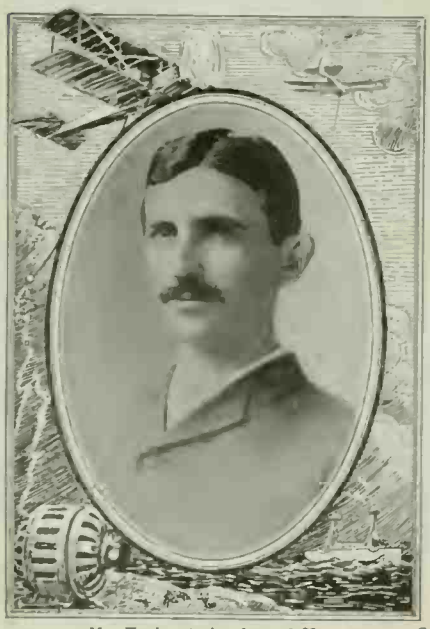
In attempting to give a connected and faithful account of my activities in this series of articles which will be presented with the assistance of the Editors of the ELECTRICAL EXPERIMENTER and are chiefly addrest to our young men readers, I must dwell, however reluctantly, on the impressions of my youth and the circumstances and events which have been instrumental in determining my career.

Our first endeavors are purely instinctive, promptings of an imagination vivid and undisciplined. As we grow older reason asserts itself and we become more and more systematic and designing. But those early impulses, tho not immediately productive, are of the greatest moment and may shape our very destinies. Indeed, I feel now that had I understood and cultivated instead of suppressing them, I would have added substantial value to my bequest to the world. But not until I had attained manhood did I realize that I was an inventor.

This was due to a number of causes. In the first place I had a brother who was gifted to an extraordinary degree—one of those rare phenomena of mentality which biological investigation has failed to explain. His premature death left my parents disconsolate. We owned a horse which had been presented to us by a dear friend. It was a magnificent animal of Arabian breed, possest of almost human intelligence, and was cared for and petted by the whole family, having on one occasion saved my father's life under remarkable circumstances. My father had been called one winter night to perform an urgent duty and while crossing the mountains, infested by wolves, the horse became frightened and ran away, throwing him violently to the ground. It arrived home bleeding and



Nikola Tesla at the Age of 23.
From An Unpublished Photograph.



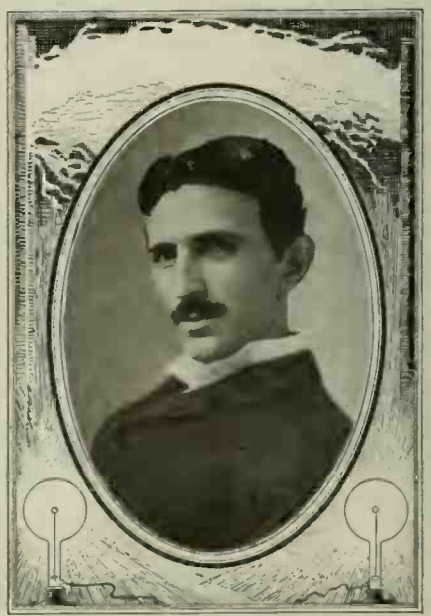
Mr. Tesla at the Age of 29.

HOW does the world's greatest inventor invent? How does he carry out an invention? What sort of mentality has Nikola Tesla? Was his early life as commonplace as most of ours? What was the early training of one of the World's Chosen? These, and many other very interesting questions are answered in an incomparable manner by Nikola Tesla himself in this, his first article.

In his autobiography, treating mainly on his early youth, we obtain a good insight into the wonderful life this man has led. It reads like a fairy tale, which has the advantage of being true. For Tesla is no common mortal. He has led a charmed life—struck down by the pest, the cholera and what not—given up by doctors at least three times as dead—we find him at sixty, younger than ever. But—read his own words. You have never read the like before.

—Editor.

Copyright, 1919, by E. P. Co. All rights reserved.



Mr. Tesla at the Age of 39.

www.americanradiohistory.com

exhausted, but after the alarm was sounded immediately dashed off again, returning to the spot, and before the searching party were far on the way they were met by my father, who had recovered consciousness and remounted, not realizing that he had been lying in the snow for several hours. This horse was responsible for my brother's injuries from which he died. I witnest the tragic scene and altho fifty-six years have elapsed since, my visual impression of it has lost none of its force. The recollection of his attainments made every effort of mine seem dull in comparison.

Anything I did that was creditable merely caused my parents to feel their loss more keenly. So I grew up with little confidence in myself. But I was far from being considered a stupid boy, if I am to judge from an incident of which I have still a strong remembrance. One day the Aldermen were passing thru a street where I was at play with other boys. The oldest of these venerable gentlemen—a wealthy citizen—paused to give a silver piece to each of us. Coming to me he suddenly stopt and commanded, "Look in my eyes." I met his gaze, my hand outstretched to receive the much valued coin, when, to my dismay, he said, "No, not much, you can get nothing from me, you are too smart." They used to tell a funny story about me. I had two old aunts with wrinkled faces, one of them having two teeth protruding like the tusks of an elephant which she buried in my cheek every time she kist me. Nothing would scare me more than the prospect of being hugged by these as affectionate as unattractive relatives. It happened that while being carried in my mother's arms they asked me who was the prettier of the two. After examining their faces intently, I answered thoughtfully, pointing to one of them, "This here is not as ugly as the other."

Then again, I was intended from my very birth for the clerical profession and this thought constantly opprest me. I longed to be an engineer but my father was inflexible. He was the son of an officer who served in the army of the Great Napoleon and, in common with his brother, professor of mathematics in a prominent institution, had received a military education but, singularly enough, later embraced the clergy in which vocation he achieved eminence. He was a very erudite man, a veritable natural philosopher, poet and writer and his sermons were said to be as eloquent as those of Abraham a Sancta-Clara. He had a prodigious memory and frequently recited at length from works in several languages. He often remarked playfully that if some of the classics were lost he could restore them. His style of writing was much admired. He penned sentences short and terse and was full of wit and satire. The humorous remarks he made were always peculiar and characteristic. Just to illustrate, I may mention one or two instances. Among the help there was a cross-eyed man called Mane, employed to do work around the farm. He was chopping wood one day. As he swung the axe my father, who stood nearby and felt very uncomfortable, cautioned him, "For God's sake, Mane, do not strike at what you are looking but at what you intend to hit." On another occasion he was taking out for a drive a friend who carelessly permitted his costly fur coat to rub on the carriage wheel. My father reminded him of it saying, "Pull in your coat, you are ruining my tire." He had the odd habit of talking to himself and would often carry on an animated conversation and indulge in heated argument, changing the tone of his voice. A casual listener might have sworn that several people were in the room.

Altho I must trace to my mother's influence whatever inventiveness I possess, the training he gave me must have been helpful. It comprised all sorts of exercises—as, guessing one another's thoughts, discovering the defects of some form or expression, repeating long sentences or performing mental calculations. These daily lessons were intended to strengthen memory and reason and especially to develop the critical sense, and were undoubtedly very beneficial.

My mother descended from one of the oldest families in the country and a line of inventors. Both her father and grandfather originated numerous implements for household, agricultural and other uses. She was a truly great woman, of rare skill, courage and fortitude, who had braved the storms of life and past thru many a trying experience. When she was sixteen a virulent pestilence swept the country. Her father was called away to administer the last sacraments to the dying and during his absence she went alone to the assistance of a neighboring family who were stricken by the dread disease. All of the members, five in number, succumbed in rapid succession. She bathed, clothed and laid out the bodies, decorating them with flowers according to the custom of the country and when her father returned he found everything ready for a Christian burial. My mother was an inventor of the first order and would, I believe, have achieved great things had she not been so remote from modern life and its multifold opportunities. She invented and constructed all kinds of tools and devices and wove the finest designs from thread which was spun by her. She even planted the seeds, raised the plants and separated the fibers herself. She worked indefatigably, from break of day till late at night, and most of the wearing apparel and furnishings of the home was the product of her hands. When she was past sixty, her fingers were still nimble enough *to tie three knots in an eyelash.*

There was another and still more important reason for my late awakening. In my boyhood I suffered from a peculiar affliction due to the appearance of images, often accompanied by strong flashes of light, which marred the sight of real objects and interfered with my thought and action. They were pictures of things and scenes which I had really seen, never of those I imagined. When a word was spoken to me the image of the object it designated would present itself vividly to my vision and sometimes I was quite unable to distinguish whether what I saw was tangible or not. This caused me great discomfort and anxiety. None of the students of psychology or physiology whom I have consulted could ever explain satisfactorily these phenomena. They seem to have been unique altho I was probably predisposed as I know that my brother experienced a similar trouble. The theory I have formulated is that the images were the result of a reflex action from the brain on the retina under great excitation. They certainly were not hallucinations such as are produced in diseased and anguished minds, for in other respects I was normal and composed. To give an idea of my distress, suppose that I had witnest a funeral or some such

(Continued on page 743)

NIKOLA TESLA
THE MAN
By H. Gernsback

THE door opens and out steps a tall figure—over six feet high—gaunt but erect. It approaches slowly, stately. You become conscious at once that you are face to face with a personality of a high order. Nikola Tesla advances and shakes your hand with a powerful grip, surprising for a man over sixty. A winning smile from piercing light blue-gray eyes, set in extraordinarily deep sockets, fascinates you and makes you feel at once at home.

You are guided into an office immaculate in its orderliness. Not a speck of dust is to be seen. No papers litter the desk, everything just so. It reflects the man himself, immaculate in attire, orderly and precise in his every movement. Drest in a dark frock coat, he is entirely devoid of all jewelry. No ring, stickpin, or even watch-chain can be seen.

Tesla speaks—a very high almost falsetto voice. He speaks quickly and very convincingly. It is the man's voice chiefly which fascinates you.

As he speaks you find it difficult to take your eyes off his own. Only when he speaks to others do you have a chance to study his head, predominant of which is a very high forehead with a bulge between the eyes—the neverfailing sign of an exceptional intelligence. Then the long, well-shaped nose, proclaiming the scientist.

How does this man, who has accomplished such a tremendous work, keep young and manage to surprise the world with more and more new inventions as he grows older? How does this youth of sixty, who is a professor of mathematics, a great mechanical and electrical engineer and the greatest inventor of all times, keep his physical as well as remarkable mental freshness?

To begin with, Tesla, who is by birth a Serbian, comes from a long-lived hardy race. His family tree abounds with centenarians. Accordingly, Tesla—barring accidents—fully expects to be still inventing in A. D. 1960.

But the chief reason for his perpetual youth is found in his gastronomical frugality. Tesla has learned the great fundamental truth that most people not only eat all of their bodily ills, but actually eat themselves to death by either eating too much or else by food that does not agree with them.

When Tesla found out that tobacco and black coffee interfered with his physical well-being, he quit both. This is the simple daily menu of the great inventor:

Breakfast: One to two pints of warm milk and a few eggs, prepared by himself—yes, he is a bachelor!

Lunch: None whatsoever, as a rule.

Dinner: Celery or the like, soup, a single piece of meat or fowl, potatoes and one other vegetable; a glass of light wine. For dessert, perhaps a slice of cheese, and invariably a big raw apple. And that's all.

Tesla is very fussy and particular about his food: he eats very little, but what he does eat must be of the very best. And he knows, for outside of being a great inventor in science he is an accomplished cook who has invented all sorts of savory dishes.

His only vice is his generosity. The man who, by the ignorant onlooker has often been called an idle dreamer, has made over a million dollars out of his inventions—and spent them as quickly on new ones. But Tesla is an idealist of the highest order and to such men money itself means but little.

www.americanradiohistory.com

Subways of Down-Town New York

THE down-town section of lower New York, including the financial or banking district in the vicinity of Wall and Broad Streets, and other well-known thorofares, such as Broadway and the Bowling Green section, bids fair to become the most thoroly subwayed section of any city in the world. A glance at the accompanying illustration, prepared by Mr. George Wall, a well-known New York artist, shows clearly some of the most ingenious engineering features connected with the gigantic subway plans which have been worked out for this narrow strip of land, which constitutes one of the most thickly populated districts anywhere in the world. Here office buildings rise twenty to thirty stories in the air, —while the heavy steel trains rumble along thru the bowels of the earth under these gigantic business structures day and night. Lucky for New York that it has a very solid rock foundation, or it is doubtful if all the ambitious subway and other arteries of travel now in operation and contemplated, could be operated with any degree of safety. In preparing the accompanying illustration, courtesy is due to the engineers of the Public Service Commission, who have supplied the necessary information concerning the various subway routes here illustrated, several of which are now under construction and not just yet in operation.

In looking at this illustration of down-town New York, the well-known "battery loop" section is shown at the bottom, the top of the illustration being north, the bottom south, and the right and left—east and west respectively. The insert map shows the general plan of the subway systems including the Hudson Tubes under the North River, as well as the Pennsylvania Railroad Tunnels under the North and East Rivers. Beginning at the west side of the perspective view we come to the new West Side Subway, sometimes referred to as the 7th Avenue Subway. This is a two-track underground railway, which runs under the 9th Avenue Elevated Railroad, as becomes apparent. A down-town train moving toward the Battery, on the West Side track, passes down around the loop on the outer or "A" track, and after it has past the Battery Subway Station, goes down an incline so as to complete its loop, two levels underground, thru a tunnel which passes under the East Side Subway (which runs on Broadway in this district) and comes out on the up-town track running north, as the second arrow "A" indicates. Right here we have one of the most unique and clever bits of subway engineering imaginable, for this two-track system fulfills two important functions.

Firstly, and as just explained, it serves as the *return loop* for the trains of the West Side Subway. Secondly, the inner track of this battery loop, or track "B," is used to return the local trains of the East Side Subway (also referred to as the old Broadway Subway), and by following the inner or "B" track around the loop, by means of the dotted lines, it will be seen that the down-town or south-bound local train can complete the loop, and eventually swing around on to the north-bound local track. The two center tracks of the East Side Subway go to Brooklyn, and are the express tracks. As the dotted lines convey, these trains dive downward two levels and pass thru the two westerly East River Tubes, one of the tubes carrying the trains to Brooklyn, and the other the trains returning from Brooklyn to New York. The East Side Subway is the older one, and the one that visitors are most familiar with and until recently,—when the change was made to the subway shuttle service between the Grand Central station and Times Square, due to the opening of the West Side Subway,—the route of the East Side Subway trains was northward from the Brooklyn Bridge terminus along Fourth Avenue, to Park Avenue, Grand Central station, thence westward under 42nd Street, then northward along Broadway, etc. At the present time, owing to the change caused by the shuttle service put into effect between the Grand Central and Times Square stations, these trains make a turn to the eastward, at Grand Central station, and then proceed northward along Lexington Avenue.

The next subway of interest is the new Triboro Subway, which is often referred to as the B. R. T. Subway, but the official name given to it just recently, is the *Triboro Subway System*. These trains will come from Brooklyn thru two new under-river tubes shown in the illustration, and proceed along under Whitehall Street at a depth of two levels, so as to pass under the East Side Subway, as the illustration clearly shows. The most southerly point of operation at the present time, is the Whitehall Street station. Passengers going south transfer at Canal Street for Brooklyn. This subway passes along Church Street, and there is a station in the Hudson Terminal Building. Somewhat north of this, it makes a turn eastward and passes back to Broadway, and from here it runs north along Broadway to Times Square. At this point there is a station two levels underground with communicating passageways, so that at this interesting transfer station a passenger may take one of several subway routes, to up-town or down-town New York, or to Brooklyn, as well as to Queens, *via* the Queensboro Subway, which operates from the Grand Central Station under the East River, thru the Steinway tunnel.

The Triboro Subway makes a turn north-eastward at 44th Street, and then runs under Seventh Avenue directly north to 59th Street, then proceeds eastward across New York at the south side of Central Park, and passes under the East River to Queens.

Referring to the two river tubes down at the Battery where the Pump Station and Construction Shaft are shown, it is interesting to note that but two tunnels will be utilized at this point to take care of four distinct arteries of subway traffic, i.e., the Brooklyn-bound subway trains from the Triboro line, as well as those from the Nassau-Broad Street Subway, as the arrows indicate; while the other East River Tube takes care of New York-bound subway trains for the Triboro and Nassau-Broad Streets Subways. This remarkable engineering feat is taken care of by means of two interlocking two-way switches in the switch bulkheads shown at this point, and, of course, a very elaborate system of interlocking switches and signals has been provided in order to prevent any collisions, as may well be imagined. It must be said to the credit of the New York Subway System, that there have been very few accidents, and these were very slight, due to the fact that very accurate and cleverly conceived electrical safety systems are in use, whereby one train cannot pass into the next "block," while it is still occupied by another train.

At present the two westerly under-river tubes leading to the Triboro Subway at the Battery are finished and ready for use, but the two easterly branches are dead-ended a short way underground, in the vicinity of the Construction Shaft.

The "Interboro" William Street Subway will soon be completed and connects with the West Side Subway, running across town at Park Place, diving underneath the East Side Subway in order to reach its destination. The William Street Subway will pass thru the Clark Street Tunnel to Brooklyn (under the East River), and will connect with the present I. R. T. system in Brooklyn between Borough Hall and Hoyt Street stations. This tunnel takes its name from Clark Street, Brooklyn.

In this illustration, the several modes of travel available in New York City are vividly depicted by the artist, including the surface or trolley cars which run along the various streets, as well as under the elevated railways. In the Battery district, here illustrated, the 6th Avenue and 9th Avenue elevated roads are shown just below Rector Street, the 6th Avenue and 9th Avenue "L" lines branching into one another, and run as a single system down to the Battery Station, which is just above the Battery Subway Station. A similar plan is followed in the operation of the 2nd and 3rd Avenue "L" lines, as the illustration indicates. Thus two lines run as a single system from the Battery "L" Station up to a short way past the Brooklyn Bridge, where they branch out into two distinct lines of traffic. From this point one elevated system runs along 2nd Avenue and the other along 3rd Avenue.

PUBLISHER'S ANNOUNCEMENT

Beginning with this issue the type size of ELECTRICAL EXPERIMENTER *pages is increased from* 10 *to* 10½ *inches. This adds an equivalent of over four pages of live articles to your magazine, and we hope that you will welcome the improvement.*

The Publishers

WHAT IS AN ENGINEER?—ASK UNCLE SAM.

Especially interesting, from the standpoint of the war, is the publication of a new definition of the engineer which has been written by A. H. Krom, director of engineering, United States Employment Service, Chicago. The definition comes as the result of the many queries that have originated thru a confusion of engineering terms and standards now in general use. After serious study and consultation with eminent, authorities, Mr. Krom prepared the following definition:

"An engineer is one who economically directs man power and, by scientific design, utilizes the forces and materials of nature for the benefit of mankind."

In writing this definition, Mr. Krom hopes to offer a practical, workable statement that will be of real value to technical men and to employers of technical men. The definition will doubtless be useful in clarifying popular misconceptions. Students of engineering and prominent scientific authorities declare that Mr. Krom's definition is representative of the highest engineering ideals and that it covers all classes of engineering. In view of the importance of the engineer in the present war, it is highly important that his status be properly defined.

www.americanradiohistory.com



Copyright, 1919, by E. P. Co.

A Comprehensive Semi-Sectional View of the Battery Section of New York City and Its Multifarious Modes of Travel, Including Subways, Elevated Lines, Surface Cars, and Ferry-Boats. This Represents One of the Most Thoroly "Subwayed" Sections of Any City in the World, and There Are As Many As Four Levels of Passenger-Carrying Railways in Operation At Some Points. This View Shows the 6th and 9th Avenue Elevated R.R. Lines On the West Side, and the 2nd and 3rd Avenue Lines Running As a Single System In This District Down to a Common Station At the Battery. At This Point There is a Large Subway Station for the Local Trains of the "East Side" (Old Broadway) Subway. These Local Trains Returning Around the "B" Track of the Loop to the Up-Town Track. The Express Trains Drop Down Two Levels Underground and Dive Thru the Two Under-River Tubes to Brooklyn. The "A" Track of the Loop is Used to Return the Trains of the "West Side" Subway to the Up-Town Track. As the Dotted Lines Indicate. These Trains Use the South Platform of the Battery Subway Station, Which is Not Shown Here. The Many Other Interesting Problems Which Are Being Engineered At This Point, Are Clearly Explained In the Accompanying Article.

(For full description see opposite page)

www.americanradiohistory.com

Popular Astronomy

THE MILKY WAY

By ISABEL M. LEWIS

OF THE U. S. NAVAL OBSERVATORY



Taken by Barnard with the 3.4-inch Lens of the Bruce Telescope Temporarily Located on Mt. Wilson, Cal. This Photograph Shows the Great Star Clouds of the Milky Way in Sagittarius. It Is In This General Direction that the Center of the Entire Galactic System Is Believed to Be Located.

THE Galaxy or Milky Way defines in the heavens the position of the fundamental plane of the visible universe and the equatorial belt of the celestial sphere. Our own sun, attended by its planet family, is but one of the innumerable stars that stream to and fro in paths as yet undefined in form, but lying closely confined to the galactic regions and apparently controlled by the strong gravitational forces that exist therein. In fact all celestial objects, whether stars, nebulae or star clusters, are influenced by the Milky Way and as a result either crowd closely toward it or seek to avoid it so far as possible. Among the objects that particularly favor the Galaxy are to be counted the helium or blue stars and the hydrogen or white stars. The giant red stars known as the *type N* stars are found almost exclusively here as are also the stars that appear to form the connecting link between stars and nebulae—the *Wolf-Rayet* stars. Here also are to be found all the gaseous nebulae, all the temporary stars, except those that have appeared in spiral nebulae, and all the loosely-formed groups or clusters of stars, such as the *Hyades* and the *Ursa Major* group, which includes *Sirius* and the brighter stars of the *Big Dipper*.

The average width of this equatorial belt of the celestial sphere has been placed at approximately twelve thousand light years, according to most recent investigations, while its diameter is now known to be at least *three-hundred thousand light years in extent*. Outside this central segment, but symmetrically distributed with reference to it, lie the vast compact systems known as the globular star clusters. Tho limited in number to less than one hundred they are composed individually of thousands, if not hundreds of thousands, of stars far superior to our own sun in size and brilliancy. The spiral nebulae, to be counted by numbers running into the hundreds of thousands, and the Greater and Lesser Magellanic clouds of the southern hemisphere, vast systems of stars and nebulosities resembling fragments of the Milky Way in appearance, are also to be included in the objects that avoid the vicinity of the Milky Way. All of these objects are characterized by extremely high velocities compared with the sluggishly moving members of the Milky Way. Their distances from the Galaxy, moreover, are inconceivably great. An estimate of the distance of the Lesser Magellanic cloud, and which is extremely reliable, places it *thirty thousand light years* away while the average distance of the globular star clusters from the central plane of the Milky Way is more than *twenty thousand light years*. Tho the distances of the spiral nebulae are still in doubt these objects are believed to be as far away on the average as the globular clusters. The theory has been advanced by Dr. Shapley of the Mt. Wilson Solar Observatory as a result of his extensive investigations of the globular star clusters and their relations to the Milky Way, that these vast systems and probably also the spiral nebulae are not found in the vicinity of the Milky Way because it would be impossible for them either to form or to exist as independent systems in the strong gravitational field of the equatorial belt. The loosely-formed star clusters that are to be found in profusion within the Milky Way may be, he considers, the remnants of compact globular clusters that have attempted to cross the central plane.

For many years it has been doubtful whether the numberless tiny points that make up the star clouds of the Milky Way are suns comparable in size to our own sun or mere star-dust, that is, fragmentary matter of planetary rather than stellar dimensions. It is now believed that thruout the length and breadth of the Milky Way the stars average the same as they do in the immediate neighborhood of the sun. There are in the star clouds of the Galaxy giant suns that surpass our own sun hundreds and even thousands of times in size and brilliancy, and there are on the other hand dwarf suns that possess only a hundredth, a thousandth or, in some instances, a ten-thousandth part of the luminosity of the sun.



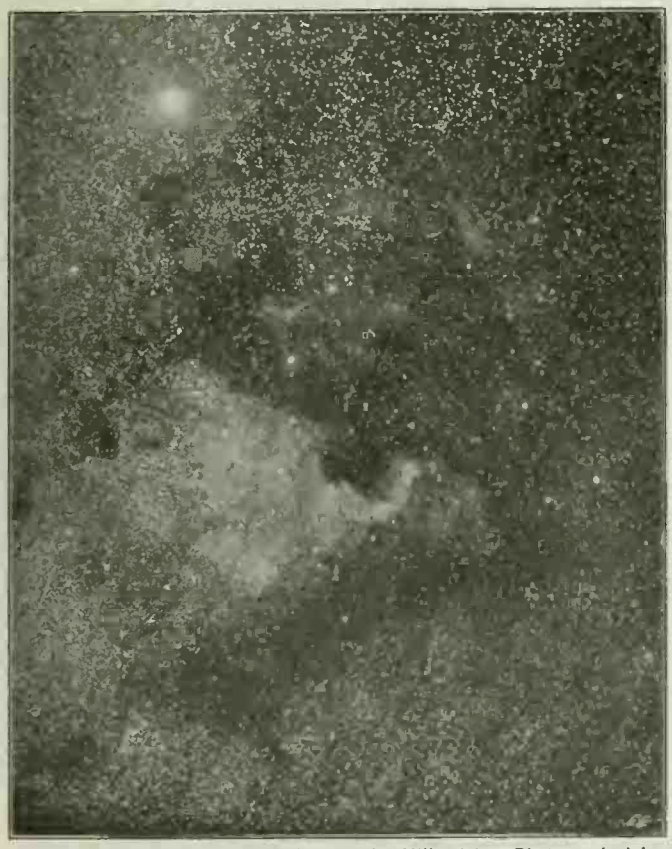
Star Clouds in Sagittarius. Photographed by Mr. Barnard of the Yerkes Observatory. This Covers a Field of About Twenty Degrees.

www.americanradiohistory.com

The hazy, milky light of the Galaxy is a familiar feature to all who have seen it at its best over sea or prairie on a moonless night of early fall, spanning the heavens in a glorious arch of awe-inspiring beauty. With the aid of the most powerful telescopes the nebulous background is resolved into innumerable individual points of light, each representing a star of the universe, a sun attended possibly by planet-worlds of its own. The impression one receives of dense clouds of stars is due, it is believed, to the great extent of the galaxy in the fundamental plane rather than to an actual crowding together of the stars. The Milky Way is known to be extremely intricate and irregular in form. It encircles the heavens in the form of a great circle, but its width varies from twenty or thirty degrees in some parts of the heavens down to barely five degrees in others. For nearly one-third of its circumference it divides into two branches. In the constellation *Argo* in the southern hemisphere, it separates into several branches crost by dark lanes that in one portion of its path nearly sever it completely. Still further south, in the vicinity of the Southern Cross, is the noted Coalsack, a huge opening in the midst of dense star clouds. The dark markings that are such a characteristic feature of the Milky Way are due in some instances to actual breaks in the star formations thru which it is possible to gaze into the immensity of space beyond, in others to the presence of dark absorbing matter that intercepts the light from the more distant star strata. There are numberless examples of such dark nebulae intermingled with vast star formations and luminous gaseous nebulae. There are all gradations in these dusky markings from an inky blackness to the greyish tinge produced by a feebly glowing nebular light. The form assumed by the star streams of the Milky Way is still unknown. There is no clue to the structure of the whole in the infinite variety of its intricate formations. No two portions of the Galaxy are alike. There is no way of determining the relative distances of the various star clouds when even the nearest are immeasurably distant. It is the comparatively recent investigations of the globular star clusters, which have been found to be symmetrically arranged with reference to the plane of the Milky Way, that have furnished a clue to the great extent of the Galaxy in the central plane of the visible universe amounting to a distance of approximately three hundred thousand light years, a value far greater than any previously assigned to celestial distances. Within six thousand light years of the central plane and fairly evenly distributed above and below it, are to be found nearly all of the stars so far catalogued, including all the naked-eye stars and, in addition, all the irregular and planetary gaseous nebulae.



Photographed by Barnard with the 10-Inch Lens of the Bruce Telescope While Temporarily Located on Mt. Wilson, Cal. (May 8, 1905, Exposure 3 h. 30 m.). This Photograph Shows About 13° of the Sky North of Theta Ophiuchi. Considered the Most Extraordinary of All the Regions of Dark Markings in the Milky Way.



Still Another View of the Wonders of the Milky Way, Photographed by Mr. Barnard. The White Spot at the Upper Left Is a Small Nebula.

In Fig. 1 is shown a section of the celestial sphere made by a plane perpendicular to the plane of the Milky Way. The crosses represent the positions of some of the globular star clusters projected upon this plane. The equatorial section, A-B, is twelve thousand light years in width and three hundred thousand light years in diameter. Midway between its upper and lower limits lies the plane of the Milky Way the pole of which is at P. C marks the center of the entire system and the globular clusters are distributed symmetrically with reference to this point. The center of the black dot, S, defines the position of our solar system in the Milky Way. The small black dot has a radius of about 1,500 light years. Within a sphere of this radius with a center at the sun lie all stars and nebulae with parallaxes greater than two thousandths of a second of arc. Therefore within the black dot lie all the stars and nebulae, the distances of which have been determined by direct means, that is practically all the stars visible to the *naked eye*, including such well-known stars as Capella, Vega, Antares, Polaris and, of course, Sirius and Alpha Centauri. Even the most massive stars of the Galaxy, thousands and tens of thousands of times more luminous than the sun, appear blended in indistinct milky light at the distance of C. Only the great telescopes break this misty light up into minute distinctive points of light of the *sixteenth* or *seventeenth stellar magnitudes*. These stars form the characteristic star clouds of the Milky Way and it is readily seen from the diagram why one receives the impression of great star density when gazing in the direction of C, from the position of the solar system at S, tho the actual star density may be nearly uniform

(*Continued on page 751*)

www.americanradiohistory.com

Women Now Trained as Meter Readers

Can women read electric meters satisfactorily? They can. Even when the meters are located in the darkest cellars. All of which has come to pass because the government had indicated that industries must help produce the needed additional military man power, and a Chicago electric light company has begun to train and employ women as meter readers. To train these new employees a temporary meter readers' school in charge of the foreman of meter readers has been opened. The equipment consists of chairs and tables, an exhibit of a number of meters and parts of meters, and a large model of a meter dial. This latter is used in meter reading practise, and examinations are held after the class has been thoroly instructed by talks accompanied by demonstrations concerning the construction and working of meters. Twenty or thirty changes are made on the large dial, each student marking down her record each time on a sheet of paper. These sheets are then collected and marked up by the instructor.



Photo Chicago Commonwealth Edison Co.

Here's a Class of Women Meter Readers Being Taught the Errors and Ways of One-Stepping Watt-Hour Meters. "The Hand Is Quicker Than the Eye," Says the Instructor. It Points to 7, but It's Only 6! What the —— ?X! That's Why They have a School. Incidentally They Are Trained How to Shoot Rats at Forty Paces.

TORPEDO TURNS TO STRIKE SHIP.

The case of the Norwegian steamer Somerstadt, which was sunk on August 12th off Fire Island by a *recurving torpedo*, as stated in the official report, has raised the question among experts as to whether the Germans have not utilized the American invention of radio or wireless-directed missiles of that character.

While there is nothing in the official report to indicate that the torpedo which destroyed the steamer took its eccentric course of passing the bow and returning to strike fatally on the port side by the use of radio power, it is not denied that such might be the case.

Secretary Daniels called in an expert when the matter was discust at Washington. In the latter's opinion there was nothing remarkable about the return of the torpedo.

He explained that there were well-known mechanical devices, such as the gyroscope, by which a torpedo could be made to go forward from the point of departure for a certain distance and then recurve, as in the present case.

Both the Army and Navy have investigated the directing of torpedoes by wireless from shore, and have found they can be given such direction. One of the inventions which attracted much attention some few years ago in this line was that of John Hays Hammond, Jr. Tests were made off Sandy Hook, and the torpedoes were given practically any desired direction.

It is noted today that the case of the Somerstadt is not the first instance of the boomerang motion of a torpedo. The same effect was produced in the submarine attack on the steamship Antilles and on the destroyer Jones.

Officials therefore are inclined to the belief that the Germans would not put any additional radio service on board a submarine to guide torpedoes when they could be directed just as well by the gyroscope plan.

An electric lighting company in New Orleans, La., has devised a portable electric light attached to a long pole. The pole is pushed into the ground and the attaching cord connected to the nearest lighting socket. The light is used for illuminating gardens, tennis courts and lawn parties.

The greater efficiency of electric cooking and the consequent conservation of fuel was pointed out in a recent article in *Elektro-Technich and Maschinenbau.* Cases are cited of bakeries in which, other factors being as nearly as possible identical, steam ovens used 0.19 to 0.21 kg. of coal per kg. of bread (i.e., 955 to 1,060 calories), while electric ovens used 0.39 to 0.42 kw-hr. per kg. of bread (i.e., 322 to 359 calories). The power consumption of the electric ovens was 90 kw. and 50 kw. respectively.

SCIENCE IN THE EVOLUTION OF BIG GUNS AND SHELL.

The view below shows one of the laboratories at Sheffield University with a number of the students at that well-known English institution studying closely the recalescence of steel, or in other words, the minute molecular changes occurring in steel by means of the apparatus shown and which are thermally registered.

So interesting and important is this particular branch of scientific work, that the King of England, who recently visited this University, was particularly impresst with the results obtained. He manifested great pleasure in observing how an elaborate chart of the changes taking place in the steel under heat treatment in an adjacent furnace, could be registered continuously by a form of tape recording machine working in conjunction with the split-second clock shown in the photograph.

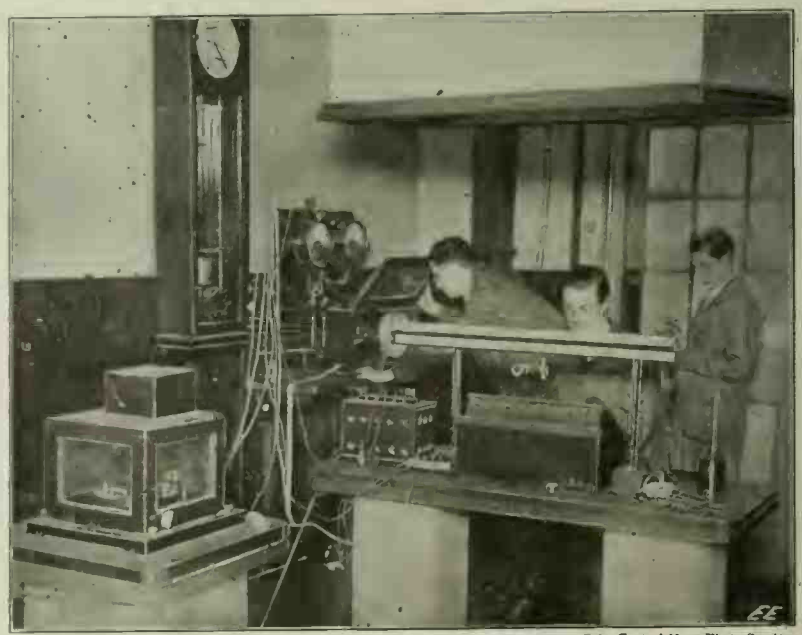


Photo © by Central News Photo Service

An English Laboratory Which Greatly Interested the King of England. Elaborate Electric Apparatus Enables the Observers to Record and Study the Heat Treatment of Steel in Adjacent Furnaces. Tape Recorders Register the Successive Changes in the Steel Under Treatment.

www.americanradiohistory.com

MT. WILSON'S HUNDRED INCH TELESCOPE

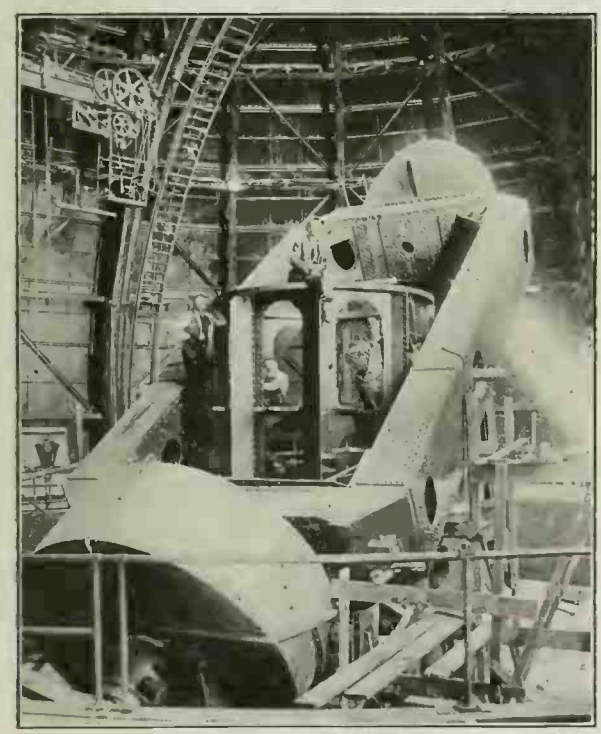
By Professor Walter S. Adams, D. Sc.
Mount Wilson Astronomical Observatory

WITH the introduction into astronomy of the instruments used in the physical laboratory for analyzing light sources and studying their brightness and mode of radiation, the telescope has come to be regarded mainly as an instrument for collecting light. The physicist to a certain extent has the light source at his control, but the light of a star is a fixt quantity, and the only way in which the astronomer can increase the brightness of the image which he desires to examine or to analyze is to increase the aperture of his telescope, say the writer in the bulletin of the *Southern California Academy of Sciences*. One instrument of *twice* the diameter of another will collect *four* times as much light, and, will form an image of a star *four* times as bright, other things being equal. At a period in astronomy when powerful spectroscopes are being employed for studying the motions and the chemical constitution of stars, and when the problem of the structure of the universe requires that we discover and determine the brightness of as many as possible of the faintest stars in the heavens, the value of a great telescope is obvious.

The project of the 100-inch reflecting telescope took form in 1906, when Mr. John D. Hooker provided the funds for the purchase of a suitable disk of glass, the erection of a building for the necessary optical work, and the employment of skilled opticians to figure the surface of the mirror. In the winter of 1908 a disk was received from the St. Gobain Glass Company of France. The mirror was finally completed in the summer of 1916. During that period the work was not strictly continuous, it being necessary occasionally to suspend polishing for considerable intervals on account of unsuitable temperature conditions.

It is not possible here to enter into a

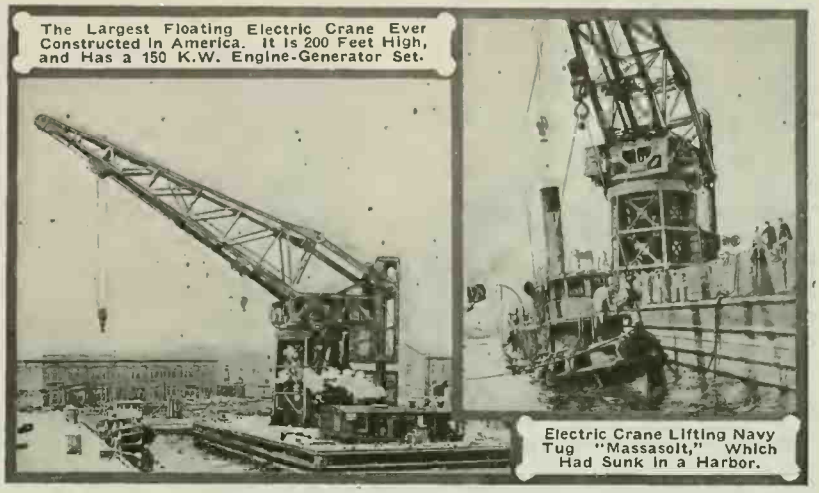
(*Continued on page 755*)



View of Mounting for Mt. Wilson's 100-Inch Reflecting Telescope. The Finished Mirror Weighs 4.5 Tons. The Telescope Is Floated on Mercury. The 600-Ton Dome Rotates Very Smoothly by Electric Motor.

Largest Electric Crane Lifts Complete Tug-boat

THE world is fast beginning to realize that American-made goods are the best to be had, and, also that they are built on integrity, and will not collapse like the German character has



The Largest Floating Electric Crane Ever Constructed In America. It Is 200 Feet High, and Has a 150 K.W. Engine-Generator Set.

Electric Crane Lifting Navy Tug "Massasoit," Which Had Sunk In a Harbor.

and the German Floating Cranes did for the Panama Canal. This "Made in America" crane is said to be the largest ever constructed in this country.

To give a more concrete idea of the amount of work this apparatus can accomplish it may be said that its capacity is equivalent to the weight of 100 of the largest touring cars. The empty lifting hooks weigh about two tons, or the equivalent of a large touring car. When the jib is raised to its maximum height it is over 200 feet above the water level, a height greater than that of an 18-story building. As previously stated, the whole structure is mounted on a flatboat, or floating pontoon, and must not be endangered by handling these immense loads.

The boat contains a complete boiler plant, and an engine driven generator which supplies the electric current for operating the various motions of the crane, which are controlled from a small house mounted high above the deck. By the means of a few levers and master controllers one operator is able to control all the functions with the utmost delicacy.

The speed can always be controlled by the means of the electrical mechanism of the crane. When heavy loads are lowered, the motors are turned into generators and thus the speed is controlled with great accuracy. In the case of an accidental interruption of electric current, all of the crane's motions are automatically locked by means of brakes, and so ensures the impossibility of dropping the load. Safety and accuracy are essential, as the crane is used to handle large guns and turrets on battleships, and if thru carelessness or inaccuracy these should be damaged, it would mean a loss of hundreds of thousands of dollars.

One of the illustrations shows the first work which the crane did. The navy tug *Massasoit* was suddenly sunk in one of the harbors. After divers had past the necessary cables under the tug, the crane rapidly and quickly lifted it to the surface, as shown.

The following data will give a good idea of the enormous size of this machine. Size of pontoon 140 feet long by 85 feet wide by 15 feet deep; size of engine generator set, 150 kw.; the crane has a main hoist consisting of two hooks of 75 tons, each fixt on the jib; an auxiliary hoist of 25 tons capacity movable up and down on the boom; the crane rotates in a *complete* circle, the rotating being controlled by two 60-h.p. motors; the boom luffs up and down from a practically vertical position to an agle of about 30 degrees from the horizontal in its lowest position; the luffing is accomplisht by two 10-inch screws operated by two 60-h.p. motors; the main hoists can operate separately or simultaneously, as desired; when lifting the maximum load it is operated by two 60-h.p. electric motors; the auxiliary hoist has separate motors for hoisting and trolleying, each of which is 60-h.p. The counter-balance at the rear end of the crane is fixt and amounts to 600,000 pounds; the total weight of the pontoon crane (displacement) is 5,000,000 pounds; the capstans are electrically driven, four in number, one at each corner of the pontoon; the anchor hoists are steam driven, two in number, one at each end. The main pivotal bearing, or step bearing supports a ball or universal joint and carries a maximum load of 2,021,000 pounds; the speed of the main hoist under maximum load is about 6 feet per minute; the speed of the auxiliary hoist is 30 feet per minute; the speed of the rotation is one revolution in four minutes; speed of luffing boom, entire range 12 minutes. The boom is of the cantilever type.

Photos courtesy Westinghouse Electric & Manufacturing Co.

www.americanradiohistory.com

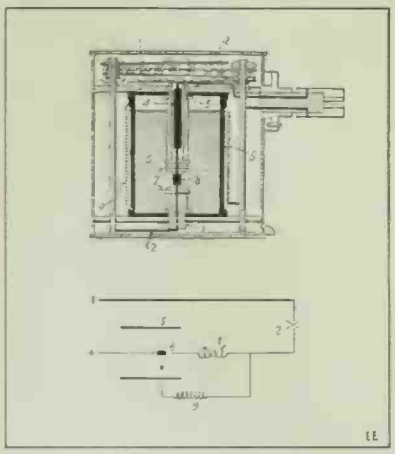
SELLING ELECTRICITY BY THE "CAN."

WE of this generation are quite familiar with the method of supplying kerosene and gasoline by the "can," but who ever heard of *selling electricity by the can?* But such an arrangement promises to come into vogue in Chicago, where the new "metering can" here illustrated has recently been developed and perfected. It has been protected by United States patents issued to Mr. E. O. Sweitzer, of Chicago, Ill., and the various details have been practically all worked out, including the design of the metering element for direct current as well as alternating current service. Owing to the abnormal conditions resulting from the great war, it was not deemed advisable to try to put this device so far on the general market, but now that peace conditions are with us, the concern who has developed this remarkably simple device are getting ready to place it on the general market. This "metering can," as it may be called, is intended to take the place of the conventional watt-hour meter, or kilowatt-hour meter, especially for small current consumers, where it is firstly—quite expensive to install a watt-hour meter, and secondly, — considerable expense is incurred on the part of the operating company, by having these meters read by professional meter-readers every month.



"Electricity by the Can." It Will Do Away with Thousands of Expensive Watt-Hour Meters. It Operates by Electrolysis, the Current, After a Certain Number of Hours, Eating Away the Conducting Member and Opening the Circuit.

When these metering units have become available, all Mr. Householder will have to do will be to go to the electric light company or their agents, and purchase several of these cans. These he takes home and uses one at a time as necessary. The apparatus works on the electrolytic principle, a certain amount of metal being acted upon by the passage of the current thru it, and after a certain number of hours the metal will have been sufficiently eaten away to open the circuit.



Section and Diagram of "Metering Can": 1. Series Resistance. 2. Copper Leads Forming Part of Main Circuit, and Making Connections with the Anode. 3. Protecting Tubes of Hard Rubber. 4. Solid Copper Cylinder Forming Part of Main Circuit, and Connected to Copper Lead at Its Upper Terminal by Means of Special Solder Which Melts at 60 Degrees. 5. Copper Cylinder. 6. Copper Sulfate Solution. 7. Rubber Washers. 8. Copper Anode. 9. Shunt Resistance.

The measurement of current depends upon the electrolytic action of a small copper cylinder of known weight, this being gradually disintegrated by electrolytic action during such time as the current may be used to light lamps or operate motors, etc., but is unaffected during the time when no current is being used. The electrolyte used either for D. C. or A. C. is a saturated solution of copper sulfate. These metering cans are arranged to give a warning signal so that the householder will know ahead of time when he should replace one of the units with a new one. The accompanying photographs show how the metering can is plugged into a wall receptacle in a very simple manner. The meter can here illustrated is so constructed and enclosed in a metal case, as to remove all chances of tampering with it or derangement by accident.

As aforementioned, the can is provided with a projecting contact arm which is inserted in the keyhole of a switch box. It is then given a slight twist to engage the contact with the spring clips of the main circuit and left there until the predetermined amount of current has been consumed. Truly it may be said that this device will mark a new era in electric service to the public.

NEW ELECTRIC FURNACE REGULATOR.

The device is installed easily, and when once in operation relieves the householder of all of his cares in relation to the furnace except the merely mechanical process of "putting on coal." The time clock arrangement makes it possible to maintain a low temperature during the night, and at the time set in the morning, opens the drafts and increases the temperature to the point desired.

This device consists of a thermostat with a clock attachment which operates a motor in the basement, which, in turn, regulates the drafts and dampers of the furnace. Two types are provided, one for use in houses already wired for electricity, and the other in which two dry batteries supply the impulse from the thermostat to the motor box, and a spring motor operates the drafts and dampers.

In the type used in houses already wired the alternating current motor is connected to the alternating main house wires. A transformer on the bottom of the motor box steps the 110 volts down to 6 volts, for use on the thermostat circuit. Thus the dry batteries are dispensed with.

The diagram shows clearly how the regulator works. The thermostat may be set at the heat desired and it will keep the room in which it is installed at that temperature, because if the temperature falls the motor in the cellar will operate sufficiently to open the drafts and increase the heat. The reverse is true when the temperature rises. The thermostat should be installed in a room as near the center of the house as possible and should not be in such a position that its action is subject to the effects of drafts from doors and windows opened for only a moment. — (*Photo courtesy W. E. Co.*



Automatic Electric Regulator Which Tends the Furnace Drafts for You. It Comprises a Thermostat, Clock, Motor and Battery or Other Sources Of Current.

AMONG the hundreds of new devices and appliances publisht monthly in the Electrical Experimenter, there are several as a rule, which interest you. Full information on these subjects, as well as the name of the manufacturer, will be gladly furnisht to you, free of charge, by addressing our Technical Information Bureau.

www.americanradiohistory.com

AN ILLUMINATED SERVICE FLAG FOR HOME AND STORE WINDOWS.

An enterprising electrical concern of Milwaukee is now offering the device shown in the accompanying illustration, known as the

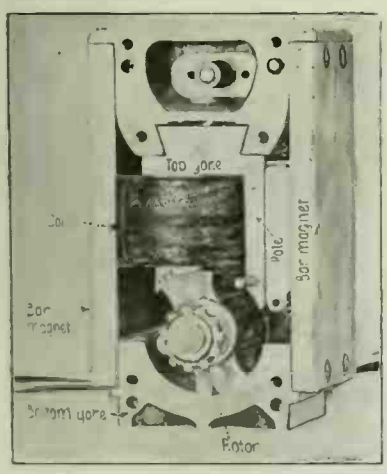


A Handsome Window Decoration in the Form of an Electric-lighted Service Flag.

"Honorlite," which is made in a form to take the place of a military service flag. The device consists of a handsome indestructible wood pulp pedestal with two modelled eagles holding a flat alabaster globe, which is 8 inches in diameter. A 3- by 5-inch service flag is shown on one face of the ball, while five blue stars are furnished loose and can be attached to the circumference or face of the ball as desired. This decorative device stands 12 inches high by 6¼ inches wide at the base, and is wired with 6 feet of cord and plug. It is pointed out by the maker that this device is one which can be used for other purposes, such as special advertising and as a special window display.

A NEW "INDUCTOR" TYPE MAGNETO FOR AUTOS.

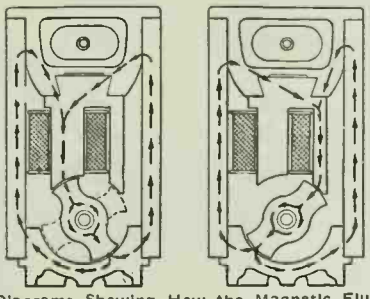
This new auto and motor-boat ignition magneto is of the *inductor* type, which means that the coils in which the current is induced are stationary, and the revolving part or rotor consists merely of a block of laminated steel. Instead of horseshoe



View of Interior of New "Inductor" Type Ignition Magneto. The Rotor Is Simply a Moving Iron Member—No Rotating Coils or Collecting Rings.

magnets, as always used in the conventional type of magneto, this magneto employs straight bar magnets, which are accurately ground and securely clamped to top and bottom yokes. The bottom yoke forms a pole piece extending nearly half way around the rotor tunnel, while the top yoke has two poles, one carrying the windings or coils, and the other serving as a magnetic by-pass. The magnetic circuit is shown diagrammatically in the two accompanying sketches. In one the rotor pole is shown opposite the pole of a top yoke which carries the windings or coils, and with the rotor in this position, the maximum flux passes thru the coils. In the other sketch the rotor is shown opposite the end of the magnetic by-pass, and in this position all of the magnetic flux passes thru the by-pass and none thru the coils. As the rotor has two poles, the flux thru the coils passes thru a maximum and a minimum twice during every revolution of the rotor.

As all coils and current carrying parts are stationary, there are no slip rings or brushes, except the brush in the distributor. The distributor gears, of bronze and steel, are of ample dimensions, and in connection with the rotating member of the current distributor, are carried in steel and bronze bearings, the sleeve of which is cast integral with the front die casting. The base and top yokes are made of gray iron, and are tied to the die-cast end plates by screws. They are located in place by dowel pins. The field structure is bored and ground as a unit, thus insuring thoroly accurate alignment of bearings and pole-faces. The stationary coil, condenser and laminated pole piece are assembled as a



Diagrams Showing How the Magnetic Flux In the "Inductor" Magneto Is Sent Thru the "Coil" Pole and Then By-past Thru a "Shunting" Pole.

unit and mounted integral with the top yoke.

This new inductor magneto gives two sparks per revolution. The spark characteristics are said to be such as to insure very effective ignition, the current rising suddenly to substantially its maximum value at the beginning, and being well sustained. One feathure that distinguishes the spark obtained from this type of magneto compared to that obtained from other magnetos, is that it passes thru the gap of the spark plugs always in the same direction. That is to say, the same part of the spark plug is always positive.

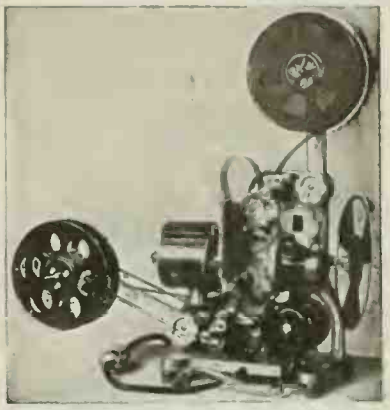
AN ELECTRIC "MOVIE" MACHINE FOR THE PARLOR.

A new type of moving picture machine for commercial, educational and home use has just been brought out by a New York concern.

Its special features are electric motor drive, by a motor that can be used on both direct and alternating currents; high illumination, and a feed mechanism that gives practically perfect results.

Motor drive was used on the older types, but it was necessary to have separate motors for the different kinds of current, and this naturally limited the use of the motor-driven machines. The new motor used here, however, operates at practically the same speed with either kind of current. Hence this machine can be used wherever there is electric light.

The illumination is provided by a 14-volt, 2-ampere, argon-filled, high efficiency light, that is sufficiently brilliant for throws as long as 100 feet, and for pictures up to 12 feet wide. The 110-volt current received



You Have Often Wisht for a Small "Movie" Machine for the Parlor—Here It is. Its Universal Motor Operates on Alternating or Direct Current.

from the lighting circuit is reduced to low voltage for the use of the lamp, by means of a rheostat; this rheostat is adjustable, so that the degree of illumination can be varied to suit conditions.

The film-moving mechanism is of the intermittent type and is of a novel design. The manufacturers claim that this projector projects an absolutely flickerless picture.

This machine is safe to use since it can take only slow-burning films, the standard celluloid film being unusable in it. Many hundreds of these special films have already been made up; special subjects can be made up as desired, and standard films can be copied on to the special stock.

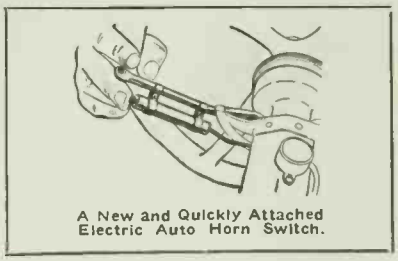
The weight of the machine is 23 pounds and it is arranged for packing in a carrying case similar to a small dress suit case.

India has increased its annual coal production to 12,000,000 tons and is introducing electrical machinery into some mines.

An electric alarm clock which awakens deaf sleepers by jarring their beds has been invented in Germany. They need it.

A NEW ELECTRIC HORN SWITCH.

Something new in the way of an electric horn switch or push button, for Ford cars, has been recently put on the market. It is attached to the throttle lever by means of two small clamps, and therefore is always within reach of the hand without an extra movement.



A New and Quickly Attached Electric Auto Horn Switch.

The device is a tube-shaped cylinder about ½ inch in diameter and 3 inches long, which contains contact point and wiring, which are cemented in place to insure durability and safety from dampness. The connection is made to the regular equipment by cutting in on the main wiring on the post.

www.americanradiohistory.com

The RADIO LEAGUE of AMERICA
HONORARY MEMBERS
CAPT. W.H.G. BULLARD, U.S.N. NIKOLA TESLA.
PROF. REGINALD FESSENDEN. DR. LEE DE FOREST.
Manager, H. Gernsback

Amateurs Win Questionable Victory

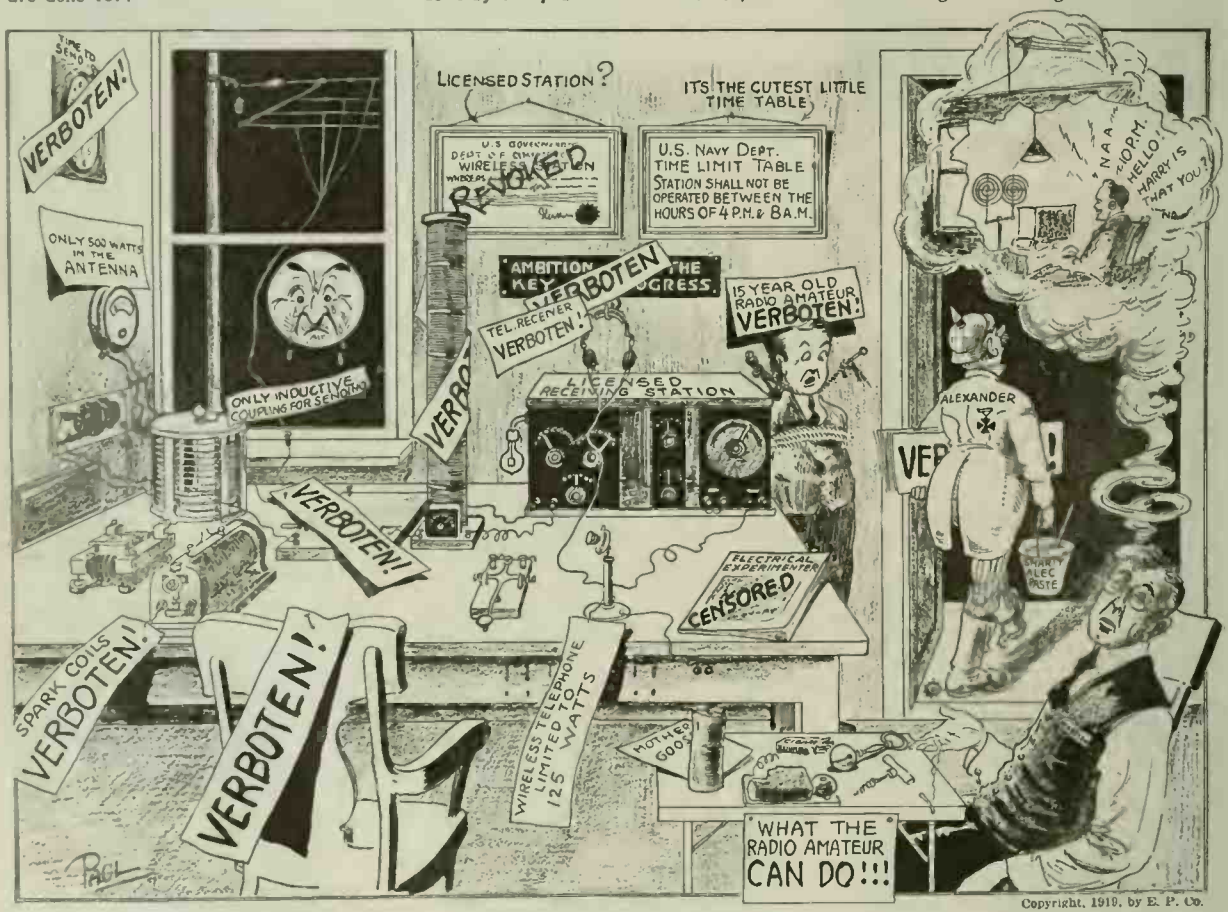
By H. GERNSBACK

PYRRHUS, when congratulated by his friends on the occasion of his victory over the Romans under Fabricius—but which cost a terrible slaughter of his own men, threw up his hands and exclaimed:

"Yes, but one more such victory, and we are done for!"

attempted any nation wide movement to secure the defeat of the bill in question, save and only the ELECTRICAL EXPERIMENTER. Altho several companies manufacturing radio instruments sent out a few thousand letters, no concentrated effort was made to appraise the entire radio fraternity as was done by this publication. About 50,000 letters were mailed out to all radio amateurs interested, and the response we know has been nothing short of wonderful. The writer was in receipt of thousands of letters from amateurs, who in turn in concert with their friends had protested vigorously to Washington, with the result that the amendment printed elsewhere in this issue came about.

The surprising thing however was that none of the other technical publications—there were only two of them commenting about the bill at all—had the situation right in hand. One publication which professes to have the interests of the amateur at heart did not even know that there was such a thing as the Padgett bill! Not one line was printed about it, and the whole situation was therefore more or less mishandled, as all the facts had not been stated clearly, if at all, as they were in the January issue of the ELECTRICAL EXPERIMENTER.



Copyright, 1919, by E. P. Co.

You Are Wrong. This Is Not In Darkest Prussia Where Everything Is Verboten (Forbidden). It Merely Represents An American Amateur Station A. D. 1919 When the Alexander Amendment Becomes a Law.

This was precisely the writer's thoughts when he read the amendments to the Alexander Bill, which has been under discussion for over a month, and which was discust at length in our January issue. After the original Alexander bill H. R. 13159 had been rushed into life, there were immediately regrets by its framers, greatly accentuated by thousands of letters of protest which came pouring in upon Mr. Alexander's committee.

Without wishing to take the credit for everything, it must be stated here that no publication, no radio club, or organization

Not only that, but the press was also appealed to as well, and many papers publisht comments and exprest themselves in no uncertain language about the drastic and entirely unjustified measure known under the title of H.R. 13159.

We wish to repeat here that if any change is to be made, we stand for the Padgett bill. It gives the amateurs exactly the same privileges as he had before the war, and this, we know, is just what the amateurs want.

Now that the situation has cleared somewhat, we are not justified in saying that we think the amateur will be suppresst entirely, for we know that he will not. As a

www.americanradiohistory.com

matter of fact, as things stand today we are not at all excited even about the amendment of the Alexander bill, for we have good and sufficient reasons to believe that the Alexander bill amended has little chance of becoming a law

There is no occasion or necessity for such a drastic measure at the present time. It is not justified, and if we take the propaganda which has been carried on for the last month in Washington, the thousands of protest letters sent to Senators and Representatives, as a fair indication as to how the wind blows, we think we are correct in saying that the temper of the statesmen in Washington today is not such as would support legislation of this kind at this time.

We might write volumes why amateurs should not be suppress, but we believe that official Washington today understands the situation fully. They know by this time what service the amateurs have rendered their country, and how many thousands of expert operators were recruited into the Army and Navy at the outset of the war. Congress will surely not blot the amateurs out of existence in recognition of their work, particularly when there has not been advanced one single, solitary, good reason why the amateur should not be allowed to pursue his innocent endeavor.

America, the greatest democratic country in the world, the one that cherishes the highest ideals of any nation, is not going to start in at this late date to take away the liberties of hundreds of thousands of loyal citizens who have already proved their worth, and will do so again.

In printing the amendment of the Alexander bill below, we call particular attention to paragraph 13. This constitutes nothing but a joker, for if the bill below became a law, and if the Navy Department was in power, it could very readily and without any trouble whatsoever prohibit the sending of messages, let us say, between the hours of 5 P.M. to 1 A.M. This, in the language of the bill, would be "definite periods of the night or day."

If we must have a law, let us have a law without "ifs" and "buts". Paragraph 13 is entirely too elastic in favor of the Government and would inevitably result in shutting the amateurs out at the slightest pretext.

There are certain things in the amendment which are undoubtedly satisfactory to everyone, but as a whole, we are not in favor of the measure. It is too autocratic, particularly the clause whereby it would be necessary for amateurs who had *receiving apparatus only* to secure licenses. Not one in a hundred would wish to go to the trouble of obtaining a license for very obvious reasons. It has been found in the past, that wherever an amateur had to obtain a *sending license*, it was done most reluctantly, and it was the cause of keeping thousands of amateurs away from wireless. It would work even more disastrously if every receiving station were to be licensed. Most of the jewelers—who receive time by wireless—and many young men would prefer not to operate their receiving stations for the word, "Government License", to many simple folk means a big undertaking, and in many cases when a young man finds out that he must obtain a Government license in order to have his wireless set, he prefers to be without it.

What good is it anyway to license a receiving wireless station? If a record of amateur stations is wanted in Washington why not let us insert a clause in the bill which would make it compulsory for every manufacturer or seller of radio apparatus to give a list of the amateurs buying such instruments, which to all intents and purposes would be the same thing as licensing and thus frightening the amateur. This system was in vogue during the war where it became necessary for all manufacturers to supply a list of radio sales to the Navy Department.

No manufacturer would object to this, we are certain, and as the government would then have the list of names it would work out the same way without discouraging thousands of amateurs.

The Alexander bill, amended, follows with our comments in parallel columns:

Alexander Wireless Bill—Amended

65TH CONGRESS, 3D SESSION, H. R. 13159.

IN THE SENATE OF THE UNITED STATES, DECEMBER 11, 1918.

Referred to the Committee on Commerce and ordered to be printed.

AMENDMENTS.

Intended to be proposed by Mr. Watson to the bill (H. R. 13159) to further regulate radio communication, viz:

On page 2, after line 8, add the following:

"The word amateur, or private, station shall be construed to mean any radio station operated by a citizen of the United States for the benefit of himself and science, and which does not do bona fide commercial radio communication."

On page 2, line 14, insert the words "private or amateur" before the words "technical and training school stations."

On page 2, strike out section 3 and in lieu thereof insert the following:

"First. The wave length of private or amateur stations shall be from one hundred and fifty meters to two hundred and twenty-five meters.

This is wholly satisfactory in all respects. It would give the amateurs twenty-five more meters to operate on than he has now. The present wireless law confines the amateur to 200 meters.

"Second. The Government shall have the right to stipulate that the power used by private or amateur stations shall not be greater than five hundred watts as measured in the antenna circuit, except by special license; and shall not be greater than two hundred and fifty watts as measured in the antenna circuit, except by special license, within one hundred and fifty miles of any seacoast, lake front of the Great Lakes, or coast of the Gulf of Mexico.

We can see no fundamental objection against this.

"Third. The Government shall have the right to prevent all persons below the age of fifteen years to use, operate, or own any sending outfit for the sending of radio disturbances into the ether.

We are wholly in accord with this as well. Boys under fifteen years of age in the past have made most of the trouble, and we believe it would be better for the fraternity if boys below this age should start in with a receiving station to obtain proficiency in the radio art.

"Fourth. The Government shall have the right to require all private or amateur station operators of receiving stations to be licensed, and failure to procure a license shall be punishable by a fine not exceeding $600.

Object most strenuously against this unjust measure. There is no necessity for licensing receiving stations only. Our jewelers, thousands of them scattered all over the country must have receiving stations to receive accurate time from Arlington and the like. Not many would want to be licensed under this measure. Secrecy in wireless is impossible anyway. If anyone must receive signals he can do so very readily and easily anyway, law or no law. Important messages are never sent out by the Government or commercial companies unless they are in code. On top of this the present wireless law already has penalties for divulging contents of messages.

"Fifth. The Government shall have the right to require all owners or operators of private or amateur stations to pass an examination whereby the operator of such station shall be able to receive ten words a minute before said operator may be licensed to operate any sending station.

We see no fundamental objection to this, except that it seems rather mysterious to us why an operator should *receive* ten words a minute. What good does the *receiving* do him. Perhaps the framers of the bill meant *"send"* not "receive."

"Sixth. Private or amateur station operators shall not be permitted to operate undamped sending outfits of greater capacity than two hundred and fifty watts as measured in the antenna circuit, except by special license, within the territorial limits of the United States.

This restriction to us seems to be too severe. We should like to see ½ K. W. inserted instead.

(*Continued on page* 735)

Don't fail to read a very interesting discussion appearing on Page 735, entitled "Amateurs Discust Officially" by Lieut. J. S. Cooper, U. S. N. R. F.

www.americanradiohistory.com



President Wilson Always in Touch with Washington—via Radio

FOR several days, going and coming in completing his mission to the European peace conference, it was and will be necessary for the President to administer the affairs of Government from the high seas. Unique as this situation is, hardly less so were the preparations made to enable him to keep in communication with the world during the voyage.

What is considered the most powerful wireless system ever installed on any ship is that carried by the steamship *George Washington*. A corner of the wireless room, fitted with the new radio devices, the latest word in invention and design, is seen in the accompanying picture.

Special arrangements never before used were made for handling President Wilson's wireless messages and to keep him in constant touch with Washington.

This announcement was made by Secretary of the Navy Daniels in connection with a statement that the Navy Department was in continuous communication with the *George Washington* and the flagship *Pennsylvania* on their trip from New York.

Means were at hand whereby he could be brought instantly into communication thru the powerful navy radio station at Annapolis, Md., and Arlington.

Mr. Daniels said:

The *George Washington* and the battleship *Pennsylvania* are both equipt with the most modern radio apparatus, some of which was installed for this particular trip.

"This apparatus includes, on the *Pennsylvania*, the most powerful transmitting set on any United States naval ship and also special receiving apparatus for receiving from high power stations used ordinarily only for transatlantic messages. The *George Washington* was also especially equipt with similar receiving apparatus. On board both ships were installed radio telephones and the newest type of low power sets for use only in communicating from ship to ship. The *George Washington* and the *Pennsylvania* were thus able to communicate with each other and at the same time receive messages from shore.

"All messages for the President were sent by the new naval high power station at Annapolis, which is five times as powerful as the Arlington station. These messages were received by the *George Washington* and the *Pennsylvania* simultaneously. All replies were forwarded from the *George Washington* to the *Pennsylvania* and then instantly relayed to shore by the *Pennsylvania*.

"At three special naval radio receiving stations, one in Maine, one in New Jersey and one in the Navy Building, Washington, expert operators listened continuously for the *Pennsylvania's* messages. The messages when received were forwarded with utmost despatch to the transatlantic radio division of the office of the Director of Naval Communications in the Navy Department, and the three copies were compared to insure accuracy. The messages were then delivered to the addresses. All outgoing messages past thru the same office in Washington.

"As the Presidential party approached Europe, by arrangement of the Navy Department, special receiving stations in both England and France listened for messages from the *Pennsylvania*, and one of the French high power stations forwarded messages direct to the ship. The President was thus kept in touch with Washington and Paris or London simultaneously, for the *George Washington* easily received the messages sent from the Annapolis station until the end of the voyage and the ship was in Brest, France."

The first Cabinet meeting in all history, directed to a certain extent by wireless from mid-ocean, was held in the White House on December 10th, with Vice-President Marshall officiating in the President's absence.

A wireless message from the *George Washington* asked Vice-President Marshall if he would preside and the latter assumed his temporary duty as acting President.

President Wilson was in constant communication with the United States and France during his entire voyage from the United States to France thru the U. S. S. *Pennsylvania's* powerful radio transmitting and receiving sets. The Annapolis high power transmitting station, transmitting on 16,900 meters, the high power transmitting set at New Brunswick, N. J., transmitting on 13,000 meters, the high power transmitting set at Tuckerton, N. J., on 9,200 meters and the high power transmitting radio station in Lyons, France, on 15,500 meters were used for communications to and from the President.

The President on board the U. S. S. *George Washington* was convoyed by the U. S. S. *Pennsylvania* (which is the best equipt ship afloat for signalling purposes in regard to radio communications) and five torpedo boat destroyers. The *Pennsylvania's* radio equipment consisted of the following apparatus: One 30 kilowatt Federal arc transmitter, which was used for transmitting messages to the United States and France on 3,600 meters, one 10 kilowatt Lowenstein spark transmitter, transmitting on 600 and 952 meters, which was used for intermediate communication with low power coastal stations; one short range radio telephone transmitter, transmitting on 297 meters and one vacuum tube short range transmitting set, transmitting on 450 meters, which were used for intercommunication between the U. S. S. *Pennsylvania* and U. S. S. *George Washington*.

The *Pennsylvania* transmitted messages direct to the United States up to a distance of 2,500 miles. Communications with

(*Continued on page 743*)



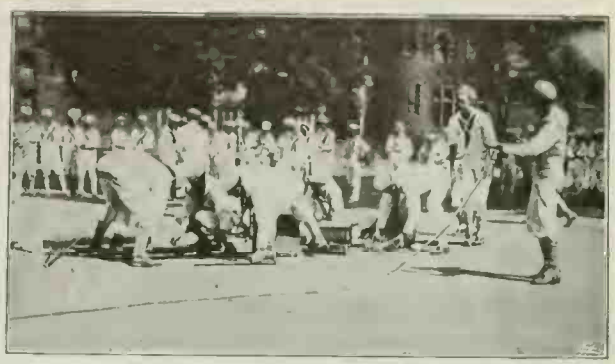
Photo © by Underwood & Underwood

It Will Undoubtedly Be of Extreme Interest to Our Radio Readers to Learn That Two of the Wireless Operators Selected For Duty on the President's Ship—the "George Washington"—Were Formerly "Radio Amateurs". See Testimony As to the Worth of This Class of Men to the Navy Given By Lieut. Cooper Before the Committee On the Merchant Marine and Fisheries, Printed Elsewhere Under the "Radio League of America" News.

www.americanradiohistory.com

Harvard Naval Radio Men Expert with Portable Sets

THE Harvard Radio School has developed thousands of expert radio operators for the United States Naval Service, and a group of them are here illustrated practising with one of the portable wireless outfits which landing parties use. It is surprising how quickly they can erect an aerial mast and connect the various instrument cabinets together with the dynamo, ready for instant service. It is all a matter of discipline, the commanding officer will tell you. Discipline and system whereby each man does a certain thing, but does it well. That in a nutshell is the whole secret of Uncle Sam's naval efficiency. These men are trained to perform their duties with clock-like precision, and each move in erecting the wireless set here shown is done identically the same each time, which is the only way that real speed can be obtained. Unlike the German system, Uncle Sam's boys are trained not only to do a certain thing in a complex task and to do it well, but they are each and every one of them educated and carefully instructed on all the details governing the operation and functioning of the complete radio outfit. Thus in an emergency any one of these radio men can do anything from tapping the key to erecting the antenna, or dissembling the gasoline engine driving the dynamo, in the event that it fails to work, and ascertain just what the trouble may be. It has been a great task to train all of these thousands of radio operators in the various complex branches of the art, but Uncle Sam's radio instructors, both naval as well as civilian, have proven their worth.



A Radio Squad From the Harvard Naval Radio School Show What They Can Do In Rapidly Setting Up a Portable Type Radio Pack Set. 1st Act—Unpacking the Instruments.

345 MARCONI RADIO STATIONS BOUGHT BY U. S. NAVY DEPARTMENT.

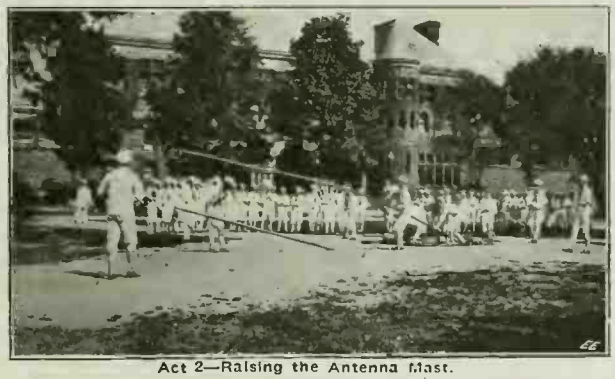
All of the American Marconi radio stations, except the four high power plants, have been bought by the Navy Department, a Washington dispatch of December 5th stated.

At the same time it developed that the department purchased the great Sayville station recently from the Alien Property Custodian along with the Marconi purchases. The American Marconi company relinquishes the field of handling ship to shore messages.

The purchase includes 45 Marconi coastal stations, nineteen of which are situated on the Atlantic and Gulf coasts, sixteen on the Great Lakes, and ten on the Pacific coast.

The four high power units which the company still retains include the Belmar-New Brunswick station in New Jersey, for transmission of messages to England; Chatham-Marion, Massachusetts to Scandinavia; Marshall-Bolinas, California to Hawaii; and Koko Head-Kahukee, Hawaii to Japan. Two units represent each station, each about fifty miles apart, one being utilized for transmission and the other for receiving.

In taking this action the United States is merely following the lead of other nations in controlling the ship to shore business; England took over these stations on her coast 12 years ago, and since that time they have been operated by the Postal Department. The same applies to France, Italy, Germany and countries in South America. Brazil has always operated her coast radio stations.



Act 2—Raising the Antenna Mast.

An official of the company points out that the cream of the business in the future will be the transatlantic message traffic. The ship to shore business has never been a big proposition, for with the exception of a few ships the private business aboard ships or to them has never been large. At the same time development of the transatlantic business is going forward, and when the Government relinquishes control of these big stations, they undoubtedly will produce big results for the company.

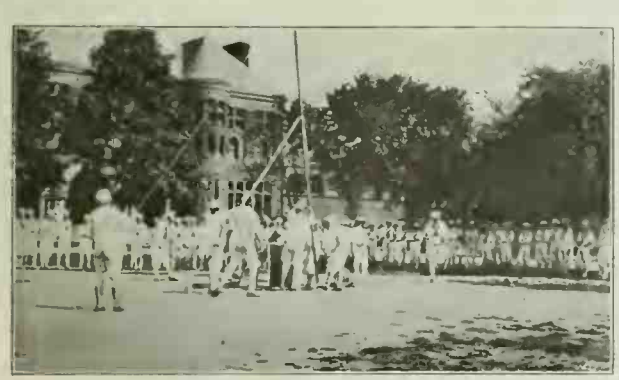
The price paid by the Government is not announced at this time altho it has been definitely settled.

The Government has also purchased from the Marconi Wireless Telegraph Company of America wireless apparatus on some 300 ships now under Government control. An announcement to that effect was recently made by Edward J. Nally, vice-president and general manager of the company.

The sale of apparatus to the Government, Mr. Nally said, is "the first result" of a change in the company's policy whereby "it will in the future sell as well as lease wireless apparatus."

A recent London dispatch quotes Godfrey Isaacs as saying that the Marconi Company would outfit airplanes employed in air passenger and mail service with wireless and would supply operators in the same way as it now serves ships. It also is intended to receive regular reports of air conditions in different localities and to circulate these for the information of the pilots. As every airplane will have either a name or distinguishing number, it will be possible to send telegrams from any part of the world or from any ship to an airplane. It is intended that this organization will be ready by the time the peace treaty is signed.

Arrangements recently have been made for the erection of wireless stations in the extreme parts of China, one on the frontier of Cashmere, and another on the Chinese side of Siberia. Mr. Isaacs has arranged with Handley-Page for the transport of the necessary machinery by one or more of his big machines. The journey inland will take two or three days in place of the same number of months.



Act 3—Mast and Aerial Raised and Apparatus Ready For Service.

NAVY MODIFIES RADIO RULES.

Naval conditions in the North Atlantic are such now that restrictions upon commercial radio communications are being removed, according to an official announcement. Personal and commercial traffic with naval vessels as well as with merchant vessels is now permitted west of the 40th meridian.

The restrictions upon land wire telegrams address to naval personnel on board naval vessels, which caused such telegrams to be forwarded thru the Bureau of Navigation, have been removed, and it is now permissible to address personal telegrams direct to men on naval vessels in an American port. Restrictions on amateur wireless stations have not been lifted.

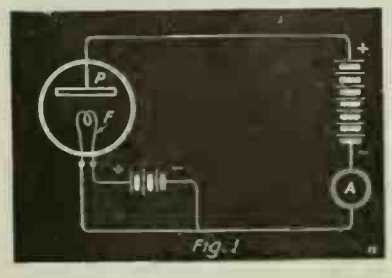
www.americanradiohistory.com

Vacuum Valve Action and the Electric Current

By K. G. ORMISTON, ASSOC., I. R. E.

RADIO INSTRUCTOR, HEALD'S ENGINEERING SCHOOL, SAN FRANCISCO

NEARLY all text-books on physics and electricity state that the direction of the electric current in the external circuit is from the positive terminal of the source of pressure to the negative terminal. The average radio student, from the time he first takes up the study of electricity, is taught that the positive pole of a battery or dynamo is in a state of high pressure and the negative pole in a state of low pressure, and that the



This Diagram Represents a Vacuum Valve Circuit, Minus the Grid Which Does Not Enter Into the Present Discussion. This Article Discusses the Direction of Current Flow Thru the Valve—a Mooted and Foggy Point to the Majority of Radio Men. Does the Current Pass from Filament to Plate Or Vice Versa?

direction of the eletcric current is from positive to negative. This conventional theory is quite satisfactory until the vacuum valve and its action is considered; then the confusion begins.

Figure 1 represents a vacuum tube with the filament heating circuit and plate circuit. (The grid is omitted as it has no bearing on the present discussion.) The positive terminal of the battery B is necessarily connected to the plate P. In studying the action of this circuit the radio student is asked to believe that the current in the plate circuit flows from the positive terminal of the battery B to the negative terminal; that is, from plate to filament within the tube, in spite of the fact that the ELECTRON STREAM IS FROM THE FILAMENT TO THE PLATE.

In this connection the leading text-books make the following statements:

1. "Using the ordinary convention for the direction of current flow (which is *opposite* to the direction of flow of the electron stream), we say that a current flows from the plate to the filament."

2. "It will prevent confusion . . . if the student understands that inconformation with the old theory electricity FLOWS IN THE DIRECTION OPPOSITE TO THE FLOW OF THE ELECTRONS."

3. ". . . the number of electrons drawn from F to P per second, that is, conventionally the current from P to F, is found . . . to be roughly proportional to the square of the field intensity."

The instructors in a certain Government Radio School, in their efforts to "conform with convention," even go so far as to teach that positive ions flow from the battery B to the plate P to *neutralize* the negative electrons discharged from the filament to the plate, and thus endeavor to show that a current actually flows from positive to negative. But these instructors fail to explain how positive ions, WHICH ARE ATOMIC IN SIZE, can flow freely thru a copper conductor or a vacuum!

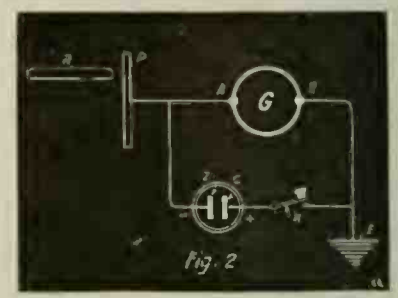
It is my personal experience that much confusion is avoided, and a far better understanding of vacuum valve action, as well as certain other phenomena, is gained if the radio student is taught from the start that the electric current is in reality a flow of negative charges, or electrons, from the negative (high potential) to the positive (low potential) pole of the source of E. M. F.

The above statement concerning the direction of the electric current is not a theory; it is a conclusion drawn from experiment. That the electric current consists of a movement of ELECTRIC CHARGES can readily be shown by the following simple experiment.*

In Figure 2, P is an insulated metal plate. G is a sensitive D'Arsonval galvanometer, connected between the plate and the earth. The simple cell ZC and key K are connected as shown, with the zinc or *negative* terminal of the cell connected to the same side of the galvanometer as the metal plate P. R is a gutta-percha rod, which is held in the hand and may be electrified by rubbing with cat's-fur. The gutta-percha rod when subjected to friction becomes *negatively* charged. When the charged rod is moved near the plate P, the galvanometer will deflect in a certain direction, let us say to the right. The deflection of the galvanometer is caused by an electric current passing thru its windings, and the current must consist of a flow of electric charges. Negative charges may be repelled from the plate by the presence of the negatively charged rod, and flow thru the galvanometer to the earth, or positive charges may be attracted from the earth and flow to the plate. In either case, it is the flow of electric charges which produces the effect of an electric current. As would be expected, when the charged rod is removed the galvanometer deflects in the opposite direction, that is, to the left. The removal of the rod either allows the negative charges which were driven from the plate to the earth, to return to the plate, or releases the excess of positive charges which had been attracted to the plate and they pass off to the earth.

During the first part of the experiment the key K has remained open. Now place a heavy shunt on the galvanometer, so the current from the simple cell cannot damage the instrument. Then close the key K. The galvanometer will deflect TO THE RIGHT. Note that the deflection is in the same direction as when the charged rod was made to approach the plate P, and therefore either *negative* charges are flowing thru the galvanometer from A to B or *positive* charges from B to A. We can now draw this conclusion: The electric current consists of either a stream of negative charges flowing from the negative terminal to the positive terminal, or a stream of positive charges flowing from positive to negative, or possibly both.

The smallest possible electric charges, both positive and negative, have been isolated in experiments by J. J. Thompson and other scientists, and their mass and velocity are definitely known. The smallest charge is *negative* in sign, that is, it shows the same characteristics as a gutta-percha rod when electrified; is approximately 1/1800th the size of the smallest atom (hydrogen), and is called the "Electron." The smallest *positive* charge is found in the atom which has lost one or more electrons, and is therefore atomic in size. This smallest positive charge, which is but an atom deficient in negative electricity, is called an "Ion."



Experimental Circuit Which Students Are Trained to Learn the Actions of and Which Proves the Audion Explanation Here Set Forth. G Is a Sensitive Galvanometer, Z-C a Simple Battery Cell, K Represents a Key, E the Earth Connection, P a Metal Plate, R a Gutta Percha Rod, Which Can Be Electrified.

It is evident that the positive ion cannot act as a carrier of electricity in a solid medium, or in a vacuum, on account of its size which must be at least as large as the smallest atom. But the electron, bearing the negative charge, can easily pass between the atoms of a solid conductor.

From the experiment of Figure 2, we concluded that the so-called electric current consists of a stream of electric charges, either positive or negative. Thompson's measurements show that the positive charge cannot flow (in the media with which we are dealing); therefore, we may state that the electric current is a movement of electrons (negative charges) from the negative pole of the source of pressure to the positive pole.

For further proof let us again consider the vacuum tube circuit of Figure 1. We have a circuit connected to the battery B, made up of copper conductors and the space F—P, which is devoid of all matter. The ammeter A indicates that an electric current flows in this circuit. Since no ponderable matter exists in the vacuum tube, the only possible carriers of electric charges within the tubes are electrons. The filament F is heated to incandescence in order that ionization will take place, and electrons will be emitted from it. It is necessary, in order to have any current at all in the plate circuit, that the positive pole of the battery B be connected to the plate P, so that the negative charges (electrons) will be attracted to the plate rather than repelled from it. With the arrangement of Figure 1 there will be a stream of electrons or negative charges flowing from F to P within the tube, and it follows that the current in the plate circuit indicated by ammeter A must consist of a *movement of electrons from the NEGATIVE pole of battery B to the POSITIVE pole.*

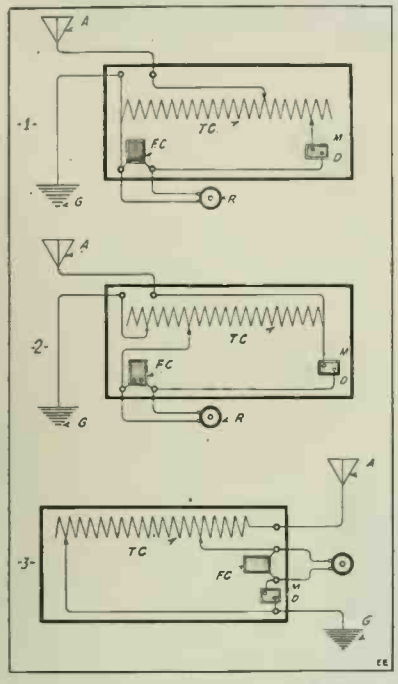
Let us not be hampered by "convention" and "old theories," but endeavor to seek the Truth. Then Progress will be assured.

* All students in elementary electricity at the Los Angeles Polytechnic High School are required to perform this experiment. See "Elementary Electricity," by Prof. H. LaV Twining.

www.americanradiohistory.com

THREE GOOD "HOOK-UPS" FOR A SMALL RECEIVING SET.

Four instruments are needed for this simple receiving set, and all are of the "E. I. Co." make. They are, one small tuning coil, one Miniature detector, one



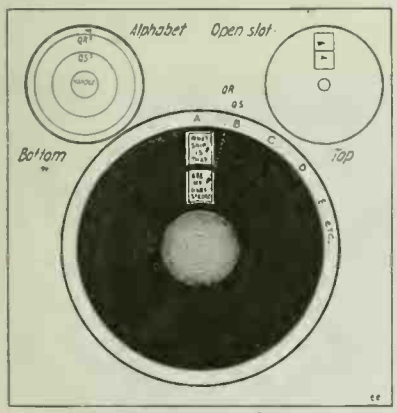
Here Are Three Simple, Yet Very Effective Hook-ups for a Small Wireless Receiving Set, Which Is Equipt with a Tuning Coil, Condenser, 'Phone and Mineral Detector.

fixt condenser and one Pony telephone receiver. In the diagrams, which are self-explanatory, A is the Aerial; G the Ground; T.C. the Tuning Coil; M.D.—Miniature detector; F.C.—fixt condenser and P.R.—Pony receiver. With a suitable aerial and ground system, you will be surprised by the good work this little set will do. It is interesting to try the different "HooR-Ups" to find which works best in your locality.

Contributed by FRED FLOYD, JR.

HOW TO LEARN THE INT'N'T'L CODE ABBREVIATIONS.

The attached drawing is that of a rotating dial to be used in quickly ascertaining the definition of the various International Radiotelegraphic Abbreviations. Such as:



Clever Dial Scheme for Use In Quickly Ascertaining the Definition of the Various International Radio Abbreviations, Such as Q R A?—Q S A?, etc.

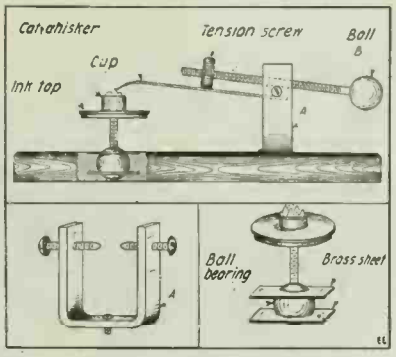
QRA? What ship or coast station is that? QSA? Are my signals strong?

As shown in the drawing the bottom or larger disc is made stationary to a wooden base and upon it the various definitions are printed above the QR's and below the QS's, so that when the smaller disc, firmly held by the rod holding the handle, is rotated in alignment with the letters of the alphabet, the definitions are indicated thru the slot cut in the rotating disc.

Contributed by E. T. J.

EFFICIENT GALENA DETECTOR.

Everyone is sure to have a small piece of brass rod for which he can find no use. The hard rubber top to an ink bottle in connection with a brass cap from an old dry cell forms a cup. A garage will give you all the slightly worn ball bearings you can use and you need but two. If you have never broken a ruler with a brass strip in it you are a wonder. A few screws, a nut, a couple of binding posts and a piece of board or fiber and you have the makings of a good detector. The accompanying illustration tells the rest. Once you have the tension screw, all you do is hook her up



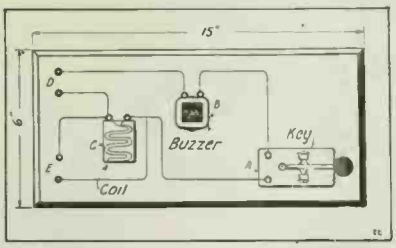
A Real "Ball-Bearing" Detector—"Radio-bugs." The Cup Swivels Nicely, While the Cat-Whisker Arm Is Balanced—a Design In Great Favor by Experts.

and with a second's adjustment (which won't knock out) in come the signals fine and clear.

Contributed by H. C. BENEDICT, JR.

NOVEL BUZZER PRACTISE SET.

In the drawing (A) is a key of any type, mounted on a board as shown. (B) is a buzzer of high pitch. (C) is a coil of



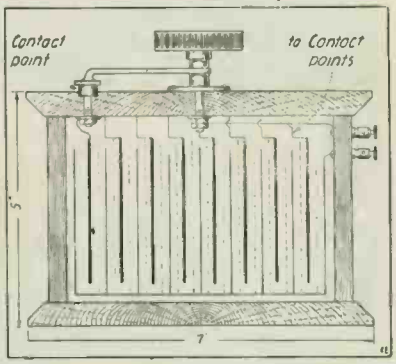
Unique Buzzer Practise Circuit in Which the 'Phones Are Shunted Across a Resistance Coil, In Series with the Buzzer.

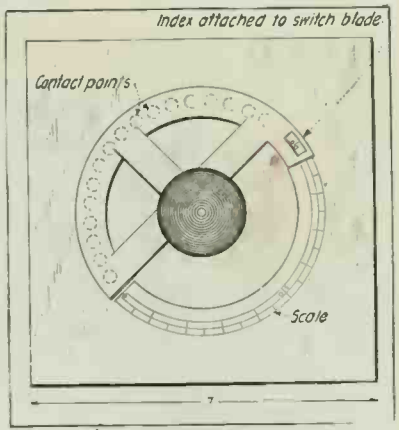
wire which is wound non-inductive; an inductive coil will not work. This coil may be made by using 50 feet of No. 24 insulated wire, doubling it and winding it double, starting with the loop end. Why this is done need not be explained here. (D) are the battery binding posts, and (E) are for the phones. A 75 ohm receiver will work fine.

Contributed by M. ABRAHAM.

A HANDY ADJUSTABLE CONDENSER.

The feature of this condenser is that the capacity units are stationary and therefore least apt to get out of order; the switch element only rotates. The builder can make the condenser of any size desired. The case is made of hardwood, sandpapered and varnished in the usual way. This con-





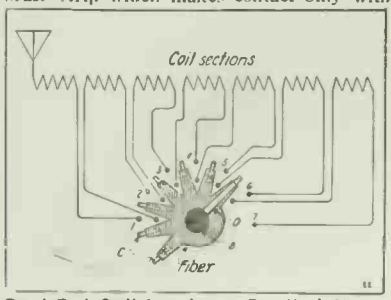
An Adjustable Condenser Suitable for Use in Radio or Spark-Coil Primary and Other Circuits. The Switch Is of the Accumulative or Integrating Type.

denser has been found suitable for every kind of work where an adjustable capacity is employed. The scale is read thru an index window attached to the moving switch blade.

Contributed by H. B. MASSINGILL.

DEAD-END SWITCH.

The ends of coil units are brought to switch points, one on each end of wire, (1, 2, 3, 4, 5, 6, 7). Note the fiber or other insulated plate, carrying at the under edge brass strips (C) which, when disc is turned (by knob B) connects the switch points over which the strips lie. D is a brass strip which makes contact only with



Dead-End Switches Are a Practical Necessity Nowadays On All Radio Receptors.

outside row of points. Suppose (D) were on point 5. Then the pairs 1, 2, 3 and 4 would be connected, but 6 and 7 would be entirely out of circuit, because (D) touches only the outside switch point. D connects to ground.

Contributed by HERBERT RICHTER.

www.americanradiohistory.com



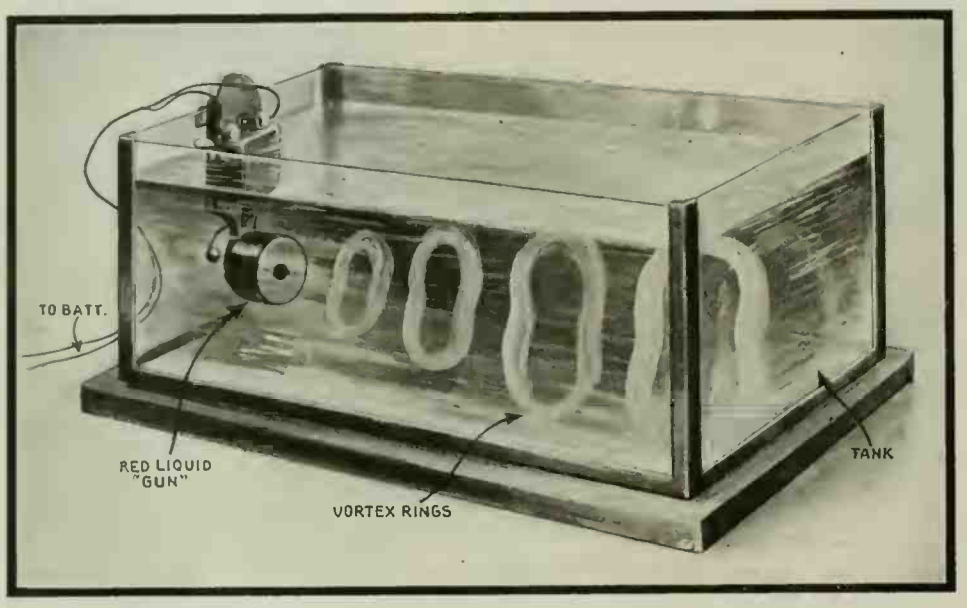
The Vortex Ring Theory of the Electron

By F. W. RUSSELL and J. L. CLIFFORD

THE discussion of the various theories of matter is one of the most important problems that confront the scientist today. Chemistry, Physics, and nearly all branches of science hinge upon this question. The atomic theory has been thoroly establisht, but the ultimate structure of the atoms is still an open question. The leading theories of today make use of smaller particles called electrons to form their hypothetical atoms. These particles were first discovered by Crookes, and about 1897 were definitely proved by Weichert, and Sir J. J. Thomson, to be negatively charged particles traveling with the enormous velocity of nearly 100,000 miles per second. In addition it was found that these particles had an extremely small mass. In fact about one eighteen-hundredth the mass of an hydrogen atom, the smallest known atom. The presence of these particles was again proved by the disintegration of Radium, and even an electric current is now believed to be a flow of these electrons. The electron then is one of the most important entities in the world today, and yet there are very few theories as to the nature of the electron. The physicist has side-stept the problem in the past by simply calling it a hard negatively charged corpuscle, but what a hard corpuscle is, is left to the reader's imagination to picture. Lately, however, the new school of French physicists have brought forward the theory which seems most complete and astounding. They claim that the electron is nothing more or less than a minute whorl in the ether, or as we shall call it an ether vortex ring.

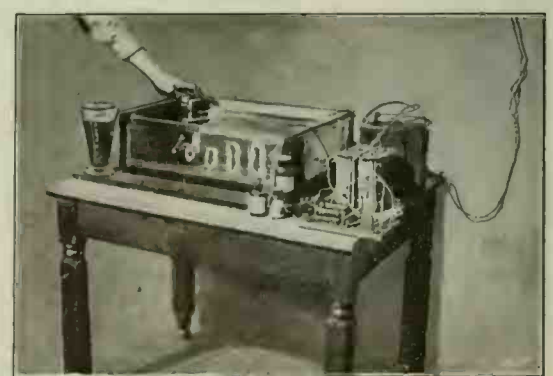
When Lord Kelvin brought forward about 1870 his famous vortex ring theory of the atom, the scientific world hailed with delight this tangible explanation of the structure of the atom. Upon the discovery of the electron, however, the vortex atom theory was thrown into the background and into obscurity. Since the new theory of the electron has been proposed, however, it is interesting to repeat and discuss the experiments with smoke and liquid rings performed by the experimenters wishing to prove the vortex atom theory.

The simplest form of apparatus needed to produce rings of smoke is a round cardboard box with a small aperture in one end. If the box is filled with smoke or with fumes of Ammonium Chlorid formed by the action of Ammonia and Hydrochloric Acid, and the opposite end tapt sharply, rings of smoke will be projected from the box and will hold their shape for some time. The rings move swiftly forward, carrying with them the same material with which they issued from the box, and seemingly possess elasticity of form. Altho many interesting phenomena may be observed using this simple form of apparatus, for accurate and detailed experiment the liquid ring apparatus, described below, will be found the more practicable.



A Most Beautiful Laboratory Experiment Is that of the "Vortex Ring". With the Simply Constructed Apparatus Here Illustrated Vortex Rings of Various Sizes and Kinds Can Be Set Up At Will, By Means of the Red Liquid "Gun" At the Left of the Tank. Various Colors of Rings Can Be Made with Different Solutions. The "Gun" Is Actuated By an Electric Bell Movement, Minus the Gong.

The first requisite is a glass tank at least 30 inches long by 12 inches wide and high. A gold fish aquarium will answer the purpose, provided it conforms to the dimensions. If an aquarium is not available, a tank may be easily constructed by making a box with the base of wood and the sides of glass plates. This box should be well coated with asphaltum in order to make it water tight. When the experimenter has provided himself with a suitable tank, the next problem which confronts him is the construction of the "gun" or projector with which to generate the vortex rings. An efficient gun may be easily manufactured from odds and ends to be found in any experimenter's laboratory. As may be seen in the drawing, Fig. 1, the two principal parts of the gun are the liquid container and the electric agitator. At one end of the liquid container, which consists of a round tin box, is fastened a diafram of Phosphor-Bronze sheet or other flexible substance. In the opposite end, which may be the cover to the box, a small hole about $^{3}/_{16}$ of an inch is cut, care being taken that the sides of the hole are smooth in order to insure perfectly formed rings.



Here We See the Actual Vortex Ring Apparatus Set Up In the Authors' Laboratory.

www.americanradiohistory.com

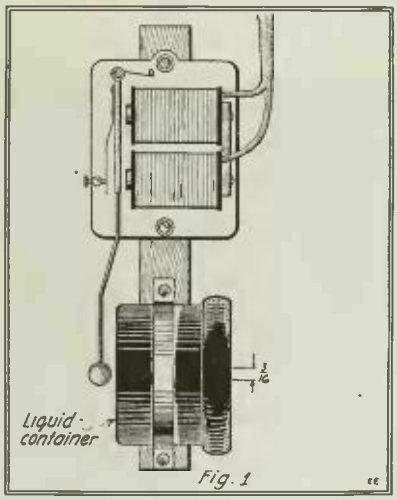
The box should be made water tight. As may be seen in the drawing the agitator consists of a strong electric bell with the gong removed, and the leads taken directly from the coils. The bell should be well impregnated in paraffine or other insulating compound so that it may be submerged without danger of short circuit. The bell should be so placed that the striker will strike the center of the diafram a forceful blow when the magnets are energized. The best position for the striker can only be determined by actual experiment.

When the projector has been completed, if the experimenter wishes to use red colored rings, the liquid container should be filled with a solution of Sodium Hydroxid, and Phenolphthalein. Be sure that all the air has been expelled, as any air in the container causes the rings to be irregular. The gun is then lowered into the tank, and the magnets energized by means of batteries, controlled by a telegraph key. Rings will be seen to issue from the aperture, and traverse the length of the tank intact. If the water is slightly acidulated with Sulfuric Acid the rings will immediately disappear upon breaking up. If the experimenter wishes to make milk-white rings, an emulsion of Silver Chlorid can be used that will become colorless in a weak solution of Ammonia. To make such an emulsion a tablespoonfull of gelatin should be dissolved in about a liter of hot water. About 15 grams of Silver Nitrat previously dissolved in water should be added. Then stirring well, add a weak solution of Hydrochloric Acid until the Nitrat is all precipitated as a chlorid. This milk-white solution should be diluted with equal parts of water before using. Rings of this solution shot out into a weak solution of Ammonia, will hold their form until broken, and will then completely disappear. The amount of current necessary for each gun can only be determined by practice, and the nature of the rings wished. After some practice, the key can be so manipulated as to produce swiftly, or slowly moving rings. Two guns should be constructed, as it is necessary in some experiments to connect them in series, and shoot rings towards each other. The guns should be so arranged on handles that it is possible to shoot rings from all angles under the water. When the guns have been adjusted and the tank filled, the experimenter is ready to begin his experiments.

The kinetic energy of these rings is considerable, as shown by several rather interesting experiments. If a light watch chain be suspended in the path of a ring it will be noticeably deflected by the impact of the ring striking it, altho the ring itself is broken. If a piece of light tissue paper is tightly stretched on a frame, and held in the path of the rings, the rings will break thru the paper, but in turn are broken up by the impact. A pretty experiment is to similarly stretch a piece of chiffon cloth and hold it before the gun. *The rings will pass thru it without being broken or disturbed in their motion.*

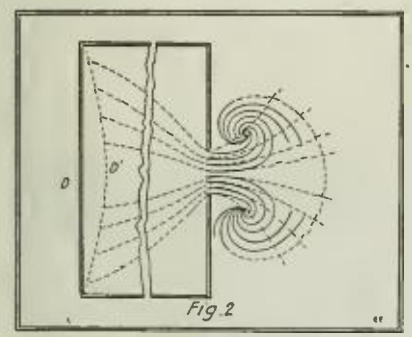
If two guns are placed opposite each other, and rings be projected simultaneously, it will be observed that if they strike each other fairly, both will be broken up. If, however, their path is such that they would merely have touched on their edges, they will bend out of their course and will pass each other without injury. This phenomenon of the mutual repulsion of the rings is in accordance with the modern idea of the electron; namely, that they are like charges of electricity, which repel each other. These vortex rings, of course, are not supposed themselves to have any electric charge, tho acting like an electron; they are simply clever illustrations of *what an electron is supposed to be.*

If a ring is shot towards the surface of the water in the tank, it will be noticed that at certain angles, it is reflected from the surface and *continues in a new path* the same as the angle of incidence. At other angles the ring will not be reflected but will jump out of the water with a spurt. Besides being reflected it can be shown that these vortex rings can be refracted. The tank should be half filled with water, and a dense solution of Sodium Chlorid siphoned into the bottom of the tank, so as to make a layer of denser liquid underneath the water. If a swiftly moving ring be shot so as to pass into the salt solution at an angle it will be noticed that the ring will pursue a slightly downward course, curving slightly.



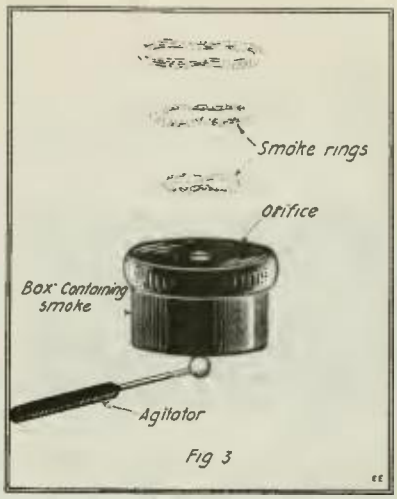
One Way of Making the Liquid "Gun" for Shooting Vortex Rings Thru Water as Shown in the Illustrations On Opposite Page.

There are many more experiments in this line, which space does not permit us to enumerate. We will, however, name a few extremely interesting experiments. The aperture can be cut in all manner of forms, thereby imparting to the ring various vibratory movements, or two holes can be cut near each other, thus projecting two rings at the same moment. Rings can also be shot into a lighter layer of oil, which is poured over the surface of the water, and interesting results may be obtained. If it is desired to procure actual models of the rings, the gun should be filled with melted paraffine, and the ring shot from a layer of hot water into a layer of cold water beneath. *The rings will harden upon coming into the cold water, and may thus be saved.*



The Formation of the Vortex Rings. When the Diafram is Moved from D to D', the Stream Lines of the Liquid Outside the Aperture Will Be Somewhat as is Indicated By the Full Lines. The Liquid Bends Into Spirals, Each Particle Moving Towards the Place Where the Pressure is Diminishing, and the Ring Formed Continues to Rotate Around a Circular Center.

A word as to the formation of the rings by the gun will doubtless be necessary. Referring to Fig. 2 it will be noticed that when the diafram D is moved from D to D' the stream lines of the liquid outside the aperture will be somewhat as is indicated by the full lines. After the liquid has issued from the aperture it would be expected that the liquid would move as the broken lines indicate. Instead it bends into spirals, each particle moving towards the place where the pressure is diminishing, and the ring formed continues to rotate around a circular center.



The Vortex Ring Smoke "Gun." Every Time the Bottom or Diafram of the Box is Struck, a Smoke Ring Issues from the Small Opening in the Top of the Box.

Water is one of the best mediums for producing vortex rings, because it is incompressible. It has, however, a great viscosity, and internal friction, which prevents their being permanently formed. According to the mathematician, in a perfect fluid, such as ether is supposed to be, a vortex ring could never be created, but if once formed could never be destroyed. Thus an electron, if it were an ether vortex ring, as is surmised, would be indestructible. This accords with the theory of matter as accepted today.

TESTING THE QUALITY OF MILK.

By means of two simple tests it is possible to determine with a reasonable degree of accuracy the quality of milk. A qualitative test to show whether the milk contains water or not is made in the following manner. Take a perfectly clean steel hatpin and immerse it point down into the milk. If on withdrawing it a film of milk covers the same, there is no free water present. On the other hand the presence of water in small quantities will prevent the milk adhering to the pin.

Should the above test show the presence of water the percentage of the same can be obtained in the following manner:—Take an ounce of plaster of Paris and wet it with the milk under test till a smooth paste is formed. Allow the paste to dry, determining the length of time that elapses before it hardens. The percentage of water can then be obtained from the following table:

Time	% Water	Time	% Water
20 min.	75	5 hrs.	12½
30 min.	50	6 hrs.	10
1 hr.	40	7 hrs.	7½
2 hrs.	25	8 hrs.	5
3 hrs.	20	9 hrs.	2½
4 hrs.	15	10 hrs.	0

This test depends on the fact that the cream in the milk retards the hardening.

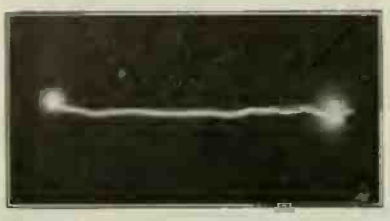
Contributed by T. W. BENJAMIN.

www.americanradiohistory.com

"Ball Lightning" Experiments

By SAMUEL S. WEISIGER, Jr.

IN the January, 1916, issue of the ELECTRICAL EXPERIMENTER you publisht a discourse on "Ball Lightning," and gave instructions for the experimental production of it. Thru the kindness of Mr. Porter, Instructor in Physics at the



This Is Another "Freak" Discharge. The Ball Travelled In a Very Crooked Path to the Positive Electrode, and Here Exploded. The Force of the Explosion Was So Great that a Part of the Spark-Ball Was Thrown to the Other Side of the Positive Electrode, from Whence it Continued to the Positive Electrode.

Allegheny High School, I have been able to make the several photos accompanying this letter. Under each photo there is given a short description of the circumstances under which each discharge was made and the phenomena connected therewith.

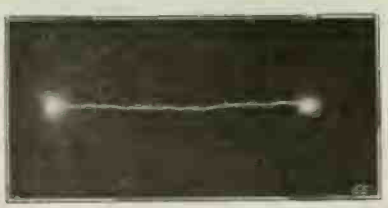
In making these photos a 75,000 volt Toepler-Holtz static machine was used. The distance between the sharp metal points was from 5.5 to 6 centimeters. This distance must be found by experiment, and altho it is absolutely essential to have the correct distance between points, it will nevertheless differ with the capacity of the static machine.

Much trouble will be encountered if the sharp points, used to produce the discharge, are not free from grease and highly polished. The best way to polish the points is to take a little powdered chalk (blackboard chalk which has been scraped to a fine powder with a knife) and put it on some kind of cloth and turn the point of the electrode, at the same time giving considerable pressure to the cloth where the point is being turned.

The best connection for the electrodes was found to be obtained by means of two brass chains.

Two large-sized, sharply pointed darning needles suitably mounted form admirable electrodes. It is practically impossible to use blunt needles.

There will be much trouble in finding the correct spacing for the electrodes and it will probably require some experimentation. In any case the spacing is dependent on the power of the static machine.



Some Trouble Was Encountered In Getting this Spark-Ball to Form. Evidence of This Is Shown By the Plate Being Exposed By a Tiny Charge Or Burst of Light On One Side of the Negative Electrode. The Uneven Course of the Spark-Ball Is Clearly Defined.

When the plate is put under the electrodes be sure to get the emulsion side up, as the discharge occurs better when the plate is placed in this manner.

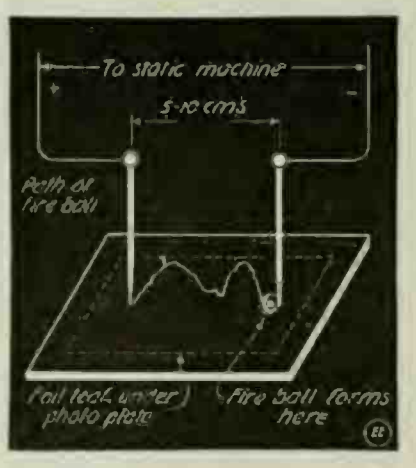
When the plate is under the electrodes and the static machine has been started, the spark ball should form very quickly. After the ball has detached itself from the electrode, turn the machine very slowly in order to expose the plate longer. The rate of travel of the spark ball is proportional to the speed of the static machine.

Should the machine be stopt before the spark ball reaches the other electrode, the plate will only show the path of the ball to that point.

* * * *

Knowing that there is considerable interest in these "Ball Lightning" experiments we have republisht below the original directions for producing ball lightning in the laboratory as outlined by the famous French scientist—M. Stéphane Leduc. His experiment makes possible the production of a slowly moving globular spark not easily obtainable in any other way, in so far as we know.

To produce this imitation ball lightning it is necessary to employ two very fine highly polished metallic points, each of which is in connection with the positive and negative poles, respectively, of a static machine of small or medium size. These

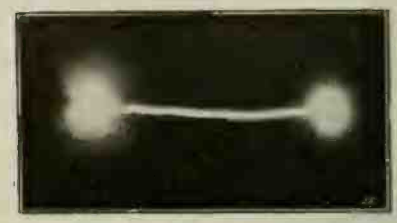


Scheme for Producing Ball Lightning In the Laboratory with Static Machine, Photograph Plate and Two Needles.

two metallic points must rest perpendicularly, as our illustration indicates, on the sensitive face of a gelatin bromid of silver photographic plate, which is placed on a metallic leaf, such as tinfoil. The two metal points are spaced about five to ten centimeters apart. When the static machine is operated an effluvium is produced around the positive point, while at the negative point there is formed a luminous *fireball* or *globule*.

Now, when this globule has reached a sufficient size, it will be seen to detach itself from the metallic point, which then ceases to be luminous, and the globule will begin to move forward slowly over the surface of the plate, taking various curved paths and eventually it will set off in a direction toward the positive metal point. When it reaches this electrode the effluvium is extinguisht and all luminous phenomena ceases. Further, the static machine acts as if its two poles were short-circuited, or, in other words, united by a conductor.

The velocity acquired by the luminous globule as it travels is quite slight, it taking from one to four minutes for it to traverse a path of six centimeters in some cases, and before reaching the positive electrode the globe bursts into two or more luminous balls which individually continue



This Is Probably the Best Photo of the Set, the Spark-Ball Being the Largest Obtained. You Will Notice the Manner In Which the Ball Broke Into Two Parts and Each Part Proceeded to the Pole. The Effluvium Around the Positive Pole Shows Signs of a Violent Explosion As Will Be Noted By Closely Examining the Tree Formation Made By the Bursting Spark-Ball.

their journey to the positive electrode. On developing the photographic plate (which, of course, should be placed under a ruby light while the foregoing experiment is conducted) there will be found a trace on it of the exact route followed by the spark globule—the point of explosion, the routes resulting from the division, and the effluvium around the positive electrode point. Also, if one should stop the experiment before the globule's arrival at the positive electrode, the photograph will only give the route to that point. The fireball takes for its course the conductor, which apparently short-circuits the static machine. If sulfur or some other powder is thrown on the photographic plate while the experiment is being conducted, and also while the ball is moving, its path will be marked by a line of aigrettes, looking very much like a luminous rosary.

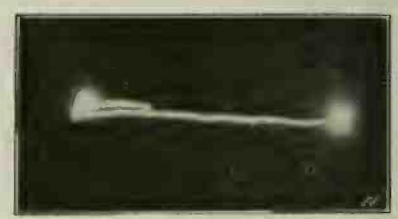
[*The Editors will be glad to hear from any of our readers who have made experiments in this direction. Photographs are particularly welcome.*—ED.]

HORSE-POWER OF WIND MILLS.

Below is given a table showing the actual useful horse-power developed by a windmill working under different conditions.

HORSE-POWER OF WINDMILLS

Diam. of Wheel in Feet	Velocity of Wind, Miles per hour: 8	10	12	16	20	25	30
	Actual useful Horse-Power Developed						
12	0	⅛	¼	½	1	1⅔	2
16	⅛	⅜	¾	1½	2¼	3½	4
20	¾	1¼	2	3	4	5½	7
25	1¼	1¾	3	4½	6	8	10
30	2	3	4	5½	7	9	12



This Is One of the "Freak" Ball Lightning Discharges. The Spark Ball Formed At the Negative Electrode and Travelled Straight for the Positive Pole, But Did Not Reach It. It Disappeared Without Exploding. The Machine Was Kept Going and for Some Unknown Reason Another Ball Formed and Backed Away from the Negative Electrode, and Broke Into Two Pieces Before It Reached The Positive Electrode.

www.americanradiohistory.com

A Useful Electrical Laboratory Switch-board

By H. DANNER

A SWITCH-BOARD is a valuable accessory to any Experimenter's electrical laboratory. The switch-board here described is intended for use on an *alternating current* circuit of 110 volts, 60 cycles frequency. But if the switch-board is to be used on a *direct current* circuit the only changes necessary are the substitution of D. C. instruments and the removal of the low voltage transformer.

The marble or slate panel is 3 ft. 10 in. long, 2 ft. 6 in. wide and 1 or 1¼ in. thick. It is supported by two angle iron uprights, 2 x 2 inches, and 6 ft. 4 in. long, plus four inches which is bent back as a foot as illustrated in Fig. 4. To make this bend saw off one side of the angle four inches from the end and after heating it red bend at right angles by putting it in a vise. Use a hammer to make a square bend. The panel is fastened to the angle irons by six ⅜ inch bolts as shown in Fig. 1. The weight of the marble or slate is supported by a piece of angle iron across the bottom of the switch-board fastened as shown in Fig. 5 (a bolt can be used instead of a rivet). The top of the board is braced to a wall by means of a flat piece of iron bent on one end to permit it being bolted to the wall.

A marble drill should be used in drilling the marble, but an ordinary drill will serve the purpose. Water will help to drill either marble or slate.

We are now ready for the instruments and switches. The voltmeter is preferably a Weston model 151, 0—150 volt scale range. The ammeter is the same model, 0—150 amperes scale range. Both instruments are 9½ inches in diameter. All connections are made at the back, conforming to standard switch-board practise.

The main line cut-out is of 100 amperes capacity and is located between the instruments. The main line switch, 100 amperes, connects the bus-bars to the line. The ammeter is connected in series with the switch (see Fig. 1). The volt-meter is connected to a small, double-pole, double-throw knife switch, one side of which is connected across the main bus-bars and the other side across the step-down transformer outlet.

The upper set of (copper) bus-bars are ⅝" x ⅛" x 24" and are spaced two inches apart. The bars leading from the main line switch to the second set of bus-bars are of the same size. The lower or second set of bus-bars are ½" x 3/64 x 24".

The bus-bars are fastened by No. 8—32 copper or brass machine screws (⅛" in diameter). All connections must be well made. The bars are insulated by bending them up and over the other bars. The switches are connected to the bus-bars by short pieces of copper bars.

The upper row of switches consist of two 60 amp. D.P.S.T. switches placed in the center and two 30 amp. D.P.S.T. switches on each side. All the switches have fuse clips attached of proper capacity.

The four switches in the lower row are 15 amp. D.P.S.T. switches.

Below this row are placed three plug receptacles, two *polarized* and the other unpolarized, located as shown in the drawing. A double-pole double-throw 15 ampere switch is placed in the middle with a small charging rheostat on the right. This switch connects the storage battery to the motor-generator and to the discharge outlet. The plug receptacle on the right is connected directly to the motor-generator and affords a source of direct current. The one to the left of the switch is connected to the storage battery and is of use in many experiments. The plug on the left side is connected to the step-down transformer.

The service to which the individual switches are put depends upon the needs of the experimenter. The two 60-amp. switches are intended for the arc, electric furnace, or for a 5 K.W. step-up transformer and other apparatus requiring over 30 amperes. The switch for the arc is connected to the stage plug at the bottom of the switch-board. A variable resistance is connected in series with the stage plug.

The first switch on the left-hand side, second row, connects the primary of the step-down transformer to the line. The next switch to the right is for a high voltage transformer. Then comes the hand wheel or knob of a small field rheostat for the motor-generator. The field rheostat is mounted behind the board in such a position as not to interfere with the other apparatus. To the right of this comes the motor-generator switch, and on the right is the switch for the lights.

The transformer slide at the lower left-hand side consists of a ¼" square brass rod 14¼" long. Over this rod a ¼" square hollow tube, 1 inch long is fitted, with a handle and spring contact large enough to cover only one contact point at a time. The contacts can be made from ⅜" round brass rod and fastened and connected in the same manner as starting box contacts. Use your judgment in all of this work. There

(*Continued on page 753*)

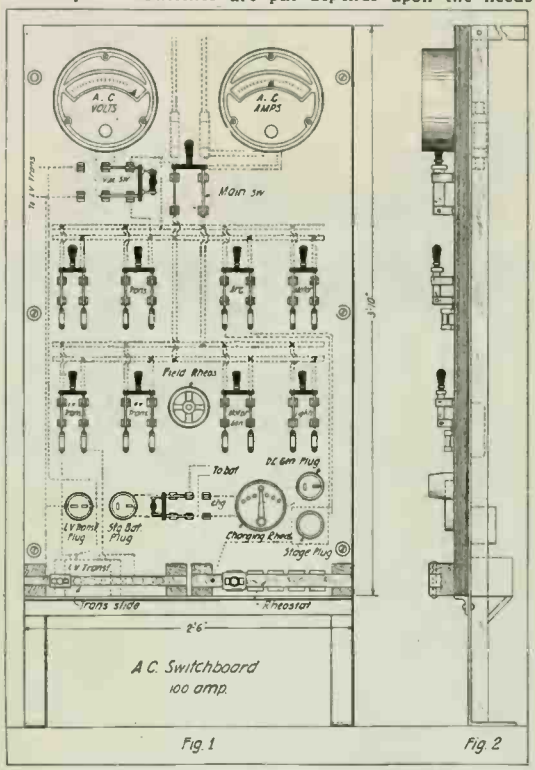
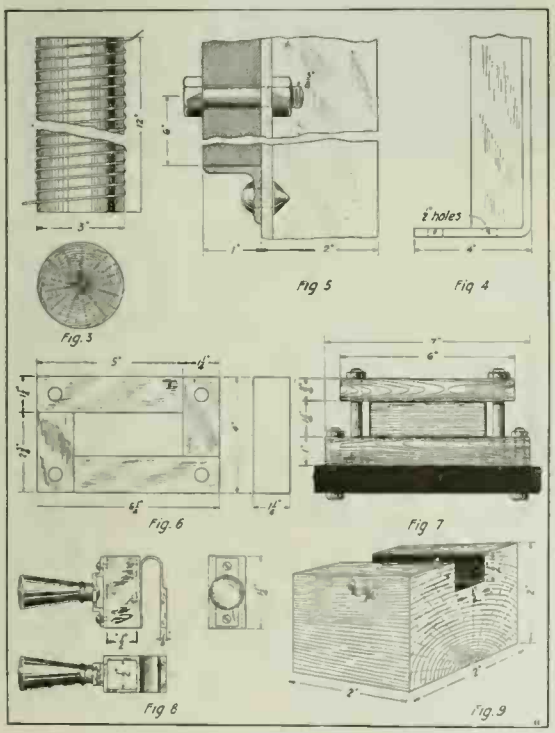


Fig. 1 Fig. 2

The Experimenter Desiring an Attractive and Efficient Switch-Board Will Find the Design Here Suggested an Excellent One. It Is Fitted with A. C. Low Voltage Transformer and D. C. Battery Charging Rheostat, as Well as Volt and Ammeter.



Details of Transformer, Sliding Switch, Switch-Board Support and Other Parts Used in Building the Laboratory Switch-Board.

www.americanradiohistory.com

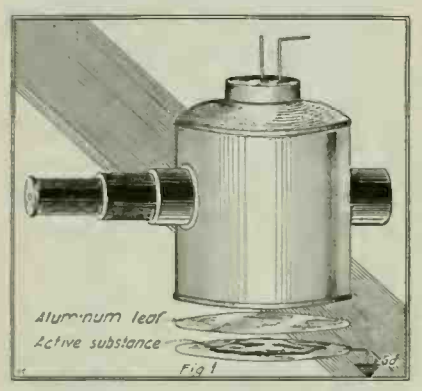
Experiments in Radio-Activity

By IVAN CRAWFORD

PART II—Ionization (Continued)

IN the first installment the construction of a super-sensitive electroscope was outlined, and the conduction of electricity thru gases partially discust.

Before going further into the mysteries of radio-active phenomena it is fitting that further experiments with this electroscope should be given. Another method



Home-Made Telescope-Electroscope For Use In Studying the Retardation of Alpha Particles By Aluminum.

for the detection of *ions* will also be given.

The retardation which an alpha particle experiences in its course thru matter, depends entirely upon the atomic weight of the atoms thru which it passes. Bragg and Kleeman found that the retardation of the alpha particle was approximately proportional to the square root of the atomic weight of the substance. In the case of metals, their weight per unit area, required to completely overcome the alpha radiation, is proportional to the square root of their atomic weight.

It was found that the retardation of the alpha particle by complex molecules was an *additive* property. For, consider that a molecule is composed of N number of atoms of atomic weight W, together with N^1 number of atoms of atomic weight W^1, etc. Then the retardation of the alpha particle is $N\sqrt{W} + N_1\sqrt{W^1} \ldots$.

Sir Ernest Rutherford has determined the specific retardation of alpha rays in metals both by observation and calculation. A few of his results with the commoner metals are given below: s is the observed stopping power of the atoms in terms of air as unity; w is the atomic weight. It will be noticed that the quotient $s/\sqrt{w}$ is approximately equal in all cases.

Metals.	Al.	Fe.	Cu.	Pb.
s	1.495	2.29	2.46	4.27
$\sqrt{w}$	5.2	7.48	7.96	14.35
$s/\sqrt{w} \times 10^3$	287	307	309	298

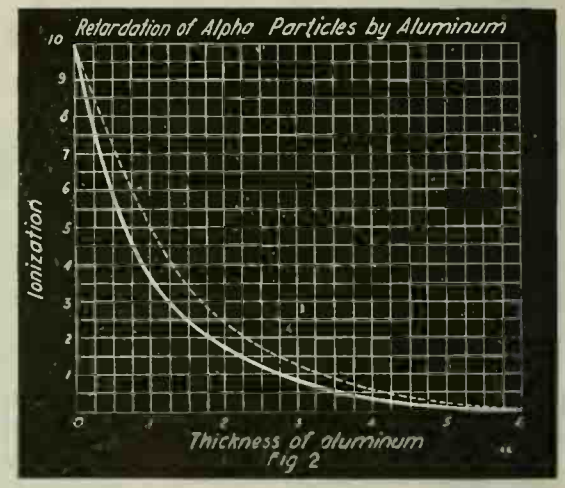
By a series of simple experiments the reader may determine the retardation of alpha particles by thin sheets of the commoner metals. On a grounded metal disc a quantity of radium bromid is placed. See Fig. 1. Thin sheets of aluminum, brass, copper, iron and lead should then be interposed between this active material and the electroscope. The discharging current should then be measured as outlined in the previous paper. The sheets of the various metals should be of the same thickness to allow comparison. It will be noticed that the experimental results will compare very favorably with the calculated values.

A very interesting experiment is to interpose successively various thicknesses of aluminum between the radium bromid and the electroscope. With the electroscope empty the gold leaf past over five divisions on the scale in 412 seconds. The time with uncovered radium bromid was 15 seconds. Upon placing a sheet of extremely thin aluminum leaf over the ionizing agent the electroscope discharged in 25 sec., showing that a portion of the alpha radiation was stopt by the aluminum leaf. When a sheet of aluminum foil about .001 of an inch thick was interposed, the electroscope was discharged in 137 sec. A sheet of aluminum .01 of an inch thick cuts off the entire radiation, and the ionization caused by beta particles, which easily penetrate this obstacle, is very small, discharging the electroscope in about 380 sec. A sheet of lead cuts off the entire radiation, the electroscope discharging the same as when empty.

To determine the retardation of alpha particles by aluminum the following experiment may be performed. The radium bromid is covered by successive layers of aluminum leaf and the discharging current measured in each instance. For radium the ionization falls off in geometrical progression as the thickness of the aluminum is increased. Thus, as Makower has shown, where I_0 is the intensity of the active substances uncovered, then I is the intensity when a thickness of aluminum, t, is interposed.

$$I = I_0 e^{-\lambda t}$$

Where e is the base of the Naperian logarithms and λ is an absorption constant which has a different value for each substance. It is proportional to s in the preceeding table. This law holds true for homogeneous radiations, but when using ordinary radium bromid as an ionizer, four sets of rays are given off, each having a different penetrating power. Until the thickness of the aluminum is great enough to cut off one set of rays the law given above will hold true. The author has found that about 6 thicknesses of aluminum are sufficient to cut off the first set of radiations. In the accompanying graph Fig. 2, the full line indicates the successive stopping powers up to 6 thicknesses of aluminum leaf for radium as determined by Rutherford. These results were obtained by the author and experiments by the reader should be proportional to these.



Graphic Chart Showing the Effect of Different Thicknesses of Aluminum In the Retardation of Alpha Particles.

That the radiations given off by radio-active materials ionize the air into positively and negatively charged carriers can be readily proven by the following experiment: Connect a spark gap with an induction coil and with a vacuum tube as indicated in Fig. 3. A large Geissler tube will give excellent results, the larger the better. The spark gap should be capable of fine and delicate adjustment. The coil must not give too strong a discharge, but the discharge must be very steady. Arrange matters so that the coil gives a steady discharge at the spark gap and then draw the electrodes apart until the discharge just passes thru the vacuum tube, only an occasional spark crossing the gap. A small quantity of radium bromid is then brought into the vicinity of the spark gap. When this is done the Geissler tube will be partially dimmed and the discharge will pass by way of the spark gap. The greater the amount of radium bromid used the more the tube will be dimmed. This is caused by the ions formed by the radiations from the active radium bromid. If care is taken that the conditions named above are secured the experiment will always be successful.

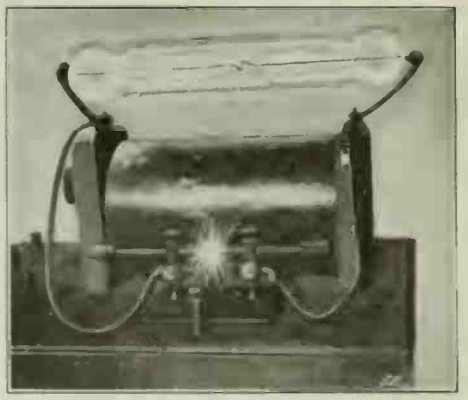


Fig. 3.—A Very Interesting Experiment Can Be Conducted With a Geissler Tube and Spark Gap, Excited By a Spark Coil, In Connection With Some Radium Bromid. The Radium Will Dim the Tube, the Spark In the Gap Becoming Heavier.

(To be continued)

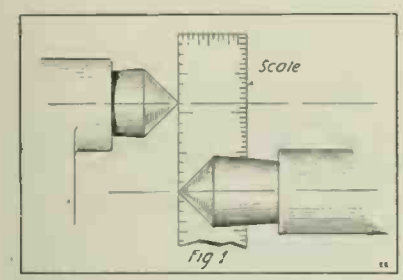
www.americanradiohistory.com

Experimental Mechanics

By SAMUEL D. COHEN

LESSON X

ANOTHER valuable feature that the lathe possesses is the cutting of tapers. Standard tapers are rated at the amount with which the diameter changes in a foot's length. We will take as an instance the standard Brown and Sharp taper, which is one-half inch per foot, and how it is turned in the lathe.



Measuring Off the Required Distance Between the "Live" and Tail-Stock Centers, Preparatory to Turning a Taper in the Lathe.

First, it can be turned by the use of a taper attachment on the saddle of the machine, or else by offsetting the tail-stock from its regular central position to give the required rate of change in the diameter. In all taper attachments the settings are graduated to read direct. Thus it is easy to set the tool for cutting the prescribed taper. The second method of offsetting the tail-stock is not as simple as the first. If the distance of the center points enter the work, or the mandrel is ignored, the mandrel length can be considered as the distance between the central points. In order to determine at what length the centers shall be offset for a given taper, a simple arithmetical calculation will be required. This is done by multiplying the length of the work or mandrel in feet by one-half the required taper in inches. To turn a Brown and Sharp taper on a piece of work nine inches long, the problem would work out in the following manner. This particular calculation refers to the one-half inch taper per foot specified in the opening paragraph of this lesson:

$$\frac{\frac{1}{2}}{2} \times \frac{9}{12} = 0.1875 = \frac{3}{16} \text{ inch.}$$

The value of 3/16 inch would be the required amount necessary to offset the center of the tail-stock. The off-centering is accomplisht by unscrewing the set screw on the base of the tail-stock and shifting it towards the cutting tool 3/16 inches away from its original center-line position. Fig. 1 illustrates the simplicity of accurately figuring the exact position of the respective centers by the use of a steel scale or rule.

It will be noticed that in the above illustrative problem that both the length and amount of taper are given. However, at times it happens that the amount of taper is not given. Let us suppose that a piece eight inches in length is to be turned on one end. The taper portion should be four inches in length. The difference in diameters of this four inch section is to be one-half inch. The problem is, how much must the tail-stock be offset? If the taper is ½ in 4 inches, it would be 1½ inches in a foot or three times as great. and the tail-stock would be moved over one-half of 1½ inches or ¾ inch. This calculation holds good were the piece a foot long, but as it is 8 inches. or ⅔ of a foot, the tail-stock should be moved over ⅔ x ¾, or ½ inch. Should the piece be twenty inches long, the tail-stock would be moved 1⅔ x ¾, or 1¼ inches.

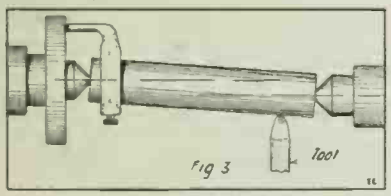
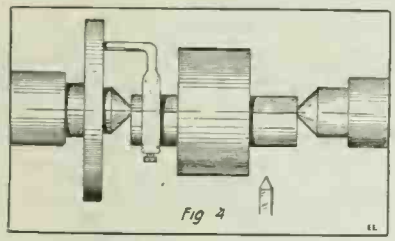


Diagram Showing Plainly How a Piece of Stock Is Placed Between Off-Set Lathe Centers When It Is To Be Turned On a Taper.

The above problem was assumed for simple calculation, the lathe centers merely touching the ends of the working piece, thus making the length of the piece the same as the distance between the centers. In actual practise the depth of the centers in the work must be considered. The calculation should be as accurate as possible to avoid continually changing the tail-stock in order to get a reasonably good taper fit. The necessity of considering the exact distance between centers depends somewhat upon its length. If the piece is very long the actual taper will differ considerably from the calculated taper. If each center enters the piece ¼ inch they would enter a total of ½ inch. The length of the piece should thus be reduced by ½ inch in the calculation. While turning the taper, the calipers should be used frequently so that it may quickly be determined whether or not the tail-stock is correctly placed for the job in hand.

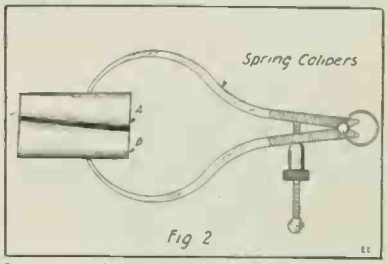


Eccentric Discs For Steam Engines and the Like Are Bothersome Jobs To Turn. This Diagram Shows How An Eccentric Is Readily Centered On An Arbor Having Off-Set Centers.

In order to test the accuracy of the taper as it is turned it should be prest lightly into a standard tapered hole and worked back and forth sufficiently to mark the places where bearings points occur. If the work has been lightly covered with some marking pigment (chalk), the bearing points will be more distinct. However care must be taken that the coating is not too heavy, as it will be liable to deceive the amateur. Adjust the taper setting until a correct fit is obtained.

Another very good method of testing the exactness of the taper is to obtain another taper mandrel or form of standard size, having the same taper pitch. and placing its surface against the one cut, as shown in Fig. 2, where either A or B can be the *standard*. Then set a pair of calipers on one side, and run over the entire surface with the same setting of the calipers. If no indication is shown of surface irregularity the taper is said to be true; if high or low marks are present, the taper is not true and a readjustment of the tail-stock setting is necessary to correct it.

In turning down a taper the centers must be employed. This work must be turned down with the aid of the face plate and dog shown in Fig. 3, which illustrates the position of offset work for taper cutting. A lathe chuck cannot be used for this class of work, as the piece to be turned down is kept rigidly in place in a central position, thus preventing its position from being offset. The chuck is used only when a taper attachment is employed. It should never be used otherwise. At times in cutting a very short taper or conical point and when a compound rest is at hand the compound rest is turned to an angle equal to the angle of the taper to be cut. However it is advisable to adhere to the simple method of cutting a taper and as soon as the novice feels quite safe with this method he will then be at liberty to try those more difficult.

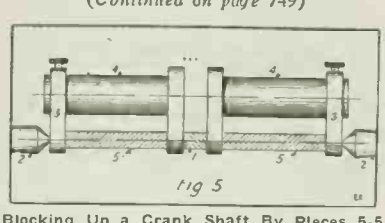


One Method of Testing the Accuracy of a Tapered Piece By Placing It Alongside a Standard Taper, and Running the Calipers Over Them.

The experimenter who is mostly familiar with the use of the lathe for turning concentric objects will now see that the lathe is just as useful in turning objects of eccentric shape. The most common of such objects is the eccentric which operates the valves of a steam engine. If the work has a hole thru it, as in the above example, the hole is first finished to the required dimensions and then a mandrel is used for carrying the work on the lathe centers. While the mandrel has been built on one set of centers exactly true with its axis, for concentric turning, it has a second set of centers which offset the amount required for the eccentricity specified. In the case of eccentrics made solid with the shaft, there are two sets of centers, one for turning the shaft—and the other for stabilizing the opposite end of the shaft. Fig. 4 shows how such an eccentric is arranged in the lathe for proper turning. Note the position of the central axis of the object with respect to the *live* and *dead* centers of the lathe. At certain times the specified eccentricity is too extreme to allow both pairs of centers coming within the limits of the diameter of the shaft. Special ends may be cast, forged (or clamped) on the ends of the work, and can afterward be machined off. In crank-shaft turning, special attachments should be provided for the ends of the shaft, or special chucks for eccentric turning may be made to hold the work.

The turning of crank pins on shafts is

(*Continued on page 749*)



Blocking Up a Crank Shaft By Pieces 5-5, and Clamps 3-3, So As To Make It Rigid While the Bearing 1 Is Being Machined In the Lathe.

www.americanradiohistory.com

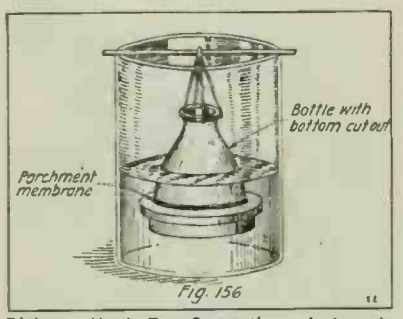
Experimental Chemistry

By ALBERT W. WILSDON

Thirty-third Lesson

ARSENIC: History.

THE ores of Arsenic, in the form of its two sulfids, *Realgar* and *Orpiment*, were known to the Alchemists. Geber was familiar with the oxid, and Mangus refers to the metal; but Brandt, in 1773, first showed that white arsenic was obtained by burning the metal.



Dialyzer Used For Separation of Arsenic Prior to Applying the "Marsh" or Other Test For the Element.

Occurrence.

This metal is quite widely distributed in nature, while in the free state it is occasionally found in distinct crystals. It is more abundantly distributed in the combined stated, as *Arsenolite* [As_2O_3], or the sulfids, as *Orpiment* [As_2S_3], and *Realgar* [As_2S_2], or in the form of the metallic arsenids. *Arsenical iron* [$FeAs_2$], and *Arsenopyrit* [FeAsS]. It is also found in reducing ores of Nickel, Cobalt, etc., being obtained as a by-product of *Cobalt Glance* [CoAsS] and *Nickel Glance* [NiAsS].

Preparation.

Metallic arsenic is prepared by subliming the native mineral or by reducing arsenous oxid with charcoal:

$$As_2O_3 + 3C = 2As + 3CO.$$

Probably the largest quantity is prepared by subliming arsenical pyrits:

$$2FeAsS = 2As + 2FeS.$$

In the first process above mentioned, the arsenical pyrits are oxidized by roasting, that is, heating with access of air. This gives the oxids of the three elements, Fe_2O_3, As_2O_3, SO_2. The first remains behind in the retort, SO_2 escapes as a gas, and As_2O_3 sublimes. It may be purified by resubliming. The metallic arsenic is obtained by reducing the oxid with charcoal.

$$As_2O_3 + 3C = 3CO + 2As.$$
$$2As_2O_3 + 3C = 3CO_2 + 4As.$$

Some Arsenic can be obtained by excluding air and heating FeAsS.

$$FeAsS = FeS + As.$$

Properties.

Arsenic appears usually in the form of a steel-gray, brittle, crystalline mass, of metallic luster.

It is a good conductor of electricity.

It is easily volatile, then possessing a garlic odor.

It hardens lead when alloyed with it; hence its use in shot manufacture.

When roasted in air, it forms As_2O_3. When air is past over it in a hot combustion tube, it burns with a blue flame.

It has great attraction for chlorin, burning in it like antimony, to form the chlorid, $AsCl_3$.

Like its salts it is poisonous when taken into the stomach.

At a temperature higher than 180°C., it unites directly with most elements.

It unites with metals to form arsenids, analogous with the sulfids.

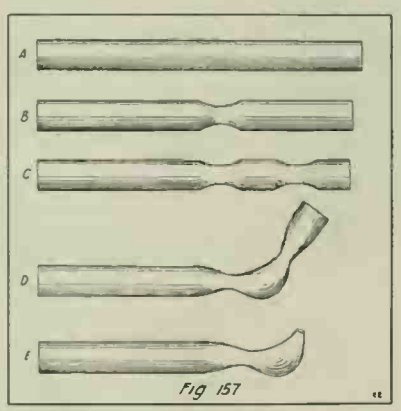
Oxids.

Two oxids are known Arsenious Oxid (As_4O_6) [usually written As_2O_3 and called arsenic trioxid, Arsenious Acid, Arsenic, White Arsenic, etc.], and Arsenic Oxid [As_2O_5]. The former only is important, being the most important commercial compound of the element. From this other compounds of the metal are formed. It is a white substance, sometimes amorphous and sometimes crystalline, which resembles flour when pulverized. It dissolves very slightly in cold water, upon which its particles seem to have a repellent action, but on boiling for a long time more dissolves. The best solvents are Hydrochloric Acid and Alkalies. With Hydrochloric acid it forms:

$$As_2O_3 + 6HCl = 2AsCl_3 + 3H_2O.$$

Salts.

There are two classes of salts, the *—ate* and the *—ite*, of which Sodium Arseniat [Na_3ASO_4] and Sodium Arsenit [Na_3AsO_3] are examples. In the former, the valence of Arsenic is 5, in the latter 3. The *—ite* salts are more frequently met with. The



Successive Stages In Preparing a "Marsh Tube."

Sulfid [As_2S_3] is a permanent and brilliant yellow pigment made by passing Hydrogen sulfid gas into a solution of an *—ite* salt. Scheele's Green [$HCuAsO_3$] and Schweinfurt or Emerald Green [$Cu(AsO_2)_2.CuAsO_3C_2H_3O_2$] both go under the name of "Paris Green," and are much used as pigments, especially for green window blinds, shipping tags, silks, etc.; also extensively employed by farmers to exterminate the potato beetle. Wall papers at one time almost always contained Arsenic, but now—owing to better substitutes and legislative prohibition—they rarely contain it. Scheele's Green is made by adding a solution of copper salt, as $CuCl_2$, to an arsenious salt solution, as HNa_2AsO_3. If these are nearly neutral, a precipitat of $HCuAsO_3$ is obtained, but if strongly acidified with Hydrochloric acid or alkalized with NH_4OH, no precepitat falls, which is the same as saying that Scheele's Green is soluble in either of the reagents. Fowler's Solution —used in medicine—is Potassium Arsenit.

Tests.

There are Four important tests, *Marsh's, Reinsch's, the Carbon,* and the *Hydrogen Sulfid*. Besides these there are *The Modified Gutzeit Test, Bettendorff's,* etc.

MARSH'S TEST.—This is the most delicate and interesting, and consists in first forming Arsin [AsH_3], then decomposing it and subliming the arsenic. Any soluble arsenical compound in presence of nascent hydrogen forms Arsin, which is readily decomposed by heat, when the arsenic sublimes. By this process a quantity far too small for the most delicate balance, can be detected,—in fact a mere trace of the element.

Explanation.—Suppose the compound to have the composition AsX_3, in which X is any nonmetallic monad. Hydrochloric acid gives this reaction:

$$AsX_3 + 3HCl = AsCl_3 + 3HX.$$

Nascent Hydrogen decomposes $AsCl_3$ and combines with both elements.

$$AsCl_3 + 6H = AsH_3 + 3HCl$$

The Arsin passes out and is burned together with the excess of hydrogen.

$$2AsH_3 + 6O = As_2O_3 + 3H_2O.$$

A Bunsen flame decomposes the Arsin.

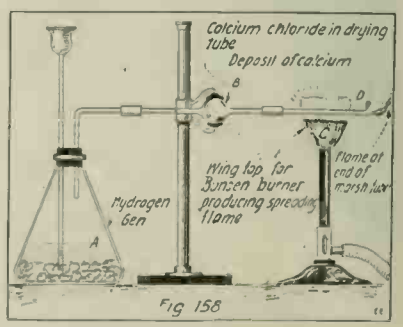
$$AsH_3 = As + 3H.$$

when the metal sublimes in the capillary tube. The question arises whether any other element than arsenic would act in a similar way. Antimony acts almost exactly like it, forming gaseous and combustible Stibin [SbH_3], which likewise decomposes and sublimes as a metallic mirror. Several tests serve to distinguish the sublimed Arsenic from Antimony, the best being the solubility of Arsenic in Sodium Hypochlorit [NaClO] and the insolubility of Antimony. The quantity of Arsenic can be determined by comparing the depth of shading of the deposit with that of tubes containing a known quantity.

REINSCH'S TEST.—This consists of depositing Arsenic on copper, then oxidizing the Arsenic and subliming the As_2O_3 formed.

The compounds of Arsenic will first change to $AsCl_3$ by Hydrochloric acid. The copper in the heated acid will withdraw the arsenic and deposit it, leaving copper chlorid in solution. Heat will vaporize the arsenic, which at the same time will combine with the oxygen in the tube to form As_2O_3, and this in turn will sublime as a white solid on the cold sides of the tube. Identification is then made by examination under a microscope, when a portion of it

(*Continued on page 750*)



Apparatus Utilized For Performing Marsh's Test For Arsenic.

www.americanradiohistory.com

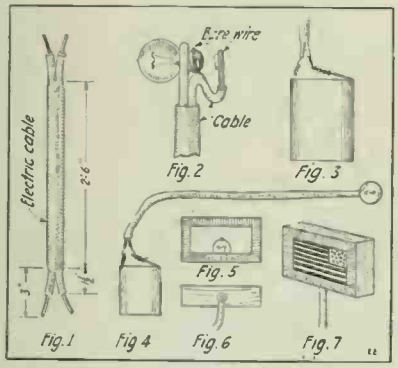


This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 is awarded; for the second best idea a $2.00 prize, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

FIRST PRIZE, $3.00

AN ELECTRIC FLAG FOR THE LAPEL.

The materials necessary for this are: 3 feet of electric cable, a flashlight bulb, a flashlight battery, a small U. S. (or



An Electric Lapel Flag Which Anyone Can Make from a Piece of Twin Cord, a Pocket Flashlight, and a Small Paper Flag.

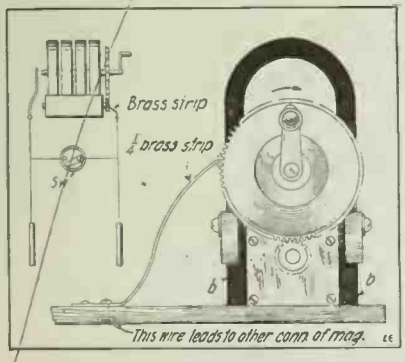
service flag) paper flag and some cardboard. Fix the cable as shown in Fig. 1, and then bend both wires on each end, as shown in Figs. 2 and 3. Make a cardboard box an inch larger each way than the flag and ¾-inch thick. On the front cut out an oblong opening ⅛-inch smaller all around than the flag. Paste the flag over this.

Contributed by FRANCIS V. SLAGT.

INTENSIFYING THE SHOCK FROM MAGNETOS.

Most people are aware that the "mag" out of an old-fashioned telephone makes a fine "shocker." My "rig" will increase its shocking capacity tremendously, as all who try it will be fain to believe.

Cut a piece of thin brass of suitable size to rest against the driving wheel when it (the brass) is secured to the base. No



The Addition of a Simple Spring Greatly Intensifies the Strength of Shock Obtainable from a Magneto.

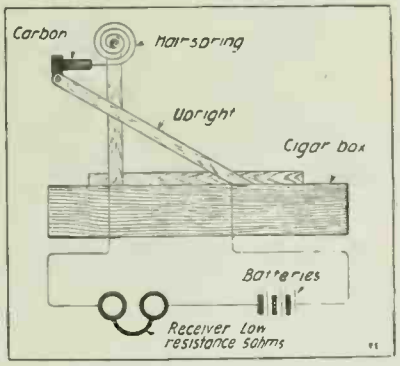
dimensions are given as the mageto-ringers vary in size.

Contributed by L. G. S. TROREY.

SECOND PRIZE, $2.00

THIS MICROPHONE MAKES AUDIBLE THE FLY'S FOOT-STEP.

This microphone, when properly constructed, is capable of making audible the footfall of a fly, the drawing of a thread across the instrument, the slightest touch on the table on which it is placed, the blowing of one's breath upon it, etc., etc. To construct this instrument first take a cigar box and remove the lid. Next hunt up a discarded alarm clock and remove the hair-spring. Secure a piece of wood, 4"x1½" upon which to fasten the uprights, and a piece of copper sheeting or any other suitable metal for the uprights. Connect these as in the diagram. From an old flashlight battery obtain the necessary carbon. Fasten the hair spring onto one upright, and the carbon to the other, first hollowing out a



A Supersensitive Microphone Made from a Cigar Box, a Piece of Carbon, and a Low Resistance Telephone Receiver.

place in the end of the carbon to receive the end of the hair spring; about 3/16 to ⅛ inch deep is sufficient. The right pressure of the spring upon the carbon must be obtained before the instrument will transmit properly. The spring must touch the carbon at all times. Connect up a battery (dry cell) and a low resistance (5 ohm) receiver, ascertain the correct pressure, and the microphone is complete.

Test it by gently touching the cigar box; a whirring noise will be heard if everything is all right. Blow gently upon it; it again whirrs. If placed in the open it will indicate when the wind is blowing, and by the amount of noise, the velocity can be judged. Under certain conditions, it will transmit speech, whistling, and so forth.

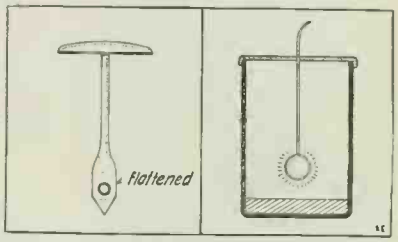
Contributed by FRED C. DAVIS.

THIRD PRIZE, $1.00

CONTACT POINT FROM UPHOLSTERY NAIL.

An ordinary upholstery nail is flattened with a hammer and a hole punched thru it with a set punch, as shown in sketch. The hole serves to thread and hold the wires. This is a cheap and practical contact point.

Contributed by BERT O'LEARY.



At Left—Contact Point Made from Upholstery Nail. At Right—The Platinum Ring That Becomes Red Hot in the Presence of Alcohol.

WHAT MAKES THE PLATINUM RING HOT?

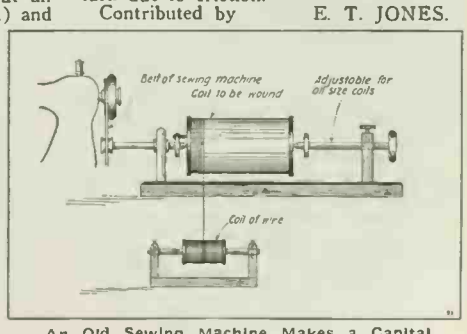
If a platinum ring (or even a piece of platinum wire) is warmed gently for a few moments and then suspended in a glass, having a small amount of alcohol in the bottom, the platinum will become red hot. The glass had best be covered with a piece of pasteboard having a hole in the center. The phenomena may be explained by the fact that platinum has the peculiar property of causing certain gases to condense on its surface. The condensation of alcohol fumes is so rapid as to cause the platinum to become incandescent.

Contributed by S. S. GARRETT.

SEWING MACHINE MAGNET WINDER.

Herewith is illustrated a wire-winding machine which is easily constructed. Most all wire winding machines are turned by hand, but by using this scheme you can both wind faster and easier. The pulley of the machine is brought against the belt of the sewing machine and the same is caused to turn due to friction.

Contributed by E. T. JONES.



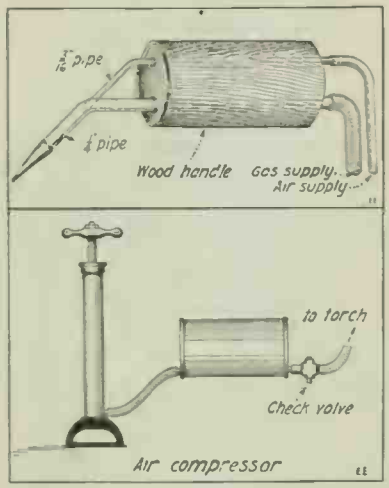
An Old Sewing Machine Makes a Capital Magnet Winder.

www.americanradiohistory.com



A HOME-MADE GAS TORCH.

As I needed a gas torch I set about to make one. I first procured two pipes, one



To Make This Gas Blow Torch You Will Require a Bicycle or Other Small Pump, a 1 to 5 Gallon Can, and Two Lengths of Rubber Tubing to Lead the Gas and Compress Air to the Torch Handle.

3/16 and one ¾ inch in diameter and about 8 inches long. I then drilled a hole in the quarter inch pipe and bent it as shown in drawing and set the other pipe into it. The handle is of oak with the edges rounded and two holes drilled thru it to fit each pipe. The air and gas supply come thru rubber hoses. A very good air compressor is made out of a bicycle pump and a one gallon can; the gas may be taken from the gas service pipes or from a carbid generator.

Contributed by HERBERT PEHRSON.

HINTS ON DRILLING GLASS.

Drilling glass is a difficult proposition and very few amateurs possess tools suitable for this purpose. The following apparatus will drill holes, varying in size from the smallest up to an inch or more.

First procure a brass tube the outside diameter of which measures the same size as the desired hole. Revolve this on the surface of the glass, either by hand or better by means of a small hand drill. The drilling must be started by allowing the lower end of the tube to be guided by a wooden block, with a hole cut in it the size of the tube. After the tube has past thru the glazing this guide can be removed. An excellent abrasive for this drill is emery dust and turpentine. It is an excellent idea to drill from both sides, since this results in a clean, smooth hole.

Contributed by PAUL G. EDWARDS.

COINS FOR WEIGHTS.

In an emergency, ordinary coins can be used as weights. The weights given in the following table are near enough for all the usual purposes.

Dime weighs	40 grains
Cent weighs	50 grains
Nickel weighs	80 grains
One-quarter Dollar weighs	100 grains
One-half Dollar weighs..	200 grains
One Dollar weighs.....	400 grains

By simple addition and subtraction a great many different weights can be made with these coins. For instance, to obtain a weight of 20 grains, place a nickel on one side of the scales and a quarter on the other, and then add enough of the chemical to balance it.

Contributed by HUGO J. ENGEL.

A RELIABLE HYDROGEN SULFID GENERATOR.

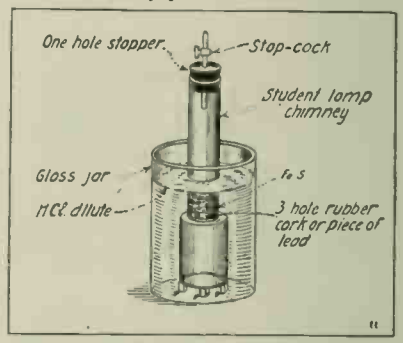
Herewith is a plan and description of a simple and cheap hydrogen sulfid generator.

This hydrogen sulfid generator has given very satisfactory service to the author. It can also be used for generating hydrogen, carbon dioxid, etc.

The necessary parts are:

1. Student lamp chimney.
2. Glass or porcelain jar (a large fruit jar will do).
3. Glass stop cock.
4. Rubber stoppers, three hole and one hole.
5. Iron sulfid (FeS).
6. Hydrochloric acid (HCl).

Contributed by JOHN R. BUXTON.



A Simple Yet Reliable Hydrogen Sulfid Generator Made From a Few Odd Pieces of Apparatus to Be Found About the Laboratory.

THE PREPARATION AND USE OF BLUE-PRINT PAPER.

The following describes the manufacture of blue-print paper in terms that can be easily understood by any one. No difficulty should be experienced in either the making or the use of the paper.

In order that the best results be obtained it is necessary that good material be used. All vessels in which the solution is made should be kept clean and when not in use should have water in them as far as possible. Do not use soap when washing the trays, as the least trace will do harm to the solution.

Where ordinary work is to be done, any kind of well sized paper will answer, if tough enough to be washed. Different grades of unsensitized papers can be bought at engineers and photo supply houses.

The following formula is for a good solution that will give excellent results to the amateur; this solution is made up of two salts, dissolved in water and applied to the surface of the paper:

Solution No. 1.

Ferrocyanid of potassium.... 1 oz.
Pure or distilled water..... 6 oz.

Solution No. 2.

Ammoniocitrat of iron..... 1 oz.
Pure or distilled water..... 6 oz.

When solutions are to be used mix equal parts of 1 and 2 and filter thru cotton or filter paper. This solution we will call No. 3.

The solutions should be applied to the paper in a dark and dry room with a very subdued light—just enough to barely see by.

Small sheets of the paper may be best covered by floating upon the surface of No. 3. This is done by taking a sheet by two diagonal corners and laying it gently on the surface of the solution. This method does away with the possibility of air bubbles forming.

One minute or less will be sufficient for sensitizing. Remove the paper by drawing over the edge of the tray to remove any surplus liquid. Take care to prevent any solution from getting on the back of the paper.

Large pieces are best sensitized by tacking down upon a smooth table with thumb tacks and painting the solution on with a wide camel's hair brush. Take care to get it on quickly and evenly. Dry the paper by hanging up by its corners to a wire so that it will swing free. Before sensitizing a batch of paper it would be best to make a trial sheet and print it. The solution may not be mixed properly or the paper may be too absorbent, in which case the solution will go into the paper and will not come out when washing, thus causing the print to fade in a short time.

After the paper has dried hard and without the slightest trace of dampness it should be rolled up and put into an airtight (tin or cardboard) tube and kept in a dark and dry place.

Printing is the exposing of the sensitized paper to the action of a powerful light with the copy to be printed placed over the paper. The direct rays of the sun are best for printing, but the electric arc is nearly as quick and has the advantage of being always constant—regardless of weather.

The drawing, tracing or negative is placed in the frame next to the glass with the paper under it, having its sensitive side up. Exposure will vary from two to ten minutes, according to the light and tracing. The correct time is only found by experience.

After the paper is sufficiently exposed, it is taken from the frame and immersed in a bath of clean running water. A print should be washed for not less than fifteen minutes or it will fade when placed in the light.

Excellent prints may be made in the following manner: Slightly expose the print so that when it is washed the white lines are not clear but appear bluish. Take the print out of the bath and lay it on a table and sponge it with a solution made up of one pound of bichromat of potash and two gallons of water. The lines will come out pure white and the background an intense blue. Wash print thoroly and dry.

White lines may be added to blue prints by the use of a solution made of soda and water to which a small quantity of prepared chalk has been added to thicken it. This solution may be applied with a ruling pen. Engineers generally use a white, red or yellow pencil for making corrections.

Contributed by RUSSEL MERRELL.

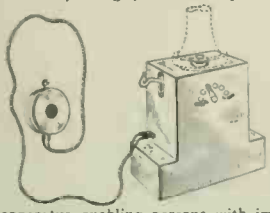
www.americanradiohistory.com



Telephone Amplifier.

(No. 1,280,556; issued to Louis Scher.)

A telephone amplifier providing a loud-speaking portable telephonic

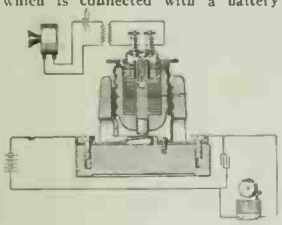


apparatus enabling persons with impaired hearing to satisfactorily use the ordinary telephone. The usual Bell telephone receiver is placed on top of the cabinet in which there is an opening communicating with a dictaphone transmitter. The transmitter in turn is connected from a rheostat and battery as well as switch-hook to a low resistance, loud-speaking telephone receiver.

Signaling Apparatus.

(No. 1,280,705; issued to Fulton Gardner.)

An ingenious signaling apparatus comprising an electromagnet in a receptacle, together with a coherer form of armature, the whole arrangement operating an alarm bell when actuated by voice or other sound waves. It is intended for bank vault protection and the like. The sound waves impinge on the microphone which is connected with a battery

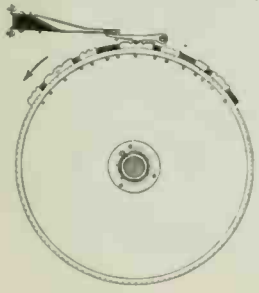


and primary of an induction coil. The secondary of this induction coil connects with the electromagnet of the relay shown in cross-section. This electromagnet acts on an iron filing armature, causing the filings to cohere, and thereby closing the bell signal circuit. A condenser is shunted across the bell in order to provide a more steady current by virtue of its charging and discharging action.

Telegraph Transmitter.

(No. 1,280,566; issued to John J. Sherry and John L. DuFrane.)

A clever mechanical arrangement comprising an automatic machine for sending out dots and dashes, either on a telegraph or radio circuit, by means of which one unskilled in the art or unfamiliar with the code may send a distress message from a ship, etc. The device should prove a fine auxiliary in all ship radio rooms, especially in case of fire, etc., as the transmitter could keep the radio ap-

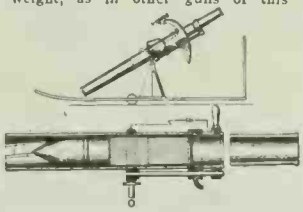


paratus sending out distress calls with location and name of ship, even tho the operator had to abandon the wireless room. There is provided a circular disk with a groove around its perifery, and in this groove there can be placed various telegraph character slugs and spaces. Thus the notched slugs corresponding to dots and dashes actuate a pawl member, opening and closing electric contacts in the manner apparent.

Non-Recoil Gun.

(No. 1,280,576; issued to Andrew J. Stone and William Shuker.)

A novel form of non-recoil gun intended for use on aircraft, etc., in which the recoil of the shell charge is minimized by the discharge from the gun of an "inertia mass," in a direction opposite to that in which the main projectile is shot. The inertia mass in this design is a small affair, and the reduction in its weight, as in other guns of this

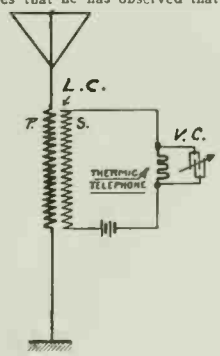


type, is made up for by the increased friction encountered by the mass, owing to the reduced bore of the barrel thru which it is simultaneously discharged with the main projectile. The inertia shell may be a copper disc or cup. The charge of explosive is fired by an electrical primer as shown, or by other means. The design of the gun is so computed that the inertia due to the heavy weight of the effective projectile plus the light frictional resistance of the projectile in the gun barrel, shall equal the inertia effects of the lighter weight of the disc plus the heavier frictional resistance of the said disc in the barrel.

Thermic Radio Detector and Telephone.

(No. 1,281,742; issued to Hendrik Zwaardemaker.)

This novel invention comprises a new form of thermic telephone and detector combined, and is suitable for use in wireless telegraphy and telephony. Prof. Zwaardemaker states that he has observed that the

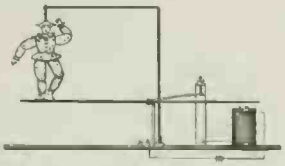


sensitiveness of the thermic telephone, serving simultaneously as detector, can be considerably increased when it works with polarization, i. e., by pre-heating it by means of a constant current such as that supplied by a battery as shown in the diagram. The battery may have a tension of two to four volts, and for increasing the sound, a variable and tunable condenser is connected in parallel to the thermic telephone element.

Dancing Toy.

(No. 1,280,307; issued to Harry Rust.)

This is an interesting electric toy and comprises a jointed doll or other figure suspended at the top in the manner shown. Underneath the fig-

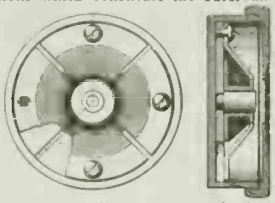


ure there is a spring platform, one end of which is provided with an electric contact, and also an electromagnet to attract it. The action is as follows: When the switch is closed, the magnet attracts one end of the spring armature, but immediately the circuit is broken and it flies back. These rapid vibrations of the spring over the magnet, transmit similar impulses to the opposite end of the armature which forms the tread under the figure, and which results in many curious and grotesque steps being evolved for the amusement of the children.

Novel Telephone Receiver.

(No. 1,283,304; issued to Thomas Rhodus.)

The receiver as shown is of the monocoil type, and the central iron core is secured to a flat base plate. In the improvement here shown, this base plate is formed with radial slits in its marginal portion to provide a series of integrally connected sectors corresponding in number with the series of independent sections which constitute the outer an-

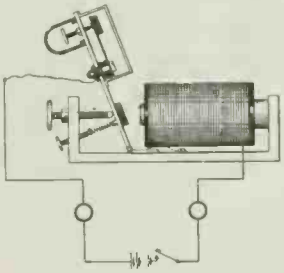


nular pole-piece. This pole-piece comprises a series of radially disposed iron sections. The resistance of the coil is 75 ohms for telephonic work.

Electromechanical Interrupter.

(No. 1,282,388; issued to François de Cannart d'Hamale.)

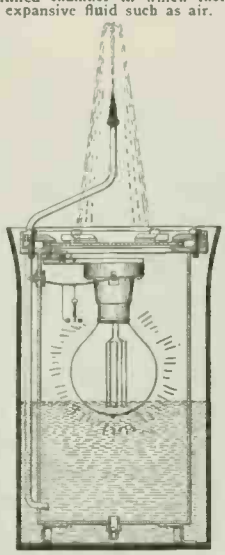
A unique electromechanical interrupter wherein the circuit is made and broken, not by virtue of an electromagnet acting on an armature and pulling it away from a stationary contact screw, but by means of a weighted auxiliary spring placed in a hermetically sealed compartment and acting by inertia. The weight supported at the top of the contact spring tends to keep on moving when the armature itself is suddenly stopt by striking against the magnet core, thus providing a very sudden break, which is highly desirable for operating induction coils.



Electric Lamp Fountain.

(No. 1,280,784; issued to Matt Luckiesh.)

An electric lamp fountain operated by the heat radiated from an incandescent lamp placed in a confined chamber in which there is an expansive fluid such as air. The

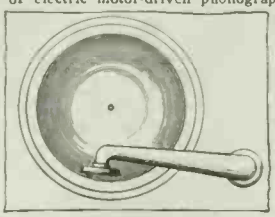


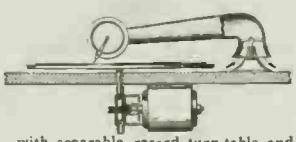
inventor mentions that a 150-watt lamp has worked the apparatus. The liquid sprayed out thru the small capillary tube falls back into a second chamber, thru which the water can reach the inner chamber again thru a check valve. A thermostat may be used to make and break the circuit intermittently when desired. The cover of the fountain may be of glass and colored when preferred for the purpose of transmitting upwardly thru the fountain spray a portion of the light from the lamp.

Electric Phonograph.

(No. 1,281,282; issued to Hans Brockmüller.)

The idea is to provide a simple form of electric motor-driven phonograph





with separable record turn-table and tone arm, so that for economical and other reasons it is not necessary to have a large special cabinet about the house. Any table can be quickly converted into a first-class phonograph by this scheme, the motor and a vertically driven shaft being secured underneath the table. The turn-table has a shaft which passes thru a hole in the top of the table, so as to engage the driving shaft frictionally. The tone arm has a special suction foot which does not require any screws, and the sound emanates around this foot.

www.americanradiohistory.com



Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light-toned ones. We pay $3.00 prize each month for the best photo. Address the Editor, "With the Amateurs" Dept.

"Amateur Electrical Laboratory" Contest

THIS MONTH'S $3.00 PRIZE WINNERS—F. L. BROOKS and W. P. CECIL

THE accompanying photos are views of our Electro Chemical Laboratory and Radio Station (which is now closed). We have quite a number of electrical apparatus such as Oudin and Tesla coils, motors, spark coils, 12 volt storage battery, Leyden jars, electrolytic-interrupter Einthoven galvanometer—which was described in the ELECTRICAL EXPERIMENTER several months ago, 50 watt step-down transformer, also 200 watt transformer located behind switch-board and controlled by a five point switch, ammeter and voltmeter also on switch board, arc spot light which will throw a beam of light over a mile, small step-up transformer, condenser and spark gap. Our Chemical "Lab" consists of about 85 chemicals and about 15 pieces of apparatus such as test tubes, Florence flasks, delivery tubes, hydrometer and other apparatus for carrying on experiments on a small scale. Last of all comes our work bench where everything has its beginning. We have a vise, gasoline blow torch, pliers, screw-drivers, twist drills and numerous other accessories. We also have a good supply of binding posts, screws, magnet wire, copper, brass and all such junk as is found in a red-headed bug's "Lab" like my pal's, not saying anything of myself.—FLOYD L. BROOKS and WM. P. CECIL, Ardmore, Oklahoma.

HONORABLE MENTION (1 Year's Subscription to the "ELECTRICAL EXPERIMENTER") T. C. QUAYLE

MY Chemical "Lab" consists of over 150 chemicals and reagents, also apparatus such as pipettes, burettes, retorts, test tubes, thistle tubes, delivery tubes, crucibles, casseroles, condensers, a Centigrade-Fahrenheit thermometer, chemists' scales, and many other pieces of laboratory glassware and apparatus, with which I carry on many interesting experiments in quantitative, qualitative and spectrum analysis. I also have gas, a Bunsen burner and a spigot for water in the "Lab". I have over 100 pieces of apparatus in my electrical "Lab", and have made a storage battery as described in the 1917 (Nov.) issue, also an arc searchlight, experimental arc furnace, magnetless buzzer, selenium cell (Bidwell type), Wheatstone bridge, electroscope, electrophorus, (sensitive) coherer, electrolytic rectifier and interrupter, Leyden jars, and many other pieces of apparatus described in the ELECTRICAL EXPERIMENTER. I also have an Oudin coil which is operated by an E. I. Co. half kilowatt coil and a rotary spark gap of my own design, also 110 volt and battery motors, hand generator, hot wire ammeter, small storage cell, switches, fuse blocks, Geissler tubes, etc.

My work-shop is complete in tools for both wood and metal working and here is where I made the articles described in the "E. E." I have drills for both wood and metal, braces, chisels, files, saws, wrenches, planes, pincers, levels, two sets of taps and dies, one for small rods, the other for pipes; also an emery wheel and bench lathe, which I designed and built.—THOMAS C. QUAYLE, Berkeley, Cal.



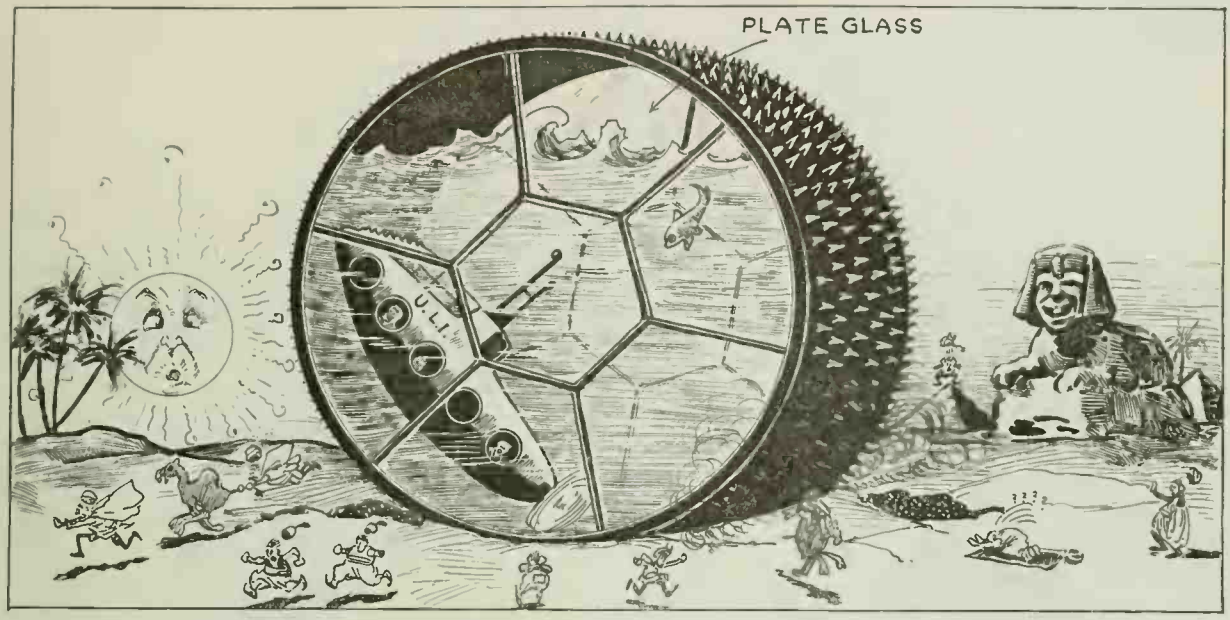
www.americanradiohistory.com

Phoney Patents

Under this heading are publisht electrical or mechanical ideas which our clever inventors, for reasons best known to themselves, have as yet not patented. We furthermore call attention to our celebrated Phoney Patent Offizz for the relief of all suffering daffy inventors in this country as well as for the entire universe.

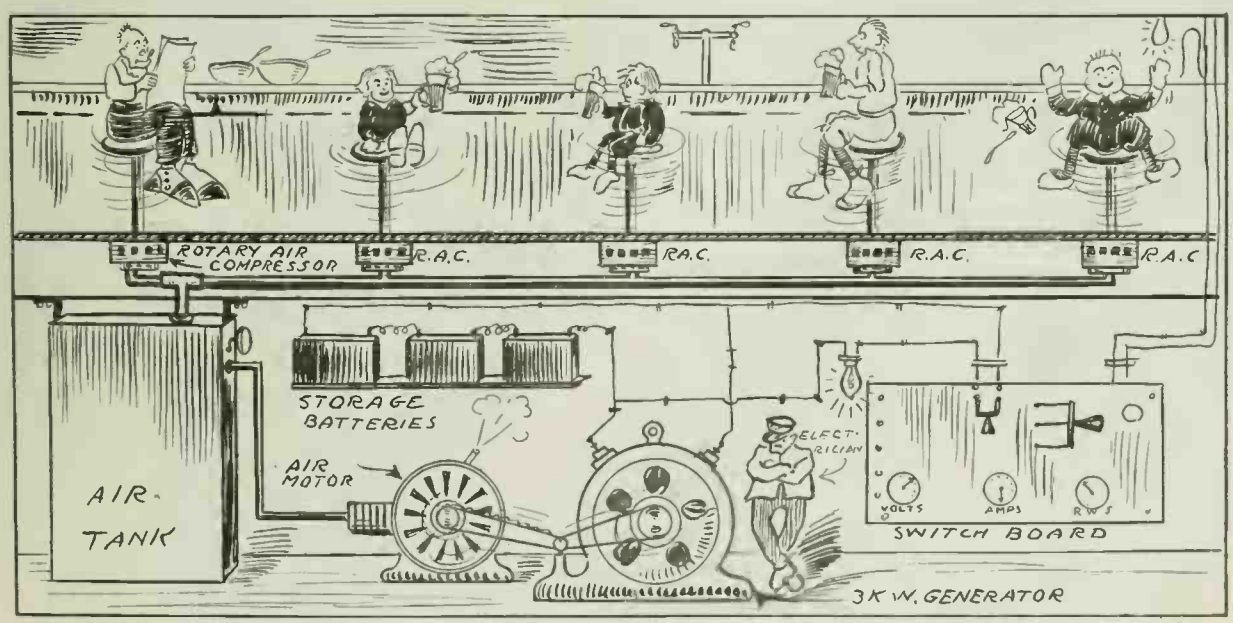
We are revolutionizing the Patent business and OFFER YOU THREE DOLLARS ($3.00) FOR THE BEST PATENT. If you take your Phoney Patent to Washington, they charge you $20.00 for the initial fee and then you haven't a smell of a Patent yet. After they have allowed the Patent, you must pay another $20.00 as a final fee. That's $40.00! WE PAY YOU $3.00 and grant you a Phoney Patent in the bargain, so you save $43.00!! When sending in your Phoney Patent application, be sure that it is as daffy as a lovesick bat. The daffier, the better. Simple sketches and short descriptions will help our staff of Phoney Patent Examiners to issue a Phoney Patent on your invention in a jiffy.

HUN U BOAT UTILIZER



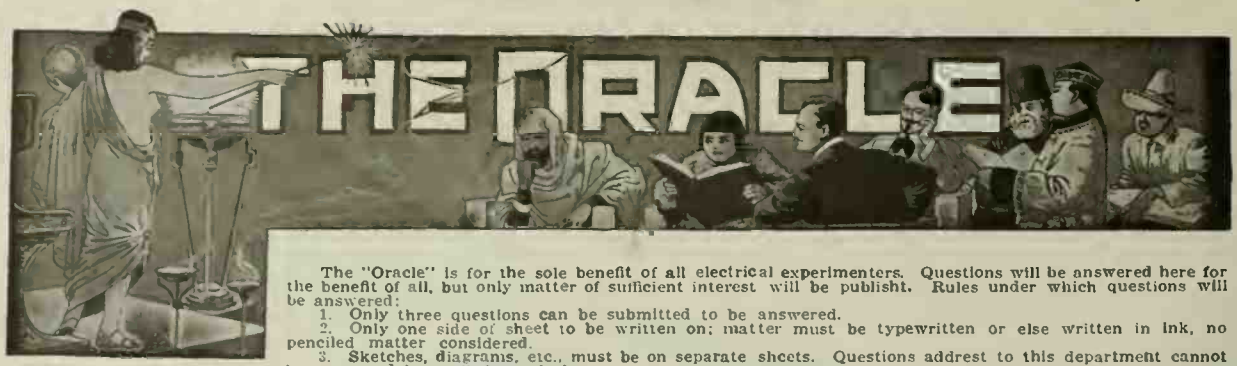
Prize Winner: HUN U-BOAT UTILIZER. Particularly Adapted for Traffic Over Deserts. Take One Gyro Electric Destroyer a la Gernsback, Knock Out All Machinery, Axles, etc., and Mount Plate Glass 16-Inches Thick in Framework Covering Both Sides. Make Waterproof and Fill Cruiser with Pure Prohibition Liquid; Also one Hun Submarine. Weight of Submarine Pressing Against Sides, as Shown, Navigates Cruiser at Rate of 25 Knots an Hour with a Fair Zephyr Breeze Nor' by West. Inventor, Jose Matz, 300 Baker St., San Francisco, Cal.

I'SCREAM GENERATOR



I'SCREAM PARLOR GENERATOR. In Order to Save Tremendous Energy Now Going to Waste In All Ice-Cream Parlors, Due to Rotating Seats, My New Patent Provides Extending Shaft to the Rotating Seat, Which Shaft Operates Rotary Air Compressor. This Control Operates Air Tank, Air Motor, Dynamo, etc. The Great Advantage to this Scheme Is That the Device Works Better the More Ice-Cream You Eat Because of the Added Momentum. Separate Patent Application Provides to Charge Customers an Extra Nickel for Allowing Them to Spin Around. Hoover says Economize, Hence no Free Rides. Inventor, Garrett W. Lewis, Yuba City, Cal.

www.americanradiohistory.com



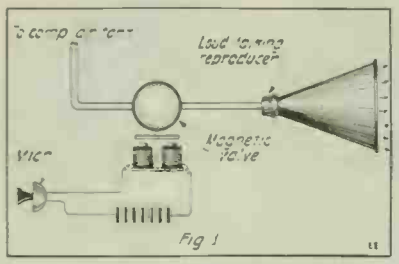
The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be publisht. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addrest to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

HURLING THE VOICE ONE MILE.

(979) W. J. M. asks:

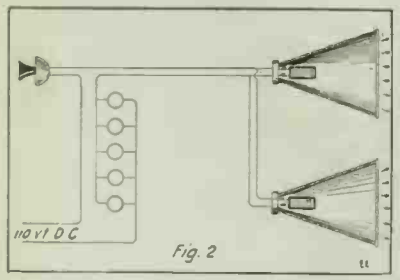
Q. 1. Is there any practical way of enormously amplifying the human voice so that same can be distinctly heard for a radius of, say, a mile, the atmosphere being comparatively free of other disturbances at the time?



Comprest Air Loud Talker Such As Used On Phonographs, and Susceptible of Development For Hurling Voice Waves a Distance of One Mile.

I understand that there are telephone transmitters now made for handling heavy currents of electricity. It occurs to me that possibly the above could be accomplisht by using such a transmitter in connection with a mammoth receiver and a suitable horn.

A. 1. One of the leading phonograph companies have developed a very clever and powerful form of comprest air amplifier which we believe might be worked up on a sufficiently large scale to answer your requirements. In this system a low power aural or electrical voice signal is caused to act, by means of a relay or other appropriate device, on an extremely sensitive valve, which permits successive puffs of comprest air from a tank or bellows to pass out thru a large amplifying horn and reproducer. We also believe that the de Forest amplifier might solve your problem, as one model is capable of amplifying 1,000,000 (one million) times. Also their Mr. C. V. Logwood has stated that he believes that your problem of amplifying the human voice so that it could be heard for a radius of one mile can be solved by modern engineering design. He states that by means of microphones suitably connected to a large *Oscillion* bulb that he has actually heard the human voice at a distance of one-half mile in California.



This Diagram Shows the Microphone Circuit For a 110 Volt D. C. Loud Talker, Having a Bank of 110 Volt Lamps in Series With the Reproducers.

The Alexanderson G. E. Co. magnetic amplifier should be of service to you in this connection. This clever and highly efficient magnetic amplifier was described in detail in the April, 1916, issue of the *Proceedings of the Institute of Radio Engineers.*

Several companies manufacture straight electro-magnetic systems of amplifying the voice, which systems are operated from 110 volt circuits. We can supply names of these concerns on receipt of stamped envelope.

Relative to these systems, the Oracle Editor would say that he has heard the loud talkers put out by one of these concerns throw the voice a distance of from 800 to 1,000 feet. The horns used are not over 2 feet long in this system, but the makers utilize special electro-magnetic reproducers which are connected in parallel when two or more are used, and these in turn are connected in series with a special microphone capable of operating on 110 volts D. C. and a bank of incandescent lamps.

ARTICLES SCHEDULED FOR MARCH "E. E."

"My Inventions"—No. 2 of a series by Dr. Nikola Tesla. Written exclusively for the ELECTRICAL EXPERIMENTER.

"A Wonderful New Electric Machine that Sorts Tobacco Leaves by Size," by George Holmes.

"How Powerful Electric Gyros Stabilize Ocean Ships"—Illustrated with excellent photos—by J. W. Harvath.

"Multiplex Telephony and Telegraphy and How It is Done," written by a Telephone Engineer.

"Exploring Polar Regions and the North Pole by Airplane."

"Locating Ore Bodies Underground by Electricity—A New Method."

A New Talking Motion Picture Invention.

"How Jimmy Saved the Bank"—A cracker-jack electrical story, by F. W. Russel.

"Experiments in Radio-Activity—Part III," by Ivan Crawford.

A Wavemeter and Decremeter Design for Radio Students, Operators and Inspectors. With data on Inductances, condensers, etc., by H. Winfield Secor, Assoc. I. R. E.

Practical Electra-plating, by Joseph Haas.

"Efficient Radio Transmitting," by Donald H. Hassell.

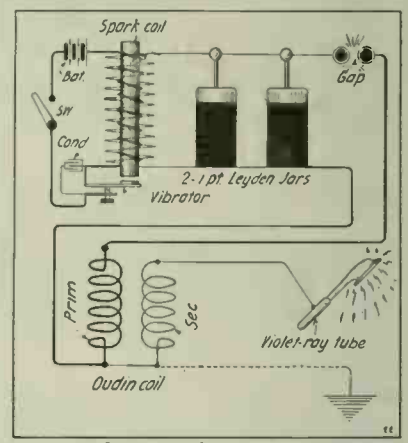
"Experiments With Ultra-Violet Light, for Amateurs," by J. C. Morris, Jr.

OUDIN COIL CONNECTION.

(980) Forrest A. Miller, Shelbyville, Kentucky, writes:

Q. 1. Asking several questions about Oudin and Tesla coils.

A. 1. By means of high frequency Tesla or Oudin currents you can charge the body so as to emit sparks and charge other bodies or persons, etc., and you will find the apparatus and method of doing this completely described in the book you are securing, viz.: "The Experimental Electricity Course"—which contains a special chapter on high frequency currents, with diagrams and full description of the apparatus used.



Hook-Up For Spark Coil, Leyden Jars, Spark Gap, Oudin Coil and High Frequency Electrode For Giving So-Called Violet Ray Treatment.

We can also very highly recommend a book by Transtrom, entitled "Electricity at High Pressures and Frequencies" which our "Book Department" can supply at $2.15 prepaid.

The diagram herewith shows how a spark coil, Leyden jars, spark gap and Oudin type of high frequency coil are properly connected. The ground connection is optional, but usually intensifies the unipolar discharge for electro-therapeutic requirements.

SIX-INCH SPARK COIL DATA.

(981) Marshall M. Wrenn, Baltimore, Md., asks the Oracle:

Q. 1. For data on six-inch spark induction coil.

(*Continued on page 726*)

www.americanradiohistory.com

FREE Test Lesson In Draftsmanship



Send for this free lesson which explains the Chicago "Tech" method of teaching Draftsmanship by mail. Positions at big salaries are now waiting for competent men. Even draftsmen of limited training and experience are snapped up and paid good salaries. If you are dissatisfied with your opportunities, learn Draftsmanship. Chicago "Tech" will train you in the most practical way in the shortest time. Mail the coupon today and let us tell you about the Chicago "Tech" method. The free lesson will show you how well equipped you are to follow Draftsmanship. Enroll in the course only if you decide that you can take it up to advantage. No cost, no obligation on you to make this investigation. Send the coupon.



$25 to $100 a Week

Draftsmen always command good salaries. And now when American industries are to be called upon to meet vast foreign and increased domestic demands, the opportunities are greater than ever. This is the time for you to prepare for a better position—a higher salary.

Come to the College or

Learn At Home

Hold you present position while training. Our experts will instruct you by mail. Only your spare time is required. You are directly under practical draftsmen and engineers. You are taught exactly the work required in the drafting rooms of big concerns. No time put in on unnecessary studies. This means thorough instruction and early graduation.

Easy Payments

The fees for Chicago "Tech" Courses are very moderate—and you can pay on easy terms. And also, you obtain in a few months what it would take several years to acquire by ordinary methods. You can get an early start. You are soon ready to take a paying position and to quickly get back the cost of your course. Then keep on earning more.

FREE Instruments

Every student of the Chicago "Tech" mail course in Draftsmanship receives this set of instruments, or a cash credit in case he already has a set. These instruments are of the same make and sizes as are used by high salaried experts in drafting rooms of factories, shops, railroads, etc. You use them while learning—then take them right into your practical work.

Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Splendid opportunities open now. Send coupon and get all the facts.

Learn All This in Spare Time

Principles of the Automobile. Every point made clear about the basic principles of propulsion—steam, gas and electric cars. Power transmission systems in pleasure and commercial cars, etc., etc.

Gasoline Engines. All about the different types. A complete course in gas engine construction, operation and repair.

Power Plants and Transmissions. Application of power by 4-6-8-12 cylinder engines. Types of clutches, gears, drives, axles, etc.

Carburetors and Fuel Supply Systems. All methods demonstrated. Fuel values. How to test. Gasoline and air mixtures. Regulation, care and management, etc., etc., etc.

Lubrication and Cooling All about oils and how to test them. Splash and circulating systems. Operation in different cars explained. Diagrams and tables. Cooling systems completely illustrated, etc.

Batteries. Electrical principles explained. Instructive diagrams of wiring and connections. Coils, condensers, vibrators, etc., etc.

Magneto Ignition. Principles and practical operation of various types and systems with diagrams. Generation of current. Field, armature, high and low tension, all explained. Complete in every point.

Starting and Lighting Systems. All modern methods. Starters—spark, mechanical, air, acetylene, electric, battery—shown in detail with diagrams and full explanations. Charging. Motor and generator adjustments, etc., etc.

Know How to Find and Fix Troubles

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men and men who know how to inspect cars. This course makes you proficient. Prepares you to take a job as an expert. Not enough competent men now available.

WRITE Send the coupon and get catalog and all information about the Course, the small fee and the easy terms. All this sent on request. Mail coupon now.

Send the Coupon—Now

The sooner you are prepared the sooner you will be holding a job that pays a large salary and opens the way to advancement. Many executives, general managers and superintendents began as draftsmen.

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send you the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything.

The coupon will bring the Test Lesson, free. Also information about the profession of Draftsmanship and detailed facts about Chicago "Tech" methods, the fees, terms, etc. Mark with X the branch you are interested in—or if in doubt about which course to take, write a letter stating facts about yourself and asking our advice which will be freely given. Mail either the coupon or letter today.

CHICAGO TECHNICAL COLLEGE,
245 Chicago "Tech" Building, Chicago

Without obligation to me, please send me your FREE Test Lesson and other interesting literature covering the subject indicated below.
Mark X opposite work in which you are especially interested.

- ☐ Architectural Drafting
- ☐ Machine Drafting
- ☐ Electrical Drafting
- ☐ Structural Drafting
- ☐ Sheet Metal Drafting
- ☐ Builders' Course
- ☐ Plan-Reading—Building
- ☐ Plan-Reading—Shop Men
- ☐ Estimating
- ☐ Surveying
- ☐ Map Drafting
- ☐ Autos and Gas Engines

Name .....

Address .....

City ..... State .....

College or Home Study? State which .....

Chicago Technical College 245 Chicago "Tech" Bldg. Chicago, Ill.

www.americanradiohistory.com

Big Money for Boys!



Learn ELECTRICITY

There is a wonderful opportunity right now for boys who like electricity. Boys who are ambitious and will train themselves in spare time can step into positions just as soon as they are ready. Good salaries are offered to start with splendid chances for rapid promotion.

For 27 years the International Correspondence Schools have been training boys for success in electricity and over 200 other subjects. They will help you prepare right at home for a position in the line of electrical work you like best—or in any other work that appeals to you. Thousands of boys, through I. C. S. training, have stepped into fine jobs, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least, and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6174, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- ELECTRICAL ENGINEER
- Electrician
- Electric Wiring
- Electric Lighting
- Electric Car Running
- Heavy Electric Traction
- Electrical Draftsman
- Electric Machine Designer
- Telegraph Expert
- Practical Telephony
- MECHANICAL ENGINEER
- Mechanical Draftsman
- Ship Draftsman
- Machine Shop Practice
- Toolmaker
- Gas Engineer
- CIVIL ENGINEER
- Surveying and Mapping
- MINE FOREMAN OR ENG'R
- ARCHITECT
- Architectural Draftsman
- PLUMBING AND HEATING
- Sheet Metal Worker
- CHEMICAL ENGINEER
- SALESMANSHIP
- ADVERTISING MAN
- Window Trimmer
- Show Card Writer
- Outdoor Sign Painter
- RAILROADER
- ILLUSTRATOR
- DESIGNER
- BOOKKEEPER
- Stenographer and Typist
- Cert. Pub. Accountant
- Traffic Management
- Commercial Law
- GOOD ENGLISH
- STATIONARY ENGINEER
- CIVIL SERVICE
- Railway Mail Clerk
- Textile Overseer or Supt.
- AGRICULTURE
- Navigator
- Poultry Raising
- Automobiles
- Spanish
- French
- Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____

AN EASY WAY TO MAKE MONEY

Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business. One man says "I made $60.00 the first day." Others average $200 to $500 a month. Very little capital needed. Jobs plentiful. Every motorist a possible customer. No experience needed. We teach you.

SHALER Tire Repair Outfit

Improved Wrapped Tread Method Used by Tire Manufacturers



Does as good work as the big high priced vulcanizing outfits. A boy can use it. It's the only vulcanizer that has Automatic Heat Control, and can't undercure or overcure a tire. Requires no watching or regulation.

FREE Book

"How to Open a Tire Repair Shop." It tells how to make big money. Don't delay. Write quick.

C. A. SHALER CO.
2201 Fourth St. Waupon, Wisconsin

THE ORACLE.

(*Continued from page 724*)

A. 1. We give you herewith necessary information for constructing a six-inch jump spark coil:

Primary, 220 ft. No. 13 D. C. C. wire.

Secondary, 7 lbs. No. 36 double silk covered wire (or enameled).

Core, 1¼ x 14" soft iron wire (thoroly annealed).

The primary condenser to be connected across the vibrator should comprise 4,500 sq. in. tinfoil, cut in suitable size sheets and interspersed between slightly larger paraffined paper sheets. If an electrolytic interrupter is used on 110 volts A. C. or D. C. then no primary condenser is necessary.

There should be a hard rubber insulating tube between the primary and secondary coils. The dimensions of this tube are 14¾" x 13¾" outside diameter by ¼" wall. The secondary consists of thirty-eight pies, each $^3/_{16}$th" thick, having an outside diameter of 4½". There should be placed between each section six pieces of well-soaked paraffin paper.

An excellent book dealing exclusively on spark coils building can be procured from our "Book Department" for $3.00. The title of this book is "Design and Construction of Induction Coils," by Collins. In this book there is given all the details for the construction of spark coils such as core dimensions, size of wire, length of primaries, etc.

DATA ON WIRELESS POWER TRANSMISSION.

(982) John Verrge, Detroit, Michigan, writes the "Oracle":

Q. 1. The sketch herewith shows my idea on the wireless transmission of power. Where can I find engineering data on the design of such a system? How can I figure the voltage required to transmit a given kilowattage over a certain distance? etc., etc.

A. 1. We have examined your query, together with diagram showing your ideas for the wireless transmission of power to electric railway cars, etc.

We regret to say that there is at the present time no engineering data available for solving the problems you outline, as while Nikola Tesla has successfully lighted lamps and operated motors by the one wire and no-wire wireless system for distances of 15 miles in his famous Colorado experiments, this branch of advanced alternating current engineering has not been made available in text-book form as yet.

You would do well to visit your public library and look up Dr. Tesla's book, entitled "Experiments with Currents of High Potential and Frequency".



PRACTICAL ARMATURE AND MAGNET WINDING, by Horstmann & Tousely. Leather covers, 252 pages, 128 illustrations, size 4½ x 6¾ inches. Price $1.00 in cloth; $1.50 in leather. Publisht by Frederick J. Drake & Co., Chicago.

This is a handbook for the practical electrician, especially those performing shop work and engaged in dynamo and motor repairs. The authors give the principles with special and clearly drawn illustrations of the elements of armature design, armature windings and the mechanical features such as balancing and ventilation of different types of armatures, etc. The section on armature windings is quite complete and gives all necessary information for laying out drum and lap windings, and for different numbers of field poles. The authors then give a discussion on armature troubles and testing for faults in the windings, armature calculations with wire tables, alternating current windings, et cetera. One of the most interesting sections of the work is that on field magnet winding, and of course this applies to magnet windings of any type. The special formulas and tables given greatly facilitate and simplify the calculation of field and other magnet windings, and it is written so clearly that any electrician or student can grasp the simple arithmetic involved after once reading it. An appendix of useful tables is given at the end of the book which will prove of great value in conjunction with the work treated upon.

PRACTICAL FLYING, by Flight Commander W. G. McMinnies, R. N. Cloth covers, 246 pages, profusely illustrated, size 5½ x 8¼ inches. Price $1.50. Publisht by George H. Doran Company, New York, N. Y.

An excellent course on flying instruction which is very ably illustrated by comprehensive sketches in plan and perspective, showing all of the parts of modern battle and scout 'planes, and giving from start to finish all of the necessary elements, including the reading of maps and the determination of location while in the air. This book, contrary to most semi-technical or technical treatises, is one that any aviator or flying enthusiast can read with extreme pleasure and at the same time greatly improve his understanding of the heavier-than-air flying machine. The author has the title of Flight-Commander of the British Royal Navy and knows whereof he speaks.

The chapters are subdivided under departmental heads, so that the book forms a very excellent reference work, as well as a class-room and general reading volume. Flight-Commander McMinnies treats the subject in a very broad way and covers such points as—"which men make good pilots"; in this chapter he evidences a good grasp of the subject of applied psychology. As we pass along thru the elementary studies of the airplane and its component parts, we find the text and drawings so interesting, that it does not tire us at all.

Some very excellent diagrams and drawings are given, showing the various accidents in landing and how they occur, also how all the fancy "stunts" are performed progressively in the air. The sections treating on cross-country flying and the determination of altitude as well as orientation, are clearly written and treated on in a manner following that found most efficient by the Allied fliers on the Western front.

GENERAL LECTURES ON ELECTRICAL ENGINEERING, by Charles Proteus Steinmetz. Cloth covers, 242 pages, 50 illustrations, size 6¼ x 9½ inches. Price $2.50. Publisht by McGraw-Hill Book Company, Inc., New York, N. Y.

This volume contains some of the most interesting lectures given by Dr. Steinmetz, and forms a most valuable work which will find a welcome in the library of every engineer, electrical man and student. Dr. Steinmetz is a speaker and writer of articles which possess great expanse of viewpoint. When he speaks of the incandescent lamp, for instance, in lecture 16 of this series here presented, the reader will be surprised at the wide range of topics he discusses. Practically every important type of lamp and their relative operating efficiencies and characteristics are treated upon in this lecture, even down to the modern gas-filled Mazda tungsten lamp. The several other lectures, of which there are 18 in all, cover such interesting and important subjects as electrochemistry, the alternating current railway motor, electric railways, lightning protection, direct current regulation and control, hunting and synchronous machines, high frequency oscillations, surges and impulses, higher harmonics of the generator wave, long distance transmission, arc lighting, modern power generation, etc., etc.

STANDARD WIRING FOR ELECTRIC LIGHT AND POWER, by H. C. Cushing, Jr. Leather covers, 360 pages, profusely illustrated, size 6¼ x 4¼ inches. Price $1.50. Publisht by H. C. Cushing, Jr., 1918, New York, N. Y.

One of the most widely read and also one of the most clearly written and easily understood works available to electrical men in all branches of the industry. Mr. Cushing's manual has been useful for many years. Each year a new edition is brought out covering the latest changes in the Fire Underwriter's rules. The author follows the Underwriter's rules and describes with the aid of simple formulas, numerous tables, and special illustrations, the exact meaning of the various clauses in the wiring code, so that this book becomes very valuable to electricians, architects, superintendents and engineers. Some of the simplest tables and methods of using them for calculating both light and power distribution wiring ever given are included in this manual, and any electrical man can understand them easily. A number of diagrams of electric motor connections, including series, shunt and compound machines, are given as well as instructions for the proper installation of all such machinery. House wiring receives special attention all the way thru the work, and electrical wiremen will find this manual a most useful and authoritative companion. It settles all wiring disputes.

www.americanradiohistory.com

Learn Electricity



In the Great Shops of

COYNE

Trade and Engineering Schools
Dept. 22, 39-51 E. Illinois St., Chicago, Ill.

PRACTICAL INSTRUCTION

FINISH IN 3 MONTHS

Thousands of skilled Electricians are needed. The demand is becoming more urgent every day. The big Industries are employing every one they can get, causing a great scarcity of trained men, throughout the country. **Big salaries are being paid everywhere.** Right now is *your* big opportunity. Make up your mind now to prepare for one of these big jobs and then get here as quick as you can for your training.

Earn $150.00 to $450.00 A Month

In the Electrical business. Come here where you will be trained in these great $93,000 shops. Experts show you everything and you learn right on the actual apparatus. You work on everything from the simple bell to the mighty motors, generators, electric locomotives, dynamos, switchboards, power plants, everything to make you a master electrician. We have thousands of successful graduates. Just as soon as you have finished we assist you to a good position. We now have more positions than we can fill. Think of it.

PREPARE for a BIG PAYING POSITION

Peace demands thousands of trained electrical men NOW all industries are preparing for the greatest year in the Nation's History in 1919. This is the big opportunity for YOU. Will You grasp it?

These courses are thorough, short and practical. All instruction given on the actual equipment. No books or useless theory. Each man trained individually and stays as long as he likes. Start any time—day or evening.

Our graduates are in great demand. We are continually receiving letters, telegrams, and telephone calls from contractors, manufacturing firms, etc., seeking our graduates to fill responsible positions. We have now more positions than we can fill and the demand is steadily growing. Every comfort is given our students while here. They live in comfortable homes in the most beautiful section of Chicago—on the lake.

The War is Over—Yes!

but the men "over there" will not be back for months—perhaps years, for their work "over there" isn't over. And so you, and thousands more must fill up the gap now that the absence of these brave workers has made in the ranks of skilled labor. Trained Electricians are needed more, perhaps, than any other class of men. The sudden ending of the war has caused the big industries to start up work sooner than any of us expected and in consequence the Manufacturers are Calling for Trained Men, and we are training men as fast as we can to meet these urgent calls. You are needed, Young Man, now! Don't wait. Don't put it off. Get in touch with us Today. Get ready to join the great "Peace Army" here at home. Your country calls. Again we say, prepare to serve your country! We'll make a trained electrician of you in three months! Let's go!

LEARN DRAFTING

Skilled Draftsmen are always in demand. Our courses are thorough—short—practical, preparing a man fully to hold a position of responsibility. We have more positions than we can fill. We also have thorough practical courses in *Plumbing and Heating and Motion Picture Operating.*

EARN YOUR WAY

Many students earn a large part of their living expenses by doing a little work in their spare time. Our employment dept. furnishes these positions without charge.

COYNE TRADE AND ENGINEERING SCHOOLS
Dept. 22, 39-51 E. Illinois St.
Chicago, Ill.

Please send at once your big Free Book—I am interested in

[ ] Electricity [ ] Drafting [ ] Plumbing
[ ] Motion Picture Operating
(*Check trade interested in*)

Name.....

Address.....

MAIL COUPON FOR FREE BOOK NOW!

www.americanradiohistory.com



BE A BOY CHEMIST

Test water, foods and other things you use and wear. Make soap, ink, dye; fire-proof cloth and wood, and work hundreds of useful, fascinating experiments just like a real chemist. Perform weird, puzzling tricks of chemical magic. You can, with "CHEMCRAFT". Outfits contain all chemicals and laboratory supplies to work each experiment many times; also a Manual of Instruction. "CHEMCRAFT" is absolutely harmless; made by a practical chemist and is scientifically correct.

Chemcraft No. 1—$1.50
West of Mississippi River and in Canada—$2.00
Chemcraft No. 2—$3.00
West of Mississippi River and in Canada—$3.50
Chemcraft No. 3—$5.00
West of Mississippi River and in Canada—$6.00

Be sure you get "CHEMCRAFT," the original and most complete and scientific chemical outfit. Ask for it by name at your Toy Store, or send price and we will deliver direct prepaid.

THE PORTER CHEMICAL CO.
Industrial Bldg., W. Washington St.
Hagerstown Maryland

BOYS
Build and Fly Your Own Training Plane



Train yourself in Aviation. Be an Amateur Aviator with an Aeroplane of your own. Learn how Aeroplanes are built; learn the principles of construction, operation and control. We sell IDEAL Accurate Scale Drawings, and Building and Flying Instructions which show you how to build a perfect Model Aeroplane, 3 ft. size, that will rise from the ground by its own power and fly like a big one. Send now for the Drawings and Instructions for the one you want to build.

Drawings and Instructions for
Curtiss Military Tractor
Bleriot Monoplane
Nieuport Monoplane
Taube Monoplane
Curtiss Flying Boat
Wright Biplane
Cecil Peoli Racer
25c EACH
Set of seven $1.60 postpaid!

Ideal Model Aeroplane Catalog 5c—None Free
Tells about Model Aeroplanes. Racing Aeroplanes, Flying Toys, and parts and supplies to build them with. 48 pages. Send only upon receipt of 5 cents.
IDEAL AEROPLANE & SUPPLY COMPANY
76-82 West Broadway New York City



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle message. Can be used with or without electric current.

All users of the Lek-Tro-Shav speak well of it

A barber says—"Have shaved for years and have never used any shaving device near its equal."
A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."
No. 1 Made for use from Light Socket.
No. 2 Made for use from Dry Battery.
Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.

VIBRATING ELECTRIC RAZOR CO.
Dept. 122. Omaha, Nebr.



Printing Cheap
Cards, circulars, labels, book, paper. Press $8. Larger $20 Job press $5 up. Save money. Print for others, big profit. All easy, rules sent. Write factory for press catalog, TYPE, cards, paper. THE PRESS CO. D-47 Meriden, Conn.

Famous Scientific Illusions

(*Continued from page 694*)

The earliest trials were made by Dalibrand in France, but Franklin himself was the first to obtain a spark by using a kite, in June, 1752. When these atmospheric discharges manifest themselves today in our wireless station we feel annoyed and wish that they would stop, but to the man who discovered them they brought tears of joy.

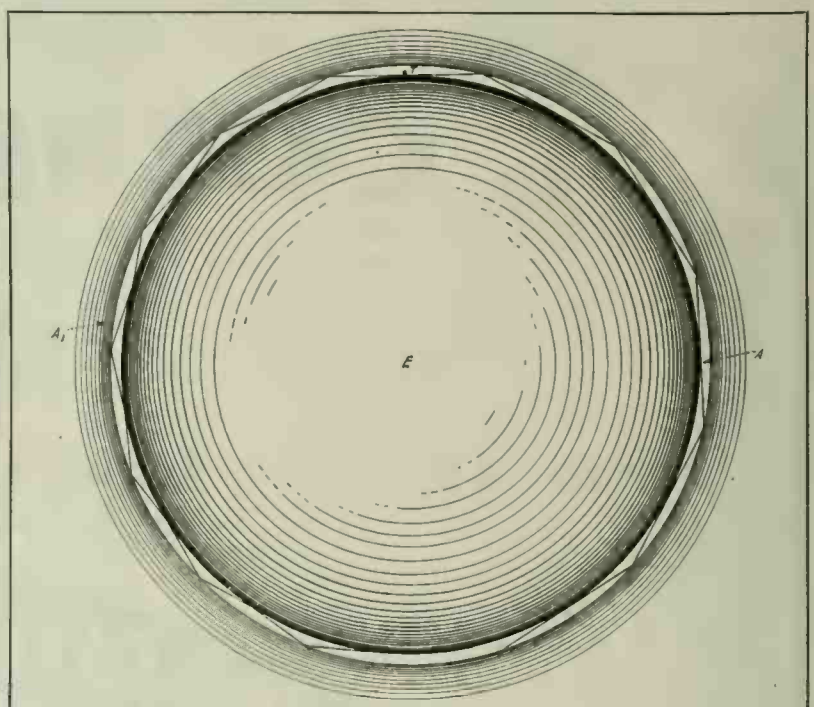


Fig. 7

The Theory Has Been Seriously Advanced and Taught that the Radio Ether Wave Oscillations Pass Around the Earth by Successive Reflections, as Here Shown. The Efficiency of Such a Reflector Cannot be more than 25 Per Cent; the Amount of Energy Recoverable in a 12,000-mile Transmission being but One Hundred and Fifteen Billionth Part of One Watt, with 1,000 Kilowatts at the Transmitter.

The lightning conductor in its classical form was invented by Benjamin Franklin in 1755 and immediately upon its adoption proved a success to a degree. As usual, however, its virtues were often exaggerated. So, for instance, it was seriously claimed that in the city of Piatermaritzburg (capital of Natal, South Africa) no lightning strokes occurred after the pointed rods were installed, altho the storms were as frequent as before. Experience has shown that just the opposite is true. A modern city like New York, presenting innumerable sharp points and projections in good contact with the earth, is struck much more often than equivalent area of land. Statistical records, carefully compiled and publisht from time to time, demonstrate that the danger from lightning to property and life has been reduced to a small percentage by Franklin's invention, but the damage by fire amounts, nevertheless, to several million dollars annually. It is astonishing that this device, which has been in universal use for more than one century and a half, should be found to involve a gross fallacy in design and construction which impairs its usefulness and may even render its employment hazardous under certain conditions.

For explanation of this curious fact I may first refer to Fig. 3, in which s is a metallic sphere of radius r, such as the capacity terminal of a static machine, provided with a sharply pointed pin of length h, as indicated. It is well known that the latter has the property of quickly dissipating the accumulated charge into the air. To examine this action in the light of present knowledge we may liken electric potential to temperature. Imagine that sphere s is heated to T degrees and that the pin or metal bar is a perfect conductor of heat so that its extreme end is at the same temperature T. Then if another sphere of larger radius, r_1, is drawn about the first and the temperature along this boundary is T_1, it is evident that there will be between the end of the bar and its surrounding a difference of temperature $T - T_1$, which will determine the outflow of heat. Obviously, if the adjacent medium was not affected by the hot sphere this temperature difference would be greater and more heat would be given off. Exactly so in the electric system. Let q be the quantity of the charge, then the sphere—and owing to its great conductivity also the pin—will be at the potential $\frac{q}{r}$. The medium around the point of the pin will be at the potential $\frac{q}{r_1} = \frac{q}{r+h}$ and, consequently, the difference $\frac{q}{r} - \frac{q}{r+h} = \frac{qh}{r(r+h)}$. Suppose now that a sphere S of much larger radius $R = nr$ is employed containing a charge Q this difference of potential will be, analogously $\frac{Qh}{R(R+h)}$. According to elementary principles of electro-statics the potentials of the two spheres s and S will be equal if $Q = nq$ in which case $\frac{Qh}{R(R+h)} =$

(*Continued on page 730*)

www.americanradiohistory.com



"Here's an Extra $50, Grace

—I'm making *real* money now!"

"Yes, I've been keeping it a secret until pay day came. I've been promoted with an increase of $50 a month. And the first extra money is yours. Just a little reward for urging me to study at home. The boss says my spare time training has made me a valuable man to the firm and there's more money coming soon. We're starting up easy street, Grace, thanks to you and the I. C. S.!"

Today more than ever before, money is what counts. The cost of living is mounting month by month. You can't get along on what you have been making. Somehow, you've simply got to increase your earnings.

Fortunately for you hundreds of thousands of other men have proved there is an unfailing way to do it. Train yourself for bigger work, learn to do some one thing well and employers will be glad to pay you real money for your special knowledge.

You can get the training that will prepare you for the position you want in the work you like best, whatever it may be. You can get it without sacrificing a day or a dollar from your present occupation. You can get it at home, in spare time, through the International Correspondence Schools.

It is the *business* of the I. C. S. to prepare men in just your circumstances for better positions at better pay. They have been doing it for 27 years. They have helped two million other men and women. They are training over 100,000 now. Every day many students write to tell of advancements and increased salaries already won.

You have the same chance they had. What are you going to do with it? Can you afford to let a single priceless hour pass without at least finding out what the I. C. S. can do for you? Here is all we ask—without cost, without obligating yourself in any way, simply mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6173, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ ELECTRICAL ENGINEER
- ☐ Electrician
- ☐ Electric Wiring
- ☐ Electric Lighting
- ☐ Electric Car Running
- ☐ Heavy Electric Traction
- ☐ Electrical Draftsman
- ☐ Electric Machine Designer
- ☐ Telegraph Expert
- ☐ Practical Telephony
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Toolmaker
- ☐ Machine Shop Practice
- ☐ Gas Engineer
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MINE FOREMAN OR ENGINEER
- ☐ ARCHITECT
- ☐ Architectural Draftsman
- ☐ PLUMBING AND HEATING
- ☐ Sheet Metal Worker
- ☐ Ship Draftsman
- ☐ CHEMICAL ENGINEER
- ☐ SALESMANSHIP
- ☐ ADVERTISING MAN
- ☐ Show Card Writer
- ☐ Outdoor Sign Painter
- ☐ RAILROADER
- ☐ ILLUSTRATOR
- ☐ DESIGNER
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Public Accountant
- ☐ Traffic Management
- ☐ Commercial Law
- ☐ GOOD ENGLISH
- ☐ Common School Subjects
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ STATIONARY ENGINEER
- ☐ Textile Overseer or Supt.
- ☐ AGRICULTURE
- ☐ Navigator
- ☐ Poultry Raising
- ☐ AUTOMOBILES
- ☐ Spanish
- ☐ French
- ☐ Italian

Name _____

Occupation & Employer _____

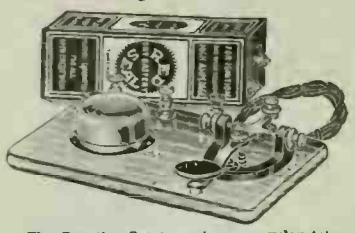
Street and No. _____

City _____ State _____

www.americanradiohistory.com

Mesco Telegraph Practice Set

For Learning Telegraph Codes



The Practice Set comprises a regular telegraph key, without circuit breaker, a special high pitch buzzer, one cell Red Seal Dry Battery, and four feet of green silk covered flexible cord.

The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes.

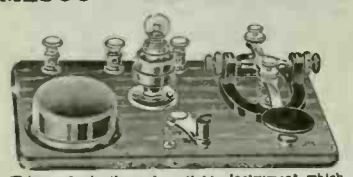
List No. Price

342 Telegraph Practice Set, with Battery and Cord.....$3.24

Weighs 4 lbs. packed.

Price does not include postage.

MESCO Combination Practice Set for learning the Morse and Continental Visual and Audible Codes



This outfit is the only reliable instrument which will enable students to become proficient operators in the U. S. Naval Service, because it is equipped with a buzzer and miniature lamp enabling the user to master both the visual and audible signals quickly.

List No. 52—Practice Set with Red Seal Battery and Cord.....$4.05

Weighs 4 lbs. packed. Price does not include postage.

Send for the New Edition of Our Catalog W28

It is pocket size, contains 248 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

Send for the Catalog Now

Manhattan Electrical Supply Co., Inc.

NEW YORK: 17 Park Place CHICAGO: 114 S. Wells St. ST. LOUIS: 1106 Pine St.

San Francisco Office: 604 Mission St.

MECHANICALLY RIGHT—A REAL LATHE

A Regular lathe, not a toy



Swing 4 inches, 11 inches between centers, 17 inches total length. Net weight 9 lbs. Shipping weight 13 lbs.

The bed of this lathe is machined. Workmanship is first class throughout. Lathe comes equipped with wood turning chuck. Lathe can be fitted with 3 inch face plate and drill chuck as special equipment. Order one today. Price $5.00 cash with order.

SYPHER MFG. CO., Dept. C., TOLEDO, OHIO

Feldman's "Geyser" Electric Water Heater

Instantaneous Hot Water

FELDMAN MFG. CO.

1500 Times Bldg. New York City

HAVE *You* SENT

for our booklet No. 4, giving diagrams and experiments with the Steco Button?

STECO. 2134 N. Clark St., Chicago, Ill.

FAMOUS SCIENTIFIC ILLUSIONS.

(*Continued from page 728*)

$\frac{nqh}{nr(nr+h)} = \frac{qh}{r(nr+h)}$. Thus the difference of potential between the point of the pin and the medium around the same



Fig. 4, Tesla Explains the Fallacy of the Franklin Pointed Lightning Rod, Here Illustrated, and Shows that Usually Such a Rod Could Not Draw Off the Electricity in a Single Cloud in Many Years. The Density of the Dots Indicates the Intensity of the Charges.

will be smaller in the ratio $\frac{r+h}{nr+h}$ when the large sphere is used. In many scientific tests and experiments this important observation has been disregarded with the result of causing serious errors. Its significance is that the behavior of the pointed rod entirely depends on the linear dimensions of the electrified body. Its quality to give off the charge may be entirely lost if the latter is very large. For this reason, all points or projections on the surface of a conductor of such vast dimensions as the earth would be quite ineffective were it not for other influences. These will be elucidated with reference to Fig. 4, in which our artist of the Impressionist school has emphasized Franklin's notion that his rod was drawing electricity from the clouds. If the earth were not surrounded by an atmosphere which is generally oppositely charged it would behave, despite all its irregularities of surface, like a polished sphere. But owing to the electrified masses of air and cloud the distribution is greatly modified. Thus in Fig. 4, the positive charge of the cloud induces in the earth an equivalent *opposite* charge, the density at the surface of the latter diminishing with the cube of the distance from the static center of the cloud. A brush discharge is then formed at the point of the rod and the action Franklin anticipated takes place. In addition, the surrounding air is ionized and rendered conducting and, eventually, a bolt may hit the building or some other object in the vicinity. The virtue of the pointed end to dissipate the charge, which was uppermost in Franklin's mind is, however, infinitesimal. *Careful measurements show that it would take many years before the electricity stored in a single cloud of moderate size would be drawn off or neutralized thru such a lightning conductor.* The grounded rod has the quality of rendering harmless most of the strokes it receives, tho occasionally the charge is diverted with damaging results. But, what is very important to note, it invites danger and hazard on account of the fallacy involved in its design. The sharp point which was thought advantageous and indispensable to its operation, is really a defect detracting considerably from the practical value of the device. I have produced a much improved form of lightning protector characterized by the employment of a terminal of considerable area and large radius of curvature which makes impossible undue density of the charge and ionization of the air.* *These protectors act as quasi-repellents and so far have never been struck tho exposed a long time.* Their safety is experimentally demonstrated to greatly exceed that invented by Franklin. By their use property worth millions of dollars which is now annually lost, can be saved.

III. The Singular Misconception of the Wireless.

To the popular mind this sensational advance conveys the impression of a single invention but in reality it is an art, the successful practise of which involves the employment of a great many discoveries and improvements. I viewed it as such when I undertook to solve wireless problems and it is due to this fact that my insight into its underlying principles was clear from their very inception.

In the course of development of my induction motors it became desirable to operate them at high speeds and for this purpose I constructed alternators of relatively

*Refer to the October, 1918, issue of this journal wherein Dr. Tesla's new form of non-pointed lightning rod was fully described and illustrated.

(*Continued on page 732*)

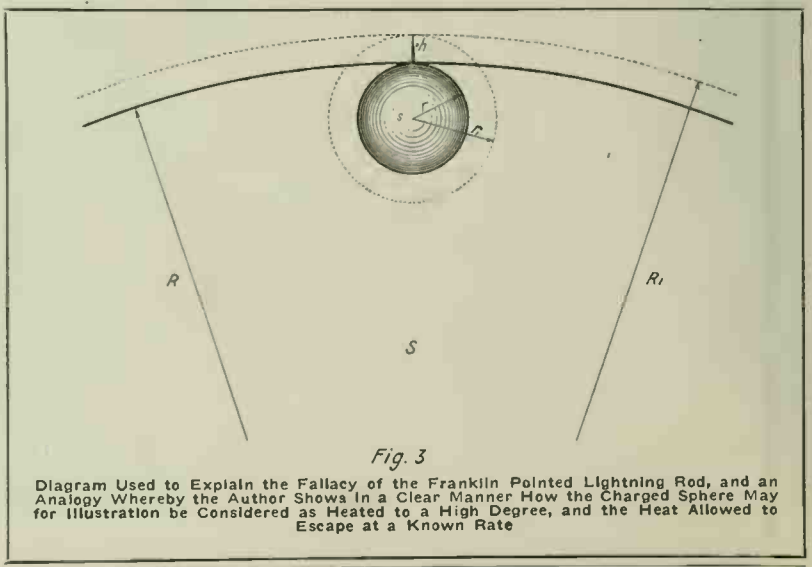


Fig. 3

Diagram Used to Explain the Fallacy of the Franklin Pointed Lightning Rod, and an Analogy Whereby the Author Shows in a Clear Manner How the Charged Sphere May for Illustration be Considered as Heated to a High Degree, and the Heat Allowed to Escape at a Known Rate

www.americanradiohistory.com



ELECTRICITY

Taught By A Practical Man

and in Your Home!

IT IS UP TO YOU

I am teaching electricity and drafting to many men, young and old, and ladies too, and wish to interest you sufficiently so you will send for my catalog which tells the whole story, as it is too much to tell here. It is up to you whether you look into the proposition, but if you are earnest in your desire to get into the electrical industry, or to become more proficient in this line, you will send for the catalog and you will not regret the time you give in doing so.

THE PURPOSE OF THE COURSE OF STUDY

I have been designing courses in electrical instruction and teaching electricity, off and on during the past 17 years, and during that time I have had an unusual opportunity to make a special study of the teaching business, from the standpoint of a practical man. This course of my own is designed with a view of reaching those who do not have a lot of time and money to devote to study work, and to give them as thorough a knowledge as possible of electricity, in the shortest possible time. The instruction is given like you were working on various jobs and I was the boss telling you what to do and how to do it, and giving the explanation necessary for the understanding of the theory covered by the subject under discussion. There are many conditions which seldom occur in the every day run of electrical experience, and these conditions I lay particular stress on. This part of the instruction makes the course particularly attractive and valuable to those already engaged in active electrical work.

FIFTY FIFTY

I work absolutely on a 50-50 basis with my students. You pay me the comparatively low price I ask, and I give you the instruction and other help as is stated in my catalog. No student is permitted to pay cash for his entire course on starting, the course being paid for in small monthly payments as you go along. Students have the privilege of discontinuing the work if they should find that it was not just what they were after, and their payments stop at the same time. This is my way of doing business and I would not want your money when I was not giving you the instruction.

Apparatus, Instruments, Material, Etc.

Certain electrical apparatus, instruments, material, charts, drafting implements, etc., as detailed in the catalog, are included in the course and are a part of the regular instruction for which there is no extra charge as it is covered by the regular monthly payments.

FILL OUT COUPON FOR ONE OF MY CATALOGS WHICH GIVES FULL INFORMATION.

BURGESS ELECTRICAL SCHOOL
745 E. 42d Street Chicago, Ill.

YORKE BURGESS,
BURGESS ELECTRICAL SCHOOL,
745 East 42nd Street, Chicago, Illinois.

Gentlemen:—
Send me catalog describing your course in Electricity and Drafting.

NAME .....
ADDRESS .....
CITY .....
STATE .....

To Practical Men and Electrical Students:

(See review of this book by Editor in December issue of your Electrical Experimenter, page 568)

I have prepared a pocket-size note book especially for the practical man and those who are taking up the study of electricity. It contains drawings and diagrams of electrical machinery and connections, over two hundred formulas for calculations, and problems worked out showing how the formulas are used. This data is taken from my personal note book, which was made while on different kinds of work, and I am sure it will be found of value to anyone engaged in the electrical business.

The drawings of connections for electrical apparatus include Motor Starters and Starting Boxes, Overload and Underload Release Boxes, Reversable Types, Elevator Controllers, Tank Controllers, Starters for Printing Press Motors, Automatic Controllers, Variable Field Type, Controllers for Mine Locomotives, Street Car Controllers, Connections for reversing Switches, Motor and Dynamo Rules and Rules for Speed Regulation. Also, Connections for Induction Motors and Starters, Delta and Star Connections and Connections for Auto Transformers, and Transformers for Lighting and Power Purposes. The drawings also show all kinds of lighting circuits, including special controls where Three and Four Way Switches are used.

The work on Calculations consist of Simple Electrical Mathematics, Electrical Units, Electrical Connections, Calculating Unknown Resistances, Calculation of Current in Branches of Parallel Circuits, How to Figure Weight of Wire, Wire Gauge Rules, Ohm's Law, Watt's Law, Information regarding Wire used for Electrical Purposes, Wire Calculations, Wiring Calculations, Illumination Calculations, Shunt Instruments and How to Calculate Resistance of Shunts, Power Calculations, Efficiency Calculations, Measuring Unknown Resistances, Dynamo and Dynamo Troubles, Motors and Motor Troubles, and Calculating Size of Pulleys.

Also Alternating Current Calculations in finding Impedance, Reactance, Inductance, Frequency, Alternations, Speed of Alternators and Motors, Number of Poles in Alternators or Motors, Conductance, Susceptance, Admittance, Angle of Lag and Power Factor, and formulas for use with Line Transformers.

The book called the "Burgess Blue Book" is published and sold by the Burgess Engineering Company for one dollar ($1.00) per copy, postpaid. If you wish one of the books, send me your order with a dollar bill, check or money order. I know the value of the book and can guarantee its satisfaction to you by returning your money if you decide not to keep it after having had it for five days.

BURGESS ENGINEERING CO., Yorke Burgess, *Consulting Engineer*
747 East 42nd Street Chicago, Illinois

www.americanradiohistory.com

You can be quickly cured, if you

STAMMER

Send 10 cents coin or stamps for 70-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering for 20 years.

Benjamin N. Bogue, 751 Bogue Building, Indianapolis

With the consent of **NIKOLA TESLA**

We have prepared a genuine, handsome photograph, autographed in facsimile by the great inventor. This photograph, taken in December, 1918, was posed especially for the cover design of the February, 1919, issue of the "Electrical Experimenter". It shows Tesla as he is today, holding his famous wireless-lighted globe. No advertising whatsoever on this photo, except for the autograph. Size about 9 x 12". Ready for framing. A striking picture of the world's greatest inventor for your den, library, laboratory, workshop or radio station. Sent prepaid in strong cardboard tube. Price $1.00.

EXPERIMENTER PUBLISHING CO
231 Fulton St. Book Department N. Y. City

FAMOUS SCIENTIFIC ILLUSIONS

(*Continued from page 730*)

high frequencies. The striking behavior of the currents soon captivated my attention and in 1889 I started a systematic investigation of their properties and the possibilities of practical application. The first gratifying result of my efforts in this direction was the transmission of electrical energy thru *one wire* without return, of which I gave demonstrations in my lectures and addresses before several scientific bodies here and abroad in 1891 and 1892. During that period, while working with my oscillation transformers and dynamos of frequencies up to 200,000 cycles per second, the idea gradually took hold of me that the earth might be used in place of the wire, thus dispensing with artificial conductors altogether. The immensity of the globe seemed an unsurmountable obstacle but after a prolonged study of the subject I became satisfied that the undertaking was rational, and in my lectures before the Franklin Institute and National Electric Light Association early in 1893 I gave the outline of the system I had conceived. In the latter part of that year, at the Chicago World's Fair, I had the good fortune of meeting Prof. Helmholtz to whom I explained my plan, illustrating it with experiments. On that occasion I asked the celebrated physicist for an expression of opinion on the feasibility of the scheme. He stated unhesitatingly that it was practicable, provided I could perfect apparatus capable of putting it into effect but this, he anticipated, would be extremely difficult to accomplish.

I resumed the work very much encouraged and from that date to 1896 advanced slowly but steadily, making a number of improvements the chief of which was my system of *concatenated tuned circuits* and method of regulation, now universally adopted. In the summer of 1897 Lord Kelvin happened to pass thru New York and honored me by a visit to my laboratory where I entertained him with demonstrations in support of my wireless theory. He was fairly carried away with what he saw but, nevertheless, condemned my project in emphatic terms, qualifying it as something impossible, "an illusion and a snare." I had expected his approval and was pained and surprised. But the next day he returned and gave me a better opportunity for explanation of the advances I had made and of the true principles underlying the system I had evolved. Suddenly he remarked with evident astonishment: "Then you are not making use of Hertz waves?" "Certainly not," I replied, "*these are radiations.* No energy could be economically transmitted to a distance by any such agency. In my system the process is one of *true conduction* which, theoretically, can be effected at the greatest distance without appreciable loss." I can never forget the magic change that came over the illustrious philosopher the moment he freed himself from that erroneous impression. The skeptic who would not believe was suddenly transformed into the warmest of supporters. He parted from me not only thoroly convinced of the scientific soundness of the idea but strongly exprest his confidence in its success. In my exposition to him I resorted to the following mechanical analogues of my own and the Hertz wave system.

Imagine the earth to be a bag of rubber filled with water, a small quantity of which is periodically forced in and out of the same by means of a reciprocating pump, as illustrated. If the strokes of the latter are effected in intervals of more than one hour and forty-eight minutes, sufficient for the transmission of the impulse thru the whole mass, the entire bag will expand and contract and corresponding movements will be imparted to pressure gauges or movable pistons with the same intensity, irrespective of distance. By working the pump faster, shorter waves will be produced which, on reaching the opposite end of the bag, may be reflected and give rise to stationary nodes and loops, but in any case, the fluid being incompressible, its inclosure perfectly elastic, and the frequency of oscillations not very high, the energy will be economically transmitted and very little power consumed so long as no work is done in the receivers. This is a crude but correct representation of my wireless system in which, however, I resort to various refinements. Thus, for instance, the pump is made part of a resonant system of great inertia, enormously magnifying the force of the imprest impulses. The receiving devices are similarly conditioned and in this manner the amount of energy collected in them vastly increased.

The Hertz wave system is in many respects the very opposite of this. To explain it by analogy, the piston of the pump is assumed to vibrate to and fro at a terrific rate and the orifice thru which the fluid passes in and out of the cylinder is reduced to a small hole. There is scarcely any movement of the fluid and almost the whole work performed results in the production of radiant heat, of which an infinitesimal part is recovered in a remote locality. However incredible, it is true that



Wireless Stations Will Shortly Re-open

Date, only, uncertain

Heed Our Advice ***ORDER NOW***

As a matter of law Congress loses all control over wireless receiving stations and transmitting stations with a range within the borders of the state where located as soon as peace is declared. The Radio Inspector of this district has already asked our co-operation in printing in the next edition of our catalog the necessity of securing licenses for transmitting sets with a range beyond the borders of the state. No wireless manufacturer wants the stations to open tomorrow. They could not take care of the business. Order now and be prepared. We have a big stock of wireless instruments.

No. 11 is our latest catalog. No new price list.

Please do not write for catalog if you have No. 11. Paper costs three times as much as formerly. Let the amateur without a catalog secure one. Write for prices in advance. Just now we have no price list, because the changes have been so frequent. Will advise through this magazine when revised price list is ready, which will be as quickly as possible.

Send 8c in coin or stamps today for our big 300 page No. 11 Electrical and Wireless Catalog. Any wireless amateur will tell you it is the one catalog to have. You need no others. Our catalog contains most everything in wireless worth while, and is a guarantee that the goods are dependable.

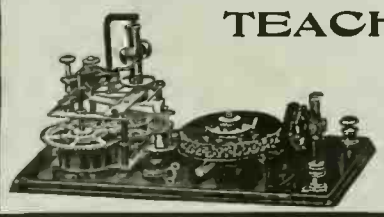
THE WILLIAM B. DUCK CO., 230-232 Superior St., Toledo, Ohio

"THERE'S MONEY IN IT"

LEARN TELEGRAPHY AT HOME

MORSE AND WIRELESS

TEACH YOURSELF



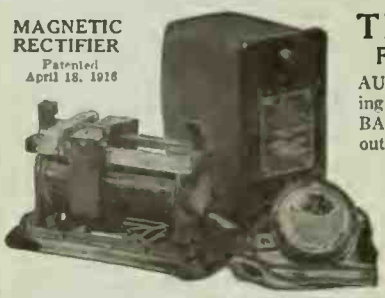
In half the usual time, at trifling cost, with the wonderful Automatic Transmitter, **THE OMNIGRAPH.** Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would.

Adopted by U. S. Gov't. 4 styles. Catalogue free.

OMNIGRAPH MFG. CO.

39L Cortlandt St. New York

MAGNETIC RECTIFIER
Patented April 18, 1916



The F-F Battery Booster

For Home Charging of Storage Batteries

AUTOMOBILE OWNERS: Eliminate your starting and lighting troubles by the use of an F-F BATTERY BOOSTER in your own garage, without breaking any electrical connections or removing battery from car. Keeps your battery 100% efficient and prolongs its life indefinitely at a cost of about six cents a month. Write for bulletin No. 12 today.

The French Manufacturing Company

Cleveland, Ohio U. S. A.

www.americanradiohistory.com

the minds of some of the ablest experts have been from the beginning, and still are, obsest by this monstrous idea, and so it comes that the true wireless art, to which I laid the foundation in 1893, has been retarded in its development for twenty years. This is the reason why the "statics" have proved unconquerable, why the wireless shares are of little value and why the Government has been compelled to interfere.

We are living on a planet of well-nigh inconceivable dimensions, surrounded by a layer of insulating air above which is a rarefied and conducting atmosphere (Fig. 5). This is providential, for if all the air were conducting the transmission of electrical energy thru the natural media would be impossible. My early experiments have shown that currents of high frequency and great tension readily pass thru an atmosphere but moderately rarefied, so that the insulating stratum is reduced to a small thickness as will be evident by inspection of Fig. 6, in which a part of the earth and its gaseous envelope is shown to scale. If the radius of the sphere is 12½", then the non-conducting layer is only 1/64" thick and it will be obvious that the Hertzian rays cannot traverse so thin a crack between two conducting surfaces for any considerable distance, without being absorbed. The theory has been seriously advanced that these radiations pass around the globe by *successive reflections*, but to show the absurdity of this suggestion reference is made to Fig. 7 in which this process is diagrammatically indicated. Assuming that there is no refraction, the rays, as shown on the right, would travel along the sides of a polygon drawn around the solid, and inscribed into the conducting gaseous boundary in which case the length of the side would be about 400 miles. As one-half the circumference of the earth is approximately 12,000 miles long there will be, roughly, thirty deviations. The efficiency of such a reflector cannot be more than 25 per cent, so that if none of the energy of the transmitter were lost in other ways, the part recovered would be measured by the fraction $(¼)^{30}$. Let the transmitter radiate Hertz waves at the rate of 1,000 kilowatts. Then about *one hundred and fifteen billionth part of one watt* is all that would be collected in a *perfect* receiver. In truth, the reflections would be much more numerous as shown on the left of the figure, and owing to this and other reasons, on which it is unnecessary to dwell, the amount recovered would be a vanishing quantity.

Consider now the process taking place in the transmission by the instrumentalities and methods of my invention. For this purpose attention is called to Fig. 8, which gives an idea of the mode of propagation of the current waves and is largely self-explanatory. The drawing represents a solar eclipse with the shadow of the moon just touching the surface of the earth at a point where the transmitter is located. As the shadow moves downward it will spread over the earth's surface, first with infinite and then gradually diminishing velocity until at a distance of about 6,000 miles it will attain its true speed in space. From there on it will proceed with increasing velocity, reaching infinite value at the opposite point of the globe. It hardly need be stated that this is merely an illustration and not an accurate representation in the astronomical sense.

The exact law will be readily understood by reference to Fig. 9, in which a transmitting circuit is shown connected to earth and to an antenna. The transmitter being in action, two effects are produced: Hertz waves pass thru the air, and a current traverses the earth. The former propagate with the speed of light and their energy is *unrecoverable* in the circuit. The latter proceeds with the speed varying as the cosecant of the angle which a radius drawn from any point under consideration forms

Increase Your Will Power In One Hour

Author of This Article Tells How He Quickly Acquired a Dominating Will Power That Earns Him Between $50,000 *and* $70,000 *a Year*

FOUR YEARS ago a man offered me a wonderful bargain. He was hard up for money and wanted to sell me some shares in a young, growing company for $1,000. Based on the earnings of the Company the stock offered me was easily worth $5,000—in fact, the man who finally bought the shares sold them again in five months at a profit of $4,300.

The reason I didn't buy the shares was that I could no more raise a thousand dollars than I could hop, skip, and jump across the Atlantic Ocean. A thousand dollars! And my income only twenty-five a week.

The second chapter in my life began a few months later, when another opportunity came to me. It required an investment of $20,000 during the first year. I raised the money easily, paid back every penny I borrowed, and had $30,000 left at the end of the first year! To date, in less than four years, my business has paid me a clear profit of over $200,000 and is now earning between $50,000 and $70,000 a year. **Yet for twelve years before, the company had been losing money every year!**

The natural question for my reader to ask is, "How could you borrow $20,000 to invest in a business which had previously been a failure, after being unable to borrow $1,000 for an investment that seemed secure?" It is a fair question. And the answer can be given in two little words— **WILL POWER.**

When the first proposition came to me I passed it by simply because I didn't have the money and couldn't borrow it. I went from one friend to the next and all turned me down. Several refused to talk business with me at all. They all liked me personally, and they asked me about the kiddies, but when it came to money matters I hadn't a chance. I was scared stiff every time I talked to one of them. I pleaded with them, almost begged them. But everybody had their "money all tied up in other investments." It was an old excuse, but I accepted it meekly. I called it hard luck. But I know today that it was nothing in the world except my lack of Will Power, or rather my weak Will Power, which kept me from getting what I wanted.

When I heard that the man sold those shares at a profit of $4,300, it seemed that my sorrow could not be greater. That profit was just about what my salary amounted to for four years! But instead of grieving over my "hard luck," I decided to find out why I was so easily beaten in everything I tried to accomplish. It must be that there was something vital that made the difference between success and failure. It wasn't lack of education, for many illiterate men become wealthy. What was this vital spark? What was this one thing which successful men had and which I did not have?

Partial List of Contents

The Law of Great Thinking
The Four Factors on which it depends.
How to develop analytical power.
How to think "all around" any subject.
How to throw the mind into deliberate, controlled, productive thinking.
Detailed directions for Perfect Mind Concentration.
How to acquire the power of Consecutive Thinking. Reasoning. Analysis.
How to acquire the skill of Creative Writing.
How to guard against errors in Thought.
How to drive from the mind all unwelcome thoughts.
How to follow any line of thought with keen, concentrated Powers.
How to develop Reasoning Power.
How to handle the mind in Creative Thinking.
The secret of Building Mind Power
How the Will is made to act.
How to test your Will.
How a Strong Will is Master of Body.
What creates Human Power.
The Six Principles of Will Training.
Definite Methods for developing Will.
The NINETY-NINE METHODS for using Will Power in the Conduct of Life.
Seven Principles of drill in Mental, Physical, Personal power
FIFTY-ONE MAXIMS for Applied Power of Perception. Memory, Imagination, Self-Analysis, Control.
How to develop a strong, keen gaze.
How to concentrate the eye upon what is before you—object, person, printed page, work.
These are only a few of the many subjects treated.

I began to read books about psychology and mental power. But everything I read was too general. There was nothing definite—nothing that told me **what to do.**

After several months of discouraging effort, I finally encountered a book called "Power of Will," by Prof. Frank Channing Haddock. The very title came to me as a shock. When I opened the book I was amazed. I realized that will power was the vital spark—the one thing that I lacked. And here in this book were the very rules, lessons and exercises through which anyone could increase their will power. Eagerly I read page after page; including such articles as, The Law of Great Thinking; How to Develop Analytical Power; How to Concentrate Perfectly; How to Guard Against Errors in Thought; How to Develop Fearlessness; How to Acquire a Dominating Personality.

An hour after I opened the book I felt like a new person. My sluggish will power was beginning to awaken. There was a new light in my eye, a new spring in my step, a new determination in my soul. I began to see, in my past, the many mistakes I had made, and I knew I would never make them again.

I practiced some of the simple exercises. They were more fascinating than any game of cards or any sport.

Then came an opportunity to acquire the business which had lost money for twelve years, and which I turned into a $50,000 a year money maker. Instead of cringing before the moneyed people, I won them over by my sheer force of will. I would not be denied. And my every act and word since then has been the result of my training in will power.

I am convinced that every man has within himself every essential quality of success except a strong will. Any man who doubts that statement need only analyze the successful men he knows, and he will find himself their equal, or their superior, in every way except in will power. Without a strong will, education counts for little, money counts for nothing, opportunities are useless.

I earnestly recommend Prof. Haddock's great work, "Power of Will," to those who feel that success is just out of reach—to those who lack that something which they cannot define, yet which holds them down to the grind of a small salary.

Never before have business men and women needed this help so badly as in these trying times. Hundreds of real and imaginary obstacles confront us every day, and only those who are masters of themselves and who hold their heads up will succeed. "Power of Will" as never before is an absolute necessity—an investment in self-culture which no one can afford to deny himself.

I am authorized to say that any reader who cares to examine "Power of Will" for five days may do so without sending any money in advance. If after one hour you do not feel that your will power has increased, and if after a week's reading you do not feel that this great book supplies that one faculty you need most to win success, return it and you will owe nothing. Otherwise send only $3, the small sum asked.

Some few doubters will scoff at the idea of will power being the fountainhead of wealth, position and everything we are striving for, but the great mass of intelligent men and women will at least investigate for themselves by sending for the book at the publisher's risk. I am sure that any book that has done for me—and for thousands of others—what "Power of Will" has done—is well worth investigating. It is interesting to note that among the 250,000 owners of "Power of Will" are such prominent men as Supreme Court Justice Parker; Wu Ting Fang, Ex-U. S. Chinese Ambassador; Gov. McKelvie, of Nebraska; Assistant Potmaster-General Britt; General Manager Christeson, of Wells-Fargo Express Co.; E. St. Elmo Lewis; Senator Arthur Capper of Kansas and thousands of others. In fact, today "Power of Will" is just as important, and as necessary to a man's or woman's equipment for success, as a dictionary. To try to succeed without Power of Will is like trying to do business without a telephone.

As your first step in will training, I suggest immediate action in this matter before you. It is not even necessary to write a letter. Use the form below, if you prefer, addressing it to the Pelton Publishing Company, 30-B Wilcox Block, Meriden, Conn., and the book will come by return mail. You hold in your hand, this very minute, the beginning of a new era in your life. Over a million dollars has been paid for "Power of Will" by people who sent for it on free examination. Can you, in justice to yourself, hesitate about sending in the coupon? Can you doubt, blindly, when you can see, without a penny deposit, this wonder-book that will increase your will power in one hour.

The cost of paper, printing and binding has almost doubled during the past three years, in spite of which "Power of Will" has not been increased in price. The publisher feels that so great a work should be kept as low-priced as possible, but in view of the enormous increase in the cost of every manufacturing item, the present edition will be the last sold at the present price. The next edition will cost more. I urge you to send in the coupon now.

PELTON PUBLISHING COMPANY
30-B Wilcox Block, Meriden, Conn.

I will examine a copy of "Power of Will," at your risk I agree to remit $3 or remail book in 5 days.

Name.....

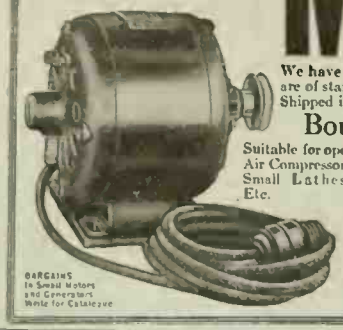
Address.....

City..... State.....

www.americanradiohistory.com

1/4 H.P., 110 volts, A.C. 60 cycle, single phase, 1750 R.P.M.

MOTORS



We have 1000 NEW WASHING MACHINE MOTORS. These are of standard manufacture and carry the regular factory guarantee. Shipped in original boxes. Complete as cut.

Bought from Bankruptcy Stock

Suitable for operating Coffee Grinders, Cream Seperators, Bottle Washers, Air Compressors, Small Lathes, Etc.

Mail $8.00 cash or Money Order. We will send C.O.D. subject to full examination. MONEY BACK GUARANTEE

$18.50 EACH

Special Quantity Prices Regular Value $34

MANUFACTURERS' DISTRIBUTER

CHAS. H. JOHNSTON - West End - Pittsburgh, Pa.

BARGAINS in Small Motors and Generators. Write for Catalogue

Wireless Taught By Mail

Merchant Marine Needs THOUSANDS of Operators

Men also needed for big Land Wireless Stations—Aerial Mail Service—Railroad and Telegraph companies. Salaries up to $200 a month. Excellent opportunities to win promotion to Radio Engineer—Inspector—or Draftsman. Chance to travel the world over or locate at Land Station in America.

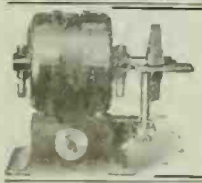


Complete Course by Mail in Ten Weeks

Our students actually pass the commercial examination in Ten Weeks or less. Start studying NOW in spare time at home. We send you Complete Set Practice Instruments for receiving and sending messages, with first lessons. We help you secure position in any branch of Commercial or Government Radio Service. Write TODAY for Free Particulars. A postal will do.

NATIONAL RADIO INSTITUTE

Dept. 68 Washington, D. C.



Grinding and Buffing Motors

An indispensable tool in any shop or laboratory. Your equipment is not complete without a BODINE grinding and buffing motor.

Save time and money by keeping your lathe tools, milling cutters and drills sharp.

Send for bulletin No. 522 giving full details of this handy machine.

BODINE ELECTRIC COMPANY. 2254 W. Ohio St., Chicago.

with the axis of symmetry of the waves. At the origin the speed is infinite but gradually diminishes until a quadrant is traversed, when the velocity is that of light. From there on it again increases, becoming infinite at the antipole. Theoretically the energy of this current is *recoverable* in its entirety, in properly attuned receivers.

Some experts, whom I have credited with better knowledge, have for years contended that my proposals to transmit power without wires are sheer nonsense but I note that they are growing more cautious every day. The latest objection to my system is found in the cheapness of gasoline. These men labor under the impression that the energy flows in all directions and that, therefore, only a minute amount can be recovered in any individual receiver. But this is far from being so. The power is conveyed in only one direction, from the transmitter to the receiver, and none of it is lost elsewhere. It is perfectly practicable to recover at any point of the globe energy enough for driving an airplane, or a pleasure boat or for lighting a dwelling. I am especially sanguine in regard to the lighting of isolated places and believe that a more economical and convenient method can hardly be devised. The future will show whether my foresight is as accurate now as it has proved heretofore.

SHIP RADIO OPERATORS ASK INCREASED WAGES.

Increased wages and the fixing of a standard wage scale for radio operators on vessels operating under Government direction was asked of the Shipping Board recently by a delegation representing the Marconi Radio Telegraphers' Association. The radio operators included in the request made of the Board are those on vessels operating in transatlantic and Gulf waters. Assurances were given the radio representatives by Board officials that their request would be taken under advisement for immediate consideration.

SKINDERVIKEN TRANSMITTER BUTTON

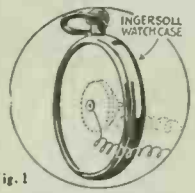


Fig. 1



Fig. 2

THE SKINDERVIKEN TRANSMITTER BUTTON presents the latest advance in microphones and marks a revolution in transmitter construction. It works on an entirely new principle, takes up practically no room, and marks the end of all telephone transmitter troubles.

The SKINDERVIKEN TRANSMITTER BUTTON can be placed in any position and it will talk loudly and distinctly and is at the same time extraordinarily sensitive. It was primarily designed to replace the old damaged or burnt out transmitter. Simply unscrew and remove the telephone transmitter front, disconnect the two inside wires, unscrew and remove the bridge and the old electrode. There remains only the diafram. These wires are then connected with the Skinderviken button, the latter screwed to the diafram, and after screwing the old transmitter housing together again, the telephone is ready for work.

ELECTRICAL EXPERIMENTER readers will be particularly interested in all the different experiments that can be performed with the Skinderviken Button. Fig. 1 shows the Skinderviken button attached to the back of an Ingersol watch case. When speaking towards the inside of the case, it will be found that the voice is reproduced clearly and loudly Fig. 2 shows another interesting stunt. By attaching the buttoo to a tin diafram about the size of half a dollar, and by holding the diafram at the side of the throat, as shown, speech can be transmitted with surprising clarity. Fig. 3 illustrates the same arrangement placed on the chest as shown. In this position the transmitter will talk clearly and loudly. Fig. 4 shows an arrangement whereby the Skinderviken button is attached on a thin wood board at the preacher's pulpit. His voice is clearly transmitted so that people hard of hearing can readily hear the sermon. Fig. 5 shows an interesting stunt, whereby a hole is drilled in the side of a thin glass water-tumbler; the sides of the glass thus acting as a diafram, the voice is clearly transmitted. Fig. 6 shows a simple match box Detectophone. The Skinderviken button is concealed inside of the box, only the small brass nut showing on the outside. This can be camouflaged as well. This device talks well. Fig. 7 shows how to transmit phonograph music at a distance merely by drilling a small hole in the phonograph arm and attaching the Skinderviken button; a very favorite experiment with all experimenters. Fig. 8 shows how a very sensitive Detectophone can be made by placing one of the buttons in the center of a lithographed cardboard picture, so that only the small brass nut shows. The large surface of the picture acts as a big diafram, and the voice is well reproduced.



$1.00 prepaid

We have such unlimited confidence in the Skinderviken transmitter button that we make the following remarkable offer. Send us one dollar ($1.00) for which we will mail one button prepaid. If you do not wish to keep it, return it within five days and your money will be refunded. Boys! send stamp for booklet No. 4. It gives diagrams and experiments using the Skinderviken Transmitter Button, and prices of telephone equipment.



Fig. 5

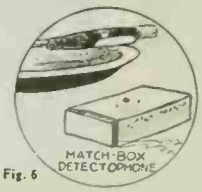


Fig. 6

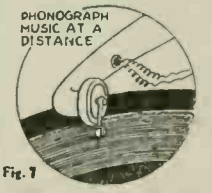


Fig. 7



Fig. 8

SKINDERVIKEN TELEPHONE EQUIPMENT CO. Address us as STECO, 2134 N. Clark St., Chicago, Ill.

www.americanradiohistory.com

ALEXANDER WIRELESS BILL, AMENDED.

(Continued from page 707)

"Seventh. It shall be lawful for the Government to deputize owners of private or amateur stations at a nominal fee for the purpose of having the radio rules and regulations enforced in such localities as the number of stations so warrants such a proceeding.	No fundamental objection to this phase. It was already done in a silent way by tacit agreement among the amateurs before the war. It was very common for the Editor of this as well as other publications to receive letters from amateurs complaining of fellow amateurs who had infracted the law. A letter to such violators from the various publications devoted to wireless usually brought speedy redress. Apparently no law was necessary.
"Eighth. The Government shall have the right to permanently revoke any license held by a private or amateur station as an extreme penalty for disobeyance of the radio rules and regulations set forth by this Act and any previous Acts concerning radio telegraphy.	We have no objection against this either. An amateur should have his license revoked if he does not play the game fair. In the five years that the 1912 Radio Act was in effect, however, we have not heard of a single case where a license was revoked.
"Ninth. It shall be lawful for the Government to provide technical schools and State universities with radio stations for the benefit of science and the training of radio operators.	No objection to this.
"Tenth. It shall be lawful for the Government to require all private or amateur stations to use inductive coupling between the antenna circuit and the circuit which includes the power transformer for damped radiotelegraphic communication.	No objection.
"Eleventh. It shall be unlawful for any private or amateur station to use a spark coil operating on direct current for the sending of radio disturbances into the ether.	We fail to see the wisdom of this. An amateur with a spark coil, we admit, can cause a lot of disturbance, but it should be remembered that a Government or commercial station can readily tune out such an amateur station without any trouble whatsoever even if it operates a block away. Furthermore, if no spark coils could be used, the amateur would naturall resort to a transformer, and there is no such apparatus made today which uses less than 100 watts. Most of the spark coils use less than 30 or 40 watts, consequently send out less disturbance than would be the case under the new measure.
"Twelfth. It shall be unlawful, except by special license, for any private or amateur station to use more than one hundred and twenty-five watts as measured in the antenna circuit, for the sending of radiotelephonic communications.	We believe that 125 watts is not sufficient. In a few years there will be thousands of radio telephone stations operating all over the country, and they will be as common as the telephone is today. Ours is a country of vast distances. This law would work especial harm to our western states where there are often no settlements a hundred miles apart. One hundred and twenty-five watts as measured in the antenna circuit we believe is insufficient to bridge such distances. We believe 250 watts should be the minimum.
"Thirteenth. The Government shall have the right to suspend the sending of radio disturbances into the ether by private or amateur stations for definite periods of the night or day in such zones as may become necessary, but nothing in this article shall be construed to mean that the sending of private or amateur stations shall be permanently suspended.	Yes, every bill must have its usual joker, and it is right here. If this clause becomes a law then any officious Government operator can take it into his head to prohibit sending in his district between the hours of 4 P. M. and 12 A. M. This period would be considered night. You said it, "GOOD Night." It would, of course, blot out all the sending stations with one stroke. If we must have a time limit, let it be stated in the law so there will not be any "ifs" and "buts"—at best such a clause as this would tend to create eternal friction between amateurs and Government officials. We believe such a clause is unjust and only at best reflects on poor and inadequate Government apparatus and still more inefficient Government radio operators.
"Fourteenth. The owner of the license of any private or amateur station must display in his station a copy of the rules and regulations of the Government regarding radio stations and failure to do so shall be punishable by a fine not exceeding $100, such rules and regulations to be furnished by the Government at a nominal cost."	No objection to this, altho every amateur operator before the war was only too proud to display his Government license once he had gone thru the trouble to get one.

RADIO AMATEURS DISCUST OFFICIALLY.

During the hearings of the Alexander Bill, H. R. 13159, before the committee on the Merchant Marine and Fisheries on December 12, 1918, many interesting points were brought out.

Lieut. J. C. Cooper, Jr., U. S. N. R. F., had been intrusted with drafting the amateur amendment, printed elsewhere in this issue. Lieutenant Cooper, who calls himself an "amateur naval officer", undertook the thankless job of drafting an amendment which would satisfy both the Navy and amateurs. In fairness to Lieutenant Cooper, let us state that he tried hard to be fair to both interests. But it is our opinion that neither Navy Department nor Amateurs are fully satisfied with the compromise amendment.

Lieutenant Cooper's statement before the committee follows:

Statement of Lieut. J. C. Cooper, Jr., United States Naval Reserve Force.

Lieut. Cooper: Gentlemen, I am an ex-amateur radio operator and "amateur naval officer," as I am soon going back to civil life to take up the practise of my profession again. As many other amateurs, when the war broke out, I offered to do what I could for the service, and have had some duties in connection with radio work which have given me an opportunity, I hope, to be able to see the point of view of the Navy and the point of view of the amateur operator to some extent at the same time.

Several days ago there was a meeting called in Capt. Todd's office—without knowing how many men would be present—of all of the ex-amateurs who happened to be on duty in the naval service in Washington. There were about 25 or 30 men present. The question of the operation of amateur stations after the war was very liberally discust, and a memorandum was prepared and sent to each of those men and other men in the naval service in Washington who had been amateurs that we could locate, with the request that the questions be answered and sent back as soon as possible, with an idea of drafting an amendment to the present law which would, as far as possible, meet the combined view of themselves as previous amateurs, knowing amateur operations and knowing what the amateur desires to do and what he has done, and also with their experience since the war as part of the Government's service that has controlled radio. I had the unfortunate responsibility of having to say the final word on collating those opinions and putting them into the form of an amendment. There is no body of men, I believe, who disagree more violently among themselves on every subject that concerns them than do the amateur radio operators. I am convinced that from now on, as these hearings are going to be printed, my name is going down in radio history among the amateurs to some as guilty of high treason, to others as being foolish, to others as deserving some credit if this amendment goes into law. I do not expect all the amateurs to agree with it all. It is the collective judgment, however, of a certain number of amateurs who have seen both the Navy point of view and the amateur point of view, and I, myself, with the approval of the department, and it is offered as an amendment to the bill.

The present law states that the amateur who does not hold a special license is authorized within 5 miles of a Government station to use a transformer input of one-half kilowatt, elsewhere 1 kilowatt,

(Continued on page 737)



Learn Drafting

Employers everywhere are looking for skilled draftsmen. They are offering good salaries to start with splendid chances for advancement.

Drafting offers exceptional opportunities to a young man because drafting itself not only commands good pay, but it is the first step toward success in Mechanical or Structural Engineering or Architecture. And drafting is just the kind of work a boy likes to do. There is an easy delightful way in which you can learn right at home in spare time. For 27 years the International Correspondence Schools have been giving boys just the training they need for success in Drafting and more than 200 other subjects. Thousands of boys have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon, then mark and mail it. This doesn't obligate you in the least and will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6175, SCRANTON, PA.

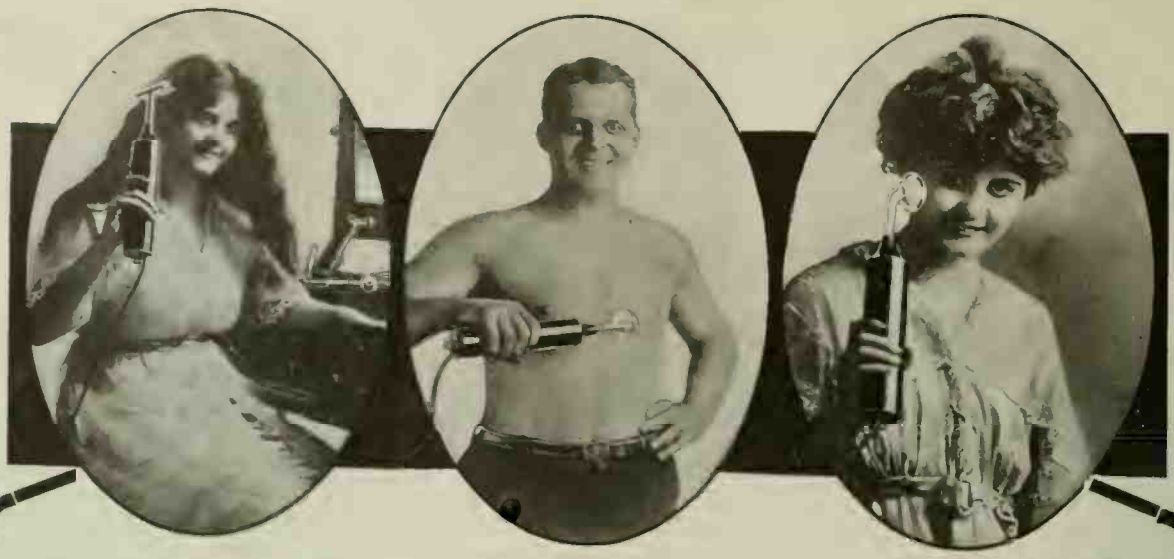
Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

MECHANICAL DRAFTING	SALESMANSHIP
STRUCTURAL DRAFTING	ADVERTISING
SHIP DRAFTING	Show Card Writer
ELECTRICAL DRAFTING	Sign Painter
ARCHITECTURAL DRAFTING	ILLUSTRATING
SHEET METAL DRAFTING	Cartooning
BOILERMAKER DRAFTING	BOOKKEEPER
BRIDGE DRAFTING	Stenographer and Typist
MACHINE DESIGN	Cert. Public Accountant
ELECTRICAL ENGINEER	TRAFFIC MANAGER
Electric Lighting and Railways	Railway Accountant
Electric Wiring	GOOD ENGLISH
Telegraph Engineer	Teacher
Telephone Work	Common School Subjects
MECHANICAL ENGINEER	Mathematics
Machine Shop Practice	CIVIL SERVICE
Gas Engine Operating	Railway Mail Clerk
CIVIL ENGINEER	AUTOMOBILE OPERAT'G
Surveying and Mapping	Auto Repairing
STATIONARY ENGINEER	PLUMBING AND HEATING
Marine Engineer	Textile Overseer or Supt.
ARCHITECT	CHEMIST
Contractor and Builder	Navigation / Spanish
Concrete Builder	AGRICULTURE / French
Structural Engineer	Poultry Raising / Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____



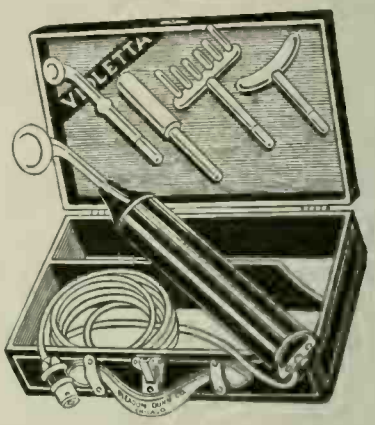
www.americanradiohistory.com



Try This Wonderful New

VIOLET-RAY

Machine—10 Days Free!



NOW in your own home you can have wonderful Violet-Ray treatments exactly as are given by eminent physicians and beauty specialists throughout the country. Now you can rid yourself of headaches, catarrh, constipation, eczema, insomnia, lumbago, nervousness. Relieve your pain from neuritis, rheumatism, and other disturbances. Multiply your bodily health, vitalize your nerves, double or treble your energy by using Violet-Rays. Sleep better, increase your strength, and improve your appetite and digestion. Soothe your nerves, reduce or increase your flesh. Tone and strengthen the entire system. Beautify your complexion! All with Violet Rays!

Not a Vibrator

The wonderful Violetta is not a Vibrator. It is not a machine that contracts the muscles—it does not shock, it does not pound the muscles—it is absolutely painless. Violet-Rays administered by the Violetta are wonderful even for infants! Relieve pain and suffering in every part of the body. Simple tests prove that Violet-Rays pass completely through every part of the body, stimulating every cell and organ. It is electricity in its highest remedial form.



Treat Yourself at Home

Here is a partial list of ailments treated successfully, with the Violetta, Violet-Ray Machine.

Asthma	Earache	Obesity
Barbers' Itch	Eczema	Pains
Boils	Eye Disease	Paralysis
Blackheads	Falling Hair	Piles
Bunions	Hay Fever	Pimples
Callous	Headache	Pyorrhea
Catarrh	Goitre	Rheumatism
Chilblains	Insomnia	Skin Diseases
Colds	Lumbago	Sore Throat
Corns	Nervousness	Sprains
Constipation	Neuralgia	Tonsilitis
Dandruff	Neuritis	Whooping Cough
Deafness		

What Physicians and Users Say

Trixie Friganza, well known actress says: "Cheerfully will I add my praise for Violetta. It's the best "pain chaser" and "soother" I've had the good fortune to find. It's WONDERFUL. It cured my brother of neuritis. As for myself I use it for facial treatments and general massage. I cannot say too much for it."

Dr. Bert H. Rice, of Vinton, Iowa, says: "I have good results with the Violetta High Frequency Instrument in all cases of neuralgia. Almost instant relief in Facial Neuralgia."

K. L. Allen, D. C., 205 Boone National Building, Boone, Iowa, says: "I have had very good results with the application of High Frequency Current in cases of Paralysis, Rheumatism and Neuritis, and think it a great help in drugless healing."

Dr. Daniels, Lisbon, North Dakota, says: "Have used the VIOLETTA in such cases as Goitre, Bronchitis, Pleurisy, Neuritis, Neuralgia, and Lumbago, and find it very beneficial. In fact, I would not be without it in my office."

Frank Borzone, Seattle, Wash., says: "I purchased the VIOLETTA for my wife who was suffering from an acute attack of Sciatica. From the very first treatment it induced peaceful rest and she is entirely well now."

BLEADON-DUN CO.,
Dept. 2B, 11-17 So. Desplaines St., Chicago, Ill.

Please send me your free book and 10 Days' Trial offer on Violetta Violet-Ray Machine.

Name .....

Address .....

.....

BOOK FREE!

Write today without fail. Mail coupon or just a post card. Let us send you our 32-page beautifully illustrated free book, describing the Violetta in detail. Read the amazing phenomena produced by Violet-Ray High frequency current. Why it produces stimulation and sedation. How to give spinal treatments with the Violetta, how to treat various ailments, including nervous troubles, rheumatism, obesity, hayfever, skin treatments, facial treatments. Note low price direct to you from our own laboratories. Note the amazingly superior construction of the Violetta in every detail. Mail coupon or postal right now before you turn this page. Violet-Raya will double your energy, will increase your life, will remove your pains and aches. Address

BLEADON-DUN CO., Dept. 2-B, 11-17 So. Desplaines St., Chicago, Ill.

www.americanradiohistory.com

RADIO AMATEURS DISCUST OFFICIALLY.

(Continued from page 735)

and to use a maximum wave length of 200 meters. All amateurs are agreed that you can not properly tune an efficient amateur station quite as low as 200 meters; that an extension in wave length is desirable. The consensus of opinion of those I have talked to is that the limitations of this amendment—that is, not to exceed 250 meters—will greatly increase the efficiency of amateur stations and will enable the amateur to further fulfill his real function, which is to train him as an operator for any national emergency that may arise, and to possibly train him as a further developer of the radio art. The amateur has no place in the scheme of things if he is not useful. The ether is a means of communication which must be put to the use of the community as a whole for the advancement of the community. Unless the amateur operator advances the art, or advances the community, the amateur has no right to exist. I, personally, as a naval officer, have had many operators under me. I have found that of the new men under me the easiest trained, the most adaptable to the new apparatus, and the most efficient men I had were ex-amateur operators.

I took two of my best men the other day and put them on the President's ship to receive official messages from Washington. They were both ex-amateur operators; and I think that I speak for Capt. Todd and the Navy when I say that no one more than the Navy realizes the value that the amateur operator was to the Navy when the war first broke out. I, personally, of course am prejudiced in favor of the amateur, because I am praising myself when I praise the amateur, because I am an amateur operator.

This amendment also licenses receiving stations without requiring a license of the operator. In other words, the jeweler who has a receiving station simply for the purpose of receiving the Arlington time signals and checking up his chronometer will not require to be a radio operator to operate his receiving station. Likewise, the amateur who is only learning to send, who is just starting, will not have to have any license in order to operate a receiving station.* We do not think, on the other hand, that any amateur ought to have a right to touch the key and to cause possible blundering interference by his lack of ability as an operator unless he can receive and send what is usually called 15 words per minute; that is, 75 letters per minute, in the ordinary standard of 5 letters to the word, which is what we use in averaging an operator's speed. I personally do not think that that limit is too high. Others may disagree with me. I personally think that no operator ought to touch a key and ought to be allowed to interefere with this medium of commerce, which is the ether, unless he has that degree of skill. If he is required to have that degree of skill, it will be an incentive to him when he is first learning the art to get up to that degree of skill as soon as he can, so that he can have a transmitting license.

This amendment includes a clause authorizing the Government, where it is found expedient—as, for instance, in large centers or elsewhere—to limit the transformer input of amateur stations to one-half kilowatt if within 100 miles of the seacoast or within 5 miles of a Government receiving station to one-fourth kilowatt. I am frank to say that those powers are higher than the consensus of opinion of these written documents from which I compiled the amendment. Those powers are more liberal than the great majority of the men who compiled these memorandums thought proper, but after talking with Capt. Todd and Commander Hooper, and with especially this idea in view, namely, that there are many amateur stations which will have to apply for license before they can again reopen, who, if the input is cut down very much from the present law, will be required to remodel a part of their apparatus or give up their apparatus if we change the power limits very much. Personally, I think that those limits are as reasonable as can be safe from the point of view of non-interference with the real business of radio, which is sending official and commercial dispatches, and that those powers are ample to provide full experimentation that an amateur ought to have occasion to do and all communication that he may have occasion to make. Mark me, it does not say that a license can not be issued up to 1 kilowatt under those limitations. It says that the Government may in its discretion put those limits on.

For example, we will take on the peninsula of Michigan or on parts of the more or less uninhabited coasts of the Gulf, there is no reason why there would be stations near enough or ships working near enough so that 1 kilowatt would necessarily cause interference by what we call "forced oscillation." The amendment leaves it in the discretion of the licensing power to cut down to those limitations amateur stations which are near the centers of commerce, where other stations are using radio for its real purpose, and still it allows the amateur to work.

There are a lot of amateur operators here, some of whom I have known personally; some I have met since I have been here to-day; some I have had correspondence with before the war. A lot of them are going to disagree with me; some of them are going to think these limitations too low and some are going to think these limitations too high. That will be for the committee to decide. This is submitted by the Navy as a measure to assist in the future development of amateur radio.

*The amendment, printed elsewhere, fails to show this.—EDITOR.

(Continued on page 738)

K. I. Shorthand hastened his promotion from stenographer to executive; now he depends upon it more than ever



You Need K.I. Shorthand Whatever Your Calling

The wonderful thing about K. I. Shorthand is the way it helps people in all walks of life. Engineers, chemists, contractors, clerks, mechanics, professional men and women, and farmers have learned K. I. Shorthand and are enthusiastic in its praise. At last you can learn shorthand so quickly and so inexpensively that it is worth your while.

This new, amazingly simple stenography will enable you to put down conversations rapidly as spoken, take messages verbatim, record board-meeting facts, jot down business-getting ideas, and stand ready to help you every time anything important must be written down fully and instantly. You do not have to study months to do this. Just five evenings at home is all that is necessary. Greater speed comes quickly with practice. Learn K. I. Shorthand because it will be the biggest little investment of your life.

You can learn in 5 evenings

K. I. Shorthand is the ideal system for stenographers or secretaries. You can prepare yourself for a position in weeks as compared to months by the old-fashioned systems—there is so much less to learn and remember. It is the most practical, concise and readable system in the world. Notes years old can be transcribed as readily as when fresh—just like longhand. Would you not give best satisfaction to your employer with a stenographic system that enables you to do that?

30 Days' Approval

Do not doubt for a minute that you can learn K. I. Shorthand in five evenings even though you may not know the first thing about stenography. It is not a bit remarkable for anyone to learn all the lessons in the system that quickly.

Why put in months of grinding study at some difficult old-fashioned system? Save time! Save money! Learn K. I. Shorthand, the new easy as A-B-C method of speed writing.

The cost of the course is lower than it has ever been possible to purchase a stenographic education. Everyone can afford it. K. I. Shorthand is used in government service and courts as well as public corporations and private businesses. Preferred for highly technical matter because of its remarkable accuracy and legibility.

Simplified K. I. Shorthand dispenses with all special positions, light and heavy shading and other confusing and speed-retarding rules of old systems. You will be delighted.

Try 2 Lessons FREE

You learn K. I. Shorthand in your own home by our mail tuition course. The lessons are fascinating. Experts guide you in quickly acquiring proficiency. Send for two free lessons and complete information. You may then continue the entire course on a month's approval.



"Go ahead! I'm getting it all in K. I. Shorthand"

Here is a complete course—not merely a text-book. Remember, there is no system to compare with K. I. Shorthand in brevity and practicability—and no course giving correspondence instruction obtainable at anything like our price.

We give you a positive guarantee that you can learn or no cost to you. King Institute is incorporated in New York State $100,000.00 authorized capital. Mail the coupon or write a letter asking for free lessons and complete information. Be sure to mention "Electrical Experimenter."

Used in Professions—"I am now past 83 and use K. I. Shorthand for my professional work in making records of cases. I like K. I. Shorthand System very much, indeed, and have recommended it to some who I think will enroll."
A. P. DAVIS, M.D.

In One Week!—"I learned K. I. Shorthand within five hours and in one week afterwards I was able to write 90 words per minute. I set down all my notes in K. I. Shorthand and can read them weeks afterwards. I believe that everybody should learn K. I. Shorthand as it is simple and also inexpensive. It is worth ten times what is asked for it. You have done everything you promised."
BYRON W. CREW.

A Pleasure to Learn—"It was a pleasure to learn K. I. Shorthand. Within three hours I could write any word. I can now write over 100 words per minute and am positive that by a little more practice I could speed up to 150 words a minute. It is easy to read one's notes in K. I. Shorthand."
(Miss) JOY WADSWORTH.

Professional Stenographer—"Until recently I knew absolutely nothing of shorthand. To-day I am holding a position as stenographer in the office of Inspector of Buildings where the terms apply almost wholly to building construction. I think this sufficient recommendation of your system."
(Mrs.) E. M. FULTON.

Used in Big Business—"I learned your system of shorthand to save time in making notes while passing about the plant. After only slight study I can take down ordinary conversations. K. I. Shorthand is practical, time-saving and simple."
S. B. ROPER

MAIL THE COUPON

KING INSTITUTE INC.

154 East 32d St., New York, N. Y.
or 8 S. Wabash Ave., Chicago, Ill.

Please send me the first two lessons in K. I. Shorthand FREE, also full information.

Name .....

Address EK-308

www.americanradiohistory.com

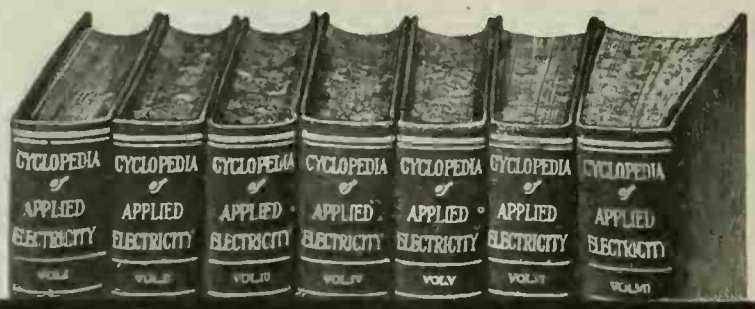
Send No Money—Just Mail This Coupon
Examine These 7 Volumes FREE

American Technical Society, Dept. E3382, Chicago, U. S. A.
Please send Cyclopedia of Applied Electricity for seven days' examination, I to pay shipping charges. I will send $2.00 within seven days and $2.00 until I have paid $19.80 or notify you and hold the books subject to your order. Title not to pass until fully paid.

REFERENCE .....

NAME .....

ADDRESS .....
Please give as reference some business man in your town and thereby avoid delay in shipment.



7 Electrical Money Makers Each 1¢ a Day!

It's Only a Step to the Big Jobs From Where You Are!

There is a big job waiting for you in the electrical profession. All you need is special training on advanced points which big men must know. And here is all this special knowledge which will enable you to master every electrical problem. This great 7-volume Cyclopedia of Applied Electricity bridges the gap between your present job and the $5,000 a year jobs.

50 Years of Electrical Experience Now at Your Finger Tips

Here in convenient form you will find everything from wiring a bell to the newest wireless discoveries. Tells all about elements of electricity—electrical measurements—underwriter's requirements—theory calculation, design and construction of generators and motors—dynamo-electric machinery—lighting machinery—power transmission—electric railways—power stations—switchboards and switching—storage batteries—applied electro-chemistry—electric elevators—electric welding and heating—wire and wireless telegraphy.

What the 7 Volumes Clearly Cover

Elements of Electricity—Electrical Measurements—Underwriter's Electrical Requirements — Theory, Calculation, Designs and Construction of Direct Current Generators and Motors — Types of Generators and Motors—Management of Electrical Machinery—Electric Lighting—Alternating Current Machinery—Power Transmission—Electric Railways—Self-Propelled Railway Cars—Trackless Trolleys—Power Stations—Switchboards and Switching—Storage Batteries—Applied Electro-Chemistry — Electric Elevators — Electric Welding and Heating—Wireless Telegraphy and Telephony — Land and Submarine Telegraphy.

Help You Fill These Jobs

Electrical Engineers, Substation Operators, Trouble Men, Switchboard Operators and Dynamo Tenders are wanted by light and power companies everywhere. The demand for their services exceeds the supply. Why not prepare yourself in your spare time—for a job paying up to $5,000 yearly? The Library of Electricity will give you the knowledge you need—in plain, everyday language.

Half Price—Easy Terms NO MONEY IN ADVANCE

Regular price $5.00 per volume. Special price less than $3.00 per volume. Easy terms only $2.00 a month—less than 1 cent a day per volume. Entire set shipped for free examination—no money in advance. Send no money. Just mail the coupon above.

MAIL COUPON NOW!

With each set we include a $12.00 Consulting Membership free. Advice of our experts for one year free. Don't be satisfied with a small job when the biggest jobs are open to trained men. Training is now offered you at a remarkable bargain. Mail coupon today without money.

American Technical Society
Dept. E-3382
CHICAGO, U. S. A.

Mail Coupon at Top of Page

Mr. Saunders: I want to ask you a few questions about the amateur. You have read the bill that is under consideration by the committee?

Lieut. Cooper: I have read it, sir.

Mr. Saunders: Aside from your amendment you have been discussing, there is no provision in the bill whatever relating to amateurs, is there?

Lieut. Cooper: I understand, sir, it was the intention of the department to license amateur operators.

Mr. Saunders: Under the bill that has been introduced there is no provision for the amateur?

Lieut. Cooper: Not under the name "amateur."

Mr. Saunders: Is there under any other name?

Lieut. Cooper: I think, sir, there would have been no reason why amateur stations should not have been licensed under the term "experimental stations."

Mr. Saunders: Suppose it is just a single individual. I understand a great many of these people who are amateurs took up this thing before the war—just young men who took up the business themselves?

Lieut. Cooper: I did so myself.

Mr. Saunders: That would not be called a station, would it?

Lieut. Cooper: Oh, yes, sir.

Mr. Saunders: Do you think, under the language "experimental stations," that any little individual amateur operator in the wilds of my district, I will say, who has been working on the thing himself as an intellectual improvement, could be described as "experimental station"?

Lieut. Cooper: I think so. But I say it is a moot point in view of the amendment.

Mr. Saunders: I do not see how that could be done with respect to the provision as to who is to be licensed as an amateur. Under that, necessarily, before any man could start out as an amateur, he must have had the opportunity to take some training at some school.

Lieut. Cooper: Very frankly I think that very few amateurs ever went to a training school.

Mr. Saunders: You require them to possess certain capacities by your amendment; they have got to have a certain facility.

Lieut. Cooper: The amateur can learn that by using the buzzer. All amateurs do the same thing, all operators.

Mr. Saunders: Can he experiment enough with the wireless apparatus to acquire that facility without having a trainer?

Lieut. Cooper: May I suggest, sir, that the process would be something like this: That by listening in, as we call it—and you will note that no license is required for receiving—a man can become accustomed to using the receiving apparatus, and he can become accustomed to the sending with a key hitched to a little buzzer, which is not a radio operator, and he can be taught to send up to any speed he can ever attain.

Mr. Saunders: He can teach himself, in other words, can he?

Lieut. Cooper: Teach himself, or be taught by other amateurs.

Mr. Saunders: He can pick that up by his own efforts, and by his own ingenuity and application at home and can acquire the facility which you have imposed upon him before he can receive a license?

Lieut. Cooper: I think any of the amateurs here will agree with me on that.

Mr. Saunders: With respect to this amateur, after he has attained that speed, and then is given the license that you contemplate, all of his operations would be controlled by the terms of his license?

Lieut. Cooper: They are at present, under the present law.

Mr. Saunders: Do you contemplate any difficulty in that connection if he operates according to the terms of his license, with the commercial operation of the Government system, or any other commercial system?

Lieut. Cooper: The limitation of wave lengths, sir, and the limitations of power in the present law of 1912, as amended by this amendment, are designed to prevent the amateur from causing interference with commercial stations.

Mr. Saunders: But you can see no danger of interference with the wireless system in the hands of private enterprise or Government control?

Lieut. Cooper: It was my view, sir, in drafting the amendment as it is, that these limitations on power and wave lengths would prevent such interference.

Mr. Saunders: So that in considering the general problem with respect to the necessity of having this entire business under Government ownership and control, we can eliminate any factor of danger from amateur operators?

Lieut. Cooper: I think so, sir, with the exception of the fact that adequate inspection of amateur stations must be had in the future if the amateur is to maintain the dignified position in the radio world that he should.

Mr. Saunders: That is by regulation?

Lieut. Cooper: Yes, sir.

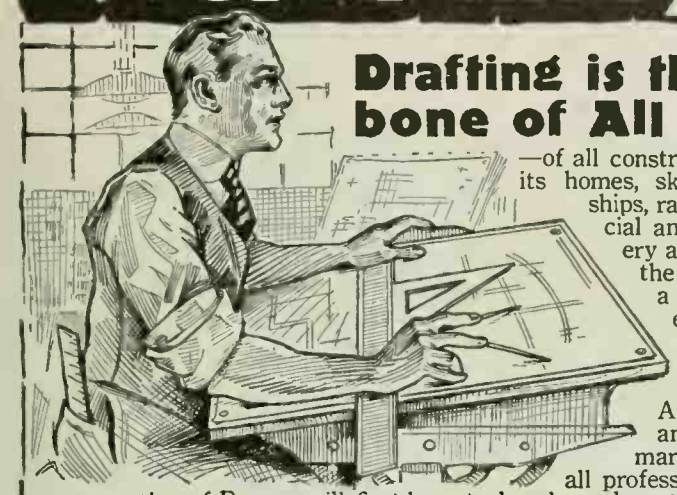
Mr. Saunders: As I said, you eliminate the amateur experimentors as a factor in determining this policy, because they will operate in a field outside of the field that this policy is designed to control?

Lieut. Cooper: That is the idea of the amendment. There is one coming factor in radio work which may adversely affect amateur operating which should be looked forward to at the present time. The fleet—and this is not disclosing military secrets—is using for intercommunicating purposes very short wave length, shorter than the one hundred fifty meters mentioned here as the minimum length that an amateur should use. Aircraft are also using various wave lengths, some of which are almost

(Continued on page 742)

www.americanradiohistory.com

What Drafting Means to the World-and You



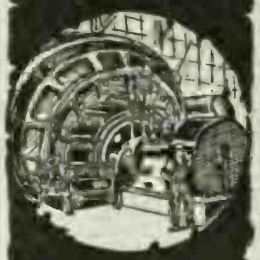
Drafting is the Backbone of All Industry

—of all construction. The world—its homes, skyscrapers, factories, ships, railroads, and commercial and industrial machinery are all monuments to the draftsman's skill. As a profession—as an avenue for advancement in every known form of engineering—drafting has no equal. Aim as high as you like and you can reach your mark in this greatest of all professions. Just as the reconstruction of Europe will first have to be planned on the drafting table, so has the world been built—so will the world continue to be built. That is why **there is no limit to your success** as a draftsman.

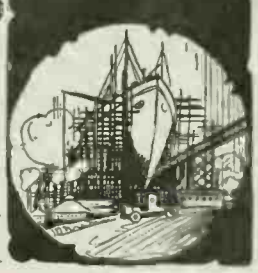












Make Drafting Your Profession

The American School Home Study Course will enable you to master this great, interesting and congenial profession without in any way interfering with your present work. Just give us a part of your **spare time** and we'll do the rest. Our lessons are simplified, well illustrated, easily understood—and we coach you carefully from first lesson to the last. **You simply can't fail if you want to win.**

Draftsmen in Big Demand

Think for a minute of the colossal reconstruction plans of the United States—to say nothing of Europe—and you will get an idea of the busy years ahead for draftsmen in all branches. But there is ALWAYS a big demand for draftsmen—BECAUSE they are the fundamental factors in world's progress.

Satisfaction Guaranteed

Don't hesitate. Don't think you can't master our lessons by Home Study until you TRY. So sure are we that you can do as well as any of our thousands of students, we **Guarantee Satisfaction** or refund your money in full. That's how confident we are in our methods. Have you as much confidence in yourself? If so, check and mail the Coupon for FREE Bulletin.

American School of Correspondence
Dept. D-7442 CHICAGO, U. S. A.

TRAINING—THE KEY TO SUCCESS

ASC

..... Draftsman and Designer	..... General Education Course	..... Civil Engineer	..... Fire Insurance Expert
..... Automobile Engineer	..... Com. School Branches	..... Structural Engineer	..... Sanitary Engineer
..... Automobile Repairman	..... Electrical Engineer	..... Mechanical Engineer	..... Heating and Ventilating Engineer
..... Airplane Mechanic	..... Electrical Light and Power Superintendent	..... Shop Superintendent	..... Master Plumber
..... High School Graduate	..... Hydroelectric Engineer	..... Steam Engineer	
	..... Telephone Engineer	..... Lawyer	
	..... Telegraph Engineer	..... Business Manager	
	..... Wireless Operator	..... Cert. Public Accountant	
	..... Architect	..... Accountant and Auditor	
	..... Building Contractor	..... Bookkeeper	
		..... Stenographer	

Name .....

Address .....

www.americanradiohistory.com

?

DO YOU KNOW?

Do you know how to make chemical tricks?
Do you know how cloth is bleached?
Do you know how to test soil?
Do you want to make invisible ink?
Do you know how to test flour?
Do you know how Chlorine Smoke and Chlorine Gas (German War Gas), is made?
What do you know about chemistry in general?

These and hundred other interesting questions are answered and demonstrated with our Chemistry Laboratory which we present herewith.

CHEMISTRY!

We present herewith to our friends our new E. I. Co. Chemical Laboratory which contains real chemicals and apparata to perform real chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.



44 Chemicals
17 Apparata
1 Instruction Book with 100 Experiments

PRICE $5.00

Shipping Weight 10 lbs

CAN BE SHIPPED BY EXPRESS ONLY

The chemicals furnished are all technically pure and put up in appropriate wooden boxes and glass bottles, and there is a sufficient quantity to make dozens of experiments with each. The apparata are of standard laboratory size and quality.

Altho all chemicals have nearly doubled in price, we have decided not to raise the price for this outfit for the present.

Read the list of chemicals and apparata and look at the actual photograph of the outfit at your right.

And order one today!

THE E. I. Co. CHEMICAL LABORATORY

DESCRIPTION OF THE OUTFIT

It contains the following 44 chemicals:

Ammonium Chloride	Brimstone	Ferrous Sulphate	Iron Chloride
Alum	Iron Oxide	Nickel Sulphate	Calcium Oxide
Antimony	Sulphate of Zinc	Sodium Phosphate	Stannous Chloride
Boracic Acid	Magnesia Carbonate	Zinc Carbonate	Nickel Chloride
Charcoal	Zinc, Metallic	Ammonium Sulphate	Hydrochloric Acid
Sodium Nitrate	Sodium Bicarbonate	Ammonium Carbonate	Sulphuric Acid
Sodium Carbonate	Sodium Sulphate	Ammonium Aqua	Iodine
Sodium Borate	Sodium Chloride	Calcium Chloride	Mercury, Metallic
Sodium Sulphite	Calcium Sulphate	Chloride of Zinc	Tin, Metallic
Manganese Dioxide	Barium Chloride	Copper Sulphate	Litmus Paper
Oxalic Acid	Lead Acetate	Glycerol	Ferrous Sulphide

The following apparata are furnished:

One Standard Washbottle	Six Assorted Test-Tubes	Glass Tubing
One Alcohol Lamp	One Test-Tube Holder	One book containing Treatise on
One Conical Glass Measure	Ten Sheets of Filter Paper	Elementary Chemistry and 100
One Erlenmeyer Flask	One Glass Dropper	Chemical Experiments to be per-
One Glass Funnel	One Spoon Measure	formed with this outfit.
One Delivery Tube		

THE ELECTRO IMPORTING Co., NEW YORK. 231 FULTON STREET

SEE OUR FULL PAGE AD ON PAGE 754 FOR FREE CYCLOPEDIA

www.americanradiohistory.com

PATENT ADVICE





Edited by H. GERNSBACK

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries address to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are publisht here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

Readers' attention is called to the fact that due to the great amount of letters to this department it is quite impossible to answer them all thru these columns: The inquiries answered in this issue date as far back as August, and if readers wish speedy service they should carefully note the announcement appearing in the preceding paragraph.

Combination Carriage and Sled.

(299) Peter E. Sparri, Detroit, Mich., sends us a description of a combination foot-power carriage and sled. This apparatus works by means of a paddle that can be raised or lowered at will. When converting the sled into a carriage, the runners are taken off, the back wheels are placed on the paddle axles and are pulled down and locked.

A. This idea is very unique and should find favor particularly in our northern states where there is a good deal of snow. We think a patent might be obtained on this device.

The same inventor also submits what he terms a "desk telephone," which is to do away with hanging up and taking down of the receiver. The idea is to have a stand which when lifted up makes the connections, while the entire combination is similar to the hand telephones, which incorporate a receiver and microphone combined.

A. This is a good idea, but we cannot offer much encouragement as to the patent phase, for the reason that a great many such devices are on the market and hundreds more have actually been patented. Somehow or other, there does not seem to be a very widespread demand for this apparatus.

Diving Device.

(300) Jess F. Perrin, Rapid City, S. D., writes as follows: "I have two ideas on which I would like to have your opinion as to practicability, usefulness and demand on the market. The first one is a small rubber device which fits in the nostrils to exclude the water when diving. It is thought that a device of this kind would be of great service to amateurs in learning how to swim. It could be retailed at 10c."

A. Without seeing the details and construction of this device, it is impossible for us to say whether it has any merit. We think, however, that there might be a demand for a device of this kind.

"The other device is an automatic printer for printing pictures. An automatic counter keeps the operator apprised as to the number of prints being taken. The prints are run thru all the necessary solutions and run out on a belt to dry. This machine could be made at an expense not exceeding $20.00. Your advice on this would also be appreciated."

A. There does not seem to be anything fundamentally new to this idea, and there are several printing machines of this kind on the market at the present time.

Automatic Airplane Control Stabilizer.

(301) Edward R. Young, Covington, Ky., writes: "Most airplanes are controlled by a 'joystick,' a lever on a universal joint arranged so that by moving it from side to side the airplane is steered and by moving backward and forward the elevation is changed. My idea embraces two levers, one to move forward and backward and the other to move from side to side. At the top of each of these levers, which are connected to the regular control wires just like a double control 'plane, is an iron rod. At the ends of these iron rods are magnets so that when the magnet at either end is excited it draws the iron rod, and joystick, a few inches in that direction, thus controlling the 'plane. Another magnet when excited will draw the rod still farther. The same applies to the other end of the iron rod and the other "joystick."

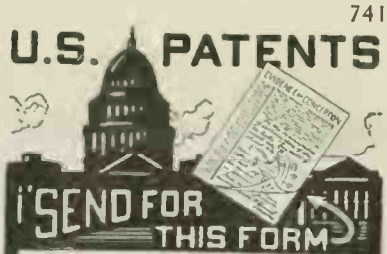
The principal part is the means for telling when these magnets should be excited. Just as we have tubes in our heads to tell us when we are off balance (literally) so is this apparatus intended to tell the airplane when it's off balance. A closed tube, longer than it is wide to prevent electrolyte from splashing, is fitted with a main contact in the bottom and contacts at each end so that if the 'plane dips forward (for example) the electrolyte runs forward, makes circuit with the first contact, excites first magnet and by the magnet drawing the "joystick" forward the level of the 'plane is corrected. If the 'plane continues to dip, the second magnet is excited which draws the "joystick" forward still farther. A large number of small magnets may be used so as to affect the 'plane very gradually and thus prevent jerks and strains. The other "joystick" fitted the same way only crosswise of the 'plane warps the wings or moves the aerofoils (at ends of wings) to control the direction of the 'plane and keep the two wings on a level.

The "brain" unit is made of porcelain, with a number of ridges on the inside to prevent the rather thick oily electrolyte from moving too freely, has a main contact to the battery and the other contacts (as many in each end as there are magnets at each end of "joystick") at each end of the tube. This is only a few inches long, the magnets are not heavy, and the whole apparatus does not take up much room and does not call for extensive changes in the airplane.

When the aviator changes the level of the 'plane he also changes the level of the porcelain tube so that when the airplane gets off of that level the device automatically corrects the position. The position of the magnets change when the aviator changes the level of the porcelain tubes so that when the airplane is on the correct level the magnets are at the ends of the iron rods at the tops of the "joysticks" ready for business. The aviator puts the 'plane on a certain level and this apparatus automatically keeps it there."

A. This is a highly ingenious idea, and Mr. Young deserves much credit for his invention. As will be noted Mr. Young has tried to design an "electro-mechanical brain" for the airplane. It is well known that the human brain has a device of this kind to keep us in an upright position. Fine tubes have a liquid which runs back and forward in these tubes and we thus stabilize ourselves. Mr. Young has tried to make use of this principle by using an electrolyte in a closed vessel and arranged to close various contacts so as to energize certain control magnets, substantially as set forth above.

While the idea is good, we have only one fault to find, viz., that the vessel containing electrolyte must be very small, as any abrupt lurching of the airplane would tend to throw the entire mechanism out of order, as can be readily imagined. If the contacts can be arranged in relatively fine, long



Don't Lose Your Rights

Before disclosing your inventioo to anyone send for blank form "Evidence of Conceptioo" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception," sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

LANCASTER & ALLWINE

255 OURAY BLDG., WASHINGTON, D. C.

PATENTS COPYRIGHTS TRADE MARKS DESIGNS

U.S. PATENTS MAKE IDEAS PAY

Our facilities for securing patents enable us to give prompt and reliable service at reasonable rates. Inventors are invited to write to us regarding questions appertaining to securing patent protection. All matters receive prompt attention. Send sketch for preliminary examination.

Books free on request.

A. M. BUCK & CO.
Patent Attorneys
205 Second National Bank Bldg., Washington, D.C.

Competent Patent Service
By a Former Examining Official of the U. S. Patent Office
NORMAN T. WHITAKER
Lawyer and Engineer
480 Whitaker Bldg. Washington, D. C.
INQUIRIES INVITED

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE OF CONCEPTION". This should be signed and witnessed and returned to us together with model or sketch and description of the invention, and we will give our opinion as to its patentable nature.

Our Illustrated Guide Book, HOW TO OBTAIN A PATENT, sent Free on request. Contains full instructions regarding Patents, Trade-Marks, Foreign Patents, Our Methods, Terms and 100 Mechanical Movements illustrated and described. Articles on Patent Practice and Procedure, and Law Points for inventors.

An actual search of United States patents made in all cases before preparing application for patent.

Electrical Cases a Specialty Highest References Prompt Attention Reasonable Terms

FREE COUPON!
VICTOR J. EVANS & CO., Patent Attorneys
New York Offices: 1001 to 1007 Woolworth Bldg.
Pittsburgh Offices: 514 Empire Bldg.
Philadelphia Offices: 135 S. Broad St.
Main Offices: 779 Ninth Street, N. W., Washington, D.C.
Name..... *Address*.....

www.americanradiohistory.com

AMERICA NEEDS YOUR IDEAS



TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection, and the commercial development of his proposition. Send sketch or model and description, for advice as to cost, probable patentability, etc. All preliminary questions gladly answered without charge.

My clients' inventions are given wide publicity through INVENTION AND MANUFACTURING SUPPLEMENT. Sample copy free.

Booklet of valuable information, and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
164 Owen Building, Washington, D. C.
2276-8 Woolworth Bldg., New York.

PATENTS

INVENTORS: Send us sketches or a model of your invention and a description of the device for advice in regard to the best way of obtaining patent protection. Our practical experience covers a period of twenty years. Our hand-book on patents is sent free on request. All communications strictly confidential. Write us today.

TALBERT & TALBERT
Patent Lawyers
4287 Talbert Bldg. Washington, D. C.

PATENTS

LACEY & LACEY

Attorneys-at-Law—Patent Practice Exclusively
Solicitors of
U. S. and Foreign Patents
Trade-Marks, Copyrights
642 F Street, N. W., Washington, D. C.

Write Us for Our Inventors' Book
PATENT-SENSE
ESTABLISHED 1869

Electricians Get up-to-date in HOUSE WIRING! Save TIME, MONEY, LABOR and MATERIAL by using our 96 GENUINE BLUE PRINT DRAWINGS, containing all the latest diagrams and connections known in house wiring—every diagram and connection up-to-the-minute as used by first class electricians for wiring BELLS, BURGLAR ALARMS, LIGHTS, ANNUNCIATORS, FIRE ALARMS and ELECTRIC GAS LIGHTING. These drawings are bound in the form of a flexible book 8 x 12, for convenience in using on the job. Send for them, and if they don't make you more efficient as a wireman and save you many times their cost as a contractor, return them and money will be refunded—you can't afford to be without them. ONE DOLLAR postpaid. Send for circulars on other sets of drawings.
PATENT SPECIALTY COMPANY
462 Sanchez Street San Francisco, Cal.

Patents Promptly Procured
Send sketch or model for actual search of U. S. Patents. Highest references. Personal service. Moderate fees. Write for Free Patent Book.
GEORGE P. KIMMEL, Patent Lawyer
99-N Oriental Bldg. Washington, D. C.

PATENTS
Inventors Invited to Write for Information and Particulars
Highest References. Best Results.
Promptness Assured.
WATSON E. COLEMAN
Patent Lawyer
624 F Street N. W. Washington, D. C.

tubes where a displacement of the liquid will take place gradually, we believe that the device will function with a greater degree of success.

Automatic Air Hose Coupling.

(302) James Witkowski, Albion, N. Y., submits a drawing of an automatic air hose coupling with drawing, and wishes our opinion whether it is patentable and if it would be of any value if a patent could be obtained on it.

A. It is impossible to figure out on paper whether the brake would work satisfactorily. Indeed, we are not sure that the device is at all new. We would advise our correspondent to have a search made in the patent office thru one of the patent attorneys to ascertain what has been done previously in the art.

Electric Heater.

(303) Gottlieb Samuel Leventhal, Elmira, N. Y., submits a drawing on an electrical idea for heating water. The device is of the usual type whereby it can be attached to any faucet, the water started running and the current turned on. As the water runs thru this device and over the heating wires, the water is heated.

A. There is nothing fundamentally new to the device as submitted, except for the attractive form that our correspondent has given it, which is in the shape of a round ball. Outside of this, there is nothing new shown, and we are quite certain that no patent could be obtained.

Mechanical Brake.

(304) Emilio R. Salazar, Havana, Cuba, writes as follows: "I am enclosing blue-print and description of a contrivance to apply brakes on railroad cars with a request for you to publish it with your advice on the idea in your Patent Advice Section. Will you kindly let me know the possibilities of this invention?"

A. This is quite a complicated apparatus, and without seeing a model we think it is almost impossible for anyone to give an intelligent opinion. A brake of this kind looks all right on paper, but it is difficult to predict in advance if it will work out in practise. We would earnestly advise that before applying for patent on this apparatus that a model should be built.

BOY BURNED WHEN WET KITE STRING TOUCHES WIRES.

While Wm. Oliver of Port Stanley was amusing himself recently flying his kite he was severely burnt on both hands, when the flying string came in contact with the high voltage wires of a local railway. While flying his kite a strong wind sent it to the ground, and the wet cord came in contact with this power wire, as it fell over it. The victim got the full benefit of the voltage. This was much too strong for the string as it burnt it in two, for which William is very thankful as it saved his life. The only other small boy there ran away when he saw what had happened so he was alone when all was over. The burnt hands healed up all right, but Master Oliver, for one, will keep clear of all overhead electric wires hereafter, when he goes kite flying. It is remarkable that he was not killed outright, the high resistance of the kite string probably being the factor that saved his life.

RADIO AMATEURS DISCUST OFFICIALLY.

(*Continued from page 738*)

down to 250 meters. There may be trouble in the future, sir, between aircraft operating overland and working with their receiving or transmitting stations, and amateur stations. That is a possibility of the future that I will call the attention of the committee to at this time, because this thing may come up here at another time under some future law, and, I simply want to warn the committee that this is a new field that we know nothing about. Aircraft radio was not in existence to any extent when amateurs last operated. There may be interference between amateur operators and aircraft radio stations, but it is hoped that there will not be.

Mr. Saunders: Government ownership has nothing to do with that problem?

Lieut. Cooper: Except the Government would probably be operating the stations for aircraft.

Mr. Saunders: The possibility which you speak of which may arise hereafter is a thing that will be met by appropriate regulations, is it not?

Lieut. Cooper: It might be, sir, if this amendment is past, that it might have to be met by legislation again reducing the wave length back to where it is now.

Mr. Saunders: Appropriate legislation?

Lieut. Cooper: It might be legislation and not regulation.

Mr. Saunders: Legislation is just that much more authoritative than regulation.

Lieut. Cooper: I usually think of "regulation" as a regulation of a department.

Mr. Saunders: I admit that is so in general, where you think of something issued by some department head or some Bureau Chief.

"Electrical Worker's Friend"

An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting.
PRICE, ONLY $3.50
Write for full particulars
J. SMITH & SON
1524 Lowrie Street, N. S. Pittsburgh, Pa.

Telegraph Pictures
BY ELECTRICITY



A complete set of two machines of this marvelous equipment for only $19.50. Instructive, mystifying and useful. This picture of President Wilson was telegraphed by these machines. Will transmit pictures, maps, drawings and hand writing. Picture telegraphing is the coming science. Write today.
L. J. LEISHMAN CO., Dept. T. Ogden, Utah

MARCONI INSTITUTE
Wireless
Aviation
Electricity
Navigation
Mathematics
Series of STANDARD PRACTICAL BOOKS
Send for free catalogue
WIRELESS PRESS Inc. 33 ELM ST NEW YORK



EVERY INVENTOR
should have this book, "PATENTS AND PATENT POSSIBILITIES." It is chock full of ideas and practical advice, telling what to invent and where to sell. Write for your copy today. IT IS FREE.
I have requests for patents upon sound inventions of all kinds. Can you help supply the demands?
My service is individual, prompt and efficient (14 years experience). Every expedient is employed to secure Patents at least possible cost.
H. S. HILL, 804 McLachlen Bldg., Washington, D. C.



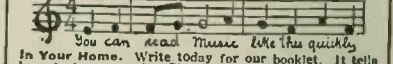
SMALL ENGINES
Perfected Gasoline Engines—½, 1 and 1½ h. p.—for Farm and Shop use. Price, $27.50 and up. Also
WASHING MACHINES
We ship on trial. Send for Booklet and Special Offer.
SIEVERKROPP ENGINE CO.
1401—19th St., Racine, Wis.
STARTER for FORD CARS

Build Your Own



PHONOGRAPH
PARTS FOR ANY STYLE MACHINE
Build your own cabinets
We show you how
Circulars and Instructions 10c.
Motors, Reproducers, etc. sold
Electro Mechanical Parts Co.
Dept. E 160 No. Wells St., Chicago, Ill.

MUSIC TAUGHT FREE



You can read Music like this quickly
In Your Home. Write today for our booklet. It tells how to learn to play Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced pupils.
American School of Music, 57 Lakeside Bldg., Chicago

GET ON THE VAUDEVILLE STAGE



I tell you how. Fascinating profession for either sex. Big salaries. Experience unnecessary. Splendid engagements always waiting. Opportunity for travel. Theatrical agents and authorities endorse my methods. Thirty years' experience as manager and performer. Illustrated book "All About Vaudeville" sent FREE.
Frederick La Delle, Sta. 246 Jackson, Mich.

NEW SCIENTIFIC WONDER
"X-RAY" CURIO



PRICE 12 C. SILVER ONLY—BIG FUN
BOYS! You apparently see thru Clothes, Wood, Stone, any object. See Bones in Flesh.
A Magic Trick Novelty given FREE with each X-Ray.
MARVEL MFG. CO., Dept. 62, New Haven, Conn.

www.americanradiohistory.com

PRESIDENT WILSON ALWAYS IN TOUCH WITH WASHINGTON—VIA RADIO.

(*Continued from page* 708)

Lyons Station, France, was established long before the *Pennsylvania* was beyond communication range of the United States.

The *Pennsylvania* has six receiving booths, which were able to receive on eight different tunes simultaneously as follows: One booth guarded Annapolis or New Brunswick tunes 16,900-13,000 meters; one booth guarded Lyons tunes 15,500 meters; one booth guarded Tuckerton's tune 9,200 meters; one booth guarded 4,000 meters (the Standard arc calling tune); one booth guarded 450 meters for the U. S. S. *George Washington* vacuum tube transmitter tune and one booth guarded 297 meters (the radio telephone tune). One additional operator guarded 600 and 952.

The radio stations at Otter Cliffs, Maine and Lyons, France, were used to receive messages from the President, transmitted by the U. S. S. *Pennsylvania's* arc.

The *George Washington's* radio equipment consisted of the following: One low power spark transmitting set, one 16,900 long wave receiving set, one short wave 600 meter spark receiving set, one short range radio telephone transmitting and receiving set, one vacuum tube 450 meter transmitting and receiving set. The U. S. S. *George Washington* was able to intercept messages transmitted by the Annapolis or New Brunswick stations and guard 600 meter (commercial calling, and emergency tune and the radio telephone and vacuum tunes) simultaneously. Messages for the President transmitted from the United States by the Annapolis, New Brunswick, Tuckerton and the Lyons station were received by the U. S. S. *Pennsylvania* and relayed to the *George Washington* by means of radio telephone and vacuum tube transmitting sets simultaneously.

The messages from the President destined to United States or France were sent from the *George Washington* to the *Pennsylvania* by the vacuum tube or radio telephone set and were relayed by the *Pennsylvania's* high power arc transmitter direct to the United States, Lyons or Brest, France.

The radio communication was directed by Commander H. W. McCormack, U.S.N., Fleet Radio Officer. Lieutenant S. V. Edwards is in charge of the radio of the *Pennsylvania*.

NIKOLA TESLA AND HIS INVENTIONS.

(*Continued from page* 697)

nerve-racking spectacle. Then, inevitably, in the stillness of night, a vivid picture of the scene would thrust itself *before* my eyes and persist despite all my efforts to banish it. Sometimes it would even remain fixt in space tho I pushed my hand thru it. If my explanation is correct, it should be possible to project on a screen the image of any object one conceives and make it visible. Such an advance would revolutionize all human relations. I am convinced that this wonder can and will be accomplished in time to come; I may add that I have devoted much thought to the solution of the problem.

To free myself of these tormenting appearances, I tried to concentrate my mind on something else I had seen, and in this way I would often obtain temporary relief; but in order to get it I had to conjure continuously new images. It was not long before I found that I had exhausted all of those at my command; my "reel" had run out, as it were, because I had seen little of the world—only objects in my home and the immediate surroundings. As I performed these mental operations for the second or third time, in order to chase the



Learn Public Speaking

10 LESSONS FREE

Write — quick — for particulars of this extraordinary offer; an opportunity you will never forget if you take advantage of it. Ten lessons in effective public speaking absolutely FREE to those who act promptly, to introduce our course in localities where it is not already known.

We teach you by mail to become a powerful and convincing speaker—to influence and dominate the decisions of one man or an audience of a thousand. We have trained hundreds and helped them to increase their earnings and their popularity. Learn, in your spare time at home, how to overcome "stage fright" and conquer fear of others; how to enlarge your vocabulary; how to develop self-confidence and the qualities of leadership; how to RULE others by the power of your speech alone; how to train your memory. Our

WHAT THE COURSE TEACHES YOU.

How to talk before your club or lodge;
How to address board meetings;
How to propose and respond to toasts;
How to make a political speech;
How to tell entertaining stories;
How to make after-dinner speeches;
How to converse interestingly;
How to write better letters;
How to sell more goods;
How to train your memory;
How to enlarge your vocabulary;
How to develop self-confidence;
How to acquire a winning personality;
How to strengthen your will power and ambition;
How to become a clear, accurate thinker;
How to develop your power of concentration;
How to be the master of any situation.

New Easy Method

perfected and taught only by Prof. R. E. Pattison Kline, former Dean of the Public Speaking Department of the Columbia College of Expression, can be learned in 15 minutes a day. Prof. Kline is one of the foremost authorities in the country on public speaking and mental development. Do not let this chance escape you.

Offer Limited

Send This Free Coupon Now

This Special Offer of TEN LESSONS FREE is made strictly for advertising purposes and will be withdrawn without notice. Write now, before it expires, and receive full particulars with enrollment blank by return mail. No obligations of any kind. Just tear off and mail this free coupon—or a postal will do.

FREE LESSONS COUPON

North American Institute,
7442 Manhattan Bldg., Chicago

I am interested in your course in Effective Public Speaking and your offer of ten lessons free. Please send full particulars. It is understood that this request places me under no obligation of any kind.

.....

.....

www.americanradiohistory.com

Learn Telegraphy-Wireless

Right In Your Own Home, in your spare time

Remarkable opportunities are offered experienced wireless operators and telegraphers. The demand is greater than the supply—steady positions at increased pay and rapid advancement are assured.

DEPENDABLE KNAPP ELECTRIC SPECIALTIES

Combination Wireless-Telegraphy Outfit



will soon make you an accomplished operator. Teaches Light and Sound Signals, both Radio and Morse. Outfit consists of exceptionally fine Telegraph Key, Buzzer, 3 Binding Posts, Lamp, Lamp Socket and Control Switch—all mounted on a highly finished base. Two outfits can be operated at considerable distance apart for sending and receiving practice.

$3.00

This Same Outfit Without Lamp **$2.50**



KNAPP LEADER

Radiates real power-plant efficiency. Will drive from either pulley.
Price, Complete, $3.50

Order to-day. Or your dealer can secure it for you. Descriptive circular and catalog of celebrated Knapp Motors and Electrical Specialties from 10c up mailed free on request.

Knapp Electric & Novelty Co.
523 West 51st Street New York City

The Breakers

Atlantic City's Newest Fire-Proof Hotel



Ocean Front. Unusually attractive during the Autumn and Winter seasons.

American and European Plans

Luxurious lobbies, spacious verandas and sun parlors overlooking the ocean. Charming afternoon musicales and evening concerts. A palatial residence for those seeking rest and recreation. Sea water baths. Fireproof garage. Illustrated booklet sent on request.

The House of Taylor



400 Baths
600 Rooms

HOTEL MARTINIQUE

BROADWAY, 33D STREET, NEW YORK
One Block from Pennsylvania Station.

Equally Convenient for Amusements, Shopping or Business

157 Pleasant Rooms, with Private Bath, $2.50 PER DAY.

257 Excellent Rooms, with Private Bath, facing street, southern exposure, $3.00 PER DAY.

Also Attractive Rooms from $1.50.
The Restaurant Prices Are Most Moderate.

What 15c will bring You from the Nation's Capital

Washington, the home of the Pathfinder, is the nerve center of civilization; history is being made at this world capital. The Pathfinder's illustrated weekly review gives you a clear, impartial and correct diagnosis of public affairs during these strenuous, epoch-making days.

The little matter of 15c in stamps or coin will bring you the Pathfinder 13 weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation: a paper that prints all the news of the world and tells the truth and only the truth: now in its 26th year. This paper fills the bill without emptying the purse: it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you would appreciate a paper which puts everything clearly, fairly, briefly—here it is. Send 15c to show that you might like such a paper, and we will send the Pathfinder on probation 13 weeks. The 15c does not repay us, but we are glad to invest in new friends. **The Pathfinder, Box 76, Washington, D.C.**



Monuments—Mausoleums—Statuary

No matter what your needs, we can serve you most advantageously. Estimates and designs submitted. Mail orders as carefully executed as though you had called in person. Write for particulars.

J. L. Wegenaar Co., 299 A B'way, N.Y.
SPECIALISTS IN DESIGN AN DCONSTRUCTION

appearances from my vision, the remedy gradually lost all its force. Then I instinctively commenced to make excursions beyond the limits of the small world of which I had knowledge, and I saw new scenes. These were at first very blurred and indistinct, and would flit away when I tried to concentrate my attention upon them, but by and by I succeeded in fixing them; they gained in strength and distinctness and finally assumed the concreteness of real things. I soon discovered that my best comfort was attained if I simply went on in my vision farther and farther, getting new impressions all the time, and so I began to travel—of course, in my mind. Every night (and sometimes during the day), when alone, I would start on my journeys—see new places, cities and countries—live there, meet people and make friendships and acquaintances and, however unbelievable, it is a fact that they were just as dear to me as those in actual life and not a bit less intense in their manifestations.

This I did constantly until I was about seventeen when my thoughts turned seriously to invention. Then I observed to my delight that I could visualize with the greatest facility. I needed no models, drawings or experiments. I could picture them all as real in my mind. Thus I have been led unconsciously to evolve what I consider a new method of materializing inventive concepts and ideas, which is radically opposite to the purely experimental and is in my opinion ever so much more expeditious and efficient. The moment one constructs a device to carry into practise a crude idea he finds himself unavoidably engrost with the details and defects of the apparatus. As he goes on improving and reconstructing, his force of concentration diminishes and he loses sight of the great underlying principle. Results may be obtained but always at the sacrifice of quality.

My method is different. I do not rush into actual work. When I get an idea I start at once building it up in my imagination. I change the construction, make improvements and operate the device in my mind. It is absolutely immaterial to me whether I run my turbine in thought or test it in my shop. *I even note if it is out of balance.* There is no difference whatever, the results are the same. In this way I am able to rapidly develop and perfect a conception without touching anything. When I have gone so far as to embody in the invention every possible improvement I can think of and see no fault anywhere, I put into concrete form this final product of my brain. Invariably my device works as I conceived that it should, and the experiment comes out exactly as I planned it. In twenty years there has not been a single exception. Why should it be otherwise? Engineering, electrical and mechanical, is positive in results. There is scarcely a subject that cannot be mathematically treated and the effects calculated or the results determined beforehand from the available theoretical and practical data. The carrying out into practise of a crude idea as is being generally done is, I hold, nothing but a waste of energy, money and time.

My early affliction had, however, another compensation. The incessant mental exertion developed my powers of observation and enabled me to discover a truth of great importance. I had noted that the appearance of images was always preceded by actual vision of scenes under peculiar and generally very exceptional conditions and I was impelled on each occasion to locate the original impulse. After a while this effort grew to be almost automatic and I gained great facility in connecting cause and effect. Soon I became aware, to my surprise, that every thought I conceived was suggested by an external impression. Not only this but all my actions were prompted in a similar way. In the course of time it became perfectly evident to me that I

www.americanradiohistory.com

was merely an *automaton* endowed with power of movement, responding to the stimuli of the sense organs and thinking and acting accordingly. The practical result of this was the art of *telautomatics* which has been so far carried out only in an imperfect manner. Its latent possibilities will, however, be eventually shown. I have been since years planning self-controlled automata and believe that mechanisms can be produced which will act as if possest of reason, to a limited degree, and will create a revolution in many commercial and industrial departments.

I was about twelve years old when I first succeeded in banishing an image from my vision by wilful effort, but I never had any control over the flashes of light to which I have referred. They were, perhaps, my strangest experience and inexplicable. They usually occurred when I found myself in a dangerous or distressing situation or when I was greatly exhilarated. In some instances I have seen all the air around me filled with tongues of living flame. Their intensity, instead of diminishing, increased with time and seemingly attained a maximum when I was about twenty-five years old. While in Paris, in 1883, a prominent French manufacturer sent me an invitation to a shooting expedition which I accepted. I had been long confined to the factory and the fresh air had a wonderfully invigorating effect on me. On my return to the city that night I felt a positive sensation that my brain had caught fire. I saw a light as tho a small sun was located in it and I past the whole night applying cold compressions to my tortured head. Finally the flashes diminished in frequency and force but it took more than three weeks before they wholly subsided. When a second invitation was extended to me my answer was an emphatic NO!

These luminous phenomena still manifest themselves from time to time, as when a new idea opening up possibilities strikes me, but they are no longer exciting, being of relatively small intensity. When I close my eyes I invariably observe first, a background of very dark and uniform blue, not unlike the sky on a clear but starless night. In a few seconds this field becomes animated with innumerable scintillating flakes of green, arranged in several layers and advancing towards me. Then there appears, to the right, a beautiful pattern of two systems of parallel and closely spaced lines, at right angles to one another, in all sorts of colors with yellow-green and gold predominating. Immediately thereafter the lines grow brighter and the whole is thickly sprinkled with dots of twinkling light. This picture moves slowly across the field of vision and in about ten seconds vanishes to the left, leaving behind a ground of rather unpleasant and inert grey which quickly gives way to a billowy sea of clouds, seemingly trying to mould themselves in living shapes. It is curious that I cannot project a form into this grey until the second phase is reached. Every time, before falling asleep, images of persons or objects flit before my view. When I see them I know that I am about to lose consciousness. If they are absent and refuse to come it means a sleepless night.

To what an extent imagination played a part in my early life I may illustrate by another odd experience. Like most children I was fond of jumping and developed an intense desire to support myself in the air. Occasionally a strong wind richly charged with oxygen blew from the mountains rendering my body as light as cork and then I would leap and float in space for a long time. It was a delightful sensation and my disappointment was keen when later I undeceived myself.

During that period I contracted many strange likes, dislikes and habits, some of which I can trace to external impressions while others are unaccountable. I had a

The Man Who *Wouldn't* Stay Down



He was putting in long hours at monotonous unskilled work. His small pay scarcely lasted from one week to the next. Pleasures were few and far between and he couldn't save a cent.

He was down—but he *wouldn't stay there!* He saw other men promoted, and he made up his mind that what they could do *he* could do. Then he found the *reason* they were promoted was because they had special training—an expert knowledge of some one line. So he made up his mind that *he* would get that kind of training.

He marked and mailed to Scranton a coupon like the one below. That was his first step upward. It brought him just the information he was looking for. He found he could get the training he needed right at home in the hours after supper. From that time on he spent part of his spare time studying.

The first reward was not long in coming—an increase in salary. Then came another. Then he was made Foreman. Now he is Superintendent with an income that means independence and all the comforts and pleasures that make life worth living.

It just shows what a man with ambition can do. And this man is only one out of hundreds of thousands who have climbed the same steps to success with the help of the International Correspondence Schools.

What about *you?*

Are you satisfied merely to hang on where you are or would you, too, like to have a real job and real money? It's entirely up to you. You don't *have* to stay down. You *can* climb to the position you want in the work you like best. Yes, you can! The I. C. S. are ready and anxious to come to you, wherever you are, with the very help you need.

Surely when you have an opportunity that means so much, you can't afford to let another priceless hour pass without at least finding out about it. And the way to do that is easy—without cost, without obligating yourself in any way, mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6176, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- ELECTRICAL ENGINEER
- Electrician
- Electric Wiring
- Electric Lighting
- Electric Car Running
- Heavy Electric Traction
- Electrical Draftsman
- Electric Machine Designer
- Telegraph Expert
- Practical Telephony
- MECHANICAL ENGINEER
- Mechanical Draftsman
- Toolmaker
- Ship Draftsman
- Machine Shop Practice
- Gas Engineer
- CIVIL ENGINEER
- Surveying and Mapping
- MINE FOREMAN OR ENGR
- ARCHITECT
- Architectural Draftsman
- PLUMBING AND HEATING
- Sheet Metal Worker
- CHEMICAL ENGINEER
- SALESMANSHIP
- ADVERTISING MAN
- Show Card Writer
- Outdoor Sign Painter
- RAILROADER
- ILLUSTRATOR
- DESIGNER
- BOOKKEEPER
- Stenographer and Typist
- Cert. Pub. Accountant
- Traffic Management
- Commercial Law
- GOOD ENGLISH
- Common School Subjects
- CIVIL SERVICE
- Railway Mail Clerk
- STATIONARY ENGINEER
- Textile Overseer or Supt.
- AGRICULTURE
- Navigator
- Poultry Raising
- Automobiles
- Spanish
- French
- Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____

CORE WIRE

We have been fortunate in securing thru auction several tons of guaranteed pure, double annealed Norway Iron Core Wire and are selling this wire to "Experimenter" readers

AT PRE-WAR PRICES 20cts LB.

This wire is just the thing for spark coils, transformers, etc., and it is, of course, a very much more superior product than the usual iron wire. We absolutely guarantee the quality.

If you ever thought of building a spark coil, transformer, or similar apparatus, now is the chance to get the right material for it. As far as we know this is the only lot of iron Norway Core Wire in the hands of any dealer at the present time, and none can be gotten until after the war.

We have only two sizes left:

26 INCHES 36 INCHES

Thickness about No. 21 B and S

If either of these sizes should be too long we advise cutting the wire down yourself by means of shears. It will pay you to do so as real Norway Iron Wire, sold by a few dealers last year, brought from 40c to 50c a pound. American core wire now sells for from 30c upwards per pound.

As long as the supply lasts we offer this wire as described above to our customers at the very low price of 20c a pound. Order at once.

ELECTRO IMPORTING CO., 231 Fulton St., N. Y. C.

www.americanradiohistory.com

$1.00 Down
Brings You A Suit
Tailor-Made-To-Order

Greatest suit offer ever made! Think of it—for only $1.00 down we make up a suit from the fabric you select strictly according to your own individual measurements, and send it to you for examination and try on. If you are perfectly satisfied, keep it and pay balance in easy monthly payments so small you scarcely miss the money. If not satisfied, return suit and we will immediately refund your dollar. Send for Style Book and see how you can



Save Half

Because of our early buying in vast quantities, our enormous volume and direct selling plan you actually get your suit at about half what it would ordinarily cost. Don't buy ready mades—don't pay double our price for a strictly made-to-order suit—a suit that is made to fit the lines of your figure perfectly, has snap and style, gives you long wear and holds its shape. That's the kind of suit you get from Stanley-Rogers and besides you have

5 Months To Pay

Absolutely wide open credit. You wear the suit while paying for it. We trust you absolutely. Your word is all the security we ask. No red tape, no delay.

$1000 Reward to anyone who proves that we do not make all our men's suits tailor-made-to-order according to each customer's individual measurements. Some firms try to fool you by telling you they make clothes "to measure", and then simply sell "hand-me-downs" altered here and there. There's a big difference between "made-to-order" and "made-to-measure". Stanley-Rogers solts SHOW the difference in style, fit and long wear.

FREE Style Book Write at once for your free copy of our wonderful 1918-19 Style Book. See the actual cloth samples of most beautiful weaves and perfect reproduction of latest fashions. Send postal or letter—NOW! Get free style book. Don't delay! Write today.

STANLEY-ROGERS CO.
1015 Jackson Blvd. Dept. 805 Chicago



THIS is Richard A. Oldham. He earned $2200.00 in four months with a Haywood Tire Repairing outfit. For 20 years he was telegraph operator on the Illinois Central Railway. He is now 58 years old. He answered my advertisement—quit his job—bought a plant and opened a business. He just wrote me "I have made more in eight months than 2½ years as operator." There are now 500 stations where tire repairing is neglected.

I Must Have 500 Men
To Fill These Positions

I have a Big interesting Book to send you. It tells all about tires—gives inside figures and profit. Send for it! What Oldham and others are doing You can do. $2500.00 to $4,000.00 per year is conservative. Like Mr. Oldham—One machine will start you. Then open a shop. You can see business all around you. Put out a Haywood Sign and business will come to you. Now get started. Send for the Big Book and start making money.



M. HAYWOOD, Pres.
Haywood Tire & Equipment Co.
1209 Capitol Ave. Indianapolis, Ind.

STAMPS

50 diff. Belgium (large bi-color), China, Jamaica, Portugal, Venezuela, etc., 10c; 100 diff., nice packet, 20c; 1,000 well mixed, 40c; 100 var. U. S., 50c; 1,000 hinges, 10c; Agts. wanted, 50%. List free. I buy stamps. L. B. Dover, Overland, Mo.

YOU CAN'T AFFORD TO BE WITHOUT THESE BOOKS:

"How to Behave." "Art of Pleasing Men." "How to Become Beautiful." 25c each. "Hypnotism." 40c. "How Gamblers Win." 50c. Satisfaction guaranteed.
W. A. Engelke, 3257 Bishop St., Cincinnati, Ohio.

violent aversion against the earrings of women but other ornaments, as bracelets, pleased me more or less according to design. The sight of a pearl would almost give me a fit but I was fascinated with the glitter of crystals or objects with sharp edges and plane surfaces. I would not touch the hair of other people except, perhaps, at the point of a revolver. I would get a fever by looking at a peach and if a piece of camphor was anywhere in the house it caused me the keenest discomfort. Even now I am not insensible to some of these upsetting impulses. When I drop little squares of paper in a dish filled with liquid, I always sense a peculiar and awful taste in my mouth. I counted the steps in my walks and calculated the cubical contents of soup plates, coffee cups and pieces of food,—otherwise my meal was unenjoyable. All repeated acts or operations I performed had to be divisible by three and if I mist I felt impelled to do it all over again, even if it took hours.

Up to the age of eight years, my character was weak and vacillating. I had neither courage or strength to form a firm resolve. My feelings came in waves and surges and vibrated unceasingly between extremes. My wishes were of consuming force and like the heads of the hydra, they multiplied. I was opprest by thoughts of pain in life and death and religious fear. I was swayed by superstitious belief and lived in constant dread of the spirit of evil, of ghosts and ogres and other unholy monsters of the dark. Then, all at once, there came a tremendous change which altered the course of my whole existence.

Of all things I liked books the best. My father had a large library and whenever I could manage I tried to satisfy my passion for reading. He did not permit it and would fly into a rage when he caught me in the act. He hid the candles when he found that I was reading in secret. He did not want me to spoil my eyes. But I obtained tallow, made the wicking and cast the sticks into tin forms, and every night I would bush the keyhole and the cracks and read, often till dawn, when all others slept and my mother started on her arduous daily task. On one occasion I came across a novel entitled "Abafi" (the Son of Aba), a Serbian translation of a well known Hungarian writer, Josika. This work somehow awakened my dormant powers of will and I began to practise self-control. At first my resolutions faded like snow in April, but in a little while I conquered my weakness and left a pleasure I never knew before—that of doing as I willed. In the course of time this vigorous mental exercise became second nature. At the outset my wishes had to be subdued but gradually desire and will grew to be identical. After years of such discipline I gained so complete a mastery over myself that I toyed with passions which have meant destruction to some of the strongest men. At a certain age I contracted a mania for gambling which greatly worried my parents. To sit down to a game of cards was for me the quintessence of pleasure. My father led an exemplary life and could not excuse the senseless waste of time and money in which I indulged. I had a strong resolve but my philosophy was bad. I would say to him, "I can stop whenever I please but is it worth while to give up that which I would purchase with the joys of Paradise?" On frequent occasions he gave vent to his anger and contempt but my mother was different. She understood the character of men and knew that one's salvation could only be brought about thru his own efforts. One afternoon, I remember, when I had lost all my money and was craving for a game, she came to me with a roll of bills and said, "Go and enjoy yourself. The sooner you lose all we possess the better it will be. I know that you will get over it." She was right. I conquered my passion

Skinderviken Transmitter Button

See what the editor of Electrical Experimenter says about the button:

New York, Oct. 22, 1918.
J. SKINDERVIKEN, National Hotel, Washington, D. C.

In writer's opinion, obtained by actual elaborate tests, your Transmitter Button is probably most efficient device of its kind on market today, due to its simplicity and other outstanding features. Should have a great future.

H. GERNSBACK.

See what a couple of Electrical Experimenter readers say about the button:

New Brighton, Pa.
Dec. 16, 1918.

Dear Sirs:
I have been using one of your Transmitter Buttons for experimental work, and it certainly lives up to all you say for it and then some.

Yours truly,
HARRY H. BRUHN.

Wash, D. C.
Dec. 18, 1918.

DEAR SIRS:
I received the Transmitter Button and I am well pleased with it. It is everything you claim it to be and more too.

Yours truly,
G. A. WICK.

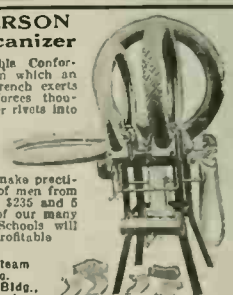
We have now thousands of buttons in stock and can ship same day as order is received. Send remittance with order as per our money back guarantee. See our ad page 734.

We have large stock of necessary supplementary equipment for experimenting. Send for a complete list. Receivers $1.00. Induction Coils from $0.35. Ringers from $0.35. Generators from $1.75.

SKINDERVIKEN TELEPHONE EQUIPMENT COMPANY
2134 North Clark Street
Chicago, Illinois

Abbreviated Address STECO

The ANDERSON Steam Vulcanizer



Anderson's Flexible Conformation Device, upon which an ordinary monkey wrench exerts tons of pressure, forces thousands of little rubber rivets into the tire's fabric, to be cooked in by our superheated dry steam system.

We guarantee to make practical vulcanizers out of men from 20 to 70 years old. $235 and 5 to 10 days in one of our many State Vulcanizing Schools will start you in this profitable business.

The Anderson Steam Vulcanizer Co.
No. 23 Williams Bldg.,
Indianapolis, Ind.

Mfrs. of the Famous Anderson Steam Vulcanizer. Owners of the Anderson method of vulcanizing



INSYDE TYRES Inner Armor for Auto Tires. Double mileage, prevent blowouts and punctures. Easily applied in any tire. Thousands sold. Details free. Agents wanted. Amer. Accessories Co., Dept. 23, Cincinnati

www.americanradiohistory.com

then and there and only regretted that it had not been a hundred times as strong. I not only vanquished but tore it from my heart so as not to leave even a trace of desire. Ever since that time I have been as indifferent to any form of gambling as to picking teeth.

During another period I smoked excessively, threatening to ruin my health. Then my will asserted itself and I not only stopt but destroyed all inclination. Long ago I suffered from heart trouble until I discovered that it was due to the innocent cup of coffee I consumed every morning. I discontinued at once, tho I confess it was not an easy task. In this way I checked and bridled other habits and passions and have not only preserved my life but derived an immense amount of satisfaction from what most men would consider privation and sacrifice.

After finishing the studies at the Polytechnic Institute and University I had a complete nervous breakdown and while the malady lasted I observed many phenomena strange and unbelievable.

(*To be continued in our March issue*)

TEN TELEPHONE OR FORTY TELEGRAPH CURRENTS OVER ONE CIRCUIT.

POSTMASTER GENERAL BURLESON on December 12th made public a letter from Theodore N. Vail announcing the invention and development by the technical staff of the Bell system of a practical method of multiplex telephony and telegraphy, which is expected to revolutionize long-distance wire communication.

Mr. Vail, who is President of the American Telephone and Telegraph Company, explained that there can be a combination of telegraphy and telephony under this invention by which a pair of wires, i.e., one full metallic circuit, will be available either for *five simultaneous telephone conversations* (*ten voices*) or for *forty simultaneous telegraph messages*, or partly for one and partly for the other.

With this new system four telephone conversations over one pair of wires are simultaneously carried on *in addition to* the telephone conversation provided by the ordinary methods. Thus, over a single pair of wires a total of five telephone conversations are simultaneously operated, each giving service as good as that provided by the circuit working in the ordinary way.

Heretofore the best telephone methods known to the art provided only one telephone conversation at a time over a single pair of wires. A number of years ago there was developed the *phantom circuit* arrangement, by which three telephone circuits were obtained from two pairs of wires, an important improvement, of which extensive use has been made commercially. Now, by the multiplex method we are enabled to obtain *five telephone circuits* over one pair of wires, that is, *ten simultaneous telephone conversations* from the two pairs of wires which formerly could be used for only three simultaneous telephone conversations. This represents an increase of more than threefold in the telephonic capacity of the wires, as compared with the best previous state of the art.

Some proposals made by the earlier workers in this particular field have naturally proved suggestive in the successful solution of the problem, particularly a suggestion made by Maj. Gen. George O. Squier, Chief Signal Officer of the United States Army, about ten years ago, and which at the time attracted very general attention.

Furthermore, while working in entirely different fields and with a different objective, Dr. Lee deForest a number of years ago invented a wireless device known as the Audion, which by improvements and adaptation has been made an important part of the Bell telephone system.



Become an Electrician In One Year Here
Or Learn An Electrical Trade In 6 Months

THIS school teaches electricity thoroughly, from the very fundamentals, including the laws and principles of electricity and the theory of direct current—together with practical lectures and problems, actual training in laboratory work and electrical machine departments of designing, building, repairing, installing, operating, etc. And the faculty here are practical electrical engineers who know how and what to teach because they know what knowledge and ability the great field of Electricity requires.

As one example of this school's thoroughness and practical training and development, witness the picture above, showing view of armature winding department, where students actually wind armature—D.C. and A.C.—by a most successfully practical and unique method.

The thoroughness in essentials here, the practical training and able faculty, together with this school's broad facilities and intensive abilities, are the reasons why you can become an Electrician here in one year, or master one of the Electrical Trades in 6 months.

If you are determined to achieve success in the Electrical Field this is your school. You will acquire and accomplish more in a shorter time at a less cost and be a fully developed, practical electrical man when you finish. Mail the coupon at the right and get complete illustrated and descriptive details of the advantages this school affords. If interested in Electrical Engineering with B.S. degree, check same on coupon. Mail the coupon now.

A STUDENTS' Cooperative Dormitory and Boarding Club is organized here with modern and completely equipped school quarters for housing and boarding students—conducted by student committees for the athletic, social and academic welfare of the students and establishing living economy and comfort. Fully explained on request.

You Can Earn While You Learn

WE will provide you with part time employment to help defray your expenses here and give you actual outside experience—without interfering with your class hours—which is fully explained in our catalog. Mail the coupon.

School of Engineering
of Milwaukee
An Electrical Technicians' Institute
Department of Practical Electricity
76-373 Broadway, Milwaukee, Wis.

Mail This Coupon NOW

School of Engineering of Milwaukee
76-373 Broadway, Milwaukee, Wis.

Without obligating me, please furnish details of ....day or ....evening course (or courses) checked below.

..Electrician
..Electro-Technician
..Electrical Engineer

Special 6 Months' Courses.

..Draftsman
..Electrical Trouble & Lineman
..Electrical Wireman
..Electrical Motor Repairman
..Telephone Trouble & Repairman
..Electrical Meterman
..Dormitory

NAME .....
ADDRESS .....
AGE .....
EMPLOYED AT .....
EDUCATION .....



TYPEWRITER SENSATION
PROMPT SHIPMENT.

$4.00 per month buys a beautifully reconstructed, latest model visible typewriter, with back spacer, decimal tabulator, two-color ribbon, etc. Every late style feature and modern operating device. Sent on approval. Catalogue and special prices free.

Harry A. Smith, 738, 218 N. Wells St., Chicago, Ill.



Captain George Frederick Campbell, Formerly Third Ace of the Royal Flying Corps. Chief Instructor of National Aero Institute.

Let Me Train YOU In
AVIATION

I want you to take up Aviation. Positions at good pay are going begging, because there are not enough trained men to fill them. LET ME TRAIN YOU for some of these big positions that pay big wages. I know the game, for I have been flying for years. My advice to you is to decide right now to take a

Home Course in Aviation

in your spare time. Send today for our FREE BOOK and I will write you a personal letter along with it. I will tell you some INSIDE facts about this great industry. You'll want to get right in. Address as follows:

Capt. Geo. F. Campbell, Chief Instructor, NATIONAL AERO INSTITUTE, DEPT. 7442, Morton Building, Chicago, Illinois.

Two Airplane Concerns agree to take every one of our students who have mastered our course for the big paying positions of Mechanics, Inspectors, Assemblers, Engineers, etc.

Why don't YOU qualify?

Fill Out This Coupon and Mail Today

Capt. George F. Campbell, Chief Instructor
National Aero Institute, Dept. 7442,
Morton Building, Chicago, Ill.

Dear Sir: Please send me without obligation, copy of "The Science of Aviation," also particulars of Mail Course in the Principles of Aviation.

Name.....
Address.....

www.americanradiohistory.com



Salesmen Must Take the Place of War Contracts

Now That The War Is Over

SALESMEN

are Needed to Get Peace-Time Orders to Keep Plants Busy

$2,500 to $10,000 A Year for Salesmen

Factories everywhere have been working day and night on war contracts. With peace returned, these factories must go back to peace time work. War contracts require no salesmen. Peace time orders must be produced by salesmen. Salesmen will be the most vital factor in business. Factories backed by best salesmen will be the busiest. Crack salesmen will command practically their own price. Prepare now for this most essential peace time work.

Let Us Make You a STAR SALESMAN

We taught E. C. Kisler—formerly earning $75 a month—has earned as high as $375 a month as salesman. We taught C. W. Birmingham—former clerk at $15 a week—has earned $125 a week as sales manager. We taught George W. Kearns—formerly earned $60 a month—has since earned $306 in one week as a salesman. Our simple course teaches the exact laws of successful selling—making you more efficient than 99 out of 100 men who learned only through grinding experience. We train you in your spare time in your own home, so you can earn while you learn.

Wonderful New Book FREE!

Investigate by writing for our free book "A Knight of the Grip" which tells what our Training and Service will do for you. Let us tell you about our Free Employment Department, which has constantly on file more requests for salesmen than we can possibly fill. WE TRAIN you and PLACE you. Write today—Now. Easy terms and special price for limited time. Don't rob your whole future by one minute's neglect. Mail coupon or postal NOW.

Mail Coupon or Postal

National Salesmen's Training Association
Dept. 42B
Chicago, Ill., U. S. A.

With no obligation on my part, send me your Illustrated Book and complete information on your Training and Free Employment Service.

Name. .....
Street .....
City .....

National Salesmen's Training Association
Dept. 42B
Chicago, Ill.
U. S. A.

DEAFNESS IS MISERY



I know because I was Deaf and had Head Noises for over 30 years. My invisible Anti-septic Ear Drums restored my hearing and stopped Head Noises, and will do it for you. They are Tiny Megaphones. Cannot be seen when worn. Easy to put in, easy to take out. Are "Unseen Comforts." Inexpensive. Write for Booklet and my sworn statement of how I recovered my hearing. A. O. LEONARD
Suite 369 70 5th Ave., N. Y. City

HAVE *You* SENT

for our booklet No. 4, giving diagrams and experiments with the Steco Button?
STECO. 2134 N. Clark St., Chicago, Ill.

CURING SOLDIERS' ILLS WITH ELECTRICITY.

(*Continued from page 695*)

were 3,000 shell-shock victims; the day the armistice was signed 2,000 of them recovered, showing what a peculiar and baffling mental ailment this is.

The photograph, Fig. 2, was taken at the American Red Cross War Hospital, located at Paignton, Devon, France, which is one of the finest and best equipt in the Red Cross service. This hospital has a staff of 150 nurses under the direction of Army medical officers. The photograph shows a soldier undergoing an electric bath treatment for rheumatism. This treatment is given in the massage room at the hospital, where multifarious other electrical machines and appliances are to be found, including electrical massage vibrators, electric heating pads, etc.

In some of the larger base hospitals, very elaborate electrical equipment has been made available. In some of the American Army hospitals in the United States, where the returning wounded are being carefully attended to, so as to make them as well and strong as they were when they went overseas to fight the Boche, there are some of the very latest instruments and apparata about which little is known outside of the medical profession. This equipment includes among other things the *Electro-cardiograph*, which comprises an extremely sensitive electrical galvanometer, capable of recording the beats of the heart on a photographic film, so that the exact condition of the heart with regard to its manner of beating and its strength, can be minutely and accurately studied by the physicians.

At one of the large New York debarkation hospitals everything is done by electricity—even to the cooking. This hospital has one of the largest X-ray laboratories in the world, each of the 26 X-ray rooms being equipt with a special dark room for rapidly developing and finishing the X-ray plates. The X-ray in itself has undoubtedly saved thousands of lives in the great conflict, in many cases when the victims of bullet and shell wounds would certainly have died, had it not been for this wonderful scientific machine. Owing to the terrific fragmentation (splintering) of the shell now used, which often causes small steel splinters to penetrate parts of the body where they would never be suspected, and which, if they were not quickly discovered by the X-ray, would be quite liable to affect the heart, lungs or blood vessels at some unexpected time and cost the victim his life. For this reason the returning wounded are most minutely examined and X-rayed, especially in the abdomen and chest regions, where many of these shell splinters, and even bullets, are fond of lodging and camouflaging themselves for long periods, only to cause trouble at some later date, with possibly fatal results.

THE UNKNOWN PURPLE.

(*Continued from page 690*)

last act, in which scene the hero is visible to the eye in flesh and blood but slowly and gradually fades away into nothing, leaving only the purple glow. This was quite impressive and, of course, was done by the usual magician's mirror effect, whereby the hero was not on the stage at all, but below it, thus casting his reflection on a fine screen on the stage; then by manipulating the lights in a certain manner the picture would dissolve into emptiness.

Altogether the stage technique is very cleverly arranged with an absurdly simple effect which in a similar attempt would be very elaborate. Outside of that the plot and theme of the play is quite out of the ordinary and is deserving of mention.

To show just how different this play is from others, reference must be made to a note in the program over which audiences puzzle themselves until the play itself makes the meaning clear. To wit: "The first epi-

AK TABLETS FOR Grippe Cold in the Head

Headaches
Neuralgias
Spanish Influenza
Women's Aches and Ills
Rheumatic and Sciatic Pains

Ask Your Druggist for A-K Tablets

Sold in Convenient Pocket Packages

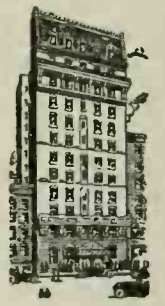
Small Size 10c — Fac-Simile — Dozen Size 25c

See Monogram AK on the Genuine

The Antikamala Remedy Company
St. Louis, Mo.

HOTEL ST. JAMES

Times Square, New York City
Just off Broadway at 109-113 West 45th St.
1½ Blocks from 45th Street Entrance to Grand Central Station.



Women will find here a home atmosphere and absence of objectionable features of ordinary hotel life.

40 Theatres, all principal shops, 3 to 5 minutes walk.

2 minutes of all subways, "L" roads, surface cars, bus lines.

An excellent Restaurant, at moderate prices.

Write for "What's Going On In New York"

All Outside Rooms
With adjoining bath - - from $1.50
With private bath - - from $2.00
Sitting room bedroom, bath, from $4.00

Furnished Apartments by the year, month or week, at special rates.

RAYMOND L. CARROLL, Pres. and Mgr.

Humanize Your Talking Machine

with the Ellis "Music Master" Reproducer. It is adapted for all makes of machines using disc records and entirely overcomes those harsh, rasping, scratching, metallic sounds, disagreeable nasal tones and other annoying "faults". Brings out all the hidden harmonies, musical shading and tone coloring and makes your old phonograph sound like an entirely different instrument. Guaranteed for five years, but improves with age and will last a lifetime. Write for circular "E".

J. H. ELLIS, P. O. Box 88
Milwaukee, Wisconsin

35 MILES PER HOUR

Is Record Of This Car

Built by a boy from Junior parts furnished by us. Any boy can build this car. Parts very cheap. Send 26 cents for blue prints and price list of parts showing how to build this speedy little car.



SYPHER MFG. CO.
156 Warren Street
TOLEDO, OHIO.

www.americanradiohistory.com

sode of the last act occurs before the last episode of the preceding act." It simply means that at that critical time the action is going on in two places at once: and because the stage cannot jump back and forth in a flash like the motion picture, part of the story has to be postponed until the scene shifters catch up.

The illustrations which we present herewith are, of course, doctored up for the reason that if they were not nothing at all would be seen. It is very necessary to show the pictures in this manner, otherwise we would revert back to our camouflaged front cover,—the blank space showing nothing,—and as the Editors must show pictures—well you know how it is:

A little camouflage here and then
Is often mightier than the pen!

EXPERIMENTAL MECHANICS.

(*Continued from page 717*)

much more difficult than the ordinary run of lathe work. Fig. 5 shows how a crank pin, 1, with its rods, is set to be revolved between centers 2, 2, of the lathe. This is made with provisions for attaching to the crank rod 4, 4, temporary support plates 3, 3, on the ends of the crank shaft, and drilling center holes in the plates in line with the *center of the crank pin to be turned.* The main portions of the crank shaft D, D, must first be turned, tho not necessarily to their finished size. The plates 3, 3, must be bored out to be a tight fit on the ends of the crank shafts, to which they are further secured by a set screw as indicated. The crank shaft is then laid on a surface plate or on the lathe bed, which will answer this purpose very well, and the centers of the crank pin, 1, determined and carefully marked on the supporting plates, 3, 3, so that when mounted between lathe centers the axis shall pass thru the central axis of the crank pin. The center holes should be drilled and countersunk in the usual way at these points. The crank shaft may then be mounted in the lathe on its centers, and one end secured to the face plate with a dog and the crank pin then turned to proper size.

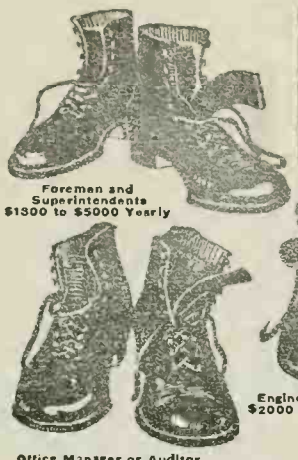
It will be found in turning crank shafts that the work as a whole is very much out of balance, and will require a counterbalance weight on the opposite side to the driving of the lathe. This work will be of interest to those building engines, etc.

(*To be continued*)

PRODUCING RAIN BY ELECTRICITY AND X-RAYS.

(*Continued from page 687*)

valve rectifiers, is used to produce the high potential current for operating the X-ray tube, and this current is fed to the tube thru the two wires leading up to the balloon. The X-ray tube itself is placed in a light water-proof compartment suspended from a spar just below the balloon, as the illustration shows. As will be seen, the Röntgen-ray tube is so hung that its rays are directed upward, so as to impinge upon the metallized surface of the balloon, which, as will be remembered, is charged at a very high potential. Suitable high voltage, strain insulators are placed in the lead wires at all the points shown. A recording instrument such as hot-wire ammeter is connected in series with the high tension lead wire. If the ground switch is closed, then any static charge in the neighborhood of the balloon is conveyed to earth, an indication being obtained on the instrument. When the ground switch is opened and the power circuit closed, the air surrounding the balloon for a radius of several hundred feet is endowed with conductive qualities as a result of the emanations from the X-ray tube. When the ultra-high voltage



Learn to Fill Bigger Shoes

NO matter what kind of work you are doing now, a set of these great home study books will quickly fit you for a bigger and better paying job. We will send any set you select for one week's FREE examination, and if you want to keep them you pay only the special reduced price—at the rate of 50 cents a week. This is your opportunity to make more money—grasp it NOW. Use these books and a little spare time and LEARN TO FILL BIGGER SHOES.

Carpentry and Contracting
Five volumes, 2138 pages and more than 400 illustrations. Prepares for Contractor, Building Superintendent and Carpenter Foreman. Regular price, $25.00. Special price, $17.80.

Civil Engineering
Nine volumes, 3900 pages and 3000 illustrations, plates and diagrams. Prepares for Civil or Structural Engineer, Transitman, Estimator, Designer or Chief Draftsman. Regular price, $45.00. Special price, $29.80.

Telephony and Telegraphy
Four volumes, 1725 pages and 2000 illustrations, plates and diagrams. Prepares for Telephone Engineer, Wire Chief, Exchange Manager, Trouble Man or Telegrapher. Regular price, $20.00. Special price, $12.80.

Steam and Gas Engineering
Seven volumes, 3300 pages and 2500 illustrations, plates, diagrams, etc. Prepares for Stationary, Marine or Locomotive Engineer or Fireman. Regular price, $35.00. Special price, $21.80.

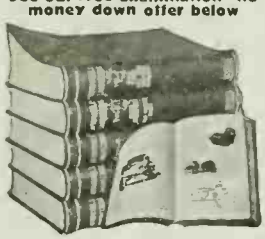
Law and Practice
(with Reading Course in 25 bound pamphlets). Thirteen volumes, 6000 pages and 24 illustrations. Prepares for all Bar Examinations. A wonderful aid to business men. Regular price, $72.00. Special price, $39.80.

Practical Accounting
Four volumes, 1840 pages and 800 illustrations, plates and diagrams. C. P. A. questions and practical problems. Prepares for Accountant, Bookkeeper or Cost Clerk. Regular price, $20.00. Special price, $12.80.

Pay Raisers

These books are written by well known authorities—the top-notchers in each line. They will help you make more money. You can't fail to understand them, because they are written in plain, everyday language. Thousands of photographs, diagrams, charts, etc., help to make difficult points as simple as A-B-C.

See our Free Examination—no money down offer below



Ask Our Experts

With these books goes free of all charge a $12.00 Consulting Membership in the American Technical Society. If any question puzzles you—write us. Our corps of experts and engineers will solve any problem. Ask all the questions you want for a whole year. This service is absolutely FREE.

Automobile Engineering
Five volumes, 2400 pages and 2000 illustrations. Prepares for Garage Foreman, Automobile Mechanic or Chauffeur. Invaluable to car owners. Regular price, $25.00. Special price, $17.80.

Machine Shop Practice
Six volumes, 2300 pages and 2500 illustrations. Prepares for Machine Shop Superintendent or Foreman, Foundryman, Pattern Maker, Tool Designer or Tool Maker. Regular price, $30.00. Special price, $19.80.

Sanitary, Heating and Ventilating Engin'ring
Four volumes, 1454 pages and more than 1400 illustrations, etc. Prepares for Sanitary Engineer, Heating and Ventilating Engineer, Master Plumber or Plumber. Regular price, $20.00. Special price, $13.80.

Mechanical and Architectural Drawing
Four volumes, 1578 pages and more than one thousand illustrations. Prepares for Architectural or Mechanical Draftsman. Regular price, $20.00. Special price, only $14.80.

Electrical Engineering
Seven volumes, 3000 pages and 2600 illustrations, plates and diagrams. Prepares for Electrical Engineer, Power Plant Superintendent, Substation Operator or Electrician. Regular price, $35.00. Special price, $19.80.

Accountancy and Business Management
Ten volumes, 3680 pages and 1867 illustrations, forms, etc. Prepares for Certified Public Accountant, Auditor, Office Manager, Accountant, Credit Man or Bookkeeper. Regular price, $50.00. Special price, $24.80.

Don't Send Any Money!

Write the name of the books you want on the coupon and mail it today. We will send the books at once, express collect, and you can use them just as if they were your own for a whole week. If you decide you don't want to keep them, send them back at our expense. If you like the books, as thousands of other men have after examination, just send us $2.00. You can send the balance of the special reduced price the same way—$2.00 each month (50 cents a week).

Start right now and learn to fill bigger shoes. There will be a better job looking for you if you do. Be ready to meet it when it comes. *Send the coupon now.*

American Technical Society, Dept. X3382, Chicago, Ill.

American Technical Society, Dept. X3382, Chicago, Illinois

Please send me set of _____ for 7 days' examination, shipping charges collect. I will examine the books thoroughly and, if satisfied, will send $2 within 7 days and $2 each month until I have paid the special price of _____. If I decide not to keep the books, I will return them by express at your expense. Title not to pass to me until the set is fully paid for.

Name _____

Address _____

Reference _____

SEND THE COUPON NOW

www.americanradiohistory.com

414 PAGES
145 ILLUSTRATIONS



$1

ELECTRICITY!

HERE'S just the book on Electricity that you need to answer your many questions—to solve your knotty problems, to teach you new kinks, to be your memory for tables, rules, formulas and other Electrical and Mechanical facts that some people try to carry in their heads—and fail.

With this "Little Giant" I. C. S. Electrical Engineer's Handbook in your pocket, toolchest, on your work bench, drawing table or desk, an hour or a day need not be lost "digging up" some forgotten rule, some unfamiliar fact; you'll just turn to the very complete index and get it "in a jiffy." Just a few of the subjects treated are:

Electricity and Magnetism: Electrical Symbols: Batteries; Circuits: Magnets; Direct and Alternating Currents: Dynamos and Motors; Belts; Shafting; Electroplating; Electrical Measurements: Meters; Arc and Incandescent Lamps: Mercury Arc Rectifiers; Transformers; Insulation; Electric Cars: Single and Multiple-Unit Control: Transmission: Rail Welding: Tables of Wires—Sizes, Capacities, etc.,—Mathematical Rules: Formulas, Symbols: Tables of Constants, Equivalents, Roots, Powers, Reciprocals, Areas, Weights and Measures: Chemistry: Properties of Metals: Principles of Mechanics: First Aid, etc.

The Electrical Engineer's Handbook is one of 22 I. C. S. Handbooks covering 22 Technical, Scientific and Commercial subjects (See titles in coupon below.) They have the contents of a full-size book condensed into pocket size ready to go with you anywhere and be at your instant command. Substantially bound in cloth, red edges, goldleaf stamping, printed from new, clear, readable type on good quality book paper and illustrated wherever a picture will help.

No Risk Money-Back Offer!

The price of the famous I. C. S. Handbooks, of which more than 2,000,000 have been sold and are in practical everyday use, is $1 per copy. So confident are we that you will find them exactly what you need for ready reference in your work, that we stand ready to promptly and cheerfully refund your money if for any reason you are not fully satisfied with their value. Simply send a letter or the coupon below, enclosing $1 for each book wanted. If at any time within 10 days you wish to return the books, your money will be refunded.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6177 Scranton, Pa.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6177, SCRANTON, PA.

I enclose $_____ for which send me postpaid the Handbooks marked X, at $1.00 each. I may return any or all and get my money back within ten days from receipt.

☐ Electrical Engineer's	☐ Advertiser's
☐ Telegraph and Teleg. Engineer's	☐ Business Man's
☐ Mechanic's	☐ Bookkeeper's
☐ Steam Engineer's	☐ Stenographer and Correspondent's
☐ Westinghouse Air Brake	☐ Salesman's
☐ Civil Engineer's	☐ Window Trimmer's
☐ Coal Miner's	☐ Cotton Textile Worker's
☐ Concrete Engineer's	☐ Farmer's
☐ Building Trades	☐ Poultryman's
☐ Plumber's and Fitter's	☐ Mariner's
☐ Chemist's	☐ Automobiles

Name_____

Street and No._____

City_____ State_____

Not Toys But Real Apparatus

the same as used by all operating companies. You had better send us your order immediately to insure prompt delivery, as this equipment will not last long at these prices.

110 Volt Generators.....3 bars, each	$3.00
4 bars, each	4.00
5 or 6 bars, each	5.00
Telephone transmitters with arms, each..	.75
Good ringers complete with bells, each....	.50
Telephone receivers, each.....	.75
Condensors, all sizes, each.....	.50
Real complete common battery telephones, wall type with 1600 Ohm ringers, each	4.50
Slightly used dry cells, per dozen.....	1.25
Large, powerful magnets, while they last, each	.50

Please send money-order or cash with your order
ELECTRICAL SPECIALTY COMPANY
128 South Eleventh Street, Philadelphia, Pa.

Learn Watchwork, Jewelrywork and Engraving Optics and instrument repair. A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL, Dept. E., Bradley Institute, Peoria, Ill., for latest catalog.

charging circuit is closed and the metallized balloon surface electrified, then the air in the vicinity of the balloon receives a powerful electrostatic charge, which acts on the aqueous particles suspended or floating in the air in the manner aforementioned. The inventor has elaborately cared for many problems which might arise in the application of his apparatus, and among other things he describes various forms of high tension uni-directional current generators and means for application against lightning discharges.

The inventor mentions that two or more operating stations for rain production may be used in cooperation, depending upon the observed meteorological conditions, these stations being located at greater or lesser distances apart. In operating multiple stations the degree and sign of the charges used therein, respectively, may be varied as required. The use of ultra-violet rays instead of Röntgen rays for ionizing the atmosphere is discust by Mr. Balsillie in the description of the apparatus, but they are of little practical use, as he points out, for they produce practical ionization effects only when reflected from a fluorescent surface.

EXPERIMENTAL CHEMISTRY.

(*Continued from page 718*)

will contain crystallin deposits. Some of the sublimat will be amorphous.

THE CARBON TEST.—In this the Arsenious Oxid [As_2O_3] is reduced by Carbon [CO being formed] to metallic Arsenic, which sublimes as in Marsh's Test.

HYDROGEN SULFID TEST.—The hydrogen sulfid preciptates arsenious sulfid [As_2S_3] [Yellow] from an acid solution of any arsenious salt

$$2AsCl_3 + 3H_2S = As_2S_3 + 6HCl.$$

Physiological Effects.

Like other arsenical comounds, the oxid is very poisonous, the lethal dose being about 2½ grains, or $^1/_6$ gram. It is called an *Irritant* poison, and acts rather slowly, as the digestive fluids have to transform it before absorption. The antidote is freshly prepared ferric hydrat [$Fe[OH]_3$], together with Magnesia.

$$2FeCl_3 + 3Mg[OH]_2 = 2Fe[OH]_3 + 3MgCl_2.$$

This forms a compound of arsenic insoluble in the fluids of the body, and precipitated in the stomach, etc. An overdose may act as an emetic.

For evidence of arsenical poisoning in post-morten examination of the liver, the stomach, etc., these organs and their contents are sometimes dialyzed before the Marsh and other tests can be applied, in order to separate the arsenic from the viscera and food products. After being treated with Hcl, $KClO_3$, etc., the finely divided substances are put into a dialyzer [a parchment membrane, see Fig. 156], and suspended in water, when the arsenic compounds, being more diffusive, pass thru the membrane in to the water of the outer vessel, leaving the other substances behind. This outer solution is then concentrated and tested for arsenic. Generally, however, the contents with the arsenic are dissolved in aqua regia and then tested by Marsh's or Reinsch's test.

Uses.

It is employed in shot manufacture to give a globular form to the grains.

Cobalt Glance, a compound of Arsenic and Cobalt, has considerable use as fly-poison under the name of *Fly-stone*. Arsenic also finds use in many rat poison compounds.

TESTS FOR ARSENIC.

Marsh's Test.

Experiment No. 148.

Make two constrictions in a tube of hard

BLISS
Electrical School

AGAIN OPEN TO CIVILIANS

FOR A QUARTER OF A CENTURY this institution has been training men for the electrical industries.

SINCE JUNE 15, 1918, the School has been filled to its maximum capacity with soldiers detailed by the WAR DEPARTMENT to receive an intensive course of instruction for electrical positions in the service.

DUE TO THE CESSATION OF HOSTILITIES the War Department has discontinued this work. We will, therefore, resume our CONDENSED COURSE IN ELECTRICAL ENGINEERING, JANUARY 15, 1919. This 26th class will graduate September 17, 1919.

The school is provided with fireproof dormitories, dining hall, excellent laboratories and shops, all thoroughly equipped throughout. A judicious combination of theory and practice results in a well-balanced course.

Because of the demand for admission EARLY APPLICATION is necessary. Catalogue upon request.



BLISS
ELECTRICAL SCHOOL
260 Takoma Ave.,
Washington, D. C.

Super-Sensitive Microphone ONLY $7.50



This instrument is offered at an extremely low price. It is excellent for building your own amplifier. Can also be used in many experiments where a sensitive microphone is required.

Detectagraph, $15

This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord, Receiver, Headband, Case and Battery.

Send for One Today and Convince Yourself.



Detectagraph $15



THE $15 MICROPHO DEAF-PHONE

is a super-sensitive instrument which has been developed to meet the demands for a practical and efficient hearing device at an extremely low price. It is equal to any $35 instrument made and superior to most of them. The outfit consists of One Super-Sensitive Transmitter with cord connector; One Super-Sensitive Ear Piece with small black cord; One Black Single Headband; Black Case and Two Batteries. WRITE TODAY FOR FREE BOOKLET

G. BOISSONNAULT CO.
26 CORTLANDT STREET NEW YORK
Makers of Super-Sensitive Microphone Apparatus

You Can Make Big Profits

CHARGING AUTO STORAGE BATTERIES

Others are clearing $100 to $150 extra profit every month, with this HB 600 watt Charger. So can you. No experience necessary. Write for particulars or send $15 first payment with trial order. *Absolute money-back guarantee.* No risk. Balance in 9 monthly payments of $20 each. *Delay means lost profits.* Order now.



Hobart Bros. Co. Box 2E, Troy, Ohio



THE MIDGET SLIDE RULE will add, subtract, multiply, divide; solve problems involving even and uneven roots and powers. Also gives the logarithms of numbers and the Sines and Cosines, Tangents and Cotangents of all angles. Its operation is very simple; quickly solves any mathematical problem. Durably made of metal. Adapted for shop and office use. Fits the pocket. 3¼ inches diameter. Price with instructions, $1.00 Your money back if you are not satisfied

Gilson Slide Rule Co., Nilss Mich

110 V. TRANSFORMER

8 Volts Secondary ONLY $1.00

A reliable transformer for all experimental work, ringing bells, etc. Consumes so little power it will not move ordinary meter. $1.00, postpaid. Cord and plug, 60c extra.

Transformer No. 10, giving 8, 12 and 18 volts secondary, with plug, $2.00 postpaid. Order from this ad.

EMPIRE TRANSFORMER CO.
Dept. 11 2214 Sedgwick St., CHICAGO

www.americanradiohistory.com

Mail Salesmen Command
$2,000 to $4,000
a Year—and positions are now open

Send for FREE copy of magazine containing list of positions open. Learn how others have increased their earning ability through a knowledge of how to get business by mail.

MAIL SALESMANSHIP MAGAZINE
Room 1219
220 W. 42nd St., New York City

TELEGRAPHY
Day and evening classes taught by expert telegraphers upon practical equipment. Splendid opportunities. Send for Folder "T". Beginners Every Monday.

MERCHANT MARINE
Thousands of wireless operators are needed. Splendid appointments, attractive salaries, rapid advancement. Day and evening classes. Beginners every Monday. Send for prospectus.

EASTERN RADIO INSTITUTE
899 Boylston St. Boston, Mass.

WANTED
IMMEDIATELY
Civilian wireless and land line operators are in great demand, owing to the government special classification.
This is your opportunity to earn big money. Our classes will quickly qualify you.
Write for booklet giving full particulars about
The Best Radio School in New York City
East Side Branch Lenox 6051
Y. M. C. A.
86th St. and Lexington Ave.
New York

SBTI
Better Your Position
Prepare for a permanent position. Railway Traffic Inspectors are always in line for advancement. No age limit—only common school education. Mighty good salary and expenses. A Railway Traffic Inspector safeguards the lives of the public and protects his company's interests—an important position. He's paid to travel and observe. Works only with railroad officials—that's why he's bound to gain a position of trust. Hundreds needed right now—thousands later. Study for only three months—we will arrange for the position. Delay never secured anyone a better position—so act immediately. Booklet B 21 tells all—write today. Address
Standard Business Training Inst.
BUFFALO, N.Y.

Build Your Own PHONOGRAPH,
It's Easy With Our Help
SAVE OVER HALF
A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fine profit building phonographs for your friends.
Write Today for Our Free Blue Print Offer. Agents wanted for our ready built Choraleons.
CHORALEON CO.
702 Mooger Bldg., Elkhart, Ind.

WIRELESS Individual instruction continues under the general supervision of E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Co.
LAND-WIRE under personal supervision of Mr. G. E. Palmer, Chief Operator of the Western Union Telegraph Co.
Y. M. C. A. Telegraph School
Marcy Ave., near Broadway, Brooklyn, N. Y.

glass [about 25 cm. long, and 8 mm. diameter] by the use of a blast-lamp flame. The first capillary should be 5 or 6 cm., from one end, or as near the end as is convenient to hold in the flame; the second one 5 or 6 cm. from the first. These capillaries should not be less than 4 or 5 mm., in diameter at the narrowest part. Between the two constrictions bend the tube upward at an obtuse angle [D]. See Fig. 157. The opposite end of the tube is next fire-polished. When all the parts are cool lay the tube down and draw a file gently across the middle of the constriction nearest the short end, and break it at this point, thus leaving a small opening and completing the tube E. A drying tube 10 or 12 cm long, 8 mm. diameter at each end, with bulb, is filled with calcium chlorid, but not so full as to clog and prevent the gas from passing. This is attached to an Erlenmeyer flask of thick glass [about 125 or 250 cc.] and to the arsenic tube. See Fig. 158. The two-hole stopper of the flask carries a thistle tube. The flask may be raised on an iron ring stand or other support, so as to allow a Bunsen flame, flattened by use of a "wing-top" to heat the arsenic tube, the latter being also supported. Not over 5 grams of arsenic-free [or C. P.] zinc are put into the flask and covered with distilled water. Thru the thistle tube are poured small successive portions of C. P. hydrochloric acid. After letting the hydrogen escape for a minute, to expel all the air from the apparatus, test the gas in the usual way, using the utmost caution to prevent an explosion. When sure that all the air is expelled, ignite the escaping hydrogen. Hold the concave side of a porcelain dish in this flame a minute to test the purity of all chemicals. If no deposit is made, pour into the flask not over 5 cc. of a solution of arsenious chlorid [$AsCl_3$] or of sodium arsenit [Na_3AsO_3]. Put the Bunsen burner under the combustion tube, having the top of the flame near the capillary, but on the side towards the flask. Keep the hydrogen burning well at the end of the tube, adding more hydrochloric acid as needed.

Look for any change of color in the hydrogen flame, and in the event of noting any, try to explain it. Hold a dish against the flame as before. What is the effect, and its explanation. Observe any deposit in the capillary; describe and account for it.

When there is no further deposit near the capillary, and the flame becomes yellow, blow out the hydrogen flame, and when the tube is cool, detach it [*avoid inhaling the fumes*] and pour 3 or 4 cc. of sodium hypochlorit into the arsenic tube, closing the capillary end with the finger. See whether the deposit dissolves. This test serves to distinguish an arsenic deposit from one of antimony, which is insoluble in sodium hypochlorit [NaOCl]. Write reactions for:

1. The action of HCl on zinc.
2. $AsCl_3$ on nascent hydrogen, forming the DEADLY gas arsin [AsH_3].

(*Continued on page 758*)

POPULAR ASTRONOMY.

(*Continued from page 701*)

thruout the equatorial segment of which A-B is a cross-section.

It should be borne in mind in connection with Fig. 1, that space, so far as we know, is without limits. Strictly speaking we should set no boundary for the universe such as is implied when we place a circle around the system of globular clusters. The region beyond A-B is unexplored. The extent of the Galaxy in the direction A-B may be even greater than is represented here. The limits in Fig. I are simply those set by the systems of globular clusters. When the distances of some of the spiral nebulae have been determined it is con-



Become a Doctor of Chiropractic
Advanced Science of Spinal Adjustment

This is the day of drugless healing! In Chiropractic—treatment of disease by spinal adjustment—Science has made a forward step. Look at the newspapers and magazines—note the trend toward the principles of drugless healing, especially Chiropractic.

You can now become a Doctor of Chiropractic through home study during spare time! We teach you thoroughly either by mail or in class. You can know independence and position! Makes no difference where you live or what you do—you should be able to qualify for this great profession. Some of our graduates report that they

Earn $3,000 or More a Year

Dr. M. D. Moore, Ky., writes of having 17 patients in one day at $2 each. Dr. L. H. Roche, New Jersey, $5,550 a year. Dr. A. H. Morrow, of Illinois, reports earning $22 a day. We could name many other Chiropractors who are making good incomes. See the facts in our Free Book. It's only a question of preparation on your part, to enter a profession that is paying others $3,000 to $5,000 or more a year. Think what it would mean to you to earn such an income and to be your own boss with your own hours. Isn't this the kind of life you are desirous of leading? Well, it is now within your reach. Truly this is a chance for you!

22 CHARTS FREE

$15 Set of 8 Anatomical Charts and $16.50 Set of Nerve and Pain Area Charts

Yes, free to you without a cent, now or later. As an inducement to secure quick action, we will give absolutely free, our big, 72-page book; a $15 set of eight Anatomical Charts, beautifully lithographed in lifelike colors, and also a complete set of colored Nerve and Pain and Concussion Charts, regular value, $16.50.

Our Lessons Teach You How to Make Spinal Adjustments for the Speedy Relief of

Headache	Neuralgia
Indigestion	Neuritis
Lumbago	Catarrh
Epilepsy	Fevers
Pleurisy	Jaundice
Constipation	Dyspepsia
Rheumatism	Paralysis

Asthma, etc.

Learn At Home In Spare Time

We train you by mail. You can learn at home in your spare time. You receive the personal instruction of men who are prominent in this great profession. Give us a portion of your spare time, and we will quickly train you to become a Doctor of Chiropractic, ready to step out and take your position of prestige in the world.

Mail Coupon NOW! Why slave your life away in work that you don't like—work that doesn't fit with your ambition? Here's the chance you've been looking for—the opportunity your ambition has sought! Mail coupon today and see the success that may be yours as a Doctor of Chiropractic. Don't delay.

AMERICAN UNIVERSITY
Manierre Bldg, Dept. 408 Chicago, Ill.

Without cost or obligation, send me by mail, postpaid, your new illustrated 72-page book, and your Free Charts Offer.

Name.....
Street and No.....
City.....State.....


FREE
$20
Violin, Hawaiian Guitar
Ukulele, Guitar, Mandolin, Cornet or Banjo

Wonderful new system of teaching note music by mail. To first pupils in each locality, we'll give a $20 superb Violin, Mandolin, Ukulele, Guitar, Hawaiian Guitar, Cornet or Banjo absolutely free. Very small charge for lessons only expense. We guarantee success or no charge. Complete outfit free. Write at once—no obligation.
SLINGERLAND SCHOOL OF MUSIC, Dept 422, CHICAGO, ILL.

LEARN WATCH REPAIRING


You can learn by our modern and original system of instruction every part of the Watch Repairing Trade at home as good or better than at a shop. You can earn money while learning and secure a well paying position or start in business after completing our course of instruction. Good watch repairers are always in demand and earn from $20 to $36 per week. For particulars apply to the
Milwaukee School of Watchmaking, 166 Mason St., Milwaukee, Wis.

www.americanradiohistory.com

Don't Be a Sickly Failure!



STRONGFORT
The Perfect Man

Are you dragging yourself about from day to day, always tired and dispirited; suffering from backache, indigestion, constipation; your billiousness showing in your face, your lack of energy in your eyes, your good-for-nothing physical conditon in the hang-dog air with which you meet your fellowmen? Have you about given up hope—and has your wife given up all hope—that you will ever get a h e a d and amount to anything in the world?

Pull Yourself Together!

Brace up! There's a way out! You can be a man again. You can be full of life and energy and good health, you can trample under foot the sickly troubles that are pulling you down; you can change the watery fluid in your veins to sparkling red blood, that will nourish mind and body, overcome all your ills, and put you at the top of the heap.

No matter what brought you to your present condition; no matter how low you have sunk; you can be RE-BUILT into a MAN, with health and strength and mental and physical vigor and efficiency.

It's Never Too Late

Strongfortism doesn't know the meaning of the words "too late." No matter what your age or condition; no matter how long you have been mired in the slough of despondency or struggling under the handicap of physical irregularities, Strongfortism can make a new man of you. Strongfortism can improve every part of your system; strengthen your heart, lungs, liver, stomach; clear your brain; steady your nerves, rid you of that eternal languid, tired feeling and start you on the path to success.

I Can Re-Create You

I KNOW that I can make you over, can improve you 100 per cent., because I have helped and am helping thousands of other men—some of them pretty far gone, too, before they took up Strongfortism. I have no pills, powders or patent medicine dope to offer you; no drugs of any kind. EXPERIENCE instead; the solid experience of a lifetime with myself and my pupils; the experience and study that have enabled me to dig out and apply to you the secret laws on which human health and happiness and vitality depend.

Send for My Free Book

"Promotion and Conservation of Health, Strength and Mental Energy" tells you all about Strongfortism; tells you how you can overcome your mental and physical ailments; how you can strengthen your vital organs; how to attain symmetry of form and figure. It's forty-eight pages of talk straight from the shoulder, telling how you can get the most pleasure out of life, from a man who knows what he's talking about.

Mark the coupon below, showing what ailments you suffer from and send it with three 2c stamps to cover mailing expenses and I will send you the book free.

LIONEL STRONGFORT

Physicol and Health Specialist

776 PARK BLDG., NEWARK, N. J.

- - - - - - CUT OUT AND MAIL THIS COUPON - - - - - -

Mr. Lionel Strongfort, Newark, N. J.

Dear Strongfort:—Please send me your book, "Promotion and Conservation of Health, Strength and Mental Energy," for postage of which I enclose three 2c stamps to cover mailing expenses. I have marked (X) before the subject in which I am interested (776)

.Colds	..Flat Chest	..Poor Memory
.Catarrh	.Deformity	..Rheumatism
.Asthma	.Insomnia	..Poor Circulation
.Obesity	.Heartweakness	..Youthful Errors
.Headache	.Short Wind	..Impoteney
.Thinness	..Flat Feet	..Vital Losses
.Rupture	.Constipation	.Skin Disorders
.Muscular Development	.Billiousness	.Despondency
..Neuritis	.Torpid Liver	.Round Shoulders
..Neuralgia	.Indigestion	.Lung Troubles
	.Nervousness	.Increased Height

Name .....

Street .....

City ..... State. .....

Age ..... Occupation. .....

Write Plainly

ceivable that the limits of the celestial sphere may be still further extended or modified. At present our tentative diagrams of the universe must be in accord with the extent of our knowledge at this time, just as the maps of the world and of our solar system drawn several centuries ago were representative of the state of man's knowledge in that age.

The theory that the structure of the Milky Way resembles a spiral nebula we have considered in a recent article on the *"Spiral Nebulae."* The laws governing the motion of bodies in a spiral formation are not yet known, but the star streams that exist within and parallel to the galactic plane may be manifestations of the workings of such laws. New methods of attacking the complicated problem of the structure of the universe and the movements of the stellar bodies are constantly being devised and perfected. The advance of astronomy in this direction has been very great in the past few decades, and a rapid increase of our knowledge in this direction is to be expected.

The center of the complete galactic system has been located according to Dr. Shapley's investigations of the globular star clusters in the direction of the richest star clouds of

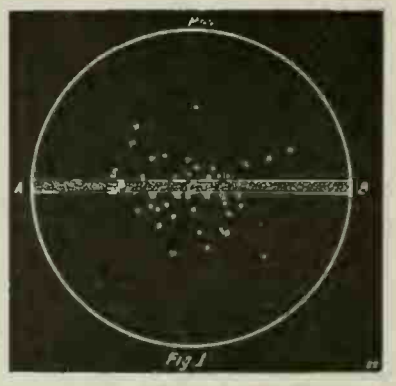


Fig. 1, Above, Shows a Section of the Celestial Sphere made by a Plane Perpendicular to the Plane of the "Milky Way." The Crosses Represent the Positions of Some of the Globular Star Clusters Projected Upon this Plane. The Equatorial Section A-B is 12,000 Light Years in Width and 300,000 Light Years in Diameter. Midway Between its Upper and Lower Limits Lies the Plane of the "Milky Way," the Pole of Which is at P. C Marks the Center of the Entire System, and the Globular Clusters are Distributed Symmetrically with Reference to this Point

Sagittarius, near the boundary of *Scorpio* and *Ophiuchus*. If there is a central nucleus of the Galaxy, it is to be looked for in this general direction which is also the center of the system of globular clusters, which are symmetrically distributed around this position (marked C in Fig. 1) above and below the plane of the Milky Way. In this direction also lies the vertex of one of the two star streams, the majority of the loosely-formed star clusters, the planetary nebulae and the peculiar Wolf-Rayet stars. It is also the region most conspicuously avoided by the spiral nebulae.

Our own solar system is situated well within the equatorial segment of the universe. It is to be found about half way from the center to the edge of the Galaxy (see S in Fig. 1) and is fully *sixty thousand light years* distant from the center of the complete system situated in Sagittarius, and only thirty light years above the central plane of the segment. It is simply one of the stars of the Milky Way, one of the numberless units of the universe. The nature of its journeyings to and fro within the limits of the equatorial region, granted that its travels are thus limited, will not be known until more is discovered regarding the details of the structure of the Milky Way and the laws that control the motions of its various members. Why the great majority of all the stars, as well as the



EARLE E. LIEDERMAN
Why not look as healthy and be as strong as I am?

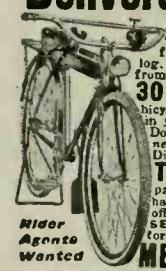
DO YOU WANT A
Wonderful Muscular Development,
with perfect health, abundance of vitality and great strength?

You can get all the above, if you want them, and I can show you how. The results of my system are shown on my own person, and that is recommendation enough.

I have prepared a booklet, illustrated with photographs of myself, which will tell you how you can obtain a development the same as I did. The name of it is "Muscular Development" GET IT—It will interest and benefit you. A copy of this instructive and illustrated booklet will be sent you upon receipt of 10c—stamps or coin.

EARLE LIEDERMAN, Dept. 205, 203 Broadway, New York City

Delivered TO You FREE



Your choice of 44 styles, colors and sizes in the famous line of "RANGER" bicycles, shown in full color in the big new Free Catalog. We pay all the freight charges from Chicago to your town.

30 Days Free Trial allowed on the bicycle you select, actual riding test in your own town for a full month. Do not buy until you get our *great new trial offer* and low Factory-Direct-To-Rider terms and prices.

TIRES LAMPS, HORNS, pedals, single wheels and repair parts for all makes of bicycles at half usual prices. No one else can offer such values and such terms.

SEND NO MONEY but write today for the big new Catalog. It's free.

Rider Agents Wanted

MEAD CYCLE COMPANY Dept. C107 Chicago

ZIP-ZIP

Patented Sept. 3rd, 1918



The Greatest 50 Ct. Article on the Market. Shipped right from the factory the same day we receive your order. The Prong is made of beautiful metal; never break or wear out; scientifically made and best workmanship. The rubbers are elastic and lasting, with plenty of pep and force. Zip-Zip complete, only 50c prepaid. Be sure the name Zip-Zip and our address appear on the article you buy. Order from us or any Sporting Goods Store in your city. Send Stamps, Coin or Money Order.



AUTOMATIC RUBBER CO., COLUMBIA, S. C.

Learn Mechanical Drawing
Earn $35 to $100 a week



Thousands of Draftsmen needed for reconstruction work. We teach you quickly and thoroughly at home, in spare time—furnish complete Drawing Outfit FREE—and help you secure position when qualified. No previous training necessary. You can quickly qualify for big position. Write for Free Book.

COLUMBIA SCHOOL OF DRAFTING,
Dept. 972, 14th and T Sts., Washington, D. C.

Be an Accountant— Step Into the Job Higher Up Through Accountancy

Our Free Book, "Stories of Success" shows how the I. A. S. intensive home-study course prepared many for the bigger job and how they got it. Low tuition; easy terms; quick results; simple, efficient method.

International Accountants Society
624 So. Michigan Ave. Dept 39-E Chicago Ill

MATHEMATICS MADE EASY



The Arcascope—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also Includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 85 cents Postpaid. Order today before you forget.

Dept. 8, L. J. LEISHMAN CO., Ogden, Utah

You Can Secure a Motor-Cycle at Little Cost



by mounting a STEFFEY motor on your bicycle.

They are best made, most reliable and best hill climbers. We sell you the complete attachment at a low manufacturer's price, or we can supply the finished parts from which you can assemble the motor yourself. Instructions and full size blueprint of drawings, 25c.

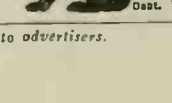
STEFFEY MFG. CO., 5025 W. Brown St., Phila., Pa.

TYPEWRITERS



ALL MAKES. SAVE $25 TO $50 on rebuilt by the well-known "Young Process." Sold for low cash-installment or rented. Rental applies on purchase price. Write for full details and guarantee. Free trial.
Young Typewriter Co., Dept. 660, Chicago.

RAISE BELGIAN HARES For U.S



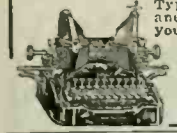
HUGE PROFITS easily and pleasantly made. We furnish stock and pay you $6.00 a pair and expert advice for all you raise. Contract and book "Fortunes in Fierce," 10c. Nothing free.
NATIONAL FOOD & FUR ASSOCIATION
Dept. MILWAUKEE, WISC

www.americanradiohistory.com

FREE TRIAL

We ship the famous Oliver Typewriter — brand new — direct from the factory to you for free trial.

If you want to own it, pay us at the rate of $3 per month. Or return it. You are your own salesman and save $43 this new way. Before our direct-to-you plan, the Oliver price was $100, now it is $57. All the saving comes from our economical distribution. Write for details of plan and our new book, "The High Cost of Typewriters—The Reason and the Remedy." Then you may have an Oliver for 5 days free trial. Write today for details.



The Oliver Typewriter Co.
672 Oliver Typewriter Bldg.
Chicago, Ill. (31.07)

STUDENTS **ART MAGAZINE**



Publishes cash art assignments, lessons and articles on Cartooning, Designing, Illustrating, Lettering, and Chalk Talking. Criticises amateurs' work. Full of interesting and helpful information for artists and art students. Satisfactory or money refunded. 10 cents a copy, $1 a year.



Send $1 NOW, stamps or bill.

STUDENTS ART MAGAZINE, Dept. 416, Kalamazoo, Mich

BE AN **ARTIST**

Earn $25 to $100 per week. Cartooning, Illustrating, Designing successfully taught by mail through new instruction method. Entire outfit free to new students. Write today for beautiful new book, "HOW TO BECOME AN ARTIST" and special free offer.

WASHINGTON SCHOOL OF ART, Inc.
1395 H St., N.W. Washington, D. C.

Combination A. C. and D. C.

Eight Inch DESK FAN

detachable plug and 8 ft. of cord. Will operate on A.C. or D.C. current, 100 to 125 volts, 30 to 60 cycles; weight 10 lbs.; black enamel finish; height 11½ in. A real fan—not a toy. Price $6.50. Agents wanted.



THE TEWNO CO.
150 Chambers St., New York

DENINGER WILL SAVE YOU $40

BIG MONEY SAVINGS FOR YOU

Used and rebuilt motorcycles, single and twins, $25 to $100. Used bicycles, $5.00; tandems, $10. All machines guaranteed in good working order. New bicycles and motorcycles at Factory prices. You save dealers' profits. Motorcycle and automobile tires too, $3.00. Complete line of parts and supplies.



Send for catalog

Deninger Cycle Co., Rochester, N.Y.

YOU 25 TO 50 DOLLARS

SAVE 25% to 60%

on slightly used

GRAFLEX-KODAKS



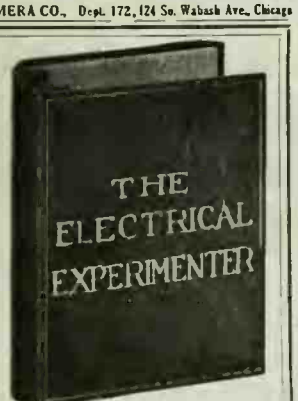
Cameras and Lenses of every description. Equal to new. Save money. Write now for **Free Bargain Book and Catalog**

listing hundreds of money-saving bargains in slightly used and new cameras and supplies. All goods sold on 10 days' Free Trial. Money back if not satisfied. You take no chances dealing with us. We have been in the photographic business over 16 years. Write NOW

CENTRAL CAMERA CO., Dept. 172, 124 So. Wabash Ave., Chicago

Handy Binder

for the Electrical Experimenter



Holds and Preserves 12 issues, each of which can be inserted or removed at will, without tools. Will keep your magazines perfectly for all time or just Preserve them like new till you bind them permanently. Made of heavy material, extra strongly reinforced at the back and covered with handsome green cloth, suitably lettered in gold.

65c

Add postage for 2 lbs.

Experimenter Pub. Co., Inc. Book Department 233 Fulton St., N. Y.

gaseous nebulae, remain closely confined to these equatorial regions, leaving to the immensity of undefined space beyond, vast and complicated systems such as the Magellanic Clouds the globular clusters and the spiral nebulae, is a problem still unsolved as is also the cause of the tremendous velocity, averaging a thousand miles per second, that is characteristic of all objects beyond the immediate vicinity of the Milky Way.

Whatever may prove to be the form and structure of the Milky Way, it is, according to all that has so far been discovered, of fundamental importance in the plan of the universe and exerts an influence over vast and massive systems situated far exterior to it.

(The next installment will appear in an early issue.)

A USEFUL ELECTRICAL LABORATORY SWITCH-BOARD.

(Continued from page 715)

are fifteen contacts and they should be spaced about ⅛" apart. The construction is shown in Fig. 8. The rods in both the transformer slide and the rheostat are mounted on a hardwood or fiber block, the dimensions of which are shown in figure 9. The rod is fastened to the block by means of screws or by a long pin thru the entire rod and block. The handle is fastened by bending a piece of brass as illustrated in the side-view. The contacts are six in number and are ⅛" thick 1" long and ¾" wide. Fasten to the marble with No. 8—32 flat-head machine screws countersunk into the contacts. Make them extend far enough behind the board to serve as connections. Therefore the heads must fit snugly because they will have to carry 60 amperes of current.

Next we will take up the construction of the transformer. The dimensions are given in Fig. 6. The core is built of No. 28 sheet iron or stove pipe iron will do. The pieces are cut 5" x 1¼" and 2¾" x 1¼". Use enough to build a core 1¼" thick when compress. The primary for 110 volts consists of 580 turns, 290 turns on each leg, of No. 18 D.C.C. magnet wire

The secondary consists of 180 turns of No. 14 or better No. 12 D.C.C. Taps are brought out for 1 volt at the fifth turn and at every additional five turns until the tap for 10 volts is brought out. Then bring out taps at the 60th turn, the 90th, 120th, 150th, and 180th turns. These are connected to the transformer contacts and the beginning of the coil is connected to one side of the plug receptacle. The other side of the plug receptacle is connected to the brass rod. But the transformer must be mounted first. Figure 7 shows how this is done.

The rheostat is made by winding No. 18 iron wire on 6 wooden cylinders three inches in diameter and 12 inches long. Wind 29 ft. of wire on each. Use nails or screws to start and end the winding. Connect in series and immerse in water. Tap the iron wire connections between each coil by using a heavy copper wire and be sure to let the copper wire make connection below the water. If the water gets too low the wire will almost instantly melt if it is carrying full load of 50 or 60 amperes. The connections are much the same as those of a starting box. Connect one side of line to rod and the other side to the 50 ampere stage plug. Then connect other terminal of stage plug to last lead of rheostat and connect the first terminal or beginning of first coil to contact No. 1, beginning of second coil to second contact, etc.

The main-line wires must be No. 1. This wire is expensive, therefore the switchboard must or rather should be near the entrance cut-out.

A 100 ampere current at 110 volts is 11 K.W., and this means the transformer supplying your house must be of that capacity.

DRAWING
Big Pay—Easy Pleasant Work

Draftsman earn $150.00 to $300.00 a month. The work is pleasant and the hours are short.

You can get this big pay too. All you need is the new 1919 edition of the Cyclopedia of Drawing and a little of your spare time. The cost is only 7 cents a day, and we give a year's consulting service free. See the FREE examination offer below.

Cyclopedia of DRAWING

4 big volumes each 6½x8¾ in., bound in genuine American Morocco and trimmed in gold 1678 pages and more than 1000 illustrations plates, diagrams and blue prints.

The only books that thoroughly cover Mechanical, Structural and Architectural Drafting in a non-technical way. You don't have to know anything about the subject to understand them. They begin at the beginning and tell you everything about Blue print Reading—Mechanical Drawing—Machine Design—Machine Drawing—Structural Drafting—Architectural Drawing and Lettering—Shades and Shadows—Perspective Drawing—Freehand Drawing—Pen and Ink Rendering—Typographical Drafting—Drawing Instruments and Their Uses and hundreds of other things connected with the work.

Use One WEEK FREE!

You can have these books for a whole week free without sending one cent. Just send the coupon below and all 4 volumes will come to you at once by express collect. Use them as if they were your own—go through them thoroughly and send them back at our expense if you don't want to keep them. If you do keep the books send us only $2.00. You can send the balance of our special introductory price—only $14.80 the same way—$2.00 each month.

Remember you don't take any chances. The risk is all ours and the benefits will all be yours—Send the coupon today

American Technical Society
Dept. O 3362 CHICAGO, U. S. A.



American Technical Society
Dept. O 3362
CHICAGO, U. S. A.

Please send me the 4-volume Cyclopedia of Drawing for 7 days' Free Examination, shipping charges collect. I will send you $2.00 in 7 days and $2.00 each month until the special price of $14.80 is paid, and you will send me a receipt showing the books are mine. If I decide not to buy I will return the books in 7 days

Name.....

Address.....

References.....

Don't Wear a Truss



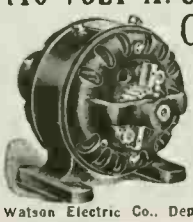
BROOKS' APPLIANCE, the modern scientific invention, the wonderful new discovery that relieves rupture will be sent on trial. No obnoxious springs or pads. Has automatic Air Cushions. Binds and draws the broken parts together as you would a broken limb. No salves. No lies. Durable, cheap.

Sent on trial to prove it. Protected by U. S. Patents.

Catalogue and measure blanks mailed free. Send name and address today.

C. E. BROOKS, 203B State Street, Marshall, Mich.

110 VOLT A. C. GENERATORS ONLY $5.00!



Holtzer-Cabot hand generators, while stock lasts, $5.00. Order today.

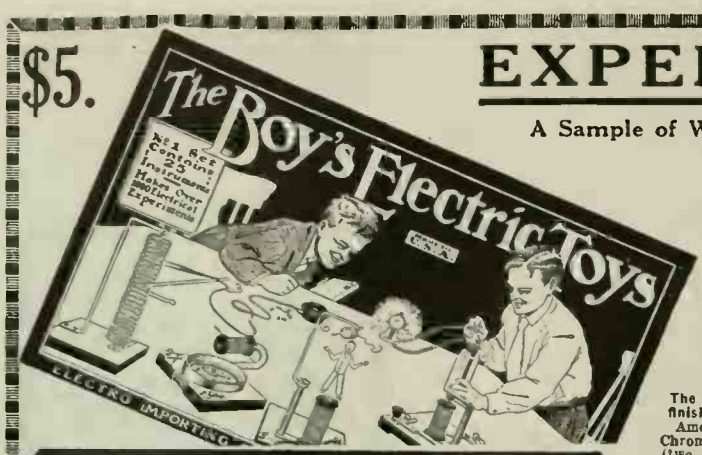
Battery chargers, 6 v. 6 amp. $10.00; 7 v. 11 amp. (like cut) $27.00; Hydro-Electric Generator complete, giving up to 25 v. 3½ amp. D.C. $25.00. Immediate shipment while stock lasts. Order from this ad.

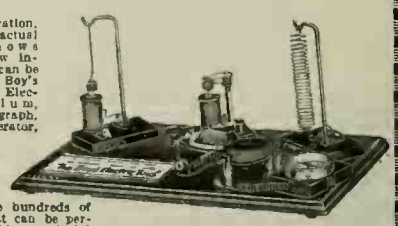
Watson Electric Co., Dept. 12, Gas Bldg., Chicago

www.americanradiohistory.com

$5. EXPERIMENTERS!

A Sample of What You Can Do With This Outfit





This illustration, made from an actual photograph, shows only a very few instruments that can be made with the Boy's Electric Toys: Electric Pendulum, Electric Telegraph, Current Generator, Electric Dancing Spiral, Galvanometer, Space does not permit us to show the hundreds of experiments that can be performed with this wonderful outfit.

The outfit contains 114 separate pieces of material and 24 pieces of finished articles ready to use at once.

Among the finished material the following parts are included: Chromic salts for battery, lamp socket, bottle of mercury, core wire (two different lengths), a bottle of iron filings, three spools of wire, carbons, a quantity of machine screws, flexible cord, two wood bases, glass plate, paraffine paper, binding posts, screw-driver, etc., etc. The instruction book is so clear that anyone can make the apparatus without trouble, and besides a section of the instruction book is taken up with the fundamentals of electricity to acquaint the layman with all important facts in electricity in a simple manner.

We guarantee satisfaction.

The size over all of the outfit is 14x9x2¾. Shipping weight, 8 lbs. **No. EX2002 "The Boy's Electric Toys," outfit as described. $5.00**

IMMEDIATE SHIPMENTS



No. EX2002

THE BOY'S ELECTRIC TOYS" contains enough material TO MAKE AND COMPLETE OVER TWENTY-FIVE DIFFERENT ELECTRICAL APPARATUS without any other tools, except a screw-driver furnished with the outfit. The box contains the following complete instruments and apparatus which are already assembled:

Student's chromic plunge battery, compass-galvanometer, solenoid, telephone receiver, electric lamp. Enough various parts, wire, etc., are furnished to make the following apparatus:

Electromagnet, electric cannon, magnetic pictures, dancing spiral, electric hammer, galvanometer, voltmeter, hook for telephone receiver, condenser, sensitive microphone, short distance wireless telephone, test storage battery, shocking coil, complete telegraph set, electric riveting machine, electric buzzer, dancing fishes, singing telephone, mysterious dancing man, electric jumping jack, magnetic geometric figures, rheostat, erratic pendulum, electric butterfly, thermo electric motor, visual telegraph, etc., etc.

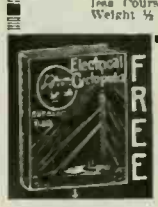
This does not by any means exhaust the list, but a great many more apparatus can be built actually and effectually.

With the instruction book which we furnish, one hundred experiments that can be made with this outfit are listed, nearly all of these being illustrated with superb illustrations. No other materials, goods or supplies are necessary to perform any of the one hundred experiments or to make any of the 25 apparatus. Everything can be constructed and accomplished by means of this outfit, two hands, and a screw-driver.

(Continued in next column)

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 19 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 228 Big Pages, 600 illustrations, 500 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy," 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 19 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.



ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

I enclose herewith 6 cents in stamps or coin for which please send me your latest Cyclopedia Catalog No. 20 as described.

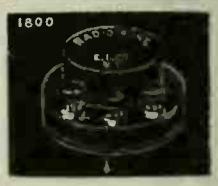
NAME .....

ADDRESS .....

STATE .....E.E. 2-19

The "Electro" Radiotone

HIGH FREQUENCY SILENT TEST BUZZER



This instrument gives a wonderful high pitched MUSICAL NOTE in the receivers. Impossible to obtain with the ordinary test buzzer. The RADIOTONE is built along entirely new lines; it is NOT an ordinary buzzer, reconstructed in some manner. The RADIOTONE has a single fine steel reed vibrating at a remarkably high speed, adjusted to its most efficient frequency at the factory. Hard silver contacts are used to make the instrument last practically forever.

Yes, the RADIOTONE is SILENT. In fact, it is so silent that you must place your ear on top of it to hear its beautiful musical note.

You will be astounded at the wonderfully clear, 500 cycle note, sounding sharply in your receivers. To learn the codes, there is absolutely nothing like it. With the radiotone, a key and one dry cell and ANY telephone, a fine learner's set is had. Two or more such sets in series will afford no end of pleasure for intercommunication work. **Shipping Weight 1 lb.**

Radiotone as described.....each **$.90**

IMMEDIATE SHIPMENTS

The "Electro" Telegraph



is not a toy, but a practical, honestly built telegraph outfit, which not only sounds but works like the big commercial instruments. By studying the code for 30 days you can become a first-class telegraph operator. Such operators are in big demand now. Outfit consists of TWO complete telegraph instruments each measuring 3½ x 2½ x 2¼. All metal parts are highly nickel plated, including key lever. Note hard rubber knob. Telegraph Code Chart, telegraph blanks and connecting wire comes with set, but no batteries. Outfit works on 2 dry cells (one cell for each instrument). The "Electro" is the ONLY Outfit that works both ways, each station can call; no switches, no extras. Nothing to get out of order. Guaranteed to please you or money back. **Price Complete as Illustrated (TWO INSTRUMENTS)..... $1.25**

Shipping Weight, 2 lbs.

IMMEDIATE SHIPMENTS

The "Electro" Codophone (*Patents Pending*)

What this remarkable instrument is and does.

$1.50



The "Electro" Codophone is positively the only instrument that will imitate a 500 cycle note exactly as heard in a Wireless receiver. The loud-talking receiver equipped with a horn, talks so loud that you can hear the sound all over the room, even if there is a lot of other noise.

THAT'S NOT ALL. By loosening or tightening the receiver cap, a tone from the lowest, softest quality, up to the loudest and highest screaming sound can be had in a few seconds.

FOR INTERCOMMUNICATION. Using two dry cells for each instrument, two Codophones when connected with one wire and return ground, can be used for intercommunication between two houses one-half mile apart.

One outfit alone replaces the old-fashioned learner's telegraph set, consisting of key and sounder.

The "Electro" Codophone is a handsome, well made instrument, fool proof, and built for hard work. Contacts are of hard silver ⅛ inch in diameter, that will outlast the instrument.

There is also a neat code chart and full directions enabling any intelligent young man or girl to learn the codes within 30 days, practising one-half hour a day.

Sizes: 6¾ x 3 x 2¾". Shipping weight, 2 lbs.

The "Electro" Codophone as described, complete..... **$1.50**

ELECTRO IMPORTING CO., 231 Fulton Street NEW YORK!

www.americanradiohistory.com

MT. WILSON'S HUNDRED-INCH TELESCOPE.

(*Continued from page 703*)

detailed description of the process of figuring the mirror. Roughly speaking it may be divided into two stages. In the first stage the mirror was brought to a spherical figure; in the second this spherical form was charged to paraboloid. The second process tho requiring much less time than the first involved very great care and frequent optical tests to avoid the introduction of zonal errors. The largest deviation of the paraboloid from the sphere in the case of this mirror is only one-thousandth of an inch. All of the optical work, with the exception of the first rough shaping, was carried on with wooden tools of various sizes and forms, and the use of rouge and distilled water as the polishing material.

After the completion of the mirror a series of photographic tests was made to determine the accuracy of its figure. These showed a remarkably high degree of perfection, every portion of the surface having the same focal length to within one part in about 90,000.

A few figures may be of interest in this connection. The finished mirror weighs *4½ tons*, about one ton of glass having been removed in the process of shaping and figuring. Its diameter is closely 101 inches, and its thickness at the edge 13 inches. The depth of the curve at the center is about 1¼ inches. The focal length of the mirror is five times its aperture, or 42 feet. A direct photograph of the moon at this focus, accordingly, would have a diameter of 4.4 inches. As in most modern reflecting telescopes the 100-inch reflector will be provided with two small convex mirrors to be attached to the upper end of the tube, either of which may be utilized to increase the focal length in much the same way as telephoto lenses are used in ordinary photography. With these mirrors focal lengths of 134 and 251 feet may be obtained and the magnification correspondingly increased.

As soon as the optical work upon the mirror disk was fully under way the design of the telescope mounting was begun. In view of the great size and the immense weights involved the "closed fork" type was finally adopted. In this form of mounting the telescope tube is hung in the center of a rectangular frame of massive steel girders, the bearings providing for north and south movements of the tube being built into the two side members. The entire rectangle is mounted on bearings at top and bottom, which furnish the east and west motion of the telescope. To relive friction the system of *mercury flotation* used most successfully for the 60-inch reflector is employed, there being two large steel floats and corresponding mercury tanks, one at either end of the rectangular axis. These floats carry about 98 per cent of the moving parts of the telescope, or some 90 tons, the remaining two per cent being carried by two large spherical defining bearings. The instrument is controlled by electric motors, which provide for three rates of speed in both north and south and east and west directions.

The driving clock which moves the telescope at a uniform rate corresponding to the rotation of the earth is placed within the concrete pier which supports the instrument and near the south end. The driving shaft extends from the clock and meshes with a worm wheel 17 feet in diameter, which is attached to the telescope axis.

The building and dome which enclose the telescope form a steel structure 100 feet high and 95 feet in diameter. The walls and roof are double thruout to admit of the free circulation of air, and thus help to equalize the temperature within the building. The shutter is of the double section type, divided in the center, and when fully open provides an aperture 20 feet wide. Like the observing platform, the crane hoist and the dome mechanism, it is operated by electric motors. The dome is mounted on 24 four-wheeled trucks running on specially ground rails, and power is applied by two driving trucks at opposite sides. When rotated the motion of the dome has been found to be remarkably smooth and free from vibration in spite of the great weight involved, which is approximately 600 tons.



Wanted—Railway Mail Clerks

$1100 to $2000 Year

Common Education Sufficient

Sure Pay, Life Job. Pull Unnecessary.

Age 16 to 40

FRANKLIN INSTITUTE
Dept. B101, Rochester, N. Y.

COUPON

Sirs: Send me, without charge, (1) sample Railway Mail Clerk Examination questions; (2) schedule showing places of all U. S. Government coming examinations; (3) list of other government jobs now open, and (4) free book describing them.

NAME .....

ADDRESS .....

STORAGE Marko BATTERY

THE MARK OF QUALITY

STORAGE BATTERIES FOR ALL PURPOSES

Better Batteries for Less Money

Backed by An Exceptional Guarantee

MARKO STORAGE BATTERIES

Capacity Quality Price

A SPECIAL MARKO STORAGE BATTERY FOR EACH MAKE OF AUTOMOBILE

PAUL M. MARKO & CO., Inc., 1402-1412 Atlantic Ave., Brooklyn, N.Y. N. Y. Depot—974 8th Ave., N. Y. City

YOU HAVE A BEAUTIFUL FACE

BUT YOUR NOSE?



BEFORE AFTER

IN THIS DAY AND AGE attention to your appearance is an absolute necessity if you expect to make the most out of life. Not only should you wish to appear as attractive as possible, for your own self-satisfaction, which is alone well worth your efforts, but you will find the world in general judging you greatly, if not wholly, by your "looks," therefore it pays to "look your best" at all times.

Permit no one to see you looking otherwise; it will injure your welfare! Upon the impression you constantly make rests the failure or success of your life. Which is to be your ultimate destiny? My new *Nose-Shaper*, "TRADOS" (Model 24) corrects now ill-shaped noses without operation, quickly, safely and permanently. Is pleasant and does not interfere with one's daily occupation, being worn at night.

Write today for free booklet, which tells you how to correct ill-shaped noses without cost if not satisfactory

M. TRILETY, Face Specialist **1038 Ackerman Bldg., Binghamton, N. Y.**

Send NO Money!

Just send coupon below and we will forward your shoes at once! They are the greatest shoe values ever offered. We are glad to send them NO MONEY IN ADVANCE because they are built so full of wear and are so comfortable and so good looking that we know when you once see them you will want to keep these wonderful shoes. Send no money—mail the coupon only and shoes will come at once.

NATIONAL WORK SHOE

Direct to You from the Shoe Market of the World

That is why the price is only $3.65. Why pay $5 or $6? Slip these shoes on in your own home. Note the splendid selected leather! Feel how soft and easy they are on your feet! Examine the "Indestructo" heavy leather sole. Customers write: "These shoes look good after 6 months of hard wear." If they aren't the best work shoe you ever saw, send them back and we'll return your money. You are the judge of the Style, Comfort and Quality. Use coupon TODAY and get your pair of these wonderful shoes while this special offer holds good.



$3.65 Black or Tan All Sizes SEND NO MONEY

SEND

Only this coupon, no money. It brings these splendid shoes to you prepaid.

BOSTON MAIL ORDER HOUSE, Boston, Mass.

NATIONAL DRESS SHOE

Smart and stylish. Genuine oak leather soles. Broad low heels. Extra quality uppers. These good-looking, dressy shoes are built for five toes and comfort. Our price only $3.85. Compare them with the best $7.00 shoe you ever saw. You must see them to appreciate their wonderful Style, Quality, Workmanship. You must try them on to enjoy their absolute Comfort. That is why we send them to you—no money in advance. Sent on approval. The shoes must convince YOU. Act NOW! Send coupon at once.



BLACK DRESS SHOES, $3.85 Send NO Money

Boston Mail Order House, Dept. S1S
Essex P. O. Building, Boston, Mass.

Send postpaid shoes marked below. I will pay for them on arrival. If they are not the best value in America, you will return my money. I risk nothing.

☐ Work Shoe, $3.65 ☐ Dress Shoe, $3.85

Size..... Color..... Size.....

Name .....

Address .....

www.americanradiohistory.com

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section seven cents a word for each insertion. No advertisement for less than 50c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. Ten per cent discount for 6 issues 20 per cent discount for 12 issues from above rate. Objectionable or misleading advertisements not accepted. Advertisements for the March issue must reach us not later than January 22.

The Circulation of the Experimenter is over 100,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Automobile Accessories

More Power, Less Fuel, No Carbon. No mystery, plain facts, results guaranteed. Write for booklet. S. O. Automobile Accessories Co., Baltimore, Md.

Fords Start Easy in Cold Weather with our new 1919 carburetors. 34 miles per gallon. Use cheapest gasoline or half kerosene. Increased power. Styles for any motor. Very slow on high. Attach it yourself. Big profits to agents. Money back guarantee. Thirty days' trial. Air-Friction Carburetor Co., 270 Madison, Dayton, Ohio.

Vulcanize on Anderson Steam Vulcanizer. See Advertisement, Page 736.

Motors, Engines and Dynamos

Small Motors and Generators: 1000 New Motors and Generators from Bankruptcy Stock, ¼ H. P. A. C., $18.50 each; ½ H. P., $30.00. **Battery Charging Sets**—Robbins & Myers new outfits, all sizes, $30.00 each and up. Charging, Lighting and Moving Picture Arc Generators, $10.00 each and up. Motors for all phases of current. Immediate delivery. Less than ½ regular prices. Write for late bulletin. Johnston, West End, Pittsburgh, Penna.

Small Gasoline Engines, ¾ H. P. $29.00. Drives Dynamo, Washing Machines, Air Brush, etc. Honest Abe, 528 S. Taylor Ave., Oak Park, Ill.

Motorcycles

Motorcycles from $25 up—New and second-hand. Easy terms, large list to choose from, all makes. Send 4c stamps for Bulletin "A." Peerless Motorcycle Co., Watertown, Mass.

Motorcycles, all makes, $25 up. New Bicycles at big reduction. Second-hand, $8.00 up. Motors, Motor attachments, Cycle Motors, Smith Motor Wheels, etc., $20 up. New parts to fit all makes carried in stock. Second-hand parts good as new, 50% discount. Expert repairing on magnetos, generators, transmissions. Motors overhauled $10.00 up. Henderson Motors our specialty. Write for Big Bargain Bulletin. American Motor Cycle Company, Dept. 17, Chicago.

Help Wanted

Men Wanted to make Toy Soldiers, Army, Navy, and other toys. Homeworkers on small scale, manufacturers on large scale. Greatest chance for industrious people for independent business. Enormous demand and future in "American-made toys". This new American work stands out conspicuously. Factories have been established, people trained, machinery made with energy and success. Dealers don't want to handle any others except "American-made". We buy these goods all year, paying fixed prices. Experience or tools not necessary. Hundred and more made complete per hour. Casting form outfits $3 up. Booklet and information free. Toy Soldier Manufacturing Co., 32 Union Square, New York.

To Ascertain the Vocation for which you are best adapted send for Zancig's Revised Horoscope. Send date of your birth and 25c. Prof. Zancig, 109 West 87th St., New York.

Business Worth While. I Start You silvering mirrors, Plating tableware; Plans Free. Clarence Sprinkle, Dept. 48, Marion, Indiana.

Thousands Government Peace Jobs open to men—women girls. $900 to $1500 year. Short hours. Paid vacations. Common education sufficient. List positions free. Write immediately. Franklin Institute, Dept. B26, Rochester, N. Y.

Song Poems Wanted

Write the Words for a Song. We write music and guarantee publisher's acceptance. Submit poems on war, love, or any subject. Chester Music Co., 538 S. Dearborn St., Suite 265, Chicago.

Telegraphy

Telegraphy, Wire and Wireless, and Railway Accounting taught thoroughly. UNPRECEDENTED DEMAND for both sexes. BIG SALARIES. Oldest and Largest School—est. 45 years. Catalog free. Dodges Institute, Seventh St., Valparaiso, Ind.

Agents Wanted

Insyde tyres, inner armor for automobile tires, double mileage and prevent punctures and blowouts. Quickly applied. Costs little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, O.

Hel-Met The Kaiser Pin—Latest war novelty. Biggest hit out, every patriotic citizen wants one. Sample 10c. Wedge Mfg. Co., "KM," Binghamton, N. Y.

$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Ave. D, Decatur, Ill.

Charlotte, N. C.
Oct. 4, 1918.

Electrical Experimenter Pub. Co.,
233 Fulton St., New York.

Dear Sirs:

It certainly was SOME RESULTS.
I've almost worn out a good typewriter.
Just about exhausted myself writing.
Used all the paper in this part of America.
And about "Gone Busted" buying postage stamps.

Now, I'm a-goina quit, and will never do it again, or at least I won't promise to answer all the letters I received from an Ad that I put in the "E. E."

The letters are still coming in.—The apparatus advertised has long since been sold. Every piece of it, The letters are from all over the United States, AND ELSEWHERE. Received one today from Shangbai, China. Can you beat that. I'm enclosing the letter from China.

It's a great life, if you don't weaken.

I wish to THANK the "E. E."—Some circulation.

Very Respectfully,
G. R. SMATHERS,
403 N. Brevard St., Charlotte, N. C.

Exchange Ads

Sell Cheap. Tram, Radioptican, lot of small stuff. 242 Grove St., Melrose, Mass.

Trade ($8.00) Rexo Junior Camera for V. P. Kodak. Must be in good condition. Morton Wienert, 404 Bay St., Taunton, Mass.

Sixty Inch High Frequency Lecture Set. Cost $200, fine. Price reasonable. J. W. Manghmer, Newman, Ill.

For Sale. Good Holtzer-Cabot late model multiple glass plate Static machine, no motor. See cut Experimenter, September, 1915, issue. Eighteen month use. First money order for $65.00 gets it. Ready for shipment with accessories. Everett Leo Deeter, Norcatur, Kansas.

Trade. Business College Course. $20 paid for Wireless Instruments. Particulars. Leroy Hobbs, Albion, Nebr.

Wireless Instruments for Exchange. 5000 miles receiving cabinet for clamped and undamped wave reception, audion cabinet, commercial type perikon detector, 80 ampere Thomson ammeter, 2000 ohm radio phones, powerful Tesler Coil, 50 watt generator. Want Weston D.C. ammeter, volt meter, A.C. volt meter, wattmeter and milli range meters. What have you in this line. All correspondence answered. Samuel D. Cohen, 281 Wyona St., Brooklyn, N. Y.

For Sale. ½ K.W. Transformer $8.00. Secondary 7000 volts, also **large variety of switches.** P. Crawford, 1310 Broeck St., Albany, N. Y.

For Sale. ½ price, 2000 ohm phones, $4.50; volt and ampere meter 175 A 90V. D.C., $15.00; ½ coil, $1.25; shocker, 75c; buzzer horn, $2.50; size 10½ hockeys, $2.00; the following new, never used 20,000 meter couplers, $15.00; rotary gaps, $10.00 to $15.00; lightning switches 100 A. 600 V. marble base, $3.00; 500 mile receiving set, $15.00. Harold Hammer, 3225 23 Ave., So. Minneapolis, Minn.

For Sale. Pope motorcycle engine, excellent condition; Bosh magneto, Schebler carbureter. Fine for small shop if fitted to base. Price, $25.00. O. N. Webb, 1923 Hayes St., Nashville, Tenn.

Exchange Ads—Cont'd

Thirty Dollars takes Radio cabinet Transformer, Condensers. Phone and large Omnigraph. Savage, 820 Beverly Rd., Brooklyn, N. Y.

Have .22 Marlin pump-action rifle; chemicals. Want closed-core transformer, Murdock moulded condensers, 110 A.C. meters. **Pray,** 102 Heath, Somerville, Mass.

Sell. Good Smith Premier typewriter $25.00. Wilkes Dearing, Covington, Tenn., Route 2.

Swap. New Auto Knitter Hosiery Machine and accessories for mortorcycle or anything you have, all answered. David Zilman, 10 Lisbon St., Malden, Mass.

For Sale. Sigwalt Printing Press No. 10, two borders, two sets of type, complete, $15. John Abderholder, 1115 Summit Ave., Jersey City, N. J.

Bargains. Flatbacked mandolin, nearly new, excellent tone, $5.25; giant sounder, $1.00; Erector motor, $1.50; Enos Johnston, 9 Rutherford St., Binghamton, N. Y.

Sell. 2000 ohm phones, headband, 8 ft. cord, $4.50. Never used. ¼ in. spark coil, 75c. Postage extra. N. E. Ristey, 707 8th Ave., S. E., Minneapolis, Minn.

For Sale. One I. C. S. Electrical Reference Library. Best offer takes same. J. H. Rappold, Newport News, Va.

Sell. 3 H. P. single, motorcycle engine, $5. Fan induction motor 110 V., $4; and others. Most anything electrical or wireless very cheap. Write me. Nowell Rang, 77 S. Spencer, Aurora, Illinois.

For Sale. Omnigraph Spring motor hardly used, 4 dials. E. N. Davis, Antrim, N. H.

Here They Are. Baloptican. High grade Bausch & Lomb Model C instrument, with attachment for opaque objects, and carrying case; good efficient Hoover Suction Sweeper; fine large Lionel Electric Train outfit; E. I. Co. Telsa Transformer; game board for 56 games, with revolving table; Baldwin Camp Lamp; 6 in. Red-Devil Water Motor. All the above in best condition, at money-saving prices. First come, first served. Be first. State very exactly what you have in Wireless goods. Vernon Chaberd, 362 Custer Ave., Youngstown, Ohio.

For Sale—½ H.P. Gasoline Engine, $20.00; Generator, 110 volts, deliver 100 watts, $10.00. B. Hoinacki, 1428 W. Superior St., Chicago, Ill.

Radio Operators: Troubles and probable causes. Source of power to antenna, each subject covered fully. Pamphlet tells you how to locate trouble. Advice from ten years' experience for 25 cents. Order while they last. E. Jones, 818 Roosevelt, New Orleans, La.

$65.00 Course in Aviation complete with blue prints, $12.00. Robert White, Madison, So. Dak.

For Sale—Motorcycles, Printing Outfits, Engines, Typewriters, etc. Sold on monthly payments. We buy. Catalogues, 10 Stamps. Sunshine Exchange Agency, Dept. EE1, Port Huron, Michigan.

Must Sell—Wireless and Electrical apparatus. Send stamps for list. Marcel Scharer, 110 West 80th St., New York City.

For Sale Electrical apparatus. Send stamp for list. M. Grainger, Kinston, N. C.

Wanted—Small lathe, screw cutting. Will pay cash. Will sell small "Goodell" lathe. Andrew Ellison, Kirksville, Mo.

Wanted—Wireless apparatus. Swap $7.50 Erector, Chemistry hooks. Write. Milton Plegge, 4464 Natural Bridge, St. Louis, Mo.

For Sale—Cyclopedia of Applied Electricity used three months. Will sell for $16. William Wolfram, 31 Norris St., Lawrence, Mass.

Will Exchange—$45 course in Aeronautics with blueprints, for Electrical or Chemical Books, or Microscope. Chas. Jeffries, Lake Charles, La.

Scenery for Hire

Collapsible Scenery for all Plays. Amelia Grain, Philadelphia, Pennsylvania.

www.americanradiohistory.com

Books

Free—$5,000 worth of valuable books as premiums. Write for more information and catalogue; it's free. I have many books on Natural healing, personal magnetism, Clairvoyance, secrship, Hypnotism, Mesmerism, concentration, character reading, mind power, etc. Tell me your wants. A. W. Martens, JX8, Burlington, Iowa.

World-Romic System, Masterkey to All Languages. Six Textbooks, $1.44. French Chart, 37c; Spanish, 37c; Aviation Dictionary, $1.50. French-English Aviation Dictionary, 01c. Languages, 143 West 47th, New York.

"James Boys", "Younger Bros.", "Allen Gang", "Villa the Bandit", "The Auto Bandits", "Harry Tracy", "Dalton Gang", "Jeff Clayton", "Behind the Scenes", "Rube Burrow", 25c each postpaid; rare Fiji Island newspaper with each dollar order. O. K. Publishing Co., Decatur, Ill.

Scientific, Technical, Engineering, Industrial Books. February list, 3c. Klaus, Eureka, Ill.

Leading Magical Magazine. You'll like it! All magicians do! Why? The value is there. Sample, 10c; three months, 25c; year $1.00. The Eagle Magician, Dept. E, Minneapolis, Minn.

What Every Draftsman Should Know. Very useful booklet. Price 12c postpaid. Wack Booklet Co., 1943 Patten St., Philadelphia, Pa.

Books on Sex. Catalog free. United Sales Co., Springfield, Ill.

Books for Real Live People. Lists free. J. E. Shcridan, 417 E. 151st., New York.

How to Locate Oil, Minerals and Valuable Substances by Wireless; Scientific Book, $3 postpaid. Astral Child Publishing Co., Corpus Christi, Texas.

To Get Better Pictures: Read the Amateur Photographer's Weekly; illustrated; weekly prize competitions; print criticisms; many unique features; $1.50 per year; three months' trial subscription 25c. Abel Publishing Company, 401 Caxton Bldg., Cleveland, Ohio.

Old E. E. Back Numbers: We have some valuable old E. E. back numbers on hand as follows: 1915—Jan., March, April, June, July, Aug., Sept., Oct., Nov., Dec., price each 35c. 1916—Jan., Feb., March, May, June, August, Sept., Oct., Nov., Dec., price each 35c. 1917—Jan., Feb., March, April, May June, July, Aug., Sept., Oct., Nov., Dec., each 35c. 1918—Jan. 35c; Mar., May, June, July, Aug., Sept., Oct., Nov., Dec., each 20c. Jan., 1919, 20c. We can fill orders at once upon receipt of your remittance, and if you have not these numbers already, now is your chance to get them, as they probably will be snapped up very quickly. Experimenter Publishing Co., 233 Fulton St., New York City.

Patent Attorneys

Patents—Fees payable in monthly installments. Send sketch for free report. Books free. Frank Fuller, Washington, D. C.

Patent Your Own Inventions. Save attorney's fees; we prepare applications; furnish full instructions and give satisfaction. Free information. Carl Larsen Co., Park Row Building, New York City.

Patents. My fee payable in installments. Full particulars return mail. Send sketch for report on patentability. John Patton Duffie, McGill Building, Washington, D. C.

Millions Spent Annually for Ideas! Hundreds now wanted! Patent yours and profit. Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. 212 Patent Dept., American Industries, Inc., Washington, D. C.

M. F. Miller, Ouray Building, Washington, D. C., Patent Attorney. Mechanical and Electrical Expert. Best quality of work and results. Moderate charges. Advice free.

Your Idea Wanted. Patent Your Invention. I'll help you market it. Send for 4 free books, list of patent buyers, hundreds of ideas wanted, etc. Advice free. Patents advertised free. Richard B. Owen, Patent Lawyer, 130 Owen Bldg., Washington, D. C., or 2278T Woolworth Bldg., New York.

Inventors! We have a proposition that will probably interest you. Inquiries Invited. The Wakefield Engineering Co., 922C F St. N. W., Washington, D. C.

Fortunes from Patents are made only from a good invention strongly protected. Send Sketch or model and $5 for thorough search and honest opinion of patentability. I give personal, conscientious and expert service. Lester Sargent, Patent Attorney, 524 Tenth Street, Washington, D. C.

Inventions Patented; Trade-Marks Registered; Labels, Prints and Publications Copyrighted; reasonable fees. Correspondence solicited; detailed information free; booklets. Jaynes & Jaynes, 702 Kellogg, Washington, D. C.

For Inventors

Inventions Commercialized. Cash or royalty. Adam Fisher Mfg. Co., 205 St. Louis, Mo.

Inventors—Market and secure your inventions through National Institute of Inventors, World Bldg., New York City. Membership co-operative organization.

Miscellaneous

Luminous Paint makes watches, clocks, anything visible at night, 25c bottle. Luminous Paint Co., 2426-X Polk St., Chicago.

Blacksmiths, Listen! Prepare for big wages in Navy and Arsenal with Toy's Modern Methods doing hard jobs easy. Forging and making solid welds, hardening and tempering to a standard, with colored tempering charts. All for one dollar. Sample free. W. M. Toy, Sidney, Ohio.

Authors! Your manuscripts criticized by editorial expert; rewritten, revised, typed, sold. Heatley, 119-16 St., West New York, N. J.

Flags and Decorations—American, Service and Allies' Flags in Silk, Bunting and Cotton, for inside and outside decorating. Quick service via insured parcel post. Price list mailed the minute your request arrives. A. Fink & Sons, Wholesale and Retail, 56 North Seventh St., Philadelphia, Pa.

Cats crave catnip. Send 10c for a "catnip mouse" (a lifelike cloth mouse, stuffed with catnip). More fun than a "barrel of monkeys," and your "kitty" will like it. Address: Percy Ewing, Decatur, Ill.

Cigarette, pipe or chewing habit conquered. Nature's method. Guaranteed. Write for free brochure. Edw. J. Woods, TA-300, Station F, New York.

Tobacco or Snuff Habit Cured or no pay; $1.00 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

Pyorrhea—H. E. Kelty, D. D. S., M. D., pyorrhea specialist for 15 years, has developed a successful home treatment for pyorrhea. Purifying, healing, preventative. Full month's treatment and booklet $1.00. Circular free. Dr. H. E. Kelty, 106 Gladwin Ave., Leonia, N. J.

Catch Fish. Descriptive folder containing valuable information mailed for stamp. George Julian, Albany Building, Boston.

"Opportunity Adlets" bring quick results. Our 100,000 circulation, net. Other firms are making money—so can you. For proof address Classified Department, Electrical Experimenter, 233 Fulton St., New York City.

Wanted—Small Gasoline and Steam Engines. Cash paid for 1 to 4 cylinder light weight Motors ¼ to 10 H.P. Johnston, West End, Pittsburgh, Pa.

Boys, Make Your Mother's Bluing. 1 pkg. 12c. 3 for 30c, 5 for 45c. Each package contains enough material to make 1 gallon of full strength liquid bluing; will not streak; makes the clothes snow white. Kralovec & Co., 2344 Altgeld St., Chicago, Ill.

Motion Pictures

Motion Picture Films. Any kind, sample and list 10c. G. Harrison, 1283 Lakeland Ave., Lakewood, Ohio.

News Correspondents

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Printing

100 Bond Noteheads, 4 lines and 100 envelopes, prepaid, $1.00. Southwestern, 1413-H Berendo, Los Angeles.

100 Envelopes and 100 Noteheads $1.00 prepaid. Any copy. Samples stamp. Elmira Specialty & Printing Co., 201 Madison Ave., Elmira, N. Y.

Stamps and Coins

Stamps—65 different 5c to approval applicants. Michaels, 5600 Prairie, Chicago.

202 different stamps 21c; 100 different U. S. 21c. C. Reitter, Box 1054, Detroit, Mich.

Full membership 15c, Collectors' Exchange Club, 45 Westminster, Worcester, Mass.

We buy and Sell Old Money. $2 to $500 each paid for hundreds of coins dated before 1895. Keep all Old Money. Send 10 cents for new illustrated Coin Value Book, 4x7. You may have valuable Coins, get posted. Clarke Coin Company, Box 110, Le Roy, N. Y.

California Gold, Quarter size, 27c; Half-dollar size, 53c; Dollar size, $1.10; Large cent, 1820, and catalogue, 10c. Norman Shultz, Kings City, Mo.

Stamps—61 all different free. Postage, 3c. Mention paper. Quaker Stamp Co., Toledo, Ohio.

500 Finely Mixed United States or Foreign Stamps, 12c. Philatelic Star, Madison, N. Y.

Novelties

Mechanical Novelty, barrel of fun, laughs and amusement, two 25c. Rullet Company, New Haven, Conn.

Nut Bowls and 60 other useful articles, made out of Native Myrtle Wood, the most beautiful finished wood on Earth. Send 3-cent stamp for illustrated descriptive catalogue giving delivered prices. J. H. Oerding & Sons, Corvallis, Oregon.

Send two dimes and get General Pershing on his horse in original colors, made of solid metal. Gem Novelty Co., 462 Wabash St., St. Paul, Minn.

Business Opportunities

Enter a New Business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a 100t specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks, at small expense; no further capital required; no goods to buy; job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston.

Make Die-Castings. Sketch, Sample, Booklet, and Proposition, 12c. R. Byrd, Box 227, Erie, Pa.

Incorporate your business under the common law. No organization tax; no franchise tax; no federal corporation tax; certificates not taxable; stockholders exempt from company debts; do business anywhere; directors reside where you wish; lowest cost organization possible. Common Law Organization Co., 4 Randolph, Detroit, Mich.

Build up an Income in Oil—Others are doing it—Why not you. Today is the opportunity. Join our easy monthly payment plan NOW—it may mean hundreds in profits. Write for information. National Oil Drilling Co., Dept. K, Houston, Texas.

$30 a Week Evenings. I made it with a small mail order business—continued my regular job daytimes. Free booklet tells how, 2c postage. Alex. W. Scott, Coboes, N. Y.

"Opportunity Ad-Lets" bring quick results. Over 100,000 circulation, net. Other firms are making money—so can you. For proof address Classified Department, Electrical Experimenter, 233 Fulton St., New York City.

Victory—Mechanical Toy Soldier window attraction. 30 inches high. Salutes, turns head, points with finger, etc., as set. Well made, nicely dressed officers, privates, Uncle Sam, etc. Electrically operated. Does some stunt every half minute or oftener as set, and will salute soldier and pay no attention to others if desired. Representative wanted in each city and town. Write for prices. The John M. Biggs Co., Box 324, Chattanooga, Tenn.

Make Big Money opening sales and setting combinations. Wayne Strong, P. O. Box 1430, Los Angeles, Cal.

Patent Time-Actuated Electric Switch. Clock movement. For show window lighting., etc. Turns circuits both on and off. Entire rights $1,000.00. Cato, 231½ So. Sixth, Springfield, Illinois.

Dollars Yearly in Your Back Yard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. Metz, 313 East 89, New York.

"Quick-Action Advertising—How it is Building Business for the Progressive Advertisers of America"; A little story of RESULTS, told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet, which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 30th Street, New York.

Blue Prints, Plans, Castings

Amateurs & Mechanics get Detailed Blue Prints on ½ H.P. Gasoline Engine. Postpaid. 30c; ¼ H.P. Horizontal Steam Engine, 50c; ¼ H.P. Vertical Steam Engine & Boiler, 70c; or all three for $1.00. Circulars on Engines and Rough Iron Engine Castings for Stamp. Universal Gas Motor Co., 53 W. Jackson Blvd., Chicago, Ill.

Experimenters—Build your own spark coils, Wimshurst machines, motors, volt ammeters. Blue prints with instructions. Parts supplied, your parts machined, all repairs made. Send for particulars. Hubert Brunotte, 126 E. 85th St., New York City.

Phonographs

Build Your Own Phonographs and manufacture them for profit. Drawing instructions, Parts, Price List, Blue Prints, etc., complete, sent free upon request. Write today. Associated Phonograph Co., Dept. E-1, Cincinnati, Ohio.

Build Your Phonograph. "Perfection" high-quality spring and electric Motors, Tone Arms, Reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Indiana.

Real Estate

Sell your property quickly for cash, no matter where located. Particulars free. Real Estate Salesman Co., Dept. 38, Lincoln, Nebr.

Formulas

160 Formulas resilvering mirrors, renewing dry batteries, luminous paints, mechanics' soap 25c, lists 2c. "Bestovall," Box 543-E, Chicago.

For the Hair

I Was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have good hair-growing results. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E. 32nd St., RA-300, New York.

Continued on Page 758

www.americanradiohistory.com

Dont Send a Penny

Here's the biggest bargain in boys' shoes you'll find anywhere. To prove it we will send you a pair without a penny of advance payment. Just send your name and address. We ship on approval so you can compare them with other hi-top shoes costing as much as $6 or $7. You know how hard boys are on shoes. These are made for just that kind of wear—to stand up under the hardest knocks a boy can give them, and you'll find these will outwear three ordinary pair. Prove it at our risk. Keep them only if satisfied. If not satisfactory, return at our expense.



Boys' Special Hi-Tops

Don't Miss This Chance

Make your boy proud and happy and keep his feet dry and warm with a pair of these wonderful Hi-Top Shoes. See how strongly they are made. Solidly made of strong wear-resisting retanned leather. Two buckles and straps fasten closely around leg. Lace Blucher style on comfortable wide last—full round toe. All seams strongly sewed. Extra heavy solid leather soles and heels, to stand the hardest wear. Tan only. Sizes 1 to 6.

SEND no money—just your name and address. See if you can find their equal for $6 or even $7. Pay **$3.90** for shoes on arrival. If not satisfactory, return them and we will refund your money. Be sure to state size wanted. Order by No. X17029. Send your order today. No risk to you.

LEONARD-MORTON & CO., Dept. X553 Chicago

Here's the New Auto-Wheel Book-Free



Write for Your Copy Today

IT'S A BOOK brimful of information a boy ought to have. It tells you how to organize an Auto-Wheel Coaster Club—how to make money with your Auto-Wheel—how to have most fun when camping and what to do in case of accident. It's a valuable book—and it's yours for the asking.

Get a Free Felt Pennant

We want to tell you all about the wonderful Auto Wheel Coaster and the patented Auto-Wheel Convertible Roadster—and to send you one of our beautiful Felt Pennants FREE. When you write for the Auto-Wheel Book give us the names of three coaster wagon dealers, mentioning which one handles the Auto-Wheel, and we'll send you a complete Auto-Wheel Catalog and the Pennant, FREE. WRITE US A LETTER TODAY. Address,

Buffalo Sled Company,

163 Schenck St., N. Tonawanda, N.Y.

In Canada: Preston, Ont.



INDEX to Volumes 1, 2, 3, 4, 5

ELECTRICAL EXPERIMENTER

Postpaid **15c**

Experimenter Publishing Co., 231 Fulton St., N. Y. City.

EXPERIMENTAL CHEMISTRY.

(*Continued from page 751*)

3. The burning of hydrogen.
4. Burning of arsin.
5. Breaking up of arsin by heat. The solution of arsenic in sodium hypochlorit gives.

6. $2As + 5NaOCl + 3H_2O = 2H_3AsO_4 + 5NaCl$.

In the same manner as above, test some solution imagined to contain arsenic.

Experiment No. 149.

Perform an experiment using $SbCl_3$ solution in exactly the same way as the $AsCl_3$ was used, and compare the results. Pay particular attention to the difference between Sb and As in position of deposit, in color, and in solubility in NaOCl.

Reinsch's Test.

Experiment No. 150.

Pour into a dish 3 or 4 cc. of a solution of arsenious chlorid [$AsCl_3$] or sodium arsenit [Na_3AsO_3] acidified with hydrochloric acid. In this solution place a strip of bright copper foil [about 3 cm. x 4 cm.] and boil the liquid for three or four minutes,—longer, if no discoloration of the copper appears.

What is the color? No change in the copper indicates absence of arsenic. In that case add more HCl and boil again. If the copper is finally discolored, take it from the liquid with the forceps, rinse it carefully, and press it lightly between the folds of filter paper to remove moisture. Then cut it into small strips with scissors; drop these strips to the bottom of a long and narrow test tube, and slowly heat the lower part of the tube.

See whether the copper changes color. Look for a sublimat. State its color; its position. Is it in color and appearance like the sublimat in Marsh's test? Compare it with metallic arsenic, arsenious oxid, etc. Examine the sublimat under a microscope, breaking the tube and scraping off a little for this purpose. Is it crystallin or amorphous?

Experiment No. 151.

Make arsenious sulfid [As_2S_3], wash it free from impurities, dry it and put it away for future use.

Experiment No. 152.

Ascertain by experiment a solvent for arsenious sulfid [As_2S_3]. Try [NH_4]$_2$ CO_3.

Experiment No. 153.

Make Paris Green [$Cu_3[AsO_3]_2$], wash, filter and dry, and put away for use.

Experiment No. 154.

Make arsenious oxid [As_2O_3], using not over ½ gram.

Experiment No. 155.

See whether As_2O_3 is at all soluble in water.

Examine the various compounds of arsenic with special regard to colors—red, yellow, green, and white—and attach names.

(*To be continued*)

JAPAN HAS WIRE-WIRELESS CENTRAL.

An exchange to wireless and wire telephones is to be establisht in Kobe very shortly by the Government Department on Communications. A wireless tower 180 feet high is now being erected in front of the largest of the Kobe telephone exchanges. Wireless telephone messages from vessels within 100 miles of the South Japan port will be connected by "Are you there?" girls with the telephones of subscribers in Kobe, Osaka, Kyoto and neighboring cities, thus serving the most densely populated section in Japan.

Opportunity Ad-lets

Continued from Page 757

Tricks, Puzzles and Games

1000 stage tricks with 500 illustrations. Catalogue 10c, small catalogue FREE. Hornmann Magic Co., Sta. 6, 170 Eighth Avenue, New York.

Black Art Hindoo Experiments, copyright 1919 Edition, 25c. Invisible Ink. Free Trick. Catalogue each order. Lindhorst Magic X Shop, St. Louis.

Tricks, Puzzles, Jokes, Toys, Games, Novelties, Doll and Cane Racks, Plays, Wigs, Stage Supplies, Escapes and Illusions. Large 1917 catalog free. Oakes Magical Co., Dept. 549, Oshkosh, Wis.

Magic Card Trick. Get these magic cards and fool your friends, 10c. Reeves & Taylor Magical Co., West Somerville, Mass.

Magical Apparatus and Ventriloquist Figures. Lowest prices. Catalog, Magic and Ventriloquist Lesson free. Write, Sylvian's Magic Shop, E-192 Clifford, Providence, R. I.

Wireless

Better stock up now on switches and switch points for that new set. Circular describing the most perfect on the market sent free. Eureka Secondary Co., 6939 S. May St., Chicago, Ill.

Rare Radium Ores. Radio-Activity Experiments. Photograph thru opaque matter, discharge electroscope, etc. One 5% uranium oxide, other 12%. Both complex chemically. Ten to twenty metals. Half ounce first, quarter second, gram uranium oxide, all for $1.00. Full description with order. O. I. Lee, 2869 Boulevard, Jersey City, N. J.

Build a Radio-Airo Station—Blue print, plans, photograph 18-22, prepaid, $5. Wm. J. Rogers, 385 Morissee Ave., Haledon, N. J.

Electrical Supplies & Appliances

Recharge 25 Dry Cells for five cents. Directions 10c. Gilbert, 28 Chestnut, Binghamton, N. Y.

Mechanics—Quickest method of making tapers in the lathe, 25c. Charles Fleischer, 1389 St. Marks Ave., Brooklyn, N. Y.

Electrical Tattooing Machines and Supplies—Catalogue free. Prof. Temke, Exp., 517 Central, Cincinnati, Ohio.

Supersensitive Microphones for Wireless Control of Lamps, Alarms, Motors, Guns, Toys, etc., by sound waves of a whistle. Description and drawings free with each instrument. Price $2.10, postpaid. James A. Campo, Suite 1316, 32 Nassau St., New York, N. Y.

Amateurs!—Make simple electric motor that works. Instructions 25c. Box 5, Hingham Centre, Mass.

Mr. Business-Man—Your advertisement here will be read by over 100,000 live prospects. The "Opportunity Ad-lets" of the Electrical Experimenter bring quick and positive results. For proof of what they have done for others address Classified Department, 233 Fulton Street, New York.

Photo Developing

Mail Us 15c with any size Film for development and 6 velvet prints. Or send 6 negatives any size and 15c for 6 prints, 8 x 10" mounted enlargements 35c. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke, Va.

Clean, Neat, Perfect Kodak Finishing at the lowest prices. Work returned the same day received. Send film for sample print and copy of Catalog on Developing, Printing, Enlarging and Hand Coloring, also copy of Photo Craft Magazine which will help you make better pictures. Photo Craft Co., Box 69, Ann Arbor, Mich.

Postcards

Everything in Postcards. Live-wire list free. Worth-while samples 25c. Mention subjects preferred. Mutual Supply Co., Bradford, Pa.

Five Prettiest Women Cards, hand colored, 25c. Durso, Dept. 41, 25 Mulberry, N. Y. City.

For Advertisers

Unheard-of Trial Offer! 1inch display or 30-word classified advertisement ten weeks, $1.00. Record Advertiser, Box 2E, Houston, Va.

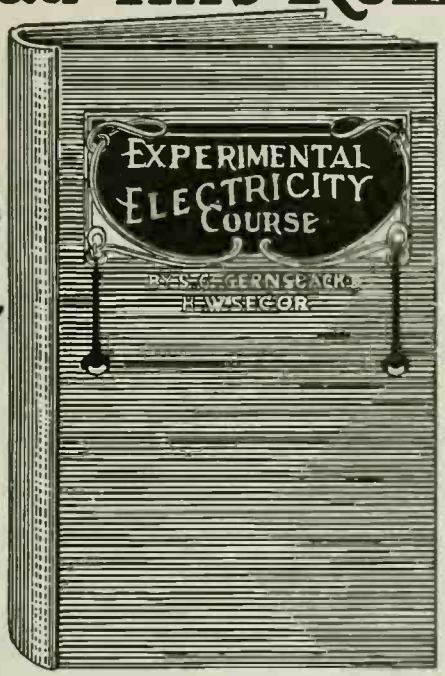
"Quick-Action Advertising—How it is Building Business for the Progressive Advertisers of America"; A little story of RESULTS told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th St., New York.

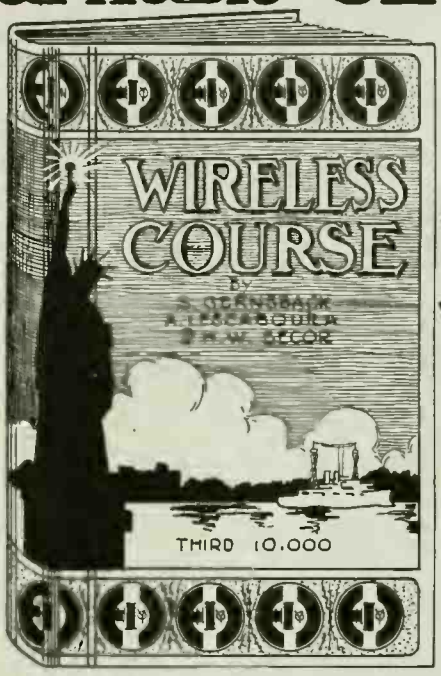
"Opportunity Ad-Lets" bring quick results. Over 100,000 circulation, net. Other firms are making money—so can you. For proof address Classified Department, Electrical Experimenter, 233 Fulton St., New York City.

www.americanradiohistory.com

Free to You!

Read this Remarkable Offer!





This masterpiece contains 160 pages, 400 illustrations. Size of book 5"x9". Printed on extra thin paper, so book can be slipped into pocket. Handsome flexible cloth cover. **FREE** with a year's subscription. Add 5c for postage.

The most comprehensive Wireless Course ever printed. Contains 160 pages, 350 illustrations. Size of book 6¾"x10". Very fine flexible cloth cover. **FREE** with a year's subscription. Add 5c for postage.

This is a very limited offer. It may be withdrawn at any time, due to the tremendous cost of paper, which IS JUST DOUBLE WHAT IT WAS ONE YEAR AGO. We have only a limited supply of these fine books on hand; after they are gone we cannot reprint the books until conditions become normal again. THIS MAY BE TWO YEARS OR MORE. Now is your chance.

The publishers of this journal have earned an enviable reputation of giving more than 100 cents' worth for each dollar spent with them. Profit by this liberal opportunity NOW; it may never be made again.

HERE'S THE OFFER

Subscribe to THE ELECTRICAL EXPERIMENTER for one year, at the regular subscription price of $2.00 per year (Canada, foreign and N. Y. C. $2.50) and we will send you FREE, POSTPAID, either one of the above books. If you subscribe for two years, BOTH BOOKS WILL BE GIVEN FREE, POSTPAID.

If you are a subscriber at present, take advantage of this wonderful opportunity anyway. If you do, we will extend your present subscription for one year.

This Offer Limited. Act Now.

EXPERIMENTER PUB CO.
223 FULTON STREET
NEW YORK CITY

FILL IN—TEAR OUT—AND MAIL

2-19

Gentlemen:

Please enter my subscription to THE ELECTRICAL EXPERIMENTER for the term of.....year..... for which I enclose herewith $..... You will also send me at once FREE prepaid your.....book...

.....

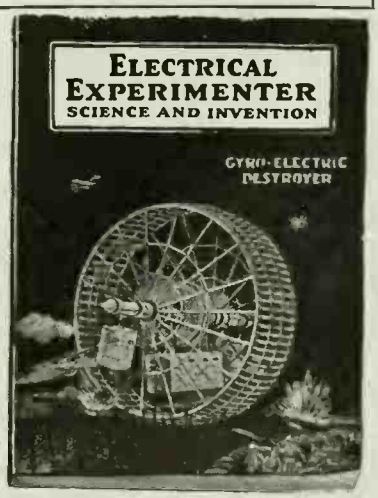
.....

Name.....

Address.....

.....

.....



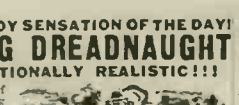
12 copies of THE ELECTRICAL EXPERIMENTER make a book 9" x 12" and 4" thick. This book will weigh 7 lbs. It is the greatest Electrical and Wireless reference work in the world. And all for **$2.00 a Year**

www.americanradiohistory.com

GREATEST TOY SENSATION OF THE DAY!

FIGHTING DREADNAUGHT

SENSATIONALLY REALISTIC!!!



Here is a model of Uncle Sam's fighting monsters. Eight big guns, each of which flashes, at correct intervals, from twelve to twenty times. Extra ammunition always obtainable Absolutely harmless. Can be operated indoors or out. Now boys, Here's your chance to own a battleship to actions, as the best of it is you can OWN the ship and command the fleet yourself! By having two or more Battleships, you can stage EXCITING NAVAL BATTLES in your own home. Extra Ammunition, Wireless and Ammunition, 15c, three for 40c, or a fleet of 1 ships for $1.50 postpaid. Extra ammunition, 8 cents per doz.

Boys, you can have Movies at your own home with this latest model

MOVING PICTURE MACHINE

Uses Standard Films same as the larger machines. Very easily managed. Simply turn the handle. Good Variety of Films always obtainable

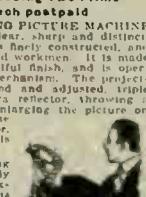
PRICE Complete ONLY **$2.50** Postpaid anywhere including Two Films

Extra Films, 15c each postpaid



THIS IS A GENUINE MOVING PICTURE MACHINE and the motion pictures are clear, sharp and distinct. The Moving Picture Machine is finely constructed, and carefully put together by skilled workmen. It is made of Russian Metal, has a beautiful finish, and is operated by a finely constructed mechanism. The projecting lenses are carefully ground and adjusted, triple polished, standard double extra reflector, throwing a ray of light many feet, and enlarging the picture on the screen up to three or four feet in area. The light is produced by a safety carbide generator, such as is used on the largest automobiles. This throws a dazzling white light on the screen.

It is a solidly constructed and durable Moving Picture Machine. The mechanism is exceedingly simple and is easily operated by the most inexperienced. The pictures shown by this marvelous Moving Picture Machine are not the common, crude and lifeless Magic Lantern variety, but are photographic reproductions of actual scenes, places, and people which never tire the audiences. This Moving Picture Machine has caused a rousing enthusiasm wherever it was used.



JOHNSON SMITH & CO.
Dept. E 3, 54 West Lake Street, CHICAGO

"The Baby" Double Action Hammerless Revolver

A HANDSOME AND MOST EFFECTIVE WEAPON

$5.50 Measures but 4½ inches long



Takes regular .22 calibre cartridges

The new Baby Double Action Hammerless Revolver has been produced to meet the ever increasing demand for a revolver that would combine small size and small in size, yet is just as effective and serviceable as the most expensive weapon sold there is no safer or better one made than this. A great feature is its safety action that guards against accidental discharge, even when it is quite safe to pull the trigger. The illustration gives an idea of its appearance, but it must be seen to be appreciated. The ammunition used is the .22 short (short) cartridge obtainable anywhere, or you may obtain the cartridges from us (cartridges can be shipped only by express). The revolver is only $8.50, sent by mail postpaid to any address. JOHNSON SMITH & CO.

TOOTH-ACHE STOP



Stops the Pain, Stops the Tooth

Squeeze a little on before each meal. The Ache Stops instantly; the pain's hardened forming an antiseptic filling. Absolutely harmless. Will make it ready for the next bad attack. 25c per tube, postpaid.

"SAFETY 1st" PINS



A clever novelty. The National Safety Friend. Convenient for those times very popular. Wear one and show your sweetheart with the movement. Also handy for wearing at amateur theatricals and the like. Two pins in gold-plated and 10c in nickel-plated. 6c each, two for 10c p. pd.

Mysterious Ghost



This is not a pretty object, but there is no fear of any people who has practical ideas. The Ghost, when disguised in a perfectly dark place, glows with a ghastly cold bluish radiance, very startling and a "creepy" sensation even when you know all about it. But a regular shocker for those who come upon it unexpectedly. A great joke to play on your mother in the dark. Price only 15 cents each, or three for 40 cents.

INKLESS PEN



WRITES with WATER 600 words from one filling. Writes as well as you did. Makes its own ink. Astonishingly clear. Better than cheaper fine fountain pens. Will last long time with no dip in glass water. No trouble—no bother—no expense. A pleasure to use. With Nickel Plated Reservoir Holder 15 CENTS. 3 for 25c

SIMPLEX TYPEWRITER ONLY $2.50

Cheap But Good. So Simple a Child Can Use It. We Guarantee the Writing.



Though so marvelously cheap, the machine is a thoroughly practical Typewriter. It is quite as easy to use it to produce writing equal to your request to that of any $1.00 machine. It can't go wrong—there is no ribbon to get out of order, and you will be surprised. With reasonable care, it will last a lifetime. It is so simple that a child just able to read and write can learn to operate it in a few minutes, and an hour's practice will make you an expert operator. Every business man should have a typewriter. It typifies and writing is indispensable and crowds the important on that the time is wasted. Every one of the business men of the world uses a typewriter. We give you the best for the least money. Prices range from $50 to $100. Our machine is fully described in this issue, and is the equal of any $1.00 machine. It can do nearly all the work that the $100 machine can do. The letters at the alphabet, the numerals 1 to 10, and punctuation marks are so arranged that the letters most used are nearest the center, thus enabling you to write rapidly. The rollers hold the paper in position while writing and at the end of each line a slight turn of the roller moves the paper up one space, which makes a clear and forces the paper forward, giving the proper line space. So that it is never necessary to use more than one hand in order to write. Each typewriter packed in a strong box, with full printed instructions for use. Price complete, $2.50 postpaid.

Johnson Smith & Co., Dept. E 3, 54 W. Lake St., Chicago.

SQUIRT RING



You may have a lot of fun with the Squirting Ring. Expert Ring. It resembles a hard-rubber, is gotten ring, attached to a rubber ball, as shown and that the latter is quite out of view when the ring is on. The proper position both as attaching ring and ball is the secret. It will be the center of attraction. While the victim is accosted in an easy social manner, you just squeeze the rubber ball and the observer appearance, a very great surprise. Price 2 for 25 cents, or 15c each, postpaid. J. S. & CO.

Wonderful X-Ray Tube



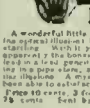
A wonderful little instrument producing optical illusion both surprising and startling. With it you can see, as apparently the bones of your fingers the hand in a large glass tube, the flesh appearing in the pale color, and many other similar illusions. A mystery that will have been able to satisfactorily explain Price 10 cents each, 2 for 15 cents, or dozen, 75 cents. Sent by mail, postpaid.

Sneezing Powder



Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or even without leaving the room—ah. It is most amusing to hear them sneeze, but they never suspect the real reason, but think for a moment it came from the other. Interest the laughing and everyone will be having the time of your life. For parties, holiday entertainments, or any place at all where there is a gathering of people it is the greatest joke ever played. Price 25c a box, 3 for 50c. JOHNSON SMITH & CO.

STAGE MONEY



With a bunch of these bills it is easy for anyone to act the part of a millionaire or prosperous. By flashing a roll of these bills at the right moment, or by the use of a genuine bill at the front of the roll, the effect is startling. Many will be fooled to be all just the genuine. Price 25c a 100 bills, 50 bills 25c, 125 for 50c, or $1.50 thousand.

NEW BOOK ON ROPE SPLICING

USEFUL KNOTS, HITCHES, SPLICES, ETC.

Men Different Knots Are Made and What They Are Used For. Knots to Use and Knots to Avoid.

A good practical handbook giving complete and simple direction for making all the useful knots, hitches, rigging splices, etc. over 100 illustrations. All about wire rope attachments, lashings, tackles, etc. 32 Heraldic Knots illustrated (of great value to mechanics, riggers, campers, boatmen. Price 20c postpaid.

Johnson Smith & Co., Dept. E 3, 54 W. Lake St., Chicago

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night



The very latest discovery in the way of luminous paint. Can be applied to any surface, and when exposed to daylight for a few minutes will remain luminous for hours. Apply it to the hands and figures of your watch, clock, or to the door. THE BRIGHTEST PAINT MADE. Quite a little applied to the dial of your bedroom clock will enable you to tell the time by night. Try one on the door, or other articles made of wood, electric lights, match boxes, and innumerable other purposes. Long time Luminous Paint, 15c a bottle, 2 bottles for 25c, postpaid. Johnson Smith & Co., Dept. E 3, 54 W. Lake St., Chicago

MUSICAL KAZOO



With the Musical Kazoo you can, without practice, play any piece you have ever heard of, imitate any kind of instrument, and sing a tune at the same time. Simply hum or whistle a tune, and the Kazoo will instantly reproduce it, adding a peculiar quality to the tone that is very pleasing. Price 10c each, postpaid. Special offer: 3 for 25c, postpaid.

MAGIC FLUTE



Wonderfully Sweet Toned and Musical

A marvelous musical instrument. Makes music, whether blown by the performer or by the voice. Can play scales, tunes of a chromatic harmonica fast, and close enough can be played upon the Humana Kazoo. Don't be disappointed. It is a scientific self-playing instrument. When properly used a great performance, or an other musical instrument, the effect is wonderful. Full printed instructions for playing sent with each instrument.

Post Paid 15c

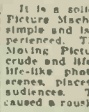
Price $1.50 per dozen. Postage 10c extra.

All the Latest Surprising and Joke Novelties

Phase a Serpents Eggs, box	10c	Cover in the Spot Trick, a series com.	10c
10 Rare Water Pistol	10c	Trick Pencil	10c
Cleopatra's Snake (very lifelike)	10c	Rubber Tanks (good joke)	10c
Fisher Bottle (a lot of fun for friends)	10c	Unmentioned Purses (Refuse the lure of gypsy mistress)	20c
Hand Auto Puzzle (Latest)	10c	Mysterious Tumbler and Vanishing Coin Trick	25c
Mysterious Ghost, all ages at night	10c	Magic Mirror (Make one pay)	25c
Rubber Razor (very convincing)	20c	Magic Plate Lifter	20c
Rubber Dagger (very convincing)	20c	Imitation Coin Tooth	10c
Window Smashers, great joke	25c	Great Surprise Puzzle	10c
Lemon Squeezers are behind you	10c	Wire Puzzles, the 22 different, $1	10c
Trained Mind Reading Mystery Cube	10c		
Phantom's Mysterious Trick Cube	10c		
Fighting Roosters, pair	10c		

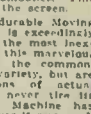
JOHNSON SMITH & CO., Dept. E 3, 54 W. Lake St., CHICAGO

ANARCHIST BOMBS



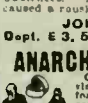
Consists of a little glass vial, containing in liquid form a chemical which will produce a very horrible odor. One dropped in a room full of people will cause more consternation than a limburger cheese. The smell will entirely disappear in a short time. 3 Boxes for 25c, shipped by express only with a Dollar's worth of other merchandise.

ITCHING POWDER



This is another good practical joke; the intense discomfiture of your victims to every one who tries it. Perfectly harmless, but thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's clothing and the powder can be relied upon to do the rest. It will result in a vigorous scratch, then some more scratch, and still more scratch. Price 10c each, 3 for 25c. Sent postpaid by express or mail, or order at least One Dollar's worth of other merchandise.)

INVISIBLE INK



The most confidential messages can be written with this ink, for the writing is INVISIBLE MARK. Cannot be seen, unless you know the secret. Invaluable for many purposes. In daily use in offices and other private memorandums, and for many other purposes. Great fun for pressing practical jokes. Only 15c Bottle

LOVE LETTER INK



Writing written with this remarkable ink vanishes entirely in a few weeks (sooner if desired), leaving the paper QUITE BLANK. 15c p. pd.

LUMINOUS INK Writing can be READ QUITE PLAINLY IN THE DARK. Writing entirely disappears in daylight. Great fun for passing like fire. Quite invisible at daytime. Full directions with each bottle; 2 for 40c postpaid.

JOHNSON SMITH & CO.

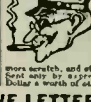
MULTIPLYING BILLIARD BALLS

The Best Feat of its Kind



This trick is an effective one, and a surprising one. The performer stands around the ball for exhibition, and apparently has a thousand in his hands. It is really very simple, and consists of a few balls held between the fingers and a second ball concealed in the palm of the hand. The balls are held in full view of the audience, and the balls of the fingers of the left hand, and even while being placed in position, another ball unapparently appears in its appearance, apparently suffers from some kind of spasm and out another ball is the result. The first can then be performed, the balls disappearing one after another until none remain. It is a very interesting trick that is quite easily performed by following the directions and necessary the apparatus. Price complete, 25 cents. POSTPAID. JOHNSON SMITH & CO.

GOOD LUCK RING

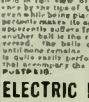


Genuine and Novel. A VERY striking and unusual ring, made of gunmetal finish, in a skull design, with two brilliant red eyes that sparkle out of the darkness of the ring, thus falling any object to which it may be sold. Be sure to send Size of Ring. Lots to the wearer. Price 15 cents each, 2 for 25c, postpaid.

guarantee that it is certainly a very unique ring and we will take a pride in seeing that you get what you want. This is a special bargain we will supply the ring at the above price, postpaid. HALF PRICE. Price, ONLY 25 CENTS. POSTPAID. JOHNSON SMITH & CO.

ELECTRIC INSOLES

Comforting to the Feet and Healthy

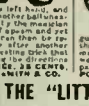


You probably suffer from Cold Feet and have you ever spent Electric Insoles in a right shoe, composed of copper and zinc generate a current of electricity constant circulation of the blood and heat to the feet. Positive cure for Chilblains, Sweaty Feet, Rheumatism and Cramps. Sent postpaid for 50c a pair.

JOHNSON SMITH & CO. (Dept. E3), 54 W. LAKE STREET, CHICAGO

THE "LITTLE GIANT" TYPEWRITER

A First Class Writing Machine For $1.25



A toy, yet little typewriter for $1.25. There is absolutely no fake about this machine—it does all the work that a $100 machine does, and is a typewriter that anyone can use. It is simple in construction, so that any one can quickly learn to operate it. It is a practical machine and is fully equipped with a full set of the alphabet, most frequent words being so grouped as to enable one to write rapidly, the numerals 1 to 0, and the usual punctuation marks being together. With this machine you can send your best love letters, address envelopes, make out bills, and do almost any kind of work not requiring a large expensive machine. With each typewriter we send a liberal supply of paper and full printed instructions for using the machine. Price complete $1.25 by mail postpaid.

SERPENT'S EGGS



Each box contains 12 Eggs, which are no larger than a grain of oats. When lit with a match, however, each one gradually hatches itself into a Snake several feet long, which curls and twists about in most wriggly manner. Price per box 10c, postpaid. Johnson Smith & Co.

MYSTIC SKELETON



A jointed figure of a skeleton 14 inches in height, will dance to music and perform many gyrations and contortions and more notable who operates it. It is a great novelty and will cause much amusement. The figure may be examined by the spectators. When handed back to the operator it is suspended by a cord to a chair or table, when it will perform its dance, and will move about in a most grotesque manner. At the command of the operator it will bow, salute, stand up, dance, etc. It is very amusing with each Skeleton, 17 the old of which anyone can readily make it perform. 10c postpaid.

CIGARETTE ROLLER

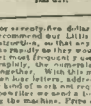


Very neat and handy. Weighs less than a quarter of a pound. It makes better cigarettes than you can buy and makes them easily and quickly. You can use just the tobacco you prefer and not the sticky "cigarette" smoke" than ready made, and more of them for the same money. Just try one and make your cigarettes just to your own liking. Price only 10c or 3 for 25c postpaid, with full instructions for use. JOHNSON SMITH & CO.

MIDGET ILLUSTRATED BIBLE

A Great Curiosity

The Smallest Bible in the World



The Midget Bible is a perfect gem in the words of art. It is printed in large, clear postage stamp and contains the OLD AND NEW TESTAMENTS, HUNDRED AND FIFTY PAGES of the NEW TESTAMENT are illustrated. This little Bible is a wonder. It is said to be very good testament. Must be seen to be appreciated. Price, only 12 cents, three Bibles for 30 cents, one dozen Bibles for $1.00, or 100 for $8.00. Good money can be made selling these Midget Bibles amongst friends, church acquaintances, Sunday Schools, bazaars, etc. Sold by Vendors, Coin Trick is sure to be dropped

The CONJURER'S CASKET

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment

ANYONE CAN DO THEM

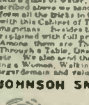
50c



It is great fun mystifying your friends. Get this Conjurer's Cabinet, and you will be a shrewd fellow in your district. It contains the apparatus for seven first-rate tricks, including The Disappearing Ball, which is performed on the lapel of your coat, vanishes from sight at will, the Magic Vase and Ball Trick to Wonder Ball is found in somewhere else's pocket. The Magic Wand with which you can produce anything out from almost to the, the Wonderful Handkerchief is required to be placed in an envelope, and when opened an entirely different handkerchief is found; The Unexpected Visitor, a card is placed in the wonderful box, and when opened again, is found to have vanished entirely, or a card selected by a person is found in a sealed envelope which he has placed in his pocket. Each trick defies the keen eye of examination by anyone from the palm of the hand, nose, cheek, wall, clothing, etc.; The Genuine Vanishing Coin Trick is to coin is dropped into a glass of water, and when the water is poured out the coin has vanished. With the seven tricks described above we send full printed instructions for performing them, and the great amusement of their friends or the public. Any boy or ordinary intelligence can perform these tricks after possessing one or two performances. Do not interfere to remove a single article contained in the Cabinet, there are twenty-five other tests and illusions fully explained with full printed instructions, for which post no extra charge. Remember, the Winner is a Pack of Cards, The first Trick, To Knott a Tumbler Through a Table; One Thousand Dollars, To Find the Number Three Thousand, Mysterious Wedding Ring, all these and the secret of performing three wonderful stage tricks, as follows: The Art of Forming a Woman's Head in the Palm of a Hand, and The Disappearing Lady; complete with full printed instructions for each trick, and reliable hints to amateur conjurers. PRICE COMPLETE ONLY 50 CENTS.

JOHNSON SMITH & CO., Dept. E 3, 54 W. Lake St., CHICAGO

The Newest Novelty Aerial Balloon



Flies gracefully in or outdoors. This is the VERY LATEST SENSATION IN BALLOONS. A brightly colored balloon that one leaves the hand and flies gracefully in the air. When released, the air pressure sends the balloon SOARING UPWARD, the big-back propeller REVOLVING AROUND AT A LIVELY RATE. The effect is startling. It is a graceful flier that makes the spectators WILD WITH JOY. May be used repeatedly indoors or outdoors. An immensely interesting toy. Price 10c each, 3 for 25c postpaid.

JOHNSON SMITH & CO., Dept. E 3, 54 West Lake Street, CHICAGO

"The Baby" Double Action Hammerless Revolver

A HANDSOME AND MOST EFFECTIVE WEAPON

$5.50 Measures but 4½ inches long

Takes regular .22 calibre cartridges

The new Baby Double Action Hammerless Revolver has been produced to meet the ever increasing demand for a revolver that would combine small size and small in size, yet is just as effective and serviceable as the most expensive weapon sold there is no safer or better one made than this. A great feature is its safety action that guards against accidental discharge, even when it is quite safe to pull the trigger. The illustration gives an idea of its appearance, but it must be seen to be appreciated. The ammunition used is the .22 short (short) cartridge obtainable anywhere, or you may obtain the cartridges from us (cartridges can be shipped only by express). The revolver is only $8.50, sent by mail postpaid to any address. JOHNSON SMITH & CO.

THE EXPO WATCH CAMERA

The most wonderful and ingenious Camera made



It is but little larger than a watch, which it closely resembles. You can carry the Expo about in your pocket and take pictures without any one being the wiser.

One Cent a Picture

The Expo loads in daylight with 24 Exposure Films, costing 50c, thus the picture taking cost of a single picture may be had for the nominal sum of One-One cent a picture. 12 Exposure Films are obtainable. The simplicity itself to operate. Take pictures through the lens, where the Real Fine Lens is located. The lens is 0/8.8, 7/81 may be enlarged to any size.

Price $2.50

QUICK AS A FLASH

This and instantaneous shutters; designed by amateurs and professionals the world over. Thoroughly practicable—practical and speeding of films just the same as ordinary cameras. Popular among newspaper reporters, detectives, and the general public. Important feature is the new one-way lock, with the Watch Cannot be unscrewed. Produces clear, sharp negatives indoors or outdoors equal to any camera on the market, all other parts operate as usual.

Expo Watch Camera $2.50 FILMS, 12 Exposure 15c, 24 Exposure, 25c
Extra Lens 50c Extra Shutter

JOHNSON SMITH & CO., Dept. E 3, 54 W. Lake St., CHICAGO

Trim Your Own Hair With the Utility Safety Hair Cutter

Cuts the Hair Any Length, Short or Long—Saves Its Cost First Time Used.

Agents Wanted



Price Only 35c Extra Blades 5c each

If you can COMB your hair you can TRIM your own hair with the UTILITY TRIMMER. Invention. The UTILITY TRIMMER will cut hair any length you desire, short or long, finish. The job so nicely as any barber and in one-fourth the time before your own mirror. The ladies can cut the children's hair at home in a jiffy; can be used as an ordinary razor is required. Made of solid nickel silver throughout, with the sides and the temples and neck. Sharpened like any razor; can be carried in the vest pocket or hand; will last a lifetime.

To use it, stand in front of a mirror, if necessary, and use the UTILITY TRIMMER like you would a comb. Place it over the hair, backward, in the direction the hair lies, but never upward. To cut long hair, first comb the hair and then cut close to the end, then start cutting with downward cuts as high as you desire, evenly all around. The trimmer has rounded ends and temples with a square cut, like a barber.

It is impossible to cut or "cut steps" in your hair with this device, as the handle guard guides the cutter blade evenly over the scalp.

To cut very close, push the blade until the cutting edge is even with the guard teeth.

To shave the face or neck it can be used as an ordinary razor by reversing the blade in the holder, the cutting edge being to the back of the holder, exposing the entire blade, except each corner. To sharpen, place blade in the holder, with the cutting edge to the back, moving the blade out until the cutting edge is clear of the back of the holder. Then move in the usual manner; the edge will be as sharp as an ordinary razor.

JOHNSON SMITH & CO., Dept. E 3, 54 W. Lake St., CHICAGO

New Vamping Card



PIANO PLAYING MADE EASY

By Theodor Hagdad
Burgenlands Simple System

Persons having registered their Musical Education need not despair, for with the aid of our new VAMPING CARD placing the card upright over the piano keyboard, you can play in any key to thousands of Songs, Ballads, Waltzes, Two-Step, etc., etc., equal to a Professional Musician. No knowledge of music is required. After using it a few times, you will be capable with the aid of the Vamping Card entirely. Only 15 cts. p. pd. Johnson Smith & Co., Dept. E 3, 54W Lake St., Chicago

THE GREAT JAPANESE UMBRELLA PALM

A Graceful House or Conservatory Plant, Quite Easily Grown. Easily Grown from Seed, Summer or Winter



The Great Japanese Umbrella Palm is a semi-aquatic plant. It is easily grown from seed in a pot filled with soil and water or in very damp soil. Probably the most novel, as well as the most interesting method, is to cultivate the plant in a bowl or jar—incre filled with water, with two or three inches of good garden soil at the bottom. The seeds need commence to germinate, and the plant shoots up stems two or three feet high and rapidly assumes a most pretty palm-like appearance, as shown in the engraving. The tops of the stems are surrounded by a whorl of umbrella-shaped leaves, of a very graceful form. From the center of the umbrellas, smaller umbrellas branch out, and the effect is decidedly novel. The Umbrella Palm is a perfect fish table or window fish the conservatory, and indeed for all decorative purposes, fish bowls, aquarium, etc. We will take a package of the seed, with full instructions for culture, for only 10 cents, or three packages for 40 cents, postpaid.

Johnson Smith & Co., Dept. E-3, 54 W. Lake St. Chicago

FIGHTING ROOSTERS



A full-blooded pair of fighting game cocks of the Vandyke breed. These birds are hatchers have red feathers, yellow legs and fiery eyes. They are very pugnacious when fighting are perfectly natural and life-like, and the sense of humor mentioned is known only to the operator who can cause them to fight at will. Each pair is sent out as often and as long as desired. Independent of their fighting proclivities they make very pretty mantel ornaments. Price for the pair, in neat box, 10 cents, 3 pair for 25 cents, by mail postpaid. Johnson Smith & Co.

LOADED CIGARETTES

Just Like Ordinary Cigarettes, But Have Been Scientifically



A box containing ten apparently genuine Cigarettes. They contain a charge which will explode when about one-third is smoked.

They appear and feel, and afford as good a smoke (while they last) that the victim be taken entirely by surprise. A great laugh producer and practical joke. Price per box, 10 cents, 3 for 25 cents, postpaid. Johnson Smith & Co., Dept. E3, 54 W. Lake St. Chicago

Potmend

Stops a leak in a minute



The finest repairer for iron—s, Aluminum, Enamelware, etc. Good for kettles, pots, pans, boilers, and every kind of ironware, also for tin, copper, aluminum, tea bottles, iron pipes, cracks in stoves, broken china, porcelain, brick-a-brac, bisque, crockery, woodenware, marble, etc. Will not crack, chip, burn, bake or boil out. THE MENDIS THE STRONGEST SPOT IN THE POT when mended. Just mix the powder with water HARDENS LIKE IRON. Fire proof, Water-proof. You can bil a big hole or a small crack. Mended place stronger than new. Replaces chipped enamel. Averages one to 8; FAILURE IS IMPOSSIBLE. Better and easier than solder. Three sizes, 15 cents, 25 cents and 50 cents.

Johnson Smith & Co., Dept. E3, 54 W. Lake St., Chicago

www.americanradiohistory.com



Every Electrical Man Wants These Books and we ship them for your inspection FREE



Flexible Covers — Handy Pocket-Size Volumes

10 Volumes — 3500 Pages — 4700 Pictures

$1 Per Volume

$1 Per Month

Just what you need to know to succeed in ELECTRICITY

EVERY electrician, every engineer, every mechanic should know about these wonderfully helpful instructive books, which give in plain words a complete working knowledge of electrical engineering in all its phases.

You run into some new electrical problem almost every day. The information you need to help you in your every day work is in

HAWKINS ELECTRICAL GUIDES

These books place electricity at your finger ends. They cover every imaginable subject, principle, theory, problem, trouble, and way of doing things electrically. Every subject is indexed so that you can turn right to it. They are a study course and a reference guide in one, written in plain every day language—no wasted words—only what you need to know—chock full of up-to-the-minute electrical knowledge. The guides are a complete course in electrical engineering. They will help you in every detail of the day's electrical work. You can't ask an electrical question that Hawkins Guides can't answer.

What Electrical Men Say

Helped Him Make Good

"It is only right for me to recommend highly the Hawkins Guides, for they have been of the greatest assistance to me in placing me in my present position as Superintendent of Construction Department of one of Ohio's largest Electrical Companies. I would like to see every man have a set of Hawkins Guides."
Geo. Knecht, Columbus, Ohio.

In the Naval Electrical Dept.

"The Hawkins Guides are great help to me in the Naval Electrical Department, which they cover very thoroughly."
C. J. Cornell,
U. S. Receiving Ship, Brooklyn, N. Y.

Superintendent

"I am now superintendent of the Dunnville Hydro-Electric Systems, and Hawkins Guides were a great help to me in holding down a responsible position."
W. E. Swartz, Dunnville, Ontario.

Wireless Operators

"I have worked wireless for ten years—but I wish I had these books years ago, as they have saved me a great deal of trouble." H. Marshall,
Steamer M & H No. 2,
Walkerville, Ont.

Pocket-Size Flexible Covers

The books are small enough to slip into your coat pocket—handsomely bound in flexible black covers.

You can carry each volume with you until you have mastered its contents. 3,500 pages of actual information and 4,700 illustrations. Once you see these books and put them into actual use you will never again want to be without them. Try it at our expense.

SEND NO MONEY

It will cost you nothing to receive these books—to look them over—ask them all the questions you can think of—use them in your work—study them—pick up some information that will increase your earning ability. We will ship you the entire set of 10 volumes entirely FREE.

This is a sign of our confidence in the guides. Pure gold does not object to being tested. Keep them for seven days and if you do not decide that you can't get along without them, return them to us and owe us nothing.

When you decide to keep them you only have to pay $1.00 down and remit the balance of $9.00 on the easy payment of $1.00 a month till paid for.

Use this coupon to get the books, it will pay you many times over.

THEO. AUDEL & CO.
72 Fifth Ave. New York, N. Y.

READ THIS PARTIAL LIST OF CONTENTS

No. 1 Contains 348 pages, 388 illustrations. Electrical signs and symbols—static and current electricity—primary cells—conductors and insulators—resistance and conductivity—magnetism—induction coils—dynamo principles—classes of dynamos—armatures—windings—commutation—brushes, etc.

No. 2 Contains 348 pages, 394 illustrations. Motor principles—armature reaction—motor starting—calculations—brake horsepower—selection and installation of dynamo and motors—galvanometers—standard cells—current measurement—resistance measurement—voltmeters—wattmeters—watt hour meters—operation of dynamos—operation of motors, etc.

No. 3 Contains 300 pages, 423 illustrations. Distribution systems—wires and wire calculations—inside, outside and underground wiring—sign flashers—lightning protection—rectifiers—storage battery systems, etc.

No. 4 Contains 270 pages. 379 illustrations. Alternating current principles—alternating current diagrams—the power factor—alternator principles—alternator construction—windings, etc.

No. 5 Contains 320 pages, 614 illustrations. A. C. Motors—synchronous and induction motor principles—A. C. commutator motors—induction motors, transformers; losses, construction, connections, tests—converters—rectifiers, etc.

No. 6 Contains 298 pages, 472 illustrations. Alternating current systems—switching devices—circuit breakers—relays—lightning protector apparatus—regulating devices—synchronous condensers—indicating devices—meters—power factor indicators—wave form measurement—switch boards, etc.

No. 7 Contains 316 pages, 379 illustrations. Alternating current, wiring power stations—turbines; management, selection, location, erection, testing, running, care and repair—telephones, etc.

No. 8 Contains 332 pages, 436 illustrations. Telegraph—simultaneous telegraphy and telephony—wireless—electric bells—electric lighting—photometry, etc.

No. 9 Contains 322 pages, 627 illustrations. Electric railways—electric locomotives—car lighting—trolley car operation—miscellaneous applications—motion pictures—gas engine ignition—automobile self-starters and lighting systems, electric vehicles, etc.

No. 10 Contains 513 pages, 599 illustrations. Elevators—cranes—pumps—air compressors—electric heating—electric welding—soldering and brazing—industrial electrolysis—electro plating—electro-therapeutic—X-rays, etc.

Also a complete 126-page ready reference index of the complete library. This index has been planned to render easily accessible all the vast information contained in the 10 electrical guides. There are over 13,500 cross references. You find what you want to know instantly.

THEO. AUDEL & CO.
72 Fifth Avenue
New York, N. Y.

Please submit me for examination Hawkins Electrical Guides (price $1 each). Ship at once, prepaid, the 10 numbers. If satisfactory I agree to send you $1 within seven days and to further mail you $1 each month until paid

Signature .....
Occupation .....
Business Address .....
Residence .....
Reference ..... E.E. Feb

SEND NO MONEY—USE THE COUPON

www.americanradiohistory.com



You Can Now TREAT YOURSELF at Home
With this Wonderful *Health Restoring*

VIOLET RAY

Most Effective Health, Strength and Beauty Agent Known to Science



YOU CAN HAVE BODILY VIGOR, SUCCESS-ATTAINING ENERGY, ATTRACTIVE, HEALTHFUL BEAUTY—All at practically no cost—The great benefits of the ***Violet Ray treatments*** heretofore only procurable at big expense from physicians and beauty specialists are now available in your own home. Look over list of treatments below. Send for particulars.



Treatment for general debility, nervousness, etc.



Quick relief for rheumatism



Inhaling ozone. For Catarrh, throat and lungs. Marvelous local results with general tonic effect

How Violet Ray Benefits

Electricity from your light socket is transformed into health and beauty-giving Violet Ray—powerfully effective, yet gentle, soothing, perfectly safe. Voltage is raised from ordinary lighting current to *several hundred thousand volts*, giving tremendous penetrative force. The irresistible, revitalizing powers of *Renulife Violet Ray* are carried at once to every nerve cell, fibre and part of body. Blood is enriched and purified by a flood of oxygen, giving added vitality and strength. Assimilation and digestion improved—functions restored to normal—extra supply of fresh blood quickly brought to area treated, removing congestion and supplying nourishment. While relieving pains and aches, the manifest results of disorders, it removes the deep-seated cause; combines the benefits of electricity, vibration, exercise, stimulation and oxidation.

Painless Electricity

Science has modified electricity that the weakest may stand its force without fear or pain. Every tissue and fibre is saturated, patient experiencing only a sensation of relief, as if standing in a ray of sunshine. *Violet Ray high frequency* has no comparison with old, crude, electrical batteries and shocking current. Every jar and shock is removed. The effects are marvelously rapid. Relief can be given in one or more treatments. Often cures are accomplished in that time. It is positive and certain in action. If you value your health, and want to keep or restore your good looks and gain vitality, throw away medicine bottles—take this sensible, scientific means. *Violet Rays* work with nature. Every day's delay makes relief more difficult.

Renulife Violet Ray
HIGH FREQUENCY GENERATORS

Offered on a Most Liberal
TRIAL PLAN
Learn the Wonderful Benefits by Actual Use

Send for Booklet, "Health via Violet Ray."



Unequaled for scalp and hair



Brings beauty parlor to your home



Tones the system. May be applied with perfect safety to infants, or weakest invalid

RENULIFE ELECTRIC CO., - - 533 Marquette Building, Detroit
CANADIAN RENULIFE ELECTRIC CO., 178 SANDWICH ST., FORD CITY, ONTARIO.

Tear Out Coupon—Get FREE BOOK

COUPON FOR BOOK and Special Information

RENULIFE ELECTRIC CO.,
533 Marquette Bldg., Detroit

Please send without obligation, your book "Health," explaining Violet Ray treatments with Renulife Generators, also gratuitous particulars as to its application for ailments checked below

TREATS SUCCESSFULLY

Abscesses	Facial Neuralgia	Obesity
Anemia	Falling Hair	Pain in Abdomen
Asthma	Female Complaints	and Chest
Arteriosclerosis	Goitre	Paralysis
Baldness	Gout	Piles
Blackheads	Haemorrhoids	Pimples
Brain Fag	Hay Fever	Pyorrhea
Bronchitis	Infantile Paralysis	Rheumatism
Bunions	Insomnia	Scars
Bruises	Lameness	Sciatica
Catarrh	Locomotor Ataxia	Skin Diseases
Colds	Lumbago	Sore Throat and Throat Diseases
Chilblains	Nervous Affections	Sprains
Dandruff	Neuralgia	Toothache
Deafness and Ear Diseases	Neuritis	Weak Eyes
Eczema		Wrinkles
Enlarged Prostate		Warts and Moles

Name .....

Address .....

.....



NOT A VIBRATOR

Model B Shown

Several Models Varying in Price

Lowest Priced Most Effective

VIOLET RAY

Instrument for Home Use

Every person would be wonderfully benefited by a few minutes' daily use. Its astonishing low price places it within the reach of all.

Write at once for full information regarding uses, benefits, price, etc.

WANTED—
Representatives to demonstrate to physicians and individuals.

THE CARLEY PRINTING CO INC.
NEW YORK

www.americanradiohistory.com

TK
7500
E54
v.6
no.

MARCH, 1919
20 CTS.

ELECTRICAL EXPERIMENTER

OVER 175 ILLUST.

SCIENCE AND INVENTION

REG. U.S. PAT. OFF.

SEARCH LIGHTS OF THE DEEP

SEE PAGE 772



www.americanradiohistory.com

Learn Electricity



In the Great Shops of

COYNE

Trade and Engineering Schools
BENNETT WELLINGTON COOKE, Director
Dept. 23, 39-51 E. Illinois St., Chicago, Ill.

PRACTICAL INSTRUCTION

FINISH IN 3½ MONTHS

Thousands of Electrical experts are needed to help rebuild the world. Come to Chicago to the great shops of Coyne and let us train you quickly by our sure, practical way, backed by twenty years of success. Hundreds of our graduates have become experts in less than four months. *You* can do the same. *Now* is your big opportunity. Come—no previous education necessary.

Earn $125.00 to $350.00 A Month

In the Electrical business. Come here where you will be trained in these great $100,000 shops. Experts show you everything and you learn right on the actual apparatus. You work on everything from the simple bell to the mighty motors, generators, electric locomotives, dynamos, switchboards, power plants, everything to make you a master electrician. We have thousands of successful graduates. Just as soon as you have finished we assist you to a good position. We now have more positions than we can fill. Think of it.

COYNE-TRAINED MEN IN DEMAND

BE A COYNE Trained Expert. Our Graduates are given the Preference. They are in demand Everywhere at big Salaries.

Our graduates are in demand because Coyne is known for its splendid practical training. We are continually receiving letters, telegrams and telephone calls from contractors, manufacturing firms, etc., seeking our graduates to fill responsible positions. We often have many more positions than we can fill and the demand is steadily growing.

We Make You an Expert in Less Than 4 Months

No need of taking from 1 to 4 years to become an expert, we have proved this in thousands of cases. The Coyne method of practical training eliminates all books, useless theory and other non-essentials and trains you in just what you need to know to become an expert.

Day or Evening Courses

Don't worry about the money. Anyone with ambition can learn here. Our tuition is low with small easy payments if desired. All tools and equipment is furnished free. Our students live in comfortable homes in the best section in Chicago—on the lake.

EARN YOUR WAY

Many students earn a large part of their living expenses by doing a little work in their spare time. Our employment dept. furnishes these positions without charge.

LEARN DRAFTING

Skilled Draftsmen are always in demand. Our courses are thorough—short—practical, preparing a man fully to hold a position of responsibility. We have more positions than we can fill. We also have thorough practical courses in *Plumbing and Heating and Motion Picture Operating.*

Send Today for Book

Write today, *now*, for the book. It tells what Coyne graduates have done. What you can do. Fill in the coupon, check the trade you are most interested in or send a postal card, do it *now*.

MAIL COUPON FOR FREE BOOK NOW!

COYNE TRADE AND ENGINEERING SCHOOLS
Bennett W. Cooke, Director
Dept. 23, 39-51 E. Illinois St.
Chicago, Ill.

Please send at once your big Free Book—I am interested in

[ ] Electricity [ ] Drafting [ ] Plumbing
[ ] Motion Picture Operating
(Check trade interested in)

Name.....

Address.....

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers

www.americanradiohistory.com

The best investment of the year—

CROFT'S ELECTRICITY



Get at the first-hand facts about electricity, taken from work itself.

This is the year of big things in electricity. Don't waste any time in getting ready for the big pay that awaits the electrically trained man Don't depend upon amateurish or theoretical books or courses to give you the necessary knowledge. Books written from practice by practical men are easiest mastered, and when you do master them, you are an expert, ready to demand the salary of an expert.

FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc.
239 West 39th Street, New York

Gentlemen:—Please send me the Library of Practical Electricity (shipping charges prepaid) for 10 days' free examination. If satisfactory, I will send $2 in ten days and $2 per month until $16 has been paid. If not wanted I will write you for return shipping instructions.

Name .....
Home Address .....
City and State .....
Name of Employer .....
His .....
Your Position .....

Ex. Mar. 19

LIBRARY SEP 2 8 1999 UNIVERSITY OF TORONTO

KNOW ELECTRICITY AS EXPERTS KNOW IT

You can now say to yourself "If others are earning $5,000 per year and up in electrical practice, I can also do it, because Croft's Library contains the same information that these men possess."

Croft's Library does contain just the information you need to reach the big position. It contains all the information you need in electrical practice. Nothing is left out. You are told of every detail in plain language and illustration.

Not one of the thousands of men who own the Croft Library has said he could not understand the books. They are as clear as the elementary readers and arithmetic you studied in school. And yet they are thorough, and do not leave off until you are an expert. They are just as valuable to the beginner as to the highest paid specialist, because they are all practice.

No one interested in any branch of electricity, or who expects to take up the work, can afford to be without Croft's Library.

READ THIS—

Electricity, from the simplest principles, to complete and economical operation of a central station—

Motors, generators, armatures, commutators, transformers, circuits, currents, switchboards, distribution systems.

Electrical machinery of every type, installation, operation and repair.

Wiring for light and power. How to do it mechanically perfect, in accordance with the National Electrical Code.

Wiring of finished buildings. Underwriters' and municipal requirements. How to do the complete job, from estimating it, to completion.

Illumination in its every phase. The latest and most improved methods of lighting. Lamps and lighting effects.

A complete course in mathematics as applied to work. A course which refreshes your mind, and gives you mastery of all the short-cuts in figuring.

Electrical practice complete. Electrical practice as experts know it. Electrical practice by experts.

8 Beautiful flexibly-bound volumes, pocket size, 3000 pages, 2100 illustrations

These eight handy, compact volumes are a work of art. Carefully indexed for quick reference and for study. Every one of the subjects are literally at the finger's end. No turning of pages for what you want.

Not one cent in advance. Merely return the coupon above. Small monthly payments if you are satisfied.

Don't wait another day if you want to know electricity as experts know it. Fill in the coupon now. We will ship the eight volumes charges paid for ten days' examination. Return them at our expense if they are not entirely satisfactory. Pay only $2 per month for eight months if you are pleased



McGraw-Hill Book Co., Inc.
239 West 39th Street New York
Publishers of books for engineers since 1876

ACT NOW

www.americanradiohistory.com

Electrical Experimenter

233 FULTON STREET, NEW YORK

Publisht by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer;) 233 Fulton Street, New York

Vol. VI. Whole No. 71 MARCH, 1919 No. 11

SEARCHLIGHTS OF THE DEEP.....Front Cover
From a painting by George Wall.

33 ASSEMBLED LOCOMOTIVES ON ONE SHIP..... 765

THE LATEST STYLE IN FLASH-LIGHTS..... 767

"THE BORDER WIRELESS" AND "THE HUN WITHIN"..... 768

GOLD AND SILVER LOCATED WITH SOUND WAVES..... 769

HOSPITAL SHIP FITTED WITH GYROSCOPIC STABILIZER.... 771

TESLA'S EGG OF COLUMBUS.....By Dr. Nikola Tesla. 774

MY INVENTIONS—No. 2 of a Series..... 776
By Dr. Nikola Tesla. Exclusive Feature.

OLDEST AND NEWEST STYLES IN TROLLEYS..... 778

"WHITE COAL" MOTOR TO HARNESS TIDES..... 779

POPULAR ASTRONOMY—SATURN—THE RINGED PLANET.... 780
By Isabel M. Lewis, of the U. S. Naval Observatory.

HOW JIMMY SAVED THE BANK.....By F. W. Russell. 782

SUBMERSIBLE BOAT RESEMBLES SEA MONSTER..... 784

EXPERIMENTAL PHYSICS—LESSON NINETEEN..... 785
By John M. Furia, A.B., M.A.

ALEXANDER WIRELESS BILL IS KILLED.....By H. Gernsback 786

AMERICA'S GREATEST WAR INVENTION—THE ROGERS' UNDERGROUND WIRELESS.....By H. W. Secor. 787

HOW I INVENTED THE AUDION.....By Dr. Lee de Forest 790

GIGANTIC 1,400 K.W. RADIO STATION AT LYONS, FRANCE... 791

WOOD FINISHING FOR THE AMATEUR.....By Arno A. Kluge. 793

EXPERIMENTAL CHEMISTRY—THIRTY-FOURTH LESSON.... 794
By Albert W. Wilsdon.

HOW TO MAKE IT DEPARTMENT—PRIZE CONTEST..... 795

WRINKLES, RECIPES AND FORMULAS...Edited by S. Gernsback 796

LATEST PATENTS DIGEST..... 797

WITH THE AMATEURS—LABORATORY PHOTO CONTEST.... 798

SCIENCE IN SLANG.....By Emerson Easterling 799

THE ORACLE..... 800

EDITORIAL

Underground Wireless

ELSEWHERE in this issue is disclosed in full detail for the first time what U. S. Navy officials term as the greatest American War Invention: "Underground and Sub-sea Wireless."

Last month we hinted editorially on the theoretical aspect of the problem—this month we are face to face with the accomplisht fact. The war has revolutionized not only peoples, nations and the whole world, but many hitherto unshakable scientific institutions as well. For over twenty years the wireless aërial—the elevated aërial wire system—was synonymous with the wireless art. The great radio station, the trans-atlantic liner, could not well be imagined without its ubiquitous stretch of elevated wires. The greatest pride of the radio amateur, the aërial on top of his house, which to him was symbolic of the young art, is doomed. This change has been brought about over night by the magic wand of science and her servant—Mr. James Harris Rogers, American, of Hyattsville, Md.

The aërial wires, down for the duration of the war, will never go up, at least as far as amateurs and private stations are concerned. As for the commercial stations, their towers too are doomed shortly for the scrap-heap. During the war Mr. Rogers developed underground and sub-sea wireless—for receiving at least—to a heretofore undreamt of state of perfection. His receiving station at Hyattsville never mist a word transmitted from French, English, Italian as well as German high power stations. *He received his messages from Europe when a thunderstorm, accompanied by terrific lightning, was going on directly above his head.* Recently, too, *he has done away entirely with static.*

When the big station at Arlington, near Washington, was out of touch with Europe, due to static disturbances, Mr. Rogers went right on receiving over his buried underground wires, just as if static never existed. Indeed the Rogers invention knows no static. Static being an atmospheric condition, a ground antenna naturally will not be affected by it.

But the most spectacular feature of Mr. Rogers' revolutionizing invention probably is his "Sub-sea Wireless." Scientists the world over, Marconi included, declared it an utter impossibility to communicate by wireless with a totally submerged submarine. Mr. Rogers, however, goes right ahead and does it, not only in fresh water *but thru salt water as well.* Indeed he establisht wireless communication with a submarine *whose aërial wires were 25 feet below the surface of the ocean!*

Altho Mr. Rogers, during the war, gave most of his attention toward receiving messages, he has made considerable progress in underground radio transmission as well. His experiments prove conclusively that, while underground radio receiving is here to stay, underground sending too will soon be practical enough, even for high power stations. It is merely a question of good insulation at present, and the end of this year, we are quite confident, will bring the solution of the problem. The Navy Department has just succeeded in transmitting a distance of 50 miles with the underground system.

At first it would seem reasonable that only long wave lengths could be used with the Rogers system. But this is not the case. Underground Radio-telephone messages, seven miles distant, come in just as clear on 300 meters wave length as does the Nauen (Germany) station with 12,600 meters wave length. This indeed is good news for our amateurs.

But in the meanwhile, all of our pet theories on wireless are thrown in a sad chaos. For we do not know as yet how the Rogers system works. We can now expect a war to the knife between our wave-propagation theorists and the new school of ground-impulse savants. Mr. Rogers himself takes the view—and he is seconded by Tesla—that the transoceanic messages which he receives over his underground system *are not Hertzian waves*—pure or even converted—but merely high frequency ground impulses.

The future may tell us which school is right.

H. GERNSBACK.

The ELECTRICAL EXPERIMENTER is publisht on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions, Canada and foreign countries, $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 20 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. A green wrapper indicates expiration. No copies sent after expiration.

All communications and contributions to this journal should be address to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

ELECTRICAL EXPERIMENTER, Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered U. S. Patent Office. Copyright, 1919, by E. P. Co., Inc., New York. The Contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.

The ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris.

www.americanradiohistory.com

How One Evening's Study Led to a $30,000 Job

A Simple Method of Mind Training That Any One Can Follow With Results From the First Day

By a Man Who Made Formerly No More Than a Decent Living

I HOPE you won't think I'm conceited or egotistical in trying to tell others how I suddenly changed from a comparative failure to what my friends term a phenomenal success.

In reality I do not take the credit to myself at all. It was all so simple that I believe any man can accomplish practically the same thing if he learns the secret, which he can do in a single evening. In fact I know others who have done much better than I by following the same method.

It all came about in a ratber odd manner. I had been worrying along in about the same way as the average man thinking that I was doing my bit for the family by providing them with three square meals a day, when an old chum of mine, Frank Powers, whom I had always thought was about the same kind of a chap as I, suddenly blossomed out with every evidence of great prosperity.

He moved into a fine new house, bought a good car and began living in the style of a man of ample means. Naturally the first thing I did when I noticed these things—for he had said nothing to me about his sudden good fortune—was to congratulate him and ask him what had brought the evident change in his finances.

"Bill," he said, "it's all come so quickly I can hardly account for it myself. But the thing that has made such difference in my life lately began with an article I read a short time ago about training the mind.

"It compared the average person's mind to a leaky pail, losing its contents as it went along, which if carried any distance would arrive at its destination practically empty.

"And it showed that instead of making the pail leakproof most of us kept filling it up and then losing all we put into it before we ever reached the place where the contents would be of real use.

"The leak in the pail, the writer demonstrated, was forgetfulness. He showed that when memory fails, experience, the thing we all value most highly, is worthless. He proved to me that a man is only as good as his memory, and whatever progress a man accomplishes can be laid directly to his powers of retaining in his mind the right things—the things that are going to be useful to him as he goes along.

"Farther on in the article I read that the power of the mind is only the sum total of what we remember—that is, if we read a book and remember nothing that was in it, we have not added one particle to our experience; if we make a mistake and forget about it, we are apt to make the same mistake again, so our experience did not help us. And so on, in everything we do. Our judgment is absolutely dependent on our experience, and our experience is only as great as our power to remember.

"Well, I was convinced. My mind was a 'leaky pail.' I had never been able to remember a man's name thirty seconds after I'd been introduced to him, and as you know, I was always forgetting things that ought to be done. I had recognized it as a fault, but never thought of it as a definite barrier to business success. I started in at once to make my memory efficient, taking up a memory training course which claimed to improve a man's memory in one evening. What you call my good fortune to-day I attribute solely to my exchanging a 'leaky pail' for a mind that retains the things I want to remember."

David M. Roth

When Mr. Roth first determined to exchange his leaky mind for one that would retain anything he wanted it to, it was because he found his memory to be probably poorer than that of any man he knew. He could not remember a man's name 20 seconds. He forgot so many things that he was convinced he could never succeed until he learned to remember. Today there are over ten thousand people in the United States whom Mr. Roth has met at different times—most of them only once—whom he can instantly name on sight.

Mr. Roth can and has hundreds of times at dinners and lectures asked fifty or sixty men he has never met to tell him their names, businesses and telephone numbers and then after turning his back while they changed seats, has picked each one out by name, told him his telephone number and business connection.

These are only a few of the scores of equally "impossible" things that Mr. Roth can do, and yet a few years ago he couldn't remember a man's name twenty seconds. Why go around with a mind like a leaky pail when, as Mr. Roth says, "What I have done any one can do."

Powers' story set me thinking. What kind of a memory did I have? It was much the same as that of other people I supposed. I had never worried about my memory one way or another, but it had always seemed to me that I remembered important things pretty well. Certainly it never occurred to me that it was possible or even desirable to improve it, as I assumed that a good memory was a sort of natural gift. Like most of us, when I wanted to remember something particularly I wrote it down on a memorandum pad or in a pocket notebook. Even then I would sometimes forget to look at my reminder. I had been embarrassed—as who has not been?—by being obliged to ask some man whom I had previously met what his name was, after vainly groping through my mind for it, so as to be able to introduce him to others. And I had had my name requested apologetically, for the same purpose, so that I knew I was no different than most men in that way.

I began to observe myself more closely in my daily work. The frequency with which I had to refer to records or business papers concerning things that at some previous time had come under my particular notice amazed me. The men around me who were doing about the same work as myself were no different than I in this regard. And this thought gave new significance to the fact that I had been performing practically the same subordinate duties at exactly the same salary for some three years. I couldn't dodge the fact that my mind, as well as most other people's, literally limped along on crutches, because it could not retain names, faces, facts, and figures. Could I expect to progress if even a small proportion of the important things I learned from day to day slipped away from me? The only value of most of my hard-won experience was being canceled—obliterated—by my constantly forgetting things that my experience had taught me.

The whole thing hit me pretty hard. I began to think about the subject from all angles as it affected our business. I realized that probably hundreds of sales had been lost because the salesman forgot some selling point that would have closed the order. Many of our men whom I had heard try to present a new idea or plan had failed to put over their message or to make a good impression because they had been unable to remember just what they wanted to say. Many decisions involving thousands of dollars had been made unwisely because the man responsible didn't remember all the facts bearing on the situation and thus used poor judgment. I know now that there isn't a day but what the average business man forgets to do from one to a dozen things that would have increased his profits. There are no greater words in the English language, descriptive of business inefficiency than the two little words "I forgot."

I had reached my decision. On the recommendation of Powers, I got in touch at once with the Independent Corporation which shortly before had published the David M. Roth Method of Memory Training. And then came the surprise of my life. In the very first lesson of the course I found the key to a good memory. Within thirty minutes after I had opened the book the secret that I had been in need of all my life was mine. Mr. Roth has boiled down the principles perfecting the memory so that the method can almost be grasped at a glance. And the farther you follow the method the more accurate and reliable your memory becomes. Within an hour I found that I could easily memorize a list of 100 words and call them off backward and forward without a mistake. I was thunderstruck with the ease of it all. Instead of study the whole thing seemed like a fascinating game. I discovered that the art of remembering had been reduced by Mr. Roth to the simplest method imaginable—it required almost nothing but to read the lessons! Every one of those seven simple lessons gave me new powers of memory, and I enjoyed the course so much that I look back on it now as a distinct pleasure.

The rest of my story is not an unusual one among American business men who have realized the value of a reliable trained memory. My income today is close to $30,000. It will reach that figure at the beginning of our next fiscal year. And two years ago I scarcely made what I now think of as a decent living.

In my progress I have found my improved memory to be priceless. Every experience, every business decision, every important name and face is easily and definitely recorded in my mind, and each remembered experience was of immense value in my rapid strides from one post to another. Of course, I can never be thankful enough that I mended that "leaky pail" and discovered the enormous possibilities of a really good memory.

SEND NO MONEY

Mr. Roth's fee for personal instruction to classes limited to fifty members is $1,000. But in order to secure nation-wide distribution for the Roth Memory Course in a single season the publishers have put the price at only five dollars, a lower figure than any course of its kind has ever been sold before, and it contains the very same material in permanent form as is given in the personal $1,000 course.

So confident is the Independent Corporation, the publishers of the Roth Memory Course, that once you have an opportunity to see in your own home how easy it is to double, yes triple the powers of your memory, and how easily you can acquire the secret of a good memory in one evening, that they are willing to send the Course on free examination.

Don't send any money. Merely mail the coupon or write a letter and the complete course will be sent, all charges prepaid, at once. If you are not entirely satisfied send it back any time within five days after you receive it and you will owe nothing.

On the other hand, if you are as pleased as are the thousands of other men and women who have used the course, send only $5 in full payment. You take no risk and you have everything to gain so mail the coupon now before this remarkable offer is withdrawn.

FREE EXAMINATION COUPON

Independent Corporation

Division of Business Education

Dept. R-1103 119 West 40th St., New York

Publishers of The Independent (and Harper's Weekly)

Please send me the Roth Memory Course of seven lessons. I will either remail the Course to you within five days after its receipt or send you $5.

Name.....

Address.....

.....Elect. Experimenter 3-19

www.americanradiohistory.com





Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Oldest and Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 5,000 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Let us explain this course to you in person. If you can't call, send now for 64-page book—it's FREE to you

New York Electrical School
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

..... (NAME)

..... (ADDRESS)

New York Electrical School
29 West 17th Street, New York

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

Electrical Experimenter

H. GERNSBACK - EDITOR
H. W. SECOR - ASSOCIATE EDITOR

Vol. VI. Whole No. 71 MARCH, 1919 Number 11

33 Assembled Locomotives on One Ship

The Enterprise of American War Engineering Which Enabled Thirty-Three Assembled Locomotives to be Delivered 'Cross Seas in a Single Ship, for Immediate Duty at the Front.

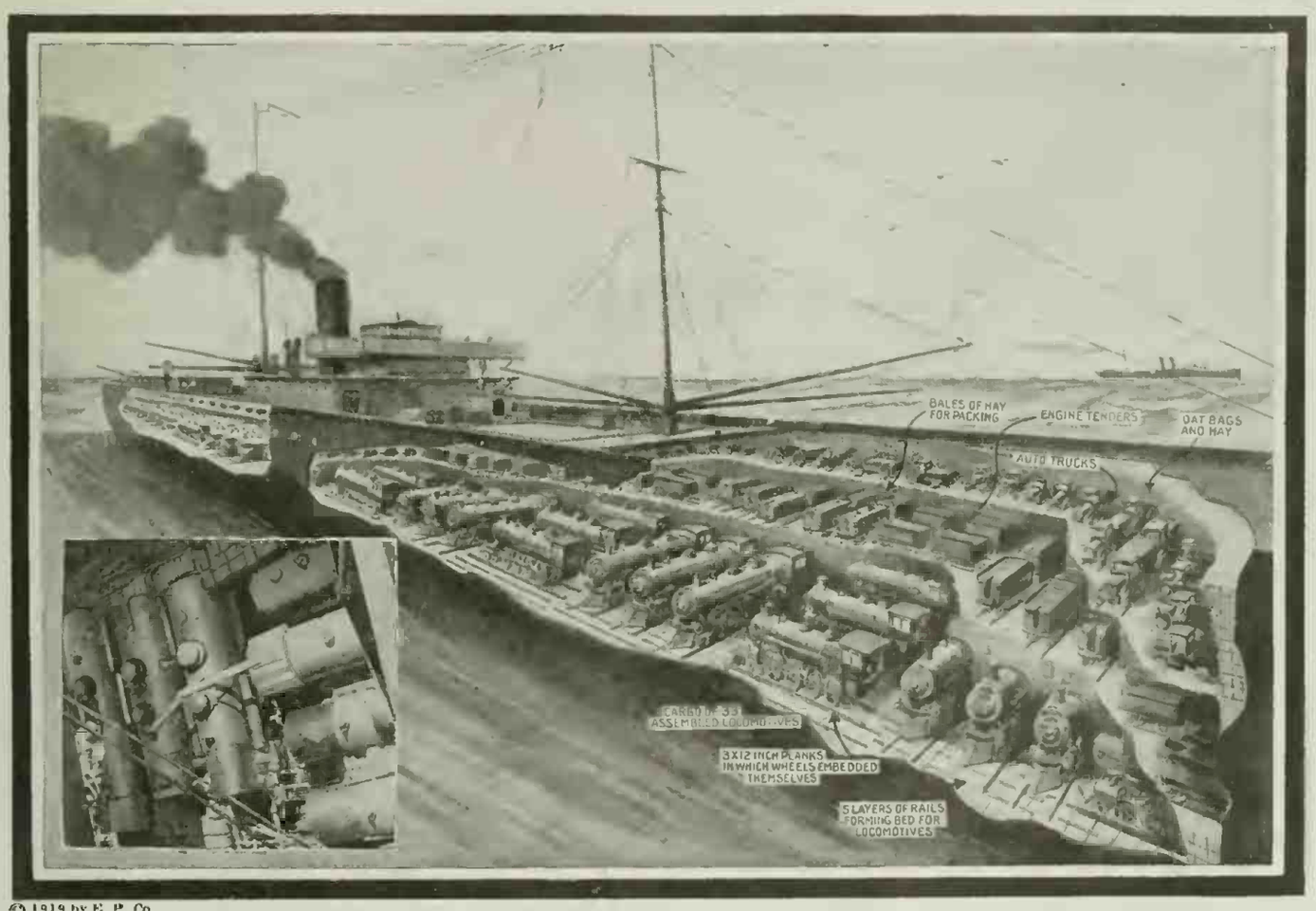
EVER persevering American ingenuity and the knowledge that "over there" thousands of our boys were depending on us folks back home, to keep our shoulders to the wheel, makes records of the seemingly impossible deeds actually accomplisht, read like the magic of Aladdin's Lamp.

As a specific instance, let us look at the railroad situation in France when General Pershing arrived on the scene of action with the first vanguard of American troops. French Atlantic ports were nearly 270 miles from the fighting front. It was one problem to get supplies across seas infested with mines and submarines, and still a greater task to move this material with all possible haste to the points where it would be most needed. It is well known that the French railroad system had collapst; all it could do was to care for the French army, and to move the thousands of tons of material necessary for the successful campaigning of Pershing's army behind a few creeping French locomotives left at our disposal was well nigh impossible.

General Pershing saw the immediate need for American railroad equipment and one of his first cables home was for the urgent delivery of locomotives, cars and rails. He made the War Department see the need of providing these facilities so that the American effort in the Great Cause would not be a failure. And so it was that Army officials undertook the buying and shipping of locomotives. The first locomotives sent were in great big hulky cases—*knocked down*. As yet they did not dream of sending them *completely assembled*.

Once these parts reached France they were put in the hands of a dozen or more

(*Continued on page* 810)



© 1919 by E. P. Co.

In the Early Months of America's Participation in the World War, Locomotives Were Shipt Overseas in Parts. In Consequence a Vast Amount of Valuable Time Was Lost in Dismounting and Reassembling the Parts. Later the Scheme Was Evolved of Loading the Locomotives Intact, as Here Shown, Thirty-three of Them Having Been Sent Over in One Vessel. Insert View Shows Scene Looking Down in Hold. Note Bales of Hay.

www.americanradiohistory.com

Five Conversations Over One Wire

Multiplex Telephony and How It Works

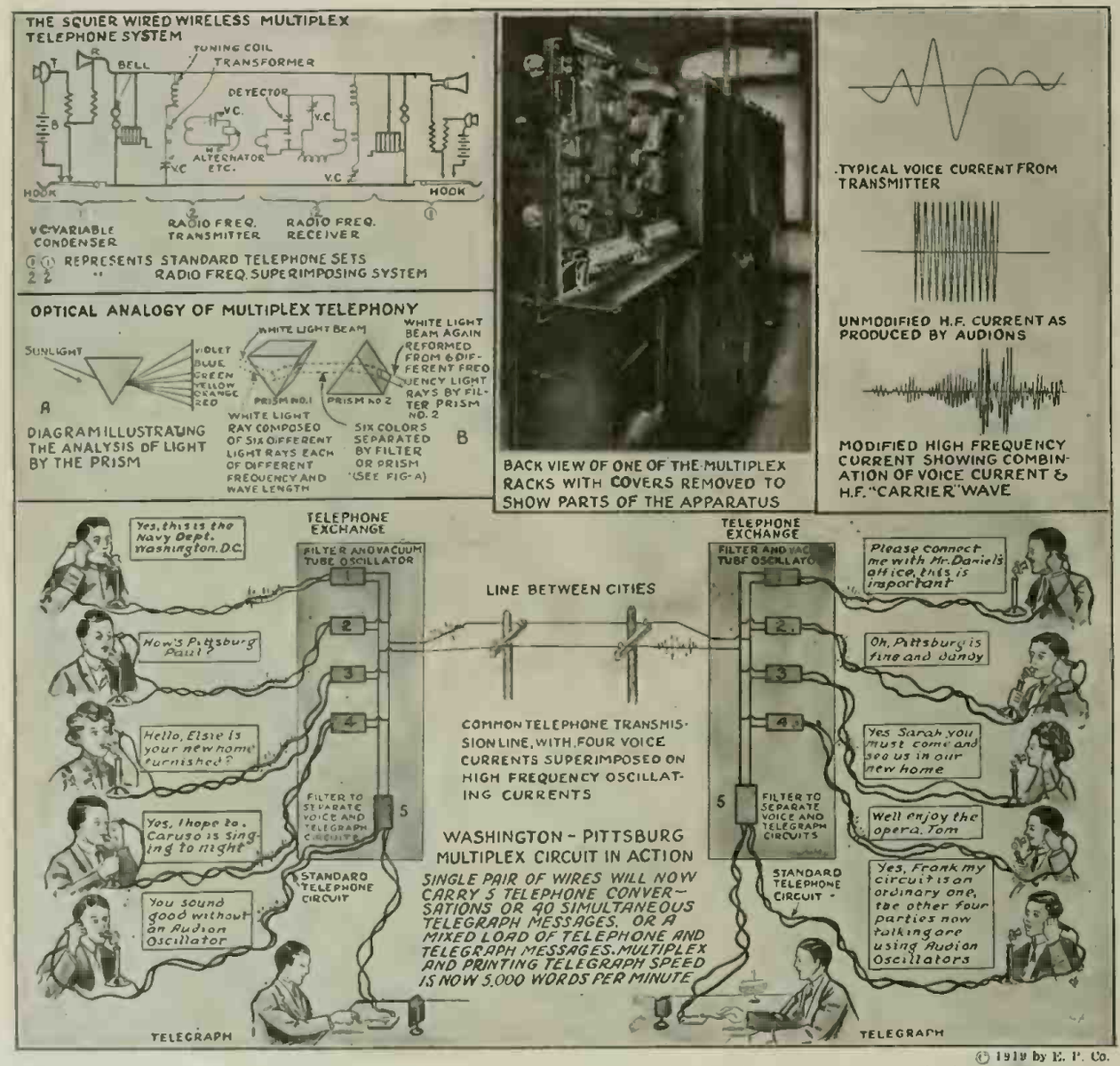
THE story of the development of the multiplex telephone and telegraph system reads like that of many other inventions. It is a story of long years of effort to accomplish a great result. The steam turbine, for example, is but recently developed to be practically useful and yet was suggested in principle as long ago as 130 B. C. Dr. Alexander Graham Bell was experimenting to produce a multiplex telegraph in 1872 and three years later, while still working on that device, he conceived of the telephone —stated Mr. Bancroft Gherardi, acting chief engineer of the American Telephone and Telegraph Company.

Now, 46 years after Dr. Bell made these experiments, the *multiplex telephone and telegraph system* has become a reality. The system is the product of no one man's efforts, but rather the result of the cumulative efforts of several hundred members of the Bell Telephone System's engineering staff, covering a period of years. It is one of the greatest single contributions to the science of telephony since that science was born in a Boston attic in 1875. Its possibilities lie in the direction of expansion of long distance service. Physically it can be employed on any open wire telephone line, but practically it is not advantageous to use it on any short line, say less than 100 miles in length. The highly technical equipment required is so costly that it is economically available only for long lines. There is at present but one installation in service, that on the Baltimore-Pittsburgh line used in the recent demonstrations. But for the great amount of war work that has engaged our attention, the system would have been demonstrated sooner, and it happened that the need for more circuits to handle the traffic between Washington and the war-work center, Pittsburgh, determined the selection of the place to make the demonstrations. There were sufficient wires from Washington to Baltimore, but not enough from Baltimore to Pittsburg. The multiplex system, therefore, was installed at Baltimore and for several months now it has been carrying messages, which come to Baltimore from Washington over the ordinary circuits and these are given to the multiplex for transmission to their destination.

For some years past the Bell System engineers have sought to make it possible for anyone to talk to anyone else in any other part of the country at any time. The phantom circuit, which utilizes wires in two ordinary circuits to provide a *third* conductor of speech, was a great step toward this goal, greatly expanding the service possibilities of existing long lines. Then came *transcontinental telephony*, making a real neighborhood of the Nation. Now, with the multiplex system, the engineers greatly enlarge the service capacity of all long lines which economically may be equipt with the system. The three transcontinental circuits, for example, two of which are of wire while one is a phantom circuit, when equipt with the multiplex system can carry 10 telephone conversations at once, instead of 3 as at present.

The new system sends five voice currents *simultaneously* over *one* telephone circuit of two wires, taking each current as it is delivered into an ordinary telephone and delivering it at its destination, thru another ordinary telephone, exactly as it was formed at the sending point. These five voice currents travel together and are sorted for delivery at their destination. Not a tone or inflection of the speaking voice is changed in passage. This result is achieved by combining each voice wave with a high-frequency inaudible *carrier current* which has characteristics in degrees of frequency that are entirely different from those of other carrier currents. See the various forms of the voice and carrier currents shown herewith. The carrier current

(*Continued on page* 826)



© 1919 by E. P. Co.

Multiplex Telephony and Telegraphy Is Now an Accomplisht Fact. How It Actually Works Is Here Explained By Analogy and Picture Diagrams. Five Telephone Conversations Can Be Carried On Over One Pair of Telephone Wires, While Telegraph Messages Fly Over the Circuit in Either Direction Simultaneously.

www.americanradiohistory.com

The Latest Style in Flashlights

A POCKET flashlight with its small one-half or one-candle-power tungsten bulb operated by a small dry-battery, has practically become a household article the world over. Flashlights are today manufactured by the million, while more millions of people are daily clamoring for them. Tens of millions of flashlights were in constant use during the progress of war-time activities in Europe, and what a great boon it has been to the soldier can well be imagined. The accompanying illustrations show a number of extremely useful and not always well-known applications of the pocket flashlight which will prove of practical use on many occasions.

One of the latest and ingenious arrangements for utilizing a flashlight is that shown at Fig. 1, which comprises an *illuminated note-pad* for use at night or in dark places. The use of this illuminated note-pad will prove very extensive undoubtedly, and for one thing it may often prove of assistance in taking notes at lectures, not to mention a very wide application in the Army and Navy. The illumination is so arranged that no noticeable glow is seen, but simply the illuminated square opening over which the paper roll slides. A second paper roll is included, so that a carbon copy can be kept for record. The case when closed resembles a kodak.

Figure two shows a self-contained *electric light mirror*, invented by Mr. H. Gernsback several years ago. This unique mirror has a small flashlight battery placed in the hollow handle. On the front of the handle a push-button is placed and the wires to the lamp at the top of the mirror frame are secreted within it.

Figure three shows the *gun-light* which has been quite extensively exploited, and while we have never had the opportunity of trying out a fountain-pen flashlight or a larger model flashlight attached to a rifle, we have seen the pistol flashlight used, and it proves one of the most deadly combinations imaginable. All the marksman has to do is to move the pistol about until the target lies in the center of the subtended flashlight zone and then pull the trigger. It should prove a fine thing for hunting down burglars, rats, cats, and what not.

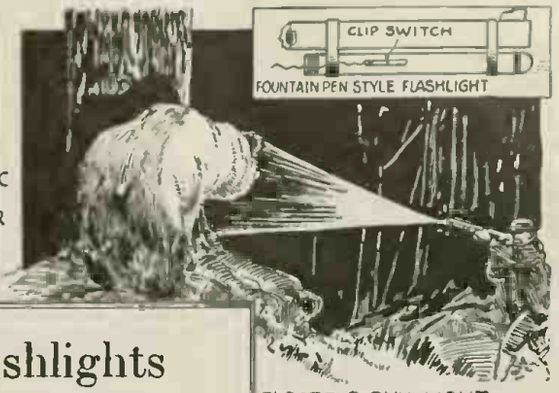
A recently patented eye-diagnostic lamp, known as a *retinoscope* is illustrated in Fig. 4. This comprises a very compact and efficient electric lamp and mirror, as well as sighting device for the use of opticians in examining the eye. The flashlight battery is contained in the handle of this efficient instrument, and the bulb of the flashlight projects a beam of light on to the small mirror, which is set at an angle of 45 degrees. Thru the center of this mirror there is a small hole which is in line with a sighting tube at the rear of the mirror frame. It is used in the manner illustrated.

The well-known flashlight combination, known as the *shave light*, is shown at Fig. 5. Several varieties of this handy device are on the market and it has proved a blessing indeed to thousands of soldiers—officers and dough-boys alike—who have often had to shave in dingy or pitch dark dug-outs and other places of shelter on the battlefield. In the shave-light device illustrated by Fig. 5, the flashlight battery is connected by means of a small flexible twin-conductor with a lamp bulb placed over the mirror.

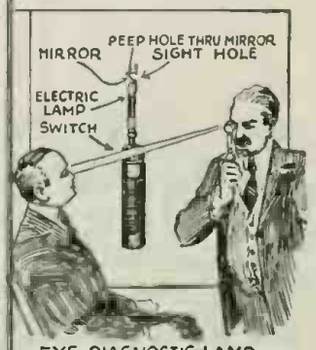
One of the latest and most practical every-day uses of the flashlight is in meter-reading. See Fig. 6. The usual application of the flashlight in this field involves the carrying of an ordinary tubular flashlight by the meter reader, but the illustration herewith shows one of the newer developments in the form of a *flashlight meter camera*. With this clever device it is only necessary to place the camera before the meter to be read, the button is prest, several flashlight bulbs connected in multiple throw a strong light on the meter dials, the camera-shutter clicks simultaneously, and (*Continued on page* 821)



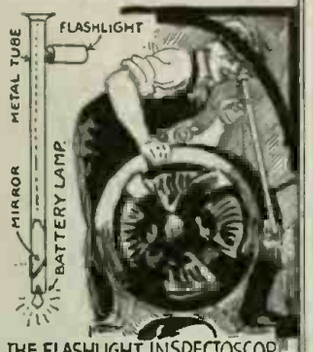




ELECTRIC GUN LIGHT



EYE DIAGNOSTIC LAMP



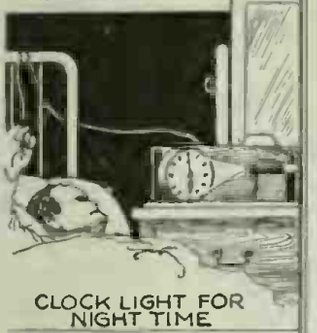
THE FLASHLIGHT INSPECTOSCOPE



ELECTRIC HAT & SHIRT FRONT ADVERTISEMENT



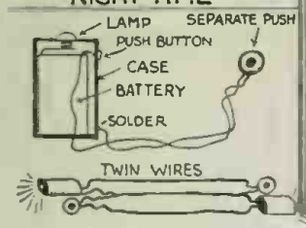
THE SHAVELIGHT FOR SOLDIERS AND CAMPERS



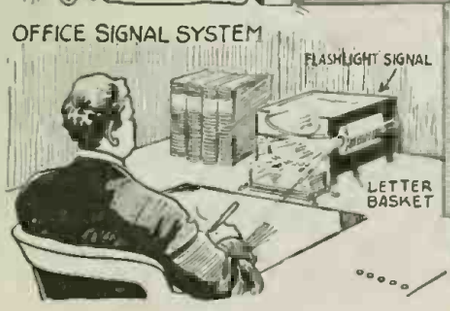
CLOCK LIGHT FOR NIGHT TIME



THE FLASHLIGHT METER CAMERA









www.americanradiohistory.com

"The Border Wireless" and "The Hun Within"

STEVE RANSOM (William S. Hart), a typical Westerner, who has been reared on a ranch in Wyoming, which was wrested from his parents by a railroad company, becomes embittered and revengeful, and taking the law into his own hands, develops into a bandit, committing several daring robberies at stations belonging to the railroad company which had despoiled him and brought his aged parents to death. He eventually becomes a fugitive with a price upon his head and drifts to Yellow Dog, Arizona, near the Mexican border.

Elsa Miller is a telegraph operator at Yellow Dog, and the guardian of her younger brother, Carl. Elsa is on her way to deliver a message to Herman Brandt at the Magdelena Mines and is attacked by Mexican bandits. Steve rescues and falls in love with her and decides to remain at Yellow Dog. Frederick Brandt loves Elsa, but she is unaware that the Magdelena Mines have been converted into the headquarters for German spies with a cleverly concealed wireless apparatus by which messages are transmitted to Mexico and from there to Honduras and then to Berlin. Brandt is in direct communication with Von Helm, head of the German Secret Service in New York City.

Steve becomes suspicious of Brandt, when he and his assistant, Frederick Schloss, express contempt for the American flag and the fighting abilities of the United States. Steve forces Brandt to kiss the American flag. War with Germany is declared, and Steve determines to enlist. He calls on Elsa, determined to reveal his past life to her, and invites her to ride part of the way with him to Fort Scott; she plainly evinces her love for Steve. During their absence Steve's shack is ransacked by Brandt and Schloss; photographs of Steve's father with an inscription on the back, reveals the fact that Steve's real name is Ransom, and not Allen—which name he assumed while in Yellow Dog. Brandt sends a telegram to the Sheriff at Willow Springs, asking for information regarding Steve and thus learns that Steve is a fugitive from justice. Carl reveals the fact that Steve is on his way to Fort Scott to enlist, and Brandt forces the boy to telegraph the commanding officer at Fort Scott the facts he has discovered regarding Steve.

While awaiting examination at Fort Scott, Steve overhears the conversation between the commanding officer and the telegraph operator, and makes his escape through a window. He is pursued by the soldiers but eludes them and takes refuge in a wooded canyon. Elsa learns of the occurrence, but this does not shake her faith in him. A day or two later, a code message comes for Brandt, and Carl starts with it for the Magdelena Mines. He is thrown from his horse and is lying unconscious, when Brandt and Schloss and another spy ride by. They go thru his clothes and find the message, which is translated with the aid of a code book. Carl, who has regained consciousness, overhears the translation of the message, the purport of which is that General Pershing is on his way to Europe and the Germans are planning to sink the vessel on which he has sailed. The two men take their departure, leaving their man to watch Carl.

Elsa now appears and Carl whispers to her the nature of the message. The German, hiding behind the bushes, overhears Carl and is about to shoot him, when Steve, who has been hiding in the bushes all the time and witnest the entire proceeding, kills the German. Carl is moved to a comfortable position, and Steve and Elsa ride to the Mine to prevent the sending of the message, which would mean the death of General Pershing, surprise the Germans, and after a fierce battle, take possession of the *wireless apparatus* and succeed in sending out a call for help to Fort Scott, after which they destroy the wireless. The soldiers arrive and make the Germans their prisoners. The charge against Steve is dismist and the story ends happily with Steve and Elsa watching the soldiers lined up for the sundown dress parade.



Top Left:—Doing the Kaiser's Dirty Work. A Scene from "The Hun Within," a Paramount-Artcraft Feature Film Drama.

Top Right:—The Secret Service Hun Seems to Be More Or Less Excited In This Scene from "The Hun Within." Note the Elaborate Wireless Receiving Set Used In This Recent Screen Play. Reality Is the Keynote In the Photo Dramas of To-day. Once a Soap Box, Fitted With a Few Dozen Binding Posts and Some Magnet Coils, Was Good Enough for a "Prop". But the Film Fans Nowadays Are a Wise Lot. Besides, There May Be a Radio Amateur In the House, and Oh! Boy! If There Is Anybody That Can Outdo Him In "Roasting" a Fake Wireless Or Electrical "Prop"—Well, We Have Failed to Meet Him. He Can Tell By the Color of the Villian's Eye Whether He Is Receiving Actual Dots and Dashes, Or Only Imagining It. And His Hands—Every False Move Is a Heart-Stab to the Radio-Bug.

Lower View:—In This Scene from "The Border Wireless," an Artcraft Feature Screen Play, "Big Bill Hart" Gives the Hun Wireless Operator a Small Installment of What Is Coming to Him While Pretty Wanda Hawley, Who Can Actually Send Legible "Morse," Cancels the Wireless Message That Has Just Gone Out.

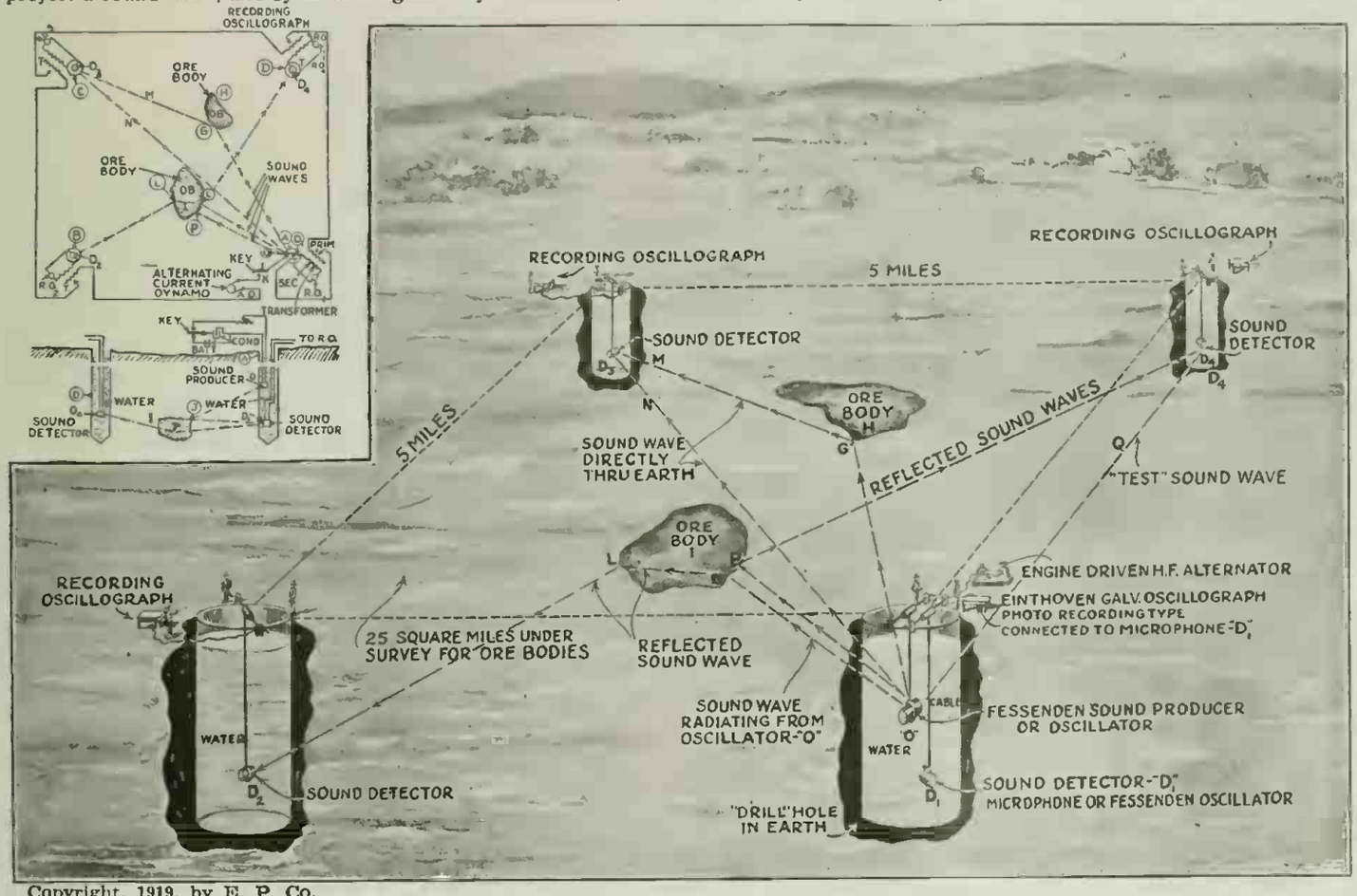
IN a large city near New York lives Henry Wagner, a German-American who left Germany years previously be-

(*Continued on page* 823)

www.americanradiohistory.com

Gold and Silver Located With Sound Waves

MOST probably you will remember having read some of those entrancing fairly tales in your younger days, wherein a person happened to be gifted with such transcendental intellectual powers, that he could for example stamp his foot on the ground or simply make a certain sound when the location of gold or silver would immediately be made known to him. Of course this all sounds like "Bul-garia" to us nowadays, but thanks to a twentieth century magician, Prof. R. A. Fessenden, the brilliant American inventor and scientist, it has become possible to do this identical thing, i.e., to project a sound wave, and by measuring its reflection and deflection scientifically by means of suitable detecting and recording instruments, to locate exactly the position of underground ore bodies, no matter what the ore may be, whether gold, silver, lead, zinc, copper, etc.



Copyright, 1919, by E. P. Co.

Now We'll All Be Rich, Thanks to Prof. Reginald A. Fessenden, the Eminent American Scientist, Who Here Tells Us How to Positively and Accurately Locate Metallic Ore Deposits in the Earth. The Principle Involves the Measuring of the Sound Velocity Between Various Points and the Determination of the Direction from Which It Is Refracted in Each Case.

As Prof. Fessenden points out in his patent on this scheme of locating ore bodies, his invention provides methods and apparatus whereby, being given or having ascertained two or more of the following quantities, i. e., the time, distance, intensity and medium, one or more of the remaining quantities may be determined. For example, being given the distance between two points in a mine, and having determined the time required by a sound wave to travel between the two points, it is then possible to draw calculations in regard to the probable nature of the rock between the two points; also, if an echo be observed or a refraction of the sound, it is possible to estimate the distance of the reflecting or refracting vein. Hence this new apparatus is intended for the location of hidden ore bodies by means of measurements made on the velocity, direction, reflection, refraction, absorption and other phenomena of sound waves transmitted thru the medium containing the ore bodies, which is invariably, of course, the earth. The inventor claims that by this means he has been able in a certain test to determine the location accurately of a body of mineral, invisible to the eye, at a distance of two and one-half miles, and further, this test was witnest and verified by a number of skilled engineers.

In starting to survey a piece of ground by this method, in which ore deposits are suspected, a space may be laid off about five miles square, as the accompanying illustration shows. This gives an area of twenty-five square miles under survey. At each corner of this square there are driven four drill holes, A, B, C, D, which are filled with water. Toward the bottom of these water filled holes there are placed sensitive sound detectors, such as microphones or small Fessenden oscillators, D_1, D_2, D_3 and D_4. These sound receiving devices are connected to the secondaries of transformers as indicated, and to oscillographs of the photographic recording type. These oscillographs employ the quartz-fiber Einthoven galvanometers. In one of the wells there is placed a powerful sound producing apparatus, O, preferably of the Fessenden oscillator type also. This is connected thru its leads, with the primaries of the transformers in the oscillograph circuits and to the alternating current dynamo, A—D, whenever the key K is deprest. Hidden ore bodies are indicated at the points H and I.

The oscillograph recording apparatus is so adjusted that when the sound-producing oscillator key, K, is deprest, a moderately strong indication is produced on the photographic records of the oscillographs, R—O, which fixes on the photographic records the exact instant at which the key is deprest. Simultaneously a sound wave is emitted from the oscillator, O, which after being reflected as at G by the ore body H, or reflected back as from J, Fig. 2, by the body I, or reflected as from P by the ore body I, or refracted as at LL, or possibly proceeding directly thru the earth as shown by the dotted lines M—N, reaches the indicators or microphones, D_3, D_4, D_2 and D_1 and is recorded on the oscillographs R—O's, 3, 4, 2 and 1.

Instead of using the alternator to produce the sound at the oscillator, O, a condenser discharge may be employed to actuate a sounder, the condenser key on being deprest charging the condenser from a battery, and on the key being released and coming against a second contact, it discharges the condenser thru the sound producing mechanism. The patent describes this auxiliary sound producing mechanism.

Since the oscillograph photographic strip moves along thru the machine with a regular and known velocity, the distance on the strips between the records produced thru the transformers whenever the key, K, is deprest, and the records made by the sound waves received, whether direct or by reflection, refraction or echo, will indicate the distance between the drill and holes and

(*Continued on page* 828)

www.americanradiohistory.com

Sorting Tobacco Leaves by Electricity

By GEORGE HOLMES

MANY ingenious machines and devices have been invented and are widely used in the manufacture of tobacco products and all modernly equipt cigar and cigarette factories bristle with machinery. The more striking is the fact that the tobacco growers and planters have been much neglected by the genius of inventors. Thus we see that tobacco is grown today with the same primitive methods as it was 100 years ago.

The inventive spirit of our progressive age, which benevolently gave a helpful lift to almost every trade and industry and handed so many labor-saving appliances to agriculture, past in silence the extensive tobacco plantations of America and the world.

Upon the initiative of one of the biggest tobacco growers in the world, a New York inventor and engineer, Mr. H. Hartman, took up the problem several years ago of tobacco planting and handling right at the farms. And what he saw there set him to thinking. He soon noticed that one of the most costly operations at a tobacco plantation is the *sorting of leaves by their different length*. Every leaf is taken by hand at both ends and measured and placed according to its length into a different box.

So-called sun-grown tobacco is usually sorted or "sized" by two inches, while shade-grown tobacco, which is used for wrappers, is "sized" partly by inches and partly by two inches. This work is done after the leaves have past thru the "curing" process and are brown, soft and pliable.

Now anyone can easily imagine the tremendous amount of manual labor involved in measuring each single leaf of the many millions grown on an average tobacco farm. But the tobacco can not be sold if not sorted into different lengths.

After many experiments with three gradually more and more improved machines, which Mr. Hartman constructed at his workshop and laboratory, he finally succeeded, and the semi-electric "Leaf Tobacco Sizing and Sorting Machine", illustrated here is the result. This machine also marks as a milestone the opening of tobacco growing to mechanical development.

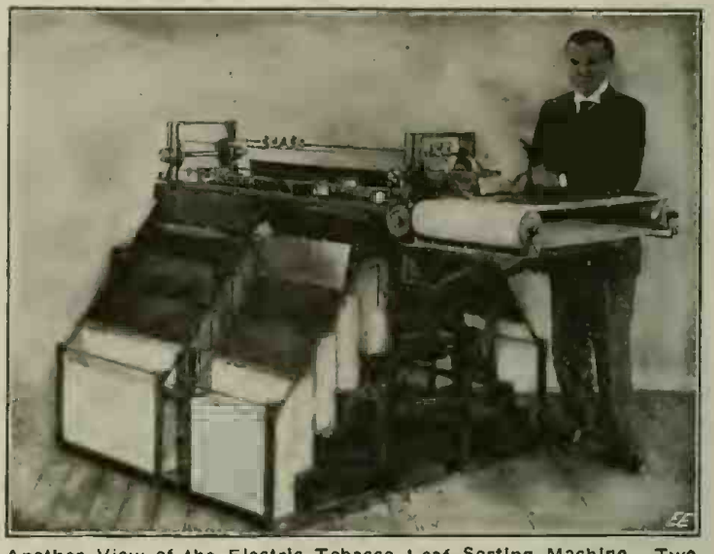
In this machine, which is also shown diagramatically, the tobacco leaves are simply placed upon a feeding belt by an operator in front of the machine. This belt brings the leaves below two curved clamp openers which always open two pairs of clamps, carried by two endless roller chains moving under 90° horizontally to the feeding belt over a distribution table or bench. The clamps, after having been opened during motion by said curved openers, grip the leaves at their stem and pull them over the table and thru a pair of resilient contact rollers, which stand vertically in the path of the motion of the clamps. As long as a leaf is between the contact rollers, a metallic electric contact between the latter is prevented, but a low voltage circuit will be closed thru them the moment the tip of the leaf passes out. As the contact rollers are co-operating with a series of contact segments arranged at the centre line along the bench, one of these segments will be swept by a contact brush from the clamp in circuit with the rollers. An electric current will then pass thru the rollers, said particular segment and one of a number of solenoids will attract its armature and thus open one of the covers, which can be seen arranged under an incline at both sides of the machine.

At the same time an electro-magnetic stop will emerge from the flat table and, being in the centre line with the clamps, will force the latter to open, and to drop the leaf upon the table, from where it will be blown the next moment by comprest air over the edge of the table and slide by gravity downward to fall into the box arranged below the open cover. According to the length of a leaf, a certain contact segment on the table will be in circuit with the contact rollers only at the moment said leaf passes entirely thru the rollers, and only that particular cover connected with said segment will open, as intermediary relays will at the same moment interrupt for a predetermined time the connection between all following segments and their respective solenoids. There are as many segments and solenoids as there are different covers. The first section, having five boxes, will receive the five shortest leaves. If a leaf is longer, no segment will come into contact in said first section, the electro-magnetic stop will not appear and the clamp will carry that leaf into the second section where the same process will be repeated. The second section provided with five boxes of longer dimensions, is an exact

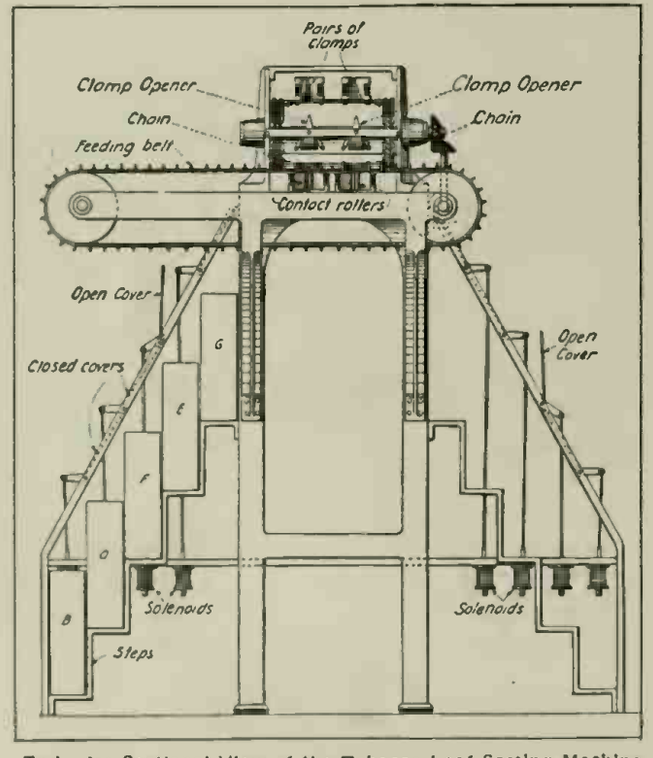
(*Continued on page* 810)



The Latest Device in the Tobacco Industry is This Electric Leaf Sorter. It Sizes the Leaves as They Pass Along and Deposits Them in the Corresponding Compartments Below.



Another View of the Electric Tobacco Leaf Sorting Machine. Two Leaves Can Be Seen Sliding Down Toward the Open Compartments. The Inventor Is Seen Operating the Machine.

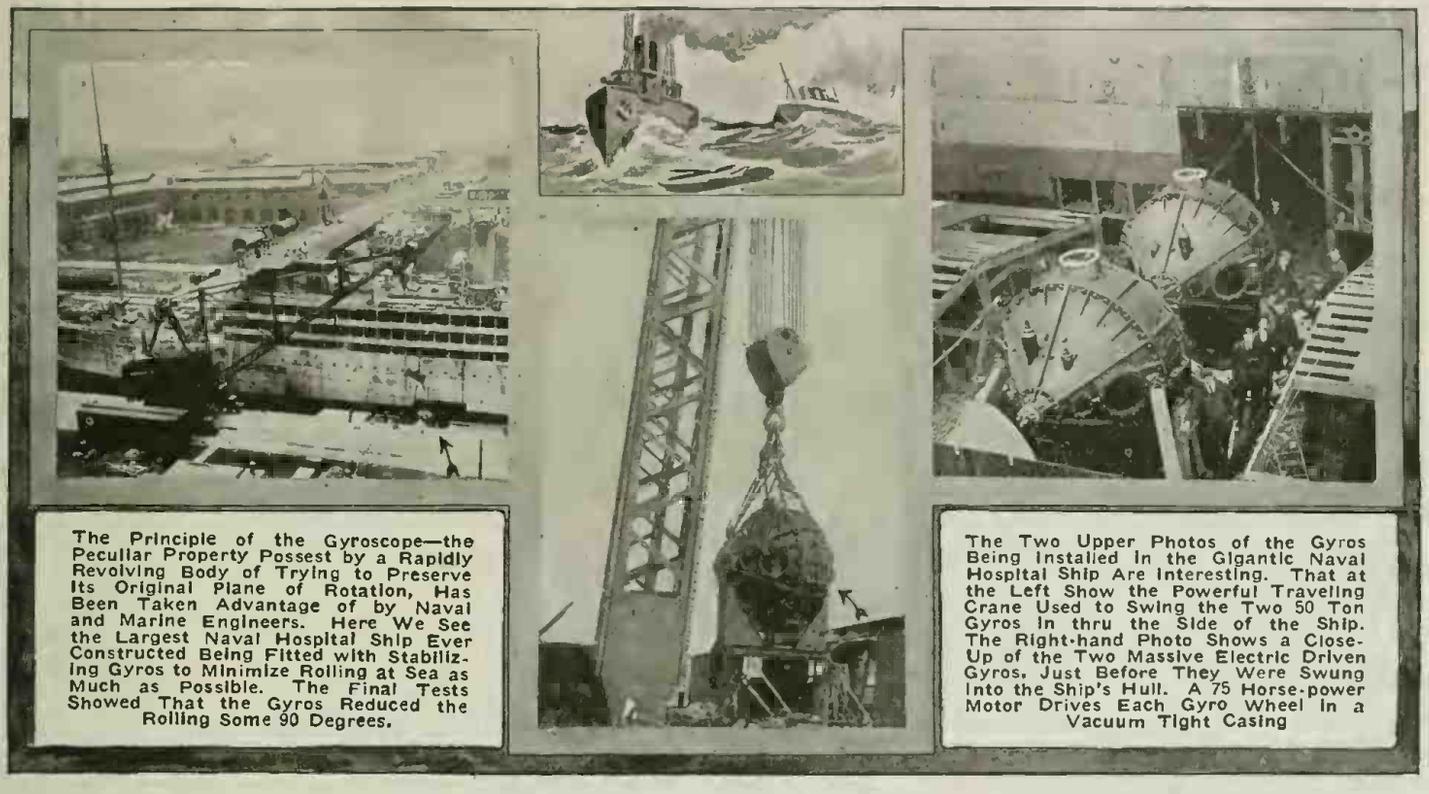


End-wise Sectional View of the Tobacco Leaf Sorting Machine. The Receptacle Doors Are Opened by Solenoids Controlled by the Sizing Mechanism at the Top of the Machine.

www.americanradiohistory.com

Hospital Ship Fitted with Gyroscopic Stabilizer

PERHAPS you are familiar with the mechanical device known as a "gyroscope", which possesses remarkable self-centering or stabilizing properties. The Sperry airplane stabilizer, as well as the non-rolling ship stabilizer, utilizes this clever device. It involves the simple phenomenon that if you take a heavy steel or other wheel and spin it at high speed, then the spinning wheel and its attached frame will tend to preserve the same plane of rotation. This is daily demonstrated by the ordinary bicycle. Hold the bicycle clear of the ground and have someone turn the pedals rapidly. Now try to turn the bicycle sidewise while the wheels are rotating at high speed. You will find it very difficult—all because of the law above stated. Thus the naval engineers have discovered that by placing one or more powerful gyros in a ship, that the ship will not roll to any appreciable extent in a heavy sea. Hospital and war-ships are therefore being fitted with giant electric driven gyros for the purpose of keeping them on a more even keel in stormy weather. The improvement in gunnery from warships so equipt and stabilized is readily apparent.



The Principle of the Gyroscope—the Peculiar Property Possest by a Rapidly Revolving Body of Trying to Preserve Its Original Plane of Rotation, Has Been Taken Advantage of by Naval and Marine Engineers. Here We See the Largest Naval Hospital Ship Ever Constructed Being Fitted with Stabilizing Gyros to Minimize Rolling at Sea as Much as Possible. The Final Tests Showed That the Gyros Reduced the Rolling Some 90 Degrees.

The Two Upper Photos of the Gyros Being Installed in the Gigantic Naval Hospital Ship Are Interesting. That at the Left Show the Powerful Traveling Crane Used to Swing the Two 50 Ton Gyros In thru the Side of the Ship. The Right-hand Photo Shows a Close-Up of the Two Massive Electric Driven Gyros, Just Before They Were Swung Into the Ship's Hull. A 75 Horse-power Motor Drives Each Gyro Wheel in a Vacuum Tight Casing

One of the accompanying photos shows Gyro unit No. 2 of the twin set just being transferred by a hundred-ton S-leg crane. A second photo shows a close-up of the two Gyro units, while the third photo shows the relative size of the Gyros with the ship and also the massive traveling crane used to swing them into the ship.

These Gyros were installed in a Naval Hospital ship so that the wounded on board would be subject to the least amount of rolling, that to the present time is very apparent on all ships, especially in bad weather. The final stabilizing test with the Gyros was found to reduce the rolling some 90 degrees, so it can be readily seen that they do help some.

The combined weight of the unit was 100 tons and the ship was the largest hospital ship ever constructed. The weight of the two gyro wheels is 25 tons each. The weight of the two casings is 25 tons each. The diameter of the gyro wheels is 9 feet, and of the casings 12 feet. The bearings used are standard roller type and self-aligning, fitted to 12-inch shafts. The power used to drive the gyro wheel is a 75 H.P. A. C. electric motor in each. The casing was made absolutely vacuum tight and the gyros run in 30 inches or nearly perfect vacuum. The bearings receive a continuous bath of oil, pumped at the rate of 200 gallons a minute, properly screened and cooled. In 35 minutes the gyro attained a speed of 1,100 R.P.M (working speed). A trial speed of 1,600 R.P.M. was attained, the current cut off and the gyros ran for *three and one-half days*, gradually dropping in speed to "Dead".

The side of the ship had to be cut away in order to install the gyros and they were slid into place by means of skids; the time required to slide them into place was 7½ minutes. Besides the 75 H.P. A. C. motor in each gyro, a rotary-converter is used and another 75 H.P. motor is used to *precess* the gyros from left to right to meet the roll of the ship. This last motor is controlled by another sensitive gyro (small and of high speed) located on the ship's bridge.

The two gyros were located amidships below medi-centric height and they ran in opposite directions to each other; that is, the port gyro ran clock-wise and the starboard gyro ran anti-clock-wise, both at the same speed. To reduce the vibration of the gyros to a minimum they were balanced by the plug-method and it took several experts two months to balance them, so perfect must the rotational balance be. Two years were required to complete the gyros and others of larger size are being constructed for super-dreadnought work. These will enable more accurate aim to be had in firing from the ship. Gyros of smaller size are also installed on submarines and destroyers, both classes of installations giving remarkable results.

THE PHOTOELECTRIC SENSITIVITY OF BISMUTHINITE AND VARIOUS OTHER SUBSTANCES.

A recent contribution to the Bureau of Standards scientific papers by Dr. W. W. Coblentz summarizes the results of an investigation of various substances (1) for an increase in electrical conductivity caused by the action of light upon them, and (2) for photoelectric activity when they were charged to a negative potential, in an evacuated chamber, and exposed to light. Pure gallium and silver sulfid were found to have but small photoelectric activity when charged to a negative potential and exposed to light. No change was observed in the electrical conductivity of tellurium, boleite, pyrite, silicon, and mixtures of the sulfids of lead and antimony, when exposed to light. An increase in conductivity was observed in crystals of bismuthinite, cylindrite, molybdenite, selenium, stibnite, boulangerite, jamesonite, and silver sulfid when exposed to light.

Experiments are described in which some of these substances were joined thru a battery to the grid circuit of an audion amplifier and a telephone. The light stimulus was interrupted by means of a rotating sectored disk, as used in Bell's selenium photophone. When using a cell or crystal of selenium the fluctuations in light intensity produced a sufficient change in conductivity to cause a musical note in the telephone. Similarly, in some samples of bismuthinite and of molybdenite, a change in conductivity was produced, which caused an audible sound in the telephone receiver. Further experiments are in progress to determine to what extent and for what wavelengths this is a true photoelectric change (increase) in conductivity, and to what extent it is caused by fluctuations in temperature with a resultant change in resistance within the crystal.

www.americanradiohistory.com

Searchlights of the Deep

Wonderful Fish of the Ocean Depths, That Carry Their Own Lights.

By Dr. E. BADE

IN former years, when the depths of the ocean were still unexplored, it was the common belief that its surface was an uneven monotonous plain, unenlivened by precipices and mountains, hills and valleys. But these ideas have been thoroly repudiated by numerous expeditions sent out to investigate and explore, as far as possible, the conditions existing at the vast bottom of the sea.

The higher parts of the ocean bed, the gentle slopes, the precipices, and the plateaus, which connect the extensive levels of the ocean, are of such an immensity that they can not be compared to anything found on the land. Deep basins of continental extent are interrupted by gigantic marine mountains, while table lands rise from the greatest depth with almost sheer and perpendicular walls.

Only those animals which live near the surface of the ocean and which have ventured within reach of the nets of fishermen, were known in the last century. These nets seldom if ever penetrate more than five hundred feet. But when speaking of the deep sea, a 1,000 foot depth or more is to be considered.

Altho depths of 12,000 feet are common thruout the ocean, a depth of more than 30,000 feet has been reached between two small islands of the Malay Archipelago.

Three hundred feet below the level of the ocean the light is so diffused that it is gloomy, and at a depth of six hundred feet our eye can not detect an infinitesimal ray.

Photographic plates sunk in the Sargasso seas show, at a depth of three hundred feet, all of the different colors of the rainbow; at a depth of 1,500 feet many of the rays can still be found; at a depth of 3,000 feet some of the rays, altho to a much smaller degree, are still present; and at a depth of 6,000 feet no rays can be detected.



A Wonderful Deep Sea Fish Carrying Its Own Electric Light Plant. This Is a Cute Little One by the Name of "Polyipnus Nuttingi Gilbert."

Light does not play such an important rôle in the existence of animal life as it does in the existence of plant life. Plants cannot exist without light. But animal life can and does exist where semi and total darkness prevail. Marine animals living at a depth of 3,000 feet are usually colored black. But those which find their existence just above this dividing line are dark gray to red in color.

But far more wonderful than the absence of light is the fact that animals can withstand the enormous pressure which exists at these depths. It is a simple matter to estimate the pressure exerted by the water at various depths. The weight of a cubic foot of water is equal to the pressure exerted by it. This pressure becomes greater the deeper we go down, and down in the profoundest depths it exerts a pressure of thousands of pounds to the square inch. A result of the pressure is that the tissues of the fish are loosely knit together, and when this enormous pressure is released by bringing these denizens of the deep to the surface, the internal pressure of the body becomes so great that *the fish literally explode.*

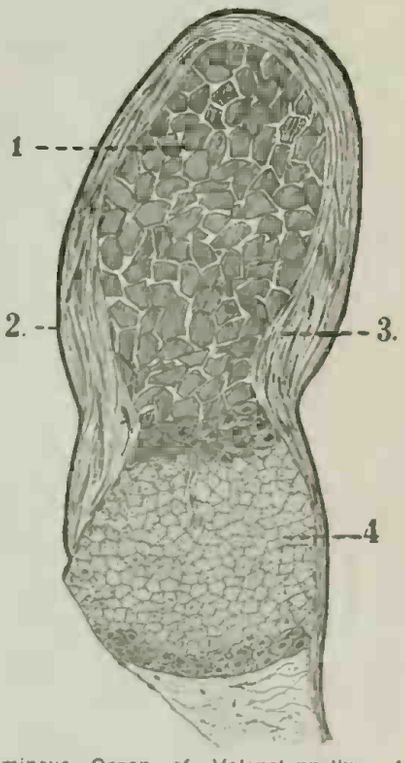
Therefore it is no wonder that when the deep sea fish are violently torn from their natural habitat they are invariably in a mutilated condition.

But in these depths of the ocean, where gloom and semi-darkness prevail, the conditions of life are far different from those of the surface waters. The brightly colored algae and sea weeds, the food of many fish, are the children of the sun, while the sinister inhabitants of the profound depths are scavengers, which kill and devour each other.

The faint almost infinitesimal light which penetrates this utter darkness is insufficient to light up the paths of the fish. They do not see their way; they only *feel* their way by means of lateral organs when they come in the vicinity of some boulder or rock. In this darkness we find the most unique and fantastic forms of life—the deep sea fish—which live in perpetual darkness. There, searchlights play thru the watery night, faintly illuminating the vast depths with a cold, death-like glow, a thing man has, as yet, not created.

This wonderful light is produced automatically by the fish. Tiny glands secrete the lighting fluid, reflectors throw it outward, and one or more lenses magnify and control its intensity. (See the illustrations herewith.)

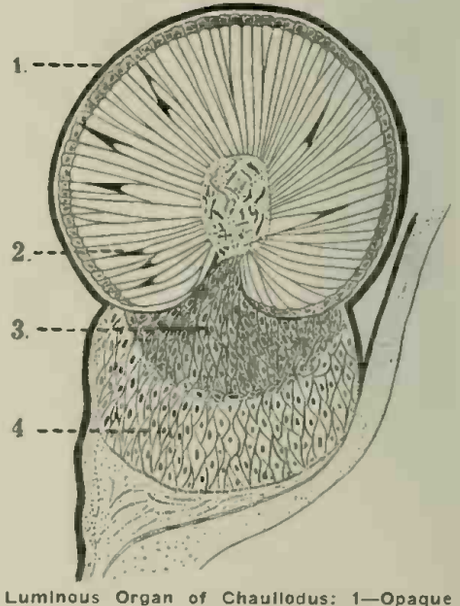
(*Continued on page* 830)



Luminous Organ of Valenciennellus: 1—Glands Which Secrete the Lighting Fluid: 2—Opaque Membrane; 3—Reflector; 4—Lens.



Luminous Organ of Gigantactics: 1—Papillary Feelers; 2—Opaque Membrane; 3—Reflector; 4—Glands Which Secrete the Light.



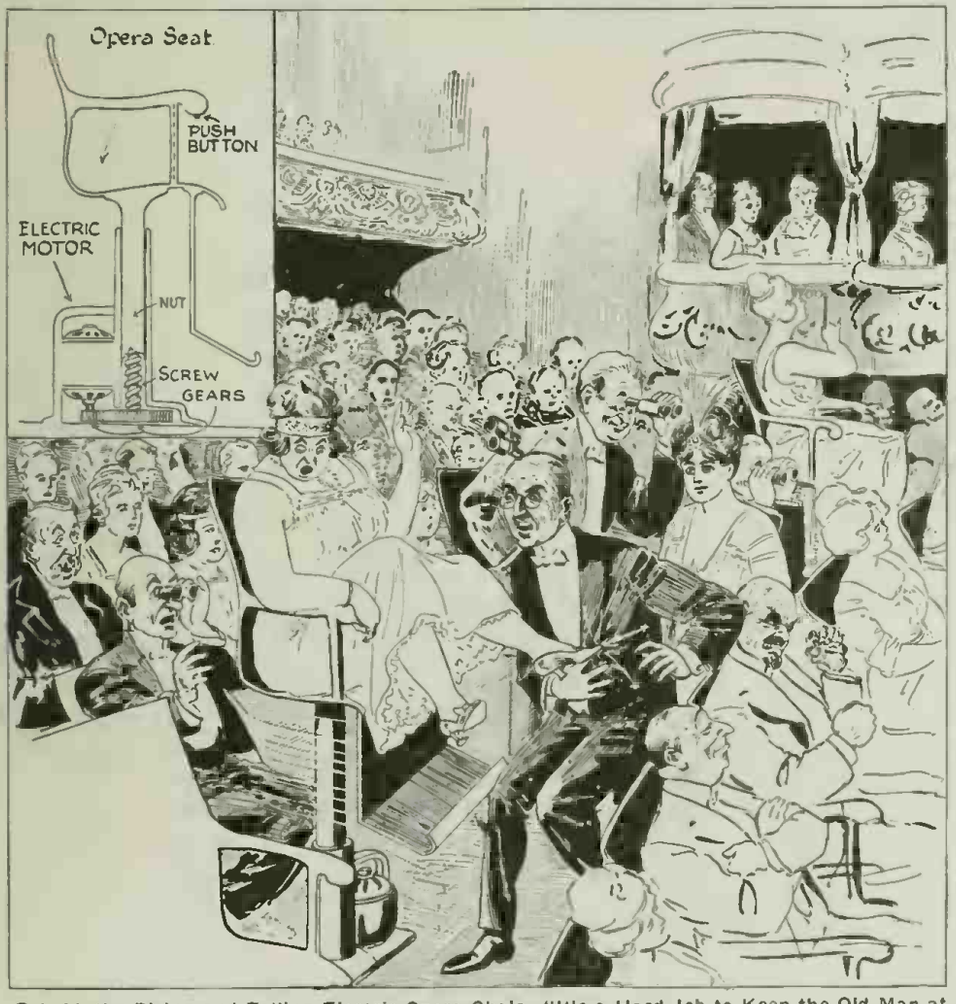
Luminous Organ of Chauliodus: 1—Opaque Membrane; 2—Glands Situated in the Inner Body; 3—Central Part of the Inner Body; 4—Lateral Part of the Inner Body.

www.americanradiohistory.com

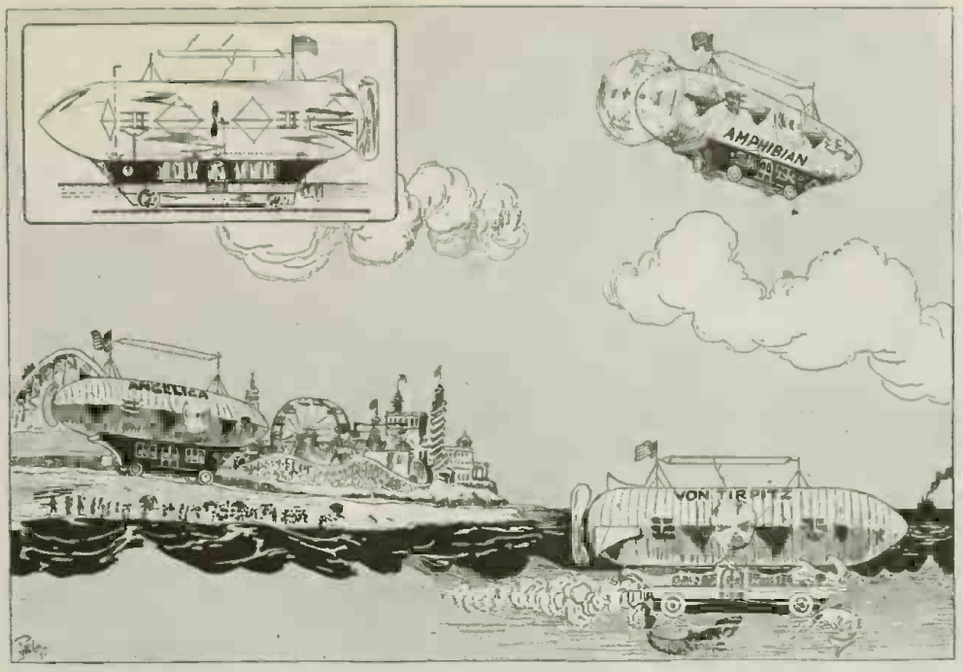
THE UPS AND DOWNS OF A THEATER CHAIR.

WE said it, friends, "the ups and downs of a theater chair", and we might add the "downs and ups"—for can you imagine in your wildest moments of philosophical ecstasy what our theaters are going to look like when Mr. Frank Adsit's electrical elevated opera chair is adopted by our theater managers. No, you guest wrong. This is not a phoney patent, but an honest to goodness U. S. patent. Our artist has endeavored to show several of the incidents which might and likely will occur if this invention comes into vogue, and who will gainsay that it will not—for have not forty-eight states—tried and true—gone clean dry without a whimper? This wonderful motor-operated theater chair is also a real boon to the prohibitionist inspector, for all he has to do is push the button and the occupants of the chairs will rise "high and dry" without a word. Coming down to the real philosophy involved in the design and operation of this newest theater chair, we find that the inventor has provided for causing it to rise and fall whenever a person wishes to pass in front of one of the chairs in order to get to his seat, to one side or the other, by means of three distrinct electromechanical agencies, to wit: 1—by means of an electric motor and screw-gear; 2—by means of mechanically driven worms placed under the floor and screw gear; 3—by means of comprest air.

A small electric motor is connected with a pinion and gear which in turn drive a vertical screw in the base of the seat. This screw registers with an "internal nut" (no, Ella, not the "nut" in the chair) in the piston of the chair as the detail illustration shows, so that when the screw is turned in one direction, the chair will be raised, and when it is turned in the other, the chair will be lowered. The running of the motor is positively controlled by the push button placed on the arm of the chair.



Behold, the Rising and Falling Electric Opera Chair. "It's a Hard Job to Keep the Old Man at Home Now," Is the Complaint of Some Wives, But Can You Imagine What Show Wifey Is Going to Have to Keep "His Nibs" at Home by the Fire-side with His Slippers on, When the 10-, 20- and 30-Cent Vaudeville Show Around the Corner Affords Such an Enticing, Bacchanalian and Irresistible Saturnalia as This? Wow! Wow! Three Booms and a Tiger for Inventor Adsit ('at's it).



You Must Not Fail to Visit the Summer Resorts This Year. They Promise to be More Alive Than Ever Before. For Example—Behold This Wonderful Amphibian of the Sea, Air and Earth. The Inventor Patented and Described Everything But the "Fare." Anyhow, We Are Going to Take Out "Accident Insurance" Before Starting on a Trip.

AN AMPHIBIAN LAND, WATER AND AIR HYDROPLANE.

THE accompanying illustration shows one of the latest inventions in the realm of hydroplanes and this particular species might well be classified as an *amphibian* of the first water. As its inventor states in his patent, —yes, he has really been granted a patent by Uncle Sam on this marvelous contraption—his airship may be used in the air, thru water or upon the land with equal facility. The inventor provides in his design for the combination of a lighter than air or buoyant flying machine with a watertight passenger compartment. Thus he has given us a vehicle which may be used on inundated or marine surfaces, and the vehicle is further provided with wheels, in such a manner as to move readily over any ground surface. The machine is fitted with suitable motors, planes and rudders, all of which are accessible and controllable from the interior of the enclosed cab of the airship. This remarkable hydroplane should prove a great boon to the management of summer resorts, who are forever on the watch for something really new and novel. As our illustration discloses, a great variety of pleasure is afforded the passengers who embark on a voyage of adventure in this hybrid airship.

The superstructure consists essentially of a cylindrical metallic tube having a cigar-shaped front end and an outer wall formed of a number of longitudinal ribs, which are in turn connected to an inner encircling band, thus forming a substantial framework for the ballonets or gas bags, which are used to give the airship the desired buoyancy. The car attached to the superstructure and ballonet frame at the bottom, is provided with windows and doors, all of which may be sealed hermetically from the interior of the car, so that the car may be run thru the water, fully submerged, when desirable or necessary, and in any event the passengers are assured of a most delightful trip among the fishes.

At the rear end of the car is a revolving screw for propelling the hydroplane thru the water, while a rudder is also used to control the direction of the airship in its flight thru the water. On top of the ballonet superstructure, the inventor places two masts for the support of a radio antenna one of which may act as a flag pole. Ar-

(*Continued on page* 815)

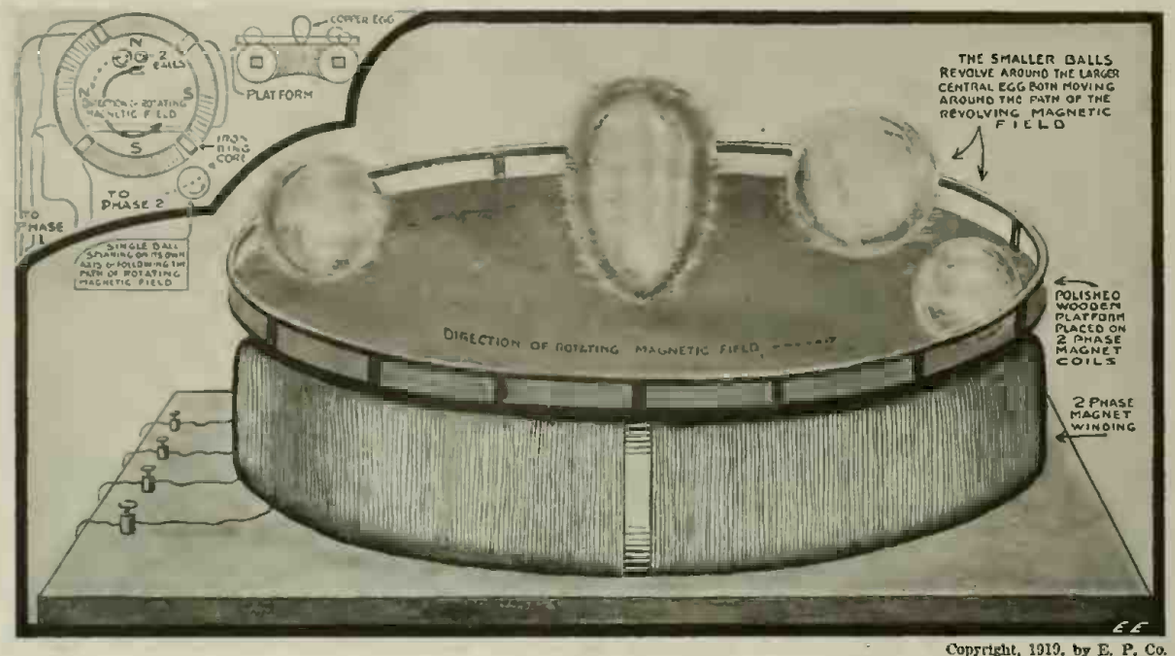
www.americanradiohistory.com

Tesla's Egg of Columbus

How Tesla Performed the Feat of Columbus Without Cracking the Egg

PROBABLY one of the most far-reaching and revolutionary discoveries made by Mr. Tesla is the so-called *rotating magnetic field.* This is a new and wonderful manifestation of force —a magnetic cyclone—producing striking phenomena which amazed the world when they were first shown by him. It results from the joint action of two or more alternating currents definitely related to one another and creating magnetic fluxes, which, by their periodic rise and fall according to a mathematical law, cause a continuous shifting of the lines of force. There is a vast difference between an ordinary electro-magnet and that invented by Tesla. In the former the lines are stationary, in the latter they are made to whirl around at a furious rate. The first attracts a piece of iron and holds it fast; the second causes it to spin in any direction and with any speed desired. Long ago, when Tesla was still a student, he conceived the idea of the rotating magnetic field and this remarkable principle is embodied in his famous *induction motor* and system of transmission of power now in universal use.

In this issue of the ELECTRICAL EXPERIMENTER Mr. Tesla gives a remarkable account of his early efforts and trials as an inventor and of his final success. Unlike other technical advances arrived at thru the usual hit and miss methods and hap-hazard experimentation, the rotating field was purely the work of scientific imagination. Tesla developed and perfected, entirely in his mind, this great idea in all its details and applications *without making one single experiment.* Not even the usual first model was used. When the various forms of apparatus he had devised were tried for the first time they worked exactly as he had imagined and he took out some forty fundamental patents covering the whole vast region he had explored. He obtained the first rotations in the summer of 1883 after five years of constant and intense thought on the subject and then undertook



Copyright, 1919, by E. P. Co.

Fig. 2. Illustrating the Polyphase Coil and Rotating Megnetic Field Which Caused Copper Eggs to Spin. Fig. 3. Insert: Detail of Coil Apparatus Showing Coil Connections to Different Phases.



Fig. 1. This hitherto unpublisht photograph is extremely interesting as it shows not only "Tesla's Electric Egg" apparatus in the center of the background, but also a comprehensive view of a corner of his famous Houston Street laboratory of a decade ago. At the left may be seen a number of Tesla's oscillators or high frequency generators, while in the rear may be noted a large high frequency transformer of the spiral type, the diameter of which was a little over nine feet. The electric egg apparatus comprising a two-phase A.C. circular core and winding, rests on a table, and this particular model measured about two feet across. In making the demonstrations, Tesla applied as much as 200 H.P. from a two-phase alternator to the exciting coils, and so intense was the revolving magnetic field created in the surrounding space, that small delicately pivoted iron discs would revolve in any part of the hall, and a great many other devices could be simultaneously operated from this magnetic field when thus excited. The frequency of the two-phase A.C. energizing the coils, was varied from 25 to 300 cycles, the best results being obtained with currents of from 35 to 40 cycles. This laboratory was lighted by Tesla's vacuum tubes, several of which may be seen on the ceiling, and each of which emitted 50 C.P. The coil resting on three legs and observed in the immediate foreground is the primary of a resonant Tesla transformer which collected energy from an oscillatory circuit encircling the laboratory, no matter in what position the transformer was placed. A low tension secondary of one or two turns of heavy cable (not visible) was provided for stepping down the energy collected by "mutual induction," and supplied the current to incandescent lamps, vacuum tubes, motors and other devices. When the circuit around the hall was strongly excited, the secondary furnished energy at the rate of about three-quarters of one horse-power.

www.americanradiohistory.com

the equally difficult task of finding believers in his discovery. The alternating current was but imperfectly understood and had no standing with engineers or electricians and for a long time Tesla talked to deaf ears. But, ultimately, his pains were rewarded and early in 1887 a company bearing his name was formed for the commercial introduction of the invention.

Dr. Tesla recently told the editors an amusing incident in this connection. He had approached a Wall Street capitalist—a prominent lawyer—with a view of getting financial support and this gentleman called in a friend of his, a well-known engineer at the head of one of the big corporations in New York, to pass upon the merits of the scheme. This man was a practical expert who knew of the failures in the industrial exploitation of alternating currents and was distinctly prejudiced to a point of not caring even to witness some tests. After several discouraging conferences Mr. Tesla had an inspiration. Everybody has heard of the "Egg of Columbus." The saying goes that at a certain dinner the great explorer asked some scoffers of his project to balance an egg on its end. They tried it in vain. He then took it and cracking the shell slightly by a gentle blow, made it stand upright. This may be a myth but the fact is that he was granted an audience by Isabella, the Queen of Spain, and won her support. There is a suspicion that she was more imprest by his portly bearing than the prospect of his discovery. Whatever it might have been, the Queen pawned her jewels and three ships were equipt for him and so it happened that the Germans got all that was coming to them in this war. But to return to Tesla's reminiscence. He said to these men, "Do you know the story of the Egg of Columbus?" Of course they did. "Well," he continued, "what if I could make an egg stand on the pointed end without cracking the shell?" "If you could do this we would admit that you had gone Columbus one better." "And would you be willing to go out of your way as much as Isabella?" "We have no crown jewels to pawn," said the lawyer, who was a wit, "but there are a few ducats in our buckskins and we might help you to an extent."

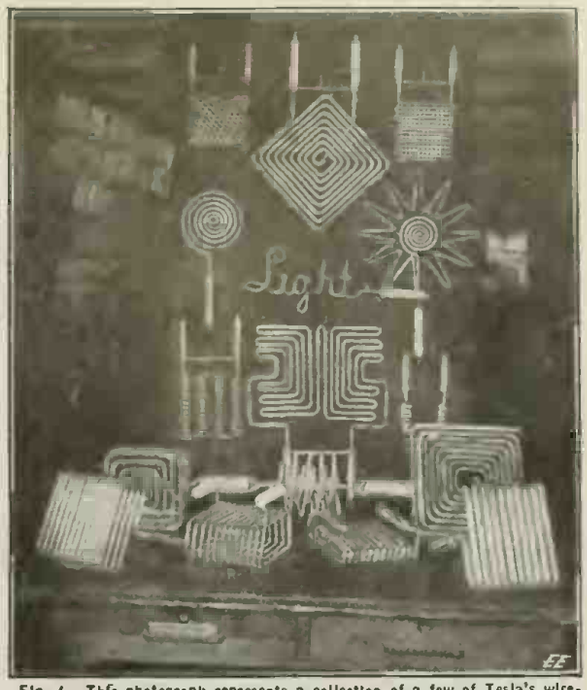


Fig. 4. This photograph represents a collection of a few of Tesla's wireless lamps, such as he proposes to use in lighting isolated dwellings all over the world from central wireless plants. The two lamps at either corner at the bottom are illuminated, owing to the fact that a high frequency oscillator was in operation some distance away when this photograph was being taken. These tubes were filled with various gases for experimental research work in determining which was most efficient.

Mr. Tesla thus succeeded in capturing the attention and personal interest of these very busy men, extremely conservative and reluctant to go into any new enterprise, and the rest was easy. He arranged for a demonstration the following day. A rotating field magnet was fastened under the top board of a wooden table and Mr. Tesla provided a copper-plated egg and several brass balls and pivoted iron discs for convincing his prospective associates. He placed the egg on the table and, to their astonishment, it stood on end, but when they found that it was *rapidly spinning* their stupefaction was complete. The brass balls and pivoted iron discs in turn were set spinning rapidly by the rotating field, to the amazement of the spectators. No sooner had they regained their composure than Tesla was delighted with the question: "Do you want any money?" "Columbus was never in a worse predicament," said the great inventor, who had parted with his last portrait of George Washington in defraying the expenses of the preparation. Before the meeting adjourned he had a substantial check in his pocket, and it was given with the assurance that there was more to be had in the same bank. That started the ball rolling. Tens of millions of horsepower of Tesla's induction motors are now in use all over the world and their production is rising like a flood.

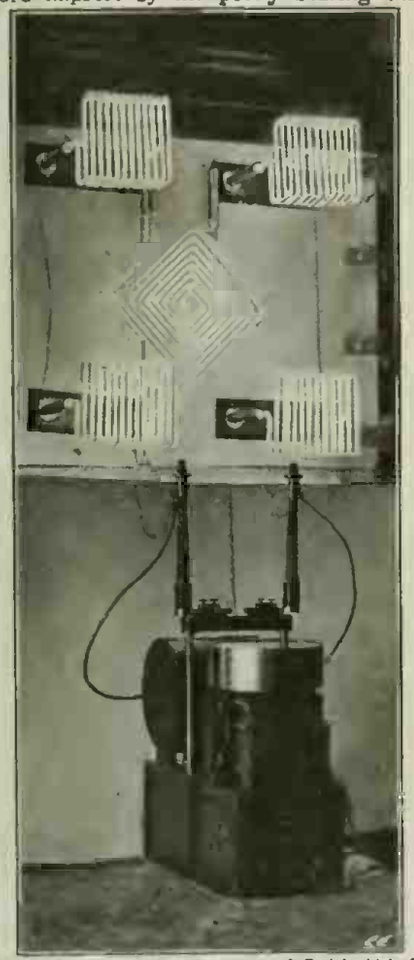


Fig. 5. This illustration shows one of Tesla's high frequency oscillation generators and a bank of his high frequency lamps lighted by the same. These highly evacuated, gas filled tubes were operated in different ways. In some cases they were connected to one wire only; in other instances to two wires, in the manner of ordinary incandescent lamps. Often, however, they were operated without any connection to wires at all, i.e., by "wireless energy", over quite appreciable distances, which could have been greatly extended with more power. The oscillator comprises a Tesla high potential transformer which is excited from a condenser and circuit controller, as described in his patents of 1896. The primary exciting element comprised a powerful electro-magnet actuating an armature, and this circuit was connected with 110 volt, 60 cycle A.C. or D.C. When the oscillator was put into operation, the interrupter actuated by the electro-magnet connected to the 110 volt circuit, became simultaneously the spark gap for the high potential exciting circuit, which included this vibrator, spark gap, a high tension condenser and the primary of the high frequency Tesla transformer. The lamps were connected to the secondary of the latter the terminals of which are seen in the rear of the machine.

In 1893 Mr. Albert Schmid, then Superintendent of the Westinghouse Electric and Mfg. Co. constructed a powerful rotating field ring with an egg made of copper, and larger than that of an ostrich, for Dr. Tesla's personal collection at the Chicago World's Fair. This piece of apparatus was one of the most attractive novelties ever publicly shown and drew enormous crowds every day. Subsequently it was taken to Mr. Tesla's laboratory and served there permanently for demonstrating rotating field phenomena. In his experiments it was practicable to use as much as 200 *horsepower* for a short time, without overheating the wires and the effects of the magnetic forces were wonderfully fascinating to observe. This is the very ring indicated in the accompanying photograph (Fig. 1), giving a view of Mr. Tesla's former laboratory at 46 E. Houston Street, New York. It is shown in detail in Fig. 2, and the mode of winding is illustrated in diagram (Fig. 3). Originally the two-phase arrangement was provided but Mr. Tesla transformed it to the three- and four-phase when desired. On top of the ring was fastened a thin circular board, slightly hollowed, and provided around its circumference with a guard to prevent the objects from flying off.

Even more interesting than the spinning egg was the exhibition of *planetary motion*. In this experiment one large, and several small brass balls were usually employed. When the field was energized all the balls would be set spinning, the large one remaining in the center while the small ones revolved around it, like moons about a planet, gradually receding until they reached the outer guard and raced along the same.

But the demonstration which most imprest the audiences was the simultaneous operation of numerous balls, pivoted discs and other devices placed in all sorts of positions and *at considerable distances from the rotating field*. When the currents were turned on and the whole animated with motion, it presented an unforgettable spectacle. Mr. Tesla had many vacuum bulbs in which small, light metal discs were pivotally arranged on jewels and these would spin anywhere in the hall when the iron ring was energized.

Rotating fields of 15,000 horsepower are now being turned out by the leading manufacturers and it is very likely that in the near future capacities of 50,000 horsepower will be employed in the steel and other industries and ship propulsion by Tesla's electric drive which, according to Secretary of the Navy Daniels' statement, has proved a great success.

But any student interested in these phenomena can repeat all the classical experiments of Tesla by inexpensive apparatus. For this purpose it is only necessary to make two slip ring connections on an ordinary small direct current motor or dynamo and to wind an iron ring with four coils as indicated in diagram Fig. 3. No particular rule need be given for the windings but it may be stated that he will get the best results if he will use an iron ring of comparatively *small section* and wind it *with as many turns of stout wire as practicable*. He can heavily copper plate an egg but he should bear in mind that Tesla's egg is not as innocent as that of Columbus. The worst that can happen with the latter is that it might be,—er—over ripe! but the Tesla egg may explode with disastrous effect because the copper plating is apt to be brought to a high temperature thru the induced currents. The sensible experimenter will, therefore, first suck out the contents of the egg—thus satisfying both his appetite and thirst for knowledge.

Besides the rotating field apparatus Mr.

(*Continued on page* 808)

www.americanradiohistory.com

My Inventions

By Nikola Tesla

2. MY FIRST EFFORTS IN INVENTION

I SHALL dwell briefly on these extraordinary experiences, on account of their possible interest to students of psychology and physiology and also because this period of agony was of the greatest consequence on my mental development and subsequent labors. But it is indispensable to first relate the circumstances and conditions which preceded them and in which might be found their partial explanation.

From childhood I was compelled to concentrate attention upon myself. This caused me much suffering but, to my present view, it was a blessing in disguise for it has taught me to appreciate the inestimable value of introspection in the preservation of life, as well as a means of achievement. The pressure of occupation and the incessant stream of impressions pouring into our consciousness thru all the gateways of knowledge make modern existence hazardous in many ways. Most persons are so absorbed in the contemplation of the outside world that they are wholly oblivious to what is passing on within themselves. The premature death of millions is primarily traceable to this cause. Even among those who exercise care it is a common mistake to avoid imaginary, and ignore the real dangers. And what is true of an individual also applies, more or less, to a people as a whole. Witness, in illustration, the prohibition movement. A drastic, if not unconstitutional, measure is now being put thru in this country to prevent the consumption of alcohol and yet it is a positive fact that coffee, tea, tobacco, chewing gum and other stimulants, which are freely indulged in even at the tender age, are vastly more injurious to the national body, judging from the number of those who succumb. So, for instance, during my student years I gathered from the published necrologues in Vienna, the home of coffee drinkers, that deaths from heart trouble sometimes reached *sixty-seven per cent* of the total. Similar observations might probably be made in cities where the consumption of tea is excessive. These delicious beverages superexcite and gradually exhaust the fine fibers of the brain. They also interefere seriously with arterial circulation and should be enjoyed all the more sparingly as their deleterious effects are slow and imperceptible. Tobacco, on the other hand, is conducive to easy and pleasant thinking and detracts from the intensity and concentration necessary to all original and vigorous effort of the intellect. Chewing gum is helpful for a short while but soon drains the glandular system and inficts irreparable damage, not to speak of the revulsion it creates. Alcohol in small quantities is an excellent tonic, but is toxic in its action when absorbed in larger amounts, quite immaterial as to whether it is taken in as whiskey or produced in the stomach from sugar. But it should not be overlooked that all these are great eliminators assisting Nature, as they do, in upholding her stern but just law of the survival of the fittest. Eager reformers should also be mindful of the eternal perversity of mankind which makes the indifferent *"laissez-faire"* by far preferable to enforced restraint. The truth about this is that we need stimulants to do our best work under present living conditions, and that we must exercise moderation and control our appetites and inclinations in every direction. That is what I have been doing for many years, in this way maintaining myself young in body and mind. Abstinence was not always to my liking but I find ample reward in the agreeable experiences I am now making. Just in the hope of converting some to my precepts and convictions I will recall one or two.

BOYS will be boys, the world over. The Boy Tesla was no exception to the universal rule, as this, his second autobiographical article clearly proves.

Mr. Tesla in his own inimitable, delightful way, here paints with a literary artist's brush his own intimate boyhood in charming as well as vivid colors.

We have often heard of Tesla, the dreamer. But if he is entitled to the epithet, his early boyhood certainly fails to reveal it. Tesla did not allow much grass to grow under his feet while a boy, for he assuredly was a strenuous, red-blooded youngster.

You will wish to read all about the greatest inventor's early boyhood. It is doubly valuable because it comes from his own pen. We promise you an interesting twenty-minutes' entertainment.

—EDITOR.



This Photograph Shows in the Background the House in Which Mr. Tesla's Family Resided. The Edifice at the Right Is the "Real Gymnasium" Where He Studied. The Ecclesiastic Gentleman Is His Uncle, the Metropolitan of Bosnia, Who Was a Great Statesman and Who Thwarted the Designs of Austria Upon Serbia at a Critical Period.

A short time ago I was returning to my hotel. It was a bitter cold night, the ground slippery, and no taxi to be had. Half a block behind me followed another man, evidently as anxious as myself to get under

(*Cont. on page* 839)

www.americanradiohistory.com



© 1919 by E. P. Co.

An interesting study of the great inventor, contemplating the glass bulb of his famous wireless light. A full description of the invention will appear shortly in the ELECTRICAL EXPERIMENTER. *This is the only profile photograph of Mr. Tesla in existence. It was taken specially for the* ELECTRICAL EXPERIMENTER.

www.americanradiohistory.com

Oldest and Newest Styles in Trolleys

VERY interesting indeed from a historical point of view are the accompanying photographs, which show respectively the oldest and newest style in trolleys, in the greatest trolley town in the universe, Brooklyn, N. Y., the home of the Brooklyn "Rapid" Transit. The photograph is of an old horse-drawn car of the vintage of 1889. Conductor Buck is seen standing alongside of the car, and it is interesting to note that the motormen in those days did not wear uniforms. Shades of Frank Julian Sprague! If the motormen of today only wore frock coats like this one does. He would be so busy reciprocating the attentions of the female passengers and passing the tea cups that we would never get on the job. Well, as we were saying, this was the latest style car—in 1889, and what is also interesting, Conductor Buck is still with the B. R. T.



Photos courtesy B. R. T. Monthly

The Newest and the Oldest in "Trolleys." The Large B. R. T. Trolley at the Top Has Two 45 Horse-power Motors to Propel It, Forty-five Times as Much as Its Early Predecessor, Shown Below, Which Boasted of the Prodigious Amount of 2 Whole Horse-power.

The larger photograph shows one of the very latest Brooklyn Rapid Transit Company's electric trolley cars, which instead of being rated at (2) horse-power, as was the 1889 model, develops the prodigious amount of 90 horse-power (each car having two 45 horse-power motors), or *forty-five times as much*. Note the great length of the modern electric trolley car and its greatly increased passenger carrying capacity compared to the old-timer of a generation ago. Now we can speed along home from the theater or from business in an electric trolley at the rate of thirty miles an hour and think nothing of it, but thirty years ago our fathers and grandfathers had to be content to travel homeward after business or the opera in one of these two-by-twice soap-boxes on wheels, pulled by two horse-power, but not always two powerful horses. When heavy snows came, it would sometimes require six to eight horses to pull the car, especially if heavily loaded.

But several of our friends recollect some interesting experiences. For instance when the horse-car got uncontrollable while descending a hill! Here's what happened many a time; the car knocked the horse down and ran up on top of him; then the passengers tumbled out post haste and helped the crew (he was a fine fellow) pull the car off the horse! And you paid as you entered, Oh! yes. If you didn't pile up front and slip your jitney in the fare box, the driver (he was the whole show) bawled you out properly. When you didn't have the change, the motorman past you an envelope containing change for your bill, and you then selected the fare and deposited it in the fare box. This wonderful mechanical masterpiece had an oil lamp inside it, so that the driver could see that you actually deposited the fare.

Electricity was a long time finding its way to trolley roads. The electric motor was developed at that time sufficiently to be adaptable for the propelling of trolley cars, but the complete details for the distribution of the current had not been fully worked out and developed to any appreciable extent. About the only thing electrical around this early traffic carrier was the "bell," and more often than not this was simply a large clapper intended to be yanked with a piece of cord. Horse-drawn trolleys, or "horse-cars" as they used to be called in the good old days, only disappeared from the streets of New York about a year and a half ago. Up to this time horse-cars were also used on Houston Street—the greatest attraction ever to out-of-town visitors. They talked about them for weeks and weeks and weeks.

HISTORIC ELECTRIC SWITCH-BOARD AND DYNAMO.

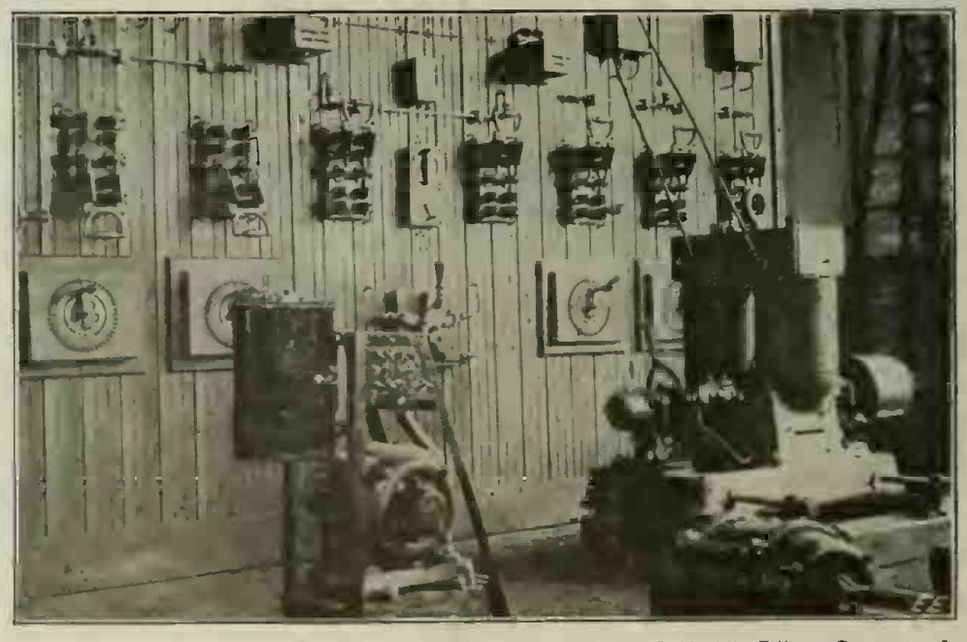
By J. Locketz.

THE electric switch-board, together with the 15 kilowatt generator shown in the accompanying photograph forms a very interesting link in the history of electric light and power development. This switch-board, as well as the dynamo, date back over thirty years and were used until recently by a western railroad when it was superseded by modern apparatus. The historic switch-board and dynamo have been donated to the Dunwoody Institute at Minneapolis.

The first thing that one notices on these old style switch-boards is that they are made of wood. A wooden switch-board was all right some years ago when 110 or 220 volts potential was considered a fairly "high" one, but nowadays when we have power developed at such tremendous voltages as 50,000 to 100,000, and even as high as 150,000 volts, there is required a better insulator than wood, such as marble.

The 15 kilowatt generator will be familiar to electricians as one of the famous old Edison machines of the bi-polar, vertical

(*Continued on page* 808)



A Wooden Railway Switchboard of Historic Interest. The 15 K. W. Edison Dynamo of Early Vintage, at the Right, Is Also of Interest. The Motor and Controller at Left Are of Modern Build.

www.americanradiohistory.com

A "White Coal" Motor to Harness the Tides

From time immemorial men have been active in trying to evolve methods that will relieve humanity from physical toil. The worldwide campaign for increased efficiency is in a large degree dependent upon this same desire to be relieved from physical labor and there is a demand everywhere for cheap power, which can, as everyone knows, be best supplied by water power.

It is claimed by Government officials that the United States has more than 40,000,000 horse-power of undeveloped water power within its boundaries. If this is true, it represents an amount of power corresponding to the amount of energy that would be derived from about 300,000,000 tons of coal worth about $600,000,000 a year in the boiler furnaces.



© International Film Service

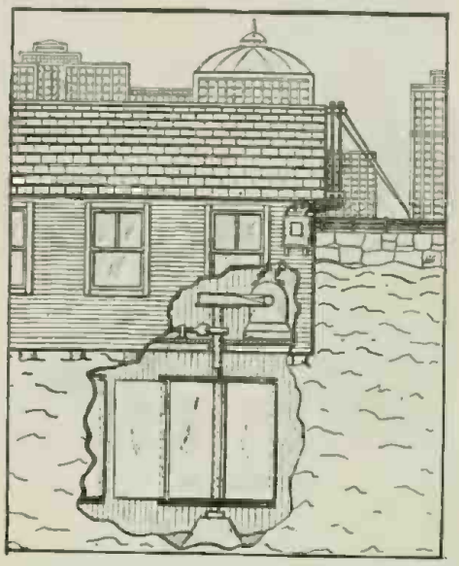
Model of the New Tidal Motor and Its Inventor, Mr. P. J. Griffin, of Boston, Who Is Seen at the Left. A Moving Current of Water Works the Device.

A new motor, shown in the illustrations, invented by Mr. P. J. Griffin of Boston, is designed to harness the energy of the tides and generate electricity by this means. The *White Coal Motor*, as it is known, is built on unique principles, being almost devoid of resistance. With this simple motor a farmer may harness the latent power of the nearest stream and generate his own electricity at very low cost. Flowing water is the only power used to generate the electricity.

Mr. Griffin, the inventor, is shown on the left in the photograph.

The inventor makes use of two sets of crosses, used as arms and mounted on a concave shaft. Secured between the outer ends of said arms are a set of flaps or wings; these wings or planes are held in place on one of their vertical edges between the outer ends of said cross arms by means of a rod (or pivot, to make a circle of 358 degrees from one side of the concave shaft to the other or opposite. On account of the above radius these wings or flaps take advantage of the same currents in its reverse, identically as that of the forward serving with the same continuous motion without any change whatsoever of any part of the device.

This invention is a cross or disk, not a wheel; it becomes a motor when wholly submerged in a current of water or fluids. The action of said forces upon the power producing planes or wings causes it to rotate and hence it becomes a wheel producing motive power on the upper end of an upright shaft. With this motor wholly submerged in water the inventor claims 1,500 h.p. to 60 square feet of surface of blades with between a five and six-mile current.



As Will Be Seen, This New Tide Motor Is a Cross or Disk. It Becomes a Motor When Wholly Submerged in a Current of Water. The Pivoted Wings Are Actuated by the Water Current, Thus Turning the Vertical Shaft, to Which a Dynamo Is Belted.

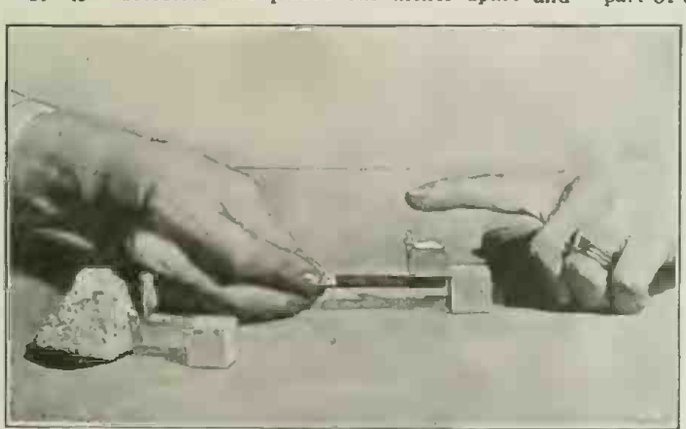
Insulating rods, tongs and similar appliances have been so perfectly developed to-day that linemen often work on charged wires carrying as high as 40,000 volts with comparative safety.

A "RADIUM DETECTOR."

A new detector of *radioactivity* has been evolved by a California inventor, Mr. L. M. Karnasch, and it is a highly sensitive scientific apparatus, constructed on the principle of an Electroscope, by means of which it is possible to distinguish radioactive substances from others. It is claimed that the presence of radium in quantities less than 100,000,000th part of a pound can be detected with absolute certainty.

The Radium Detector consists of two insulating stands, to each of which is fastened a small "flag." A generator, in the form of a stick of electrite or hard rubber composition, 2¾ inches long, ⅝ of an inch in width, and 1/16 of an inch in thickness completes the outfit. The detector is mounted on a small sulfur compound block which forms a ¾ of an inch cube. A small piece of aluminum sheet extends horizontally ¾ of an inch from the cube and has a width of ½ an inch; it is bent into an "L" shape, the vertical side of which stands from each side of the upright aluminum ¼ of an inch above the top of the cube. There is a thin wire stretched taut across the plate and on this wire is placed a small "indicating flag."

Detection of the presence of Radium is accomplisht by the use of two of these detectors placed on a flat surface, preferably a glass top table and at a point of height, convenient for observation. The detectors are placed six inches apart and an initial charge is imparted to each one by means of the brisk rubbing of the generator stick between a folded piece of dry wool cloth or silk. The application of the generator to the detector causes the latter to become actively charged.



At Last! A Real Radium Detector. It Works on the Principle of the "Electroscope." Radioactive Substances Will Dissipate the Charge Rapidly on the "Test" Detector, Causing Its Flag to Fall.

After the detectors have become charged, the small flag raises and stands out in a horizontal position. The substance to be tested is placed under or near the metal part of one of the detectors, without touching it. The second detector is located about six inches away without any substance near it and it is used as a check upon the first detector. The flags of both detectors are then observed for a period of five minutes.

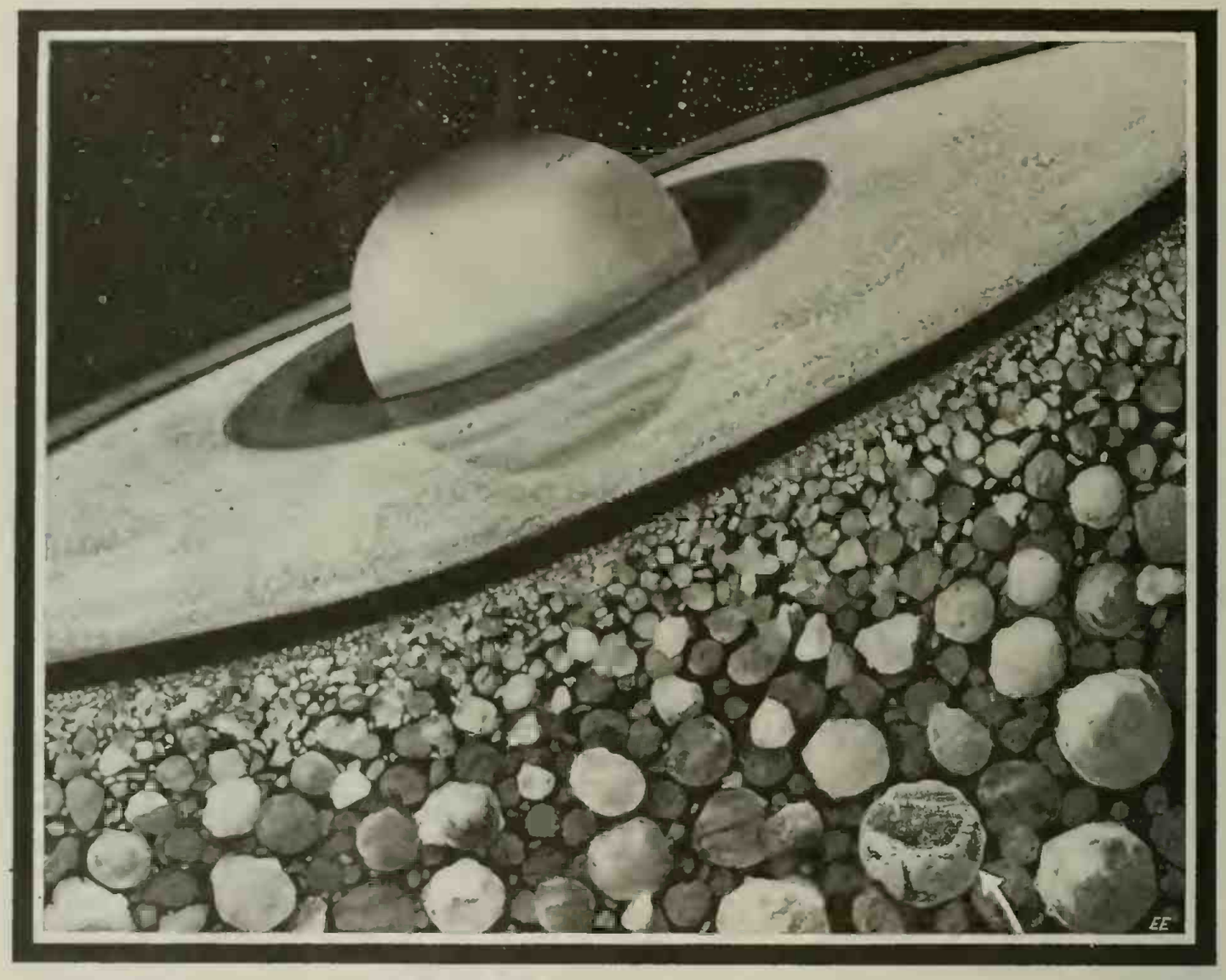
If the flag of the detector near which the substance or ore has been placed, drops from the horizontal position with greater rapidity than the "check up" detector, the substance is then radioactive. The strength of the radioactivity can be approximately determined with this detector by noting the period of time it takes to discharge the detector. The flags will fall in about 8 or 10 minutes when a weak radioactive substance is employed, such as Uranium Nitrat, while Carnotit and pitch blend will cause the flags to fall in from two to three minutes.

www.americanradiohistory.com

Popular Astronomy

Saturn—The Ringed Planet

By ISABEL M. LEWIS
OF THE U. S. NAVAL OBSERVATORY

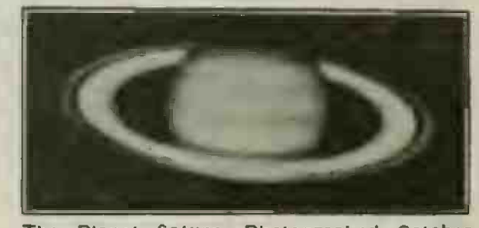


Very Recent Discoveries Tend to Prove with Irrefutable Evidence That the Rings of Saturn Are Not at All Solid as Has Long Been Thought. Instead, the Entire Ring System Is Made up of Tiny Little Moonlets, the Largest of Which Is Probably Not More Than Four Miles in Diameter. These Little Bodies in Their Rotation Around Saturn Revolve as Independent Bodies Floating Free in Space Without Touching Each Other. Collisions, However, Once in a While Are Bound to Occur. In Our Illustration the Arrow Points to One of These Little Moonlets, and in Order to Show Its Size, We Have Depicted Upon It the Lower Part of New York City, as It Would Appear if Viewed from Space about One Mile Above. This Illustration Strikingly Shows the Tremendous Size of the Saturnian system.

NEARLY everyone, with the exception of a few unusually earth-bound individuals, has felt at some time or other a strong desire to gaze at some of the beauties and wonders of the heavens thru a telescope and the one object that all of us wish to see, if, perchance, this desire is to be gratified, is Saturn, whose unusual ring system has so far as we know no counterpart in the sky.

All the planets in the solar system with the exception of the two innermost, Mercury and Venus, are attended by satellites but Saturn, alone, has in addition to a large and imposing family of nine moons, three distinct rings of great dimensions which form a total mass composed of swarms of minute particles revolving around the planet.

Why Saturn should be the only planet to possess such a system of rings has not yet been explained in an entirely satisfactory manner, depending as it does upon the manner of the origin of the entire solar system which it is now agreed could not have followed the course outlined by the Nebular Hypothesis of La Place. The theory of the origin of the Rings of Saturn is involved in the theory of the origin of the solar system and every theory advanced to explain the manner in which the solar system came into existence must satisfactorily explain the cause of this peculiar appendage of Saturn.



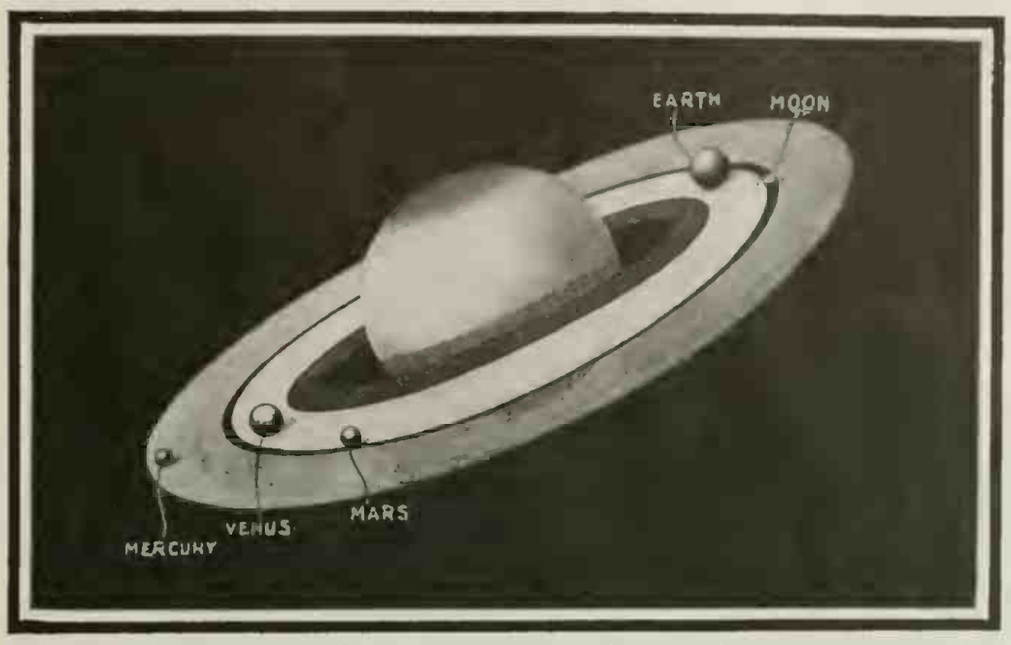
The Planet Saturn, Photographed October 1909 with Mt. Wilson 60" Reflector. This Is an Actual Photograph of the Planet.

There is an interesting law known as "Roche's Law," however, named from its investigator, that states that no satellite of a planet can exist intact within 2.44 . . . times the radius of the planet. This limit is spoken of as "Roche's Limit" and applying it to the planet Saturn we find that the rings of Saturn fall within this limit. It does not necessarily follow from this that the minute particles of which the rings are composed are the shattered remains of one small satellite but rather that they are the material from which a satellite might have been formed were it not so close to the planet. Within "Roche's Limit" the mutual attraction of the various particles for each other that would tend eventually to gather them into one body is overcome by tidal forces that arise from such close proximity to the huge planet. The stress and strain of such forces is so great that no grouping of particles can take place. This explains, possibly, why the rings continue

www.americanradiohistory.com

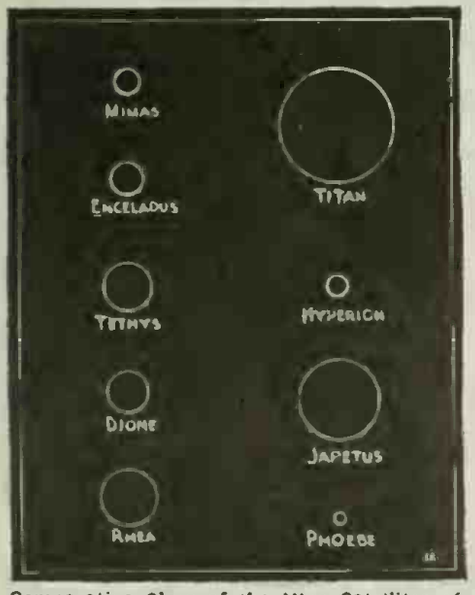
to exist in their present condition. The total mass of the rings is known to be very small, for they do not disturb the motions of any of the nearer and smaller satellites, tho tiny Mimas six hundred miles in diameter is only thirty-one thousand miles beyond the outer edge of the outer ring.

An interesting observation was made a year or so ago of the passage of the rings of the planet between us and a star. Tho the light of the star was diminished to one-fourth of its normal brightness when the rings past before it, at no time was its light entirely eclipsed by any of the particles. It was computed that if the diameters of any of the individual particles had amounted to as much as three or four miles the star would have been temporarily eclipsed. An upper limit for the size of the moonlets was thus obtained. The average diameter of the particles is probably much less than three miles.



In Order to Understand How Tremendously Large the Saturnian System Is, Our Artist Projected upon the Rings of Saturn All of the Minor Planets, Including the Earth. It Should Be Understood That These Rings Are Not Solid, But Are Merely Composed of Small Little Moonlets (See Large Drawing on Opposite Page). It Will Be Noticed That If All the Minor Planets and Our Own Moon Were Laid Side by Side, They Would Just About Cover the Breadth of Saturn's Rings. The Moon Is Just Wide Enough to Bridge the Gap Existing between the Outer and the Second Ring.

The thickness of the ring system is not over fifty or one hundred miles, but its total diameter is one hundred and seventy-two thousand miles. There are, in all, three concentric rings (see Fig. 1). The faint inner ring, known as the "crape" ring, is invisible in a telescope under four inches in aperture. According to extensive measurements by Barnard of the dimensions of the planet and its ring system the width of this inner ring is eleven thousand miles. Just beyond the crape ring is the chief, bright ring, eighteen thousand miles in width. It shades gradually in brightness from its juncture with the crape ring to its most luminous portion at its outer edge, which is separated from the third or outer ring by a gap two thousand two hundred miles in width, known as Cassini's Division. The third or outer ring is eleven thousand miles wide and is less bright than the central ring. The inner edge of the inner ring is but six thousand miles above the surface of the planet. On account of the curvature of the planet the ring system is invisible from the north and south pole of Saturn. As is the case with the satellites of a planet the inner particles of the rings revolve around the planet more rapidly than the outer particles. The innermost particles of the crape ring require but five hours for one journey around Saturn while the outermost particles of the outer ring require one hundred and thirty-seven hours, or nearly six days to complete one revolution.



Comparative Sizes of the Nine Satellites of Saturn, Arranged in the Order of Their Distances Outward from the Planets (Reading from Top to Bottom). Titan Is the Exact Duplicate of the Planet Mercury in Size, and Japetus Is Very Nearly Equal to Our Own Moon in Size.

In addition to the gap in the rings known as Cassini's Division several other fainter divisions exist. If a group of moonlets were to revolve around the planet in the positions marked by these gaps their periods of revolution would be commensurable with the periods of several of the satellites of Saturn. As a result the attraction exerted on such particles by these satellites would gradually disturb their motion in such a way as to draw them away from these positions. It is owing, therefore, to the attractions of the satellites of Saturn for the moonlets that these gaps in the rings exist.

It results from the disturbances produced in the motion of the moonlets by the other satellites of Saturn that collisions are bound to occur occasionally among the various particles. When two particles collide the period of revolution of one or both of them is reduced and as a result collisions tend to bring the moonlets gradually closer and closer to the surface of the planet. The dusky inner ring, it has been suggested, may consist largely of particles whose periods have been continually shortened by collisions.

Saturn may, therefore, lose its ring system in the course of time thru its gradually being drawn down upon the planet by collisions of the various particles until all of the material is finally swept up by the planet. Such a change would probably require millions of years, however, as collisions are probably, on the whole, infrequent. It is possible that the ring system of Saturn may have been much more extensive in the past than it is now and other members of our solar system may have had such appendages in the far distant past.

The appearance of the rings of Saturn as viewed from our planet changes periodically as a result of the revolutions of the earth and Saturn around the sun, which places them in constantly changing positions with reference to each other. The rings lie in the plane of Saturn's equator, which is inclined twenty-seven degrees to its orbit and twenty-eight degrees to the Earth's orbit.

Since the position of the equator remains parallel to itself while the planet is journeying around the sun it happens that half the time the earth is elevated above the plane of the rings and the remainder of the time it lies below the plane of the rings. Twice in the period of Saturn's revolutions around the sun, which occupies nearly thirty years, the earth lies directly in the plane of the rings and at this time the rings entirely disappear from view for a short time. The last disappearance of the rings of Saturn took place in the fall of 1907 and the next disappearance will occur in November, 1920. Between these two dates the southern surface of the rings remains the visible one. Half way between the two dates of disappearance the rings are tilted at their widest angle with reference to the earth and they are then seen to the best advantage. They are now becoming narrower and narrower and as the date of their disappearance approaches they will appear more and more like a line of light extending to either side of the planet's equator. Even in the most powerful telescope the rings entirely disappear from view for a few hours at the

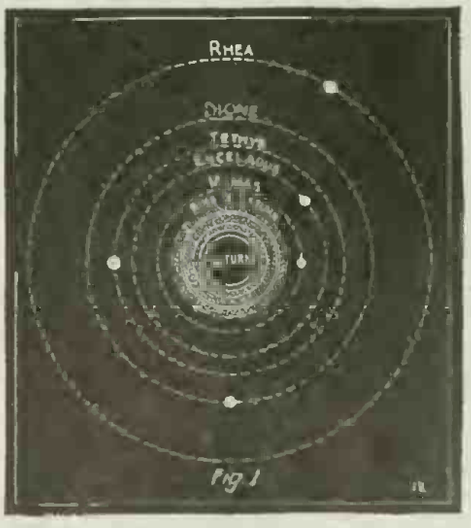


Fig. 1 Shows the Dimensions of the Ball and Rings of Saturn and the Orbits of the Five Inner Satellites.

time the earth lies exactly in the same plane. It is at this time that the ball of

(*Continued on page* 821)

www.americanradiohistory.com

How Jimmy Saved the Bank

By F. W. RUSSELL

As the hands of the big clock in the office of the First National Bank pointed nine, old Mr. Hutchinson past between the long rows of desks towards the door of the big burglar-proof safe. For the last ten years he had past along that same isle and at exactly the same hour. He reached the door and put his hand on the huge nickle-plated handle, by means of which the door was pulled open. The great weight was so delicately balanced that only a slight pull was necessary to open it, but this time it did not yield to the usual effort; Mr. Hutchinson applied all his strength to the task, but the door did not yield an inch. What could be wrong?

Mr. Wallace, the president of the bank had wanted an absolutely burglar-proof safe, so his brother, an Electrical Engineer, had undertaken to design one, which he claimed would foil the efforts of the most ambitious cracksman. It had a marvelous time-lock consisting of five clocks timed to a hair. These, beginning at fifteen minutes to eight, closed five different contacts in a special motor circuit; that is, the first contact was closed at a quarter to eight, the next at exactly eight, and so on at intervals of fifteen minutes, until the last contact was closed at a quarter to nine, starting an induction motor which drew the bolts. The current for this motor was brought in thru the top of the safe. Two holes had been made here which were comparatively small at the top and bottom but which bulged out at the center. Heavily flanged brass rods had been set in these holes and porcelain molded around them. These were protected by a thick layer of concrete which covered the safe on all sides, excepting the front. The current which operated the clock contacts, was supplied by a small storage battery kept in the safe and charged every day.

Mr. Hutchinson's first thought was that he might have been too soon, tor even his almost machine-like actions might have for once been at fault, but no, the huge clock above the safe by which the time mechanism was set every evening, showed exactly twelve minutes to nine. The safe was three minutes late already! He tried the door again in order to be sure that he was in no way at fault, for he took great pride in his reputation for punctuality and promptness, and to his mind nothing could be more humiliating than to be laughed at by some of the bank clerks simply because of some thoughtless mistake. But his utmost exertions were futile. The giant door did not yield a fraction of an inch. He proceeded hurriedly, to keep from being questioned, to the office of Mr. McGinnis, Mr. Wallace's secretary, who took charge of affairs when his chief was away.

"Mr. McGinnis," he gasped breathlessly, "the safe won't open!"

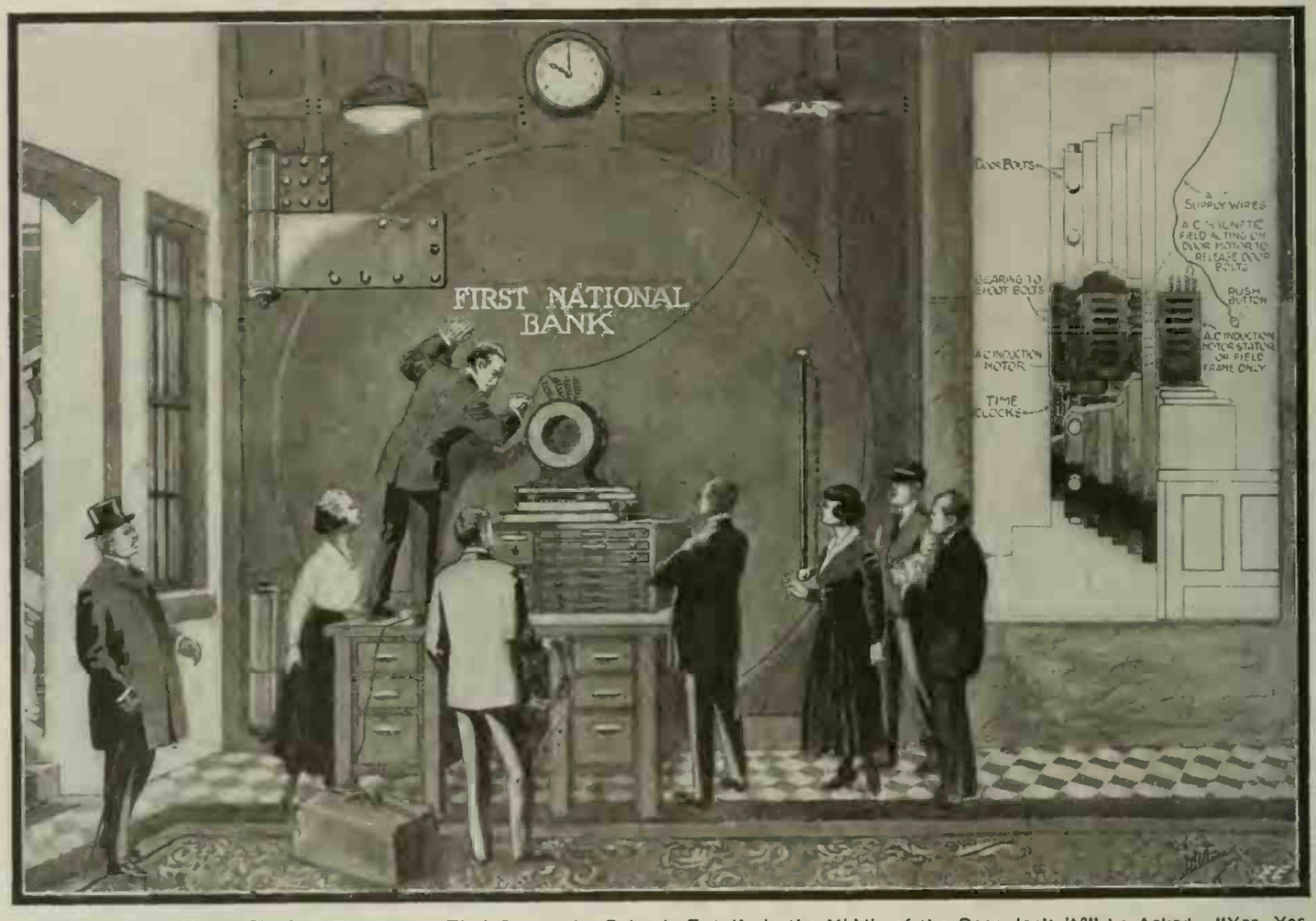
Mr. McGinnis gazed at him in blank astonishment.

"No sir! no sir!" He raced on, getting his breath in gulps. "I went there at the usual time sir, and the door would not give. I know I was not ahead of time, for I waited nearly five minutes and tried again. I pulled with all my might, sir."

He paused and looked inquiringly at the secretary, who had sunk into one of the large leather arm chairs against the wall, and sat gazing at the floor. Suddenly he got up and looked at his watch, started to sit down again, changed his mind and began to pace the long office thoughtfully. Mr. McGinnis was a man who had never in the experience of anyone, been known to become visibly excited, but Mr. Hutchinson could see that he was now making a strong effort to contain himself. Finally he came to a halt before Mr. Hutchinson, and with his eyes still on the floor he began:

"Hutchinson, that safe must be opened! I have no idea what can be the matter; I have no idea how to open it—but it must be done. There are some papers in there that must be gotten at by noon, or we will be practically ruined. We can borrow enough money to carry us thru the day, but those papers have got to be attended to. Mr. Wallace as you know, left yesterday morning for a short cruise on his yacht. I do not think he knows of any way to open it, but it would be best to ask him and inform him of the situation."

"Ask him? How are you going to ask him?" inquired the impatient Hutchinson.



Jimmy Turned to Mr. McGinnis—"That Motor That Draws the Bolts is Exactly in the Middle of the Door, Isn't It?" he Asked. "Yes, Yes, Exactly. . . . But What are You Going to do?" Said Mr. McGinnis. All Eyes Were Turned Inquiringly on Jimmy, Who Stood on the Desk Holding a Push Button in His Hand and Listening Intently With His Ear Glued Against the Door. Suddenly a Low Hum Was Heard and Then a Click Which Was Unmistakable. A Cheer Burst From the Surrounding Bank Attaches—Jimmy Had Saved the Bank.

www.americanradiohistory.com

Mr. McGinnis looked at him reprovingly. "He keeps in touch with his home thru his son Jimmy's wireless. We will go and see him at once; you must go with me."

They left the building together and hailed a passing taxi. After giving the direction, Mr. McGinnis settled back in the seat with the outward appearance of a man without a worry. Mr. Hutchinson sat with clasped hands, and silently shook his head. He had no faith in this wireless business, or in fact in anything, now that the safe which had always been his pet had failed him. They stopt on the way, and Mr. McGinnis explained the situation to the Citizens National Bank, securing a sufficient loan to carry them thru the day. The car soon cleared the crowded down-town district and sped along the smooth streets, until after a short ride it drew up before the white marble home of the Wallaces.

The door was opened by John, the butler, who informed them that Jimmy was at home. He was at that moment in his workshop, or in good American, his "joint."

Was the gentlemen's business very important? It was. Well John might venture into those dangerous regions if that was the case. John went off slowly showing no enthusiasm for his task. There were memories still fresh in his mind of electrified door-knobs that stuck to the hand, and one rug in particular on which he had shown a surprising amount of activity. He approached the door cautiously and knocked.

"Hello, who is it?" came a voice from within.

"Mr. McGinnis and Mr. Hutchinson are down-stairs wishing to see you."

"I can't come down, am too busy; tell them to come on up." Jimmy said this last standing in the open door. He was a tall slender young fellow, but well built, with a shock of brown hair, above a pleasant face. He was a typical "Bug"—always had a binding-post or a piece of wire in his pocket, and spent all his time collecting "junk" or "making somethin."

Mr. McGinnis and Mr. Hutchinson were shown up and entered the room. It was a regular "joint" all right; wire on the floor, hung from the ceiling and draped along the walls, switches nailed up here and there, and tables and chairs covered with tools and apparatus. Jimmy swept two chairs clean, but his visitors remained standing.

"Jimmy," the secretary began hurriedly, for the first time in many years not pausing to weigh his words, "The bank is in great danger. The safe won't open and there are some very important papers in it which have to be attended to. I want you to call your father, and ask him if there is any way to open it. You can get him, can't you?"

"What's this, you say, the safe won't open?" burst out Jimmy, looking dazedly at Mr. McGinnis.

"Yes, yes, and I want you to ask your father if he knows any way to open it. I say, you can get him, can't you?"

"O, sure, of course, just a minute." Jimmy dashed to his wireless table and threw in the antenna switch. In a moment the hum of the rotary gap was being drowned by the high-pitched spark, as the call of his father's yacht was being tapt out rapidly. After the second trial Jimmy was answered by the Yacht's radio operator.

After a few minutes, Jimmy rose from the table with a downcast look. The two men could read his mind before he had opened his mouth. "He don't know—he's all excited. That's natural enough tho. He's coming right back." Jimmy stood for some time looking at the floor in a thoughtful attitude. Finally, as Mr. McGinnis started to go, he called him back. "Wait a minute, there ought to be some way to open that safe; sit down and think; there is no use getting excited."

Mr. McGinnis was far from being excited. "There is no use," he said, starting to go again. "You know how your Uncle brags about that safe, and he knew what he was doing when he designed it. We will just have to wait and see what happens."

"No, you have got the wrong dope," said Jimmy, his right hand idly turning the rotor (revolving member) of a medium size 220-volt induction motor on an adjacent table. "I'll admit that my Uncle is a bright man, but he may have mist something. Let's see; that storage battery must have gone wrong because that motor is as simple as they go. You know an induction motor has—oh! I've got it! maybe?"

Mr. Hutchinson gazed at him in wonder. Mr. McGinnis after his first astonishment rushed up to him and grasping him by the shoulder, stammered out, "What—what—what do you mean?"

"Don't bother me," said Jimmy, busily rolling up a long extension cord, "just tell me, have you got 220 volts A. C. at the bank?"

"Yes, yes," stammered Mr. McGinnis. "Yes, but what——"

Mr. McGinnis obeyed, and Mr. Hutchinson trailed out after him, not having recovered his senses as yet. The car was out in front and the two got in. In a moment Jimmy came running down the steps with a large black bag, which was apparently very heavy. The big car dashed thru the streets, narrowly missing several bewildered pedestrians and shaving passing vehicles by the fraction of an inch. As the car drew up in front of the bank, Jimmy was out over the door in an instant, dragging his bag along with him. When the secretary reached him, he was busily running the extension cord from a near-by lamp socket to the safe, in the mean time warding off a swarm of inquisitive bank clerks. When he had finished and had attached the two loose cord ends to two more protruding from the motor, he turned to Mr. McGinnis—"That motor is exactly in the middle, isn't it?" he asked.

"You mean the one that draws the bolts? Yes, yes, exactly; I remember that from when your Uncle explained it to me. What are you going to do?"

"Roll one of these desks over here", was all the answer they got. The order was obeyed by half a dozen clerks, who soon had one of the big flat tops on the required spot. By piling some large books and a file cabinet on top of this, the required level was soon attained. Jimmy lifted up his bag and took something out of it.

Just then a little man in great excitement burst thru the group. "Good heavens!" he exclaimed. "So it is true. I couldn't believe it. What are you doing, James, my boy!"

"Little idea of mine, going to try to open it," said Jimmy, "don't get excited tho; it may not work."

"Going to try to open it?" Mr. Wallace queried dazedly. He had just arrived and had driven to the bank at top speed.

"Ugh, ugh," said Jimmy. Then turning around, "Give us a little juice over here, one of you fellows!" In the scramble which followed some one accidently pushed the button, and the juice was on.

All eyes were turned inquiringly towards Jimmy, who stood on the desk holding a push button which was connected to a round black object on top of the pile of books. Suddenly, he prest the button and bent his ear to the door of the safe; a low hum was heard on the inside and then a click, which was unmistakable.

A cheer burst from the surrounding clerks, and as the desk was rolled away, Jimmy grasped the big nickle plated handle and swung the door wide open. But the mystery was yet to be explained and all eyes were again turned on Jimmy.

"How did you do it, son? How did you do it?" gasped Mr. Wallace, looking with mingled wonder and pride at his young hopeful.

"Oh, it's nothing!" said Jimmy, "You see an *induction motor* has no electrical wire connection between the field and the armature." All nodded understandingly. "And so I figured that if I used a bigger and more powerful field, I ought to be able to spin that armature from the outside; so I just lined them up and you know what happened. Simple little thing, isn't it, when you come to think about it?"

"James, you know that thing—that transformer you were longing for in that catalog the other day? How much does it cost?" asked Mr. Wallace, as he sat down and began to fill out a check.

(THE END)

THE APRIL NUMBER "E. E."

The April number of the ELECTRICAL EXPERIMENTER *will abound with new and refreshing articles. Among those in preparation there are the following attractive contributions:*

"My Inventions"—No. 3 of a series by Dr. Nikola Tesla, the eminent electrical scientist. This paper will describe his wonderful discovery of the "Revolving Magnetic Field"—the forerunner of the Tesla induction motor, which has revolutionized the electrical power industry.

"Do Wireless Waves Travel Above the Earth or Thru It?", by Dr. Lee de Forest. An exclusive feature article which you can't afford to miss.

Electricity—the Hotel Servant of a Thousand Uses. How it furnishes every conceivable want to the hotel guest—all at the push of a button.

"New X-Ray-less Photography of the Bones", by Charles Battell Loomis.

"Will Man Freeze the Earth to Death? Can He Exhaust the Heat-Giving Radium?" by E. T. Bronsdon.

"The 'Noiseless' Phonograph — it don't annoy the neighbors"—by Thomas Reed.

"'Putting It Over' on Fritz. Some radio and other tricks of the war," by K. K. Sammerin.

"New French and American Audions".

"A New Lightweight Commercial Radio Transmitter".

"Experiments in Radio-activity", Part III, by Ivan Crawford.

"Some New Regenerative Vacuum Tube Circuits", by Samuel D. Cohen.

Besides "Experimental Mechanics", New "Experimental Chemistry Questions and Answers", "Physics".

DO IT ELECTRICALLY.

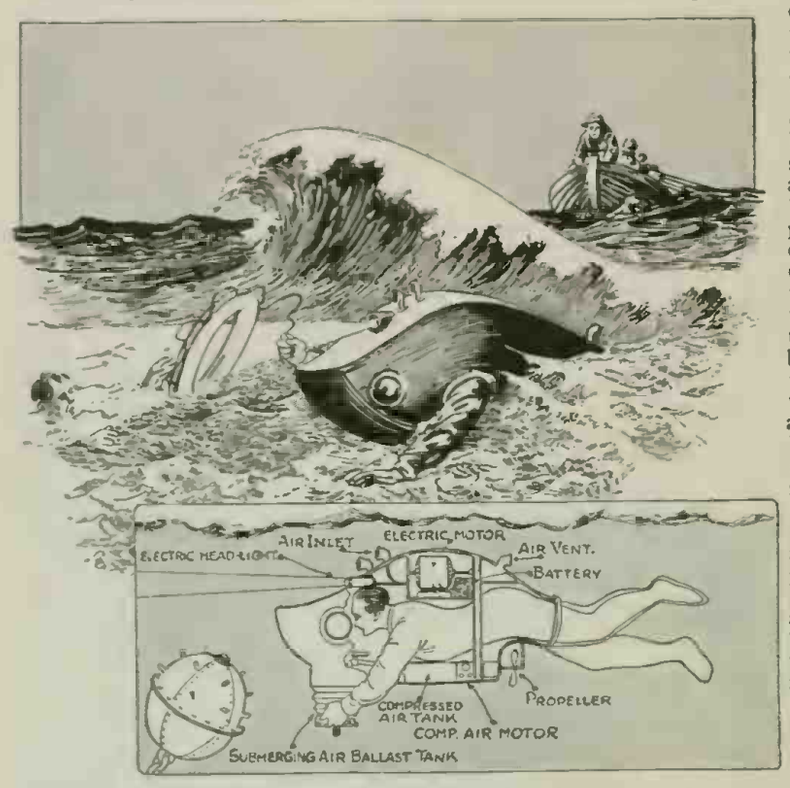
When Milli Ampere first saw Volt
  Her charms past all resistance.
A spark coiled in his heart poor colt—
  He needed prompt assistance.
And she, tho plighted to old Watt,
  Could alternate affection,
So let her eye bolt glances hot,
  Right in poor Volt's direction.
The current of Watt's wrath flowed strong!
  He vowed Volt should not meter.
For daughter Poly Phase had long
  Hoped that Volt would be sweeter.
And so to Milli Ampere, he
  A stern note did transmitter,
Requesting she transform, and be,
  If possible, less bitter.
So Milli Ampere flirted not,
  But knew that it was wise
To regulate the rage of Watt
  And with him synchronize.
Then Volt with Poly Phase did fuse—
  From her he did not roam.
They rectified divergent views
  And started a small Ohm.

—W. F. Leggett, in Western Electric News.

www.americanradiohistory.com

Submersible Boat Resembles Sea Monster

THE peculiar looking submersible one-man boat shown in the accompanying view has for its primary object, so its inventor, Mr. Worth R. Barringer, of Denver, Colorado, states—to provide a vessel of this character constructed so as to contain a single occupant and provided with suitable means whereby submergency of the vessel as well as its travel thru the water may be controlled by the occupant. He mentions, among other advantages, that it should prove useful and convenient for submarine observations and in the removal of submerged mines and for various other similar and analogous purposes. Also the inventor claims that his device can be used as a diving suit, and can be readily donned by the individual.



With a Little Ingenuity Amateur Mechanics Can Construct a One-Man Submersible Boat of the Type Here Shown. The Arms and Legs Fit into Flexible Rubber Extensions, the Same as in a Diving Suit. An Electric or Comprest Air Motor May Propel the Device.

The body of the submersible diving suit is preferably made of aluminum. The front or nose portion of the body is provided with transparent panes or windows, as shown, thru which the occupant can see either to the right or left and forward. Suitable rubber or other flexible water-proof compartments are adapted to receive the lower limbs of the operator. An electric motor is arranged to operate a propeller, the motor receiving its current from a storage or other battery. But this is not all. The inventor takes Time by the fore-lock and practises safety first. He also supplies a comprest-air motor with a storage tank containing air under high pressure for operating it, all of which is used to drive the propeller. Suitable vents are provided for the efflux of vitiated air as well as air inlets or ventilators, which are arranged in the top wall of the body. These vents are fitted with suitable valves, such as the float-ball type, which will automatically close, due to the pressure of the water upon submergence. An electric light bulb is also arranged in the top of the body, which is supplied with current from the storage battery.

Sleeves made of rubber or other suitable flexible material are attached on the front of the body on either side to accommodate the arms. These are fitted with suitable gloves to receive the hands of the operator. To submerge, the "human fish," a collapsible tank is arranged on the under side of the body. The tank is equipt at its lower end with suitable valves and hand-holds. There is also provided a pipe connecting the comprest air tank to the upper end of the collapsible bellows tank, in which pipe line there is placed a suitable valve. When it is desired to submerge, the bellows tank is collapsed, the air being expelled from the tank thru suitable valves. This results in the displacement of the vessel, so that it will submerge. When the operator desires to rise to the surface, he withdraws his arm from one of the sleeves and opens a comprest-air pipe valve from the storage tank into the collapsible bellows tank, thus expanding it and causing the vessel to rise, owing to the increased buoyancy.

Finally, the inventor mentions that it will of course be understood that the vessel may be provided with an oxygen supply tank, so as to afford an ample supply of oxygen during prolonged submergence of the vessel. If there is anything under the heavens that this inventor forgot, we have failed to perceive it in looking over his patent, but he might have conscientiously attached a 69 cent alarm clock to the rear wall of the inner compartment so as to arouse the submarine explorer from prolonged slumber, which might result disastrously in the event the "ship" became uncontrollable and started off on a long journey toward foreign shores. We presume the sailor carries sufficient tea biscuits in his box to weather the voyage, and providing he has the foresight to procure a few dozen choice tea and bouillon capsules as adapted by the United States Army for emergency rations, he should have a delightful cruise. *Bon voyage!*

PREDICT AERIAL MAIL SERVICE BETWEEN EUROPE AND AMERICA.

All mails between Europe and the United States eventually will be carried by airplane, according to Lord Morris, who has championed a movement before a Parliamentary committee for the establishment of a port of call for Atlantic aërial liners on the west coast of Ireland.

Already, he says, a regular daily mail service by airplane is maintained between England and France without interruption by the weather.

BRITISH TANKS CARRY THEIR OWN "CARPET."

The photograph herewith shows a giant British tank ready to go into action. This tank is fitted with a new superstructure, which comprises a rugged steel wire timber "carpet." It is used to breach shell-holes, gulleys and trenches, in making advances over rough ground. This "carpet" is quickly unrolled when needed, and is very effective on muddy ground. The giant caterpillar treads or belts do not grip into the mud when the carpet is used, and thus one of the greatest drawbacks to the use of the tanks has been overcome. This photograph is one of the most remarkable taken during the war and shows British infantry reinforcements accompanied by tanks, all awaiting orders to "get into it." The smoke from the battle almost obscures the tanks and men in the background of the picture.



© Underwood & Underwood

Unhampered by the Heavy Shellfire, This Re-enforcement of British Infantry Has Been Brought to the Front and Are Awaiting Orders to Get Into It. One of the British Tanks with the New Superstructure, Which is Used to Carpet the Mud Which the Caterpillar Wheels Do Not Grip, Is Advancing. The Smoke from the Battle Almost Obscures the Tanks and Men in the Background of the Picture.

www.americanradiohistory.com

Experimental Physics

By JOHN M. FURIA, A. B., M. A., (Columbia University)

LESSON NINETEEN

Radio-activity—Experiment 108.

WRAP a photographic plate in a piece of perfectly opaque black paper. Lay a coin on top of the paper and suspend a pinch of the mineral Uranium a little above the coin. Set this aside for a few days, after

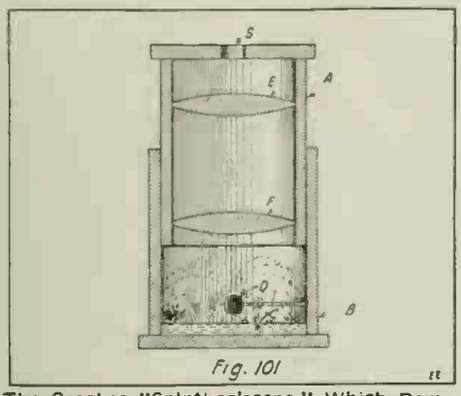


Fig. 101

The Crookes "Spintharlscope," Which Demonstrates In a Popular Way the Wonders of Radium. These Can Be Purchased On the Market.

which time develop the plate. A shadow picture of the coin such as one would obtain after exposure to X-rays will appear on the plate. This is precisely the experiment that Henri Becquerel, of Paris, performed in 1896, which led him to the conclusion that *Uranium is a source of rays that affect photographic plates and which have the power of penetrating opaque objects just as X-rays do.* The rays are known as *Becquerel Rays*, after their discoverer, and the phenomenon is called *Radio-activity*. Shortly after Becquerel's discovery Madame Curie, of Paris, assisted by her husband—Prof. Curie, made an investigation of all the known elements to ascertain which of them possest this same remarkable property that Uranium possesses. She found that *Thorium* in any of its compounds was a radio-active substance (Thorium is the chief constituent of Welsbach gas mantles). During the investigation Madame Curie noticed that *Pitchblende* (the crude ore from which Uranium is extracted) which consists of Uranium Oxid to a great extent, discharged her electroscope (a test for radio-activity) about four times as fast as pure Uranium does. She concluded that the radio-activity of pitchblende was due to some unknown element in it more powerfully radio-active than either Uranium or Thorium. After a tedious and difficult research she succeeded in separating a few hundredths of a gram of this hitherto unknown element from several tons of pitchblende. This new element which she named *Radium* proved to be a million times more radio-active than Thorium or Uranium. Radium has attracted the attention of the foremost scientists the world over.

Before proceeding with the following experiments let us note carefully the following characteristics of Radium. The Radium atom is heavier than any other atom. Radium constantly emits three distinct kinds of rays namely alpha, beta, and gamma which I shall refer to by α, β, and γ respectively. α, β, and γ rays all affect photographic plates, discharge a charged electroscope and are deflected by magnetic fields. α and β, both impart electric charges to bodies they come in contact with. In particular, the α rays are not as penetrating as the β and γ rays; they are deflected by a magnet in a direction opposite to the direction of deflection of β rays and travel at about 20,000 miles per second. The β rays are like cathode rays and they travel at from 50,000 to 180,000 miles per second. The γ rays are not deflected by a magnet but they have greater penetrating power than either the α or β rays. From these properties we conclude that α rays are streams of positively charged particles (atoms of Helium); β rays are negatively charged particles like cathode rays, i. e., electrons and γ rays are irregular pulses like X-rays.

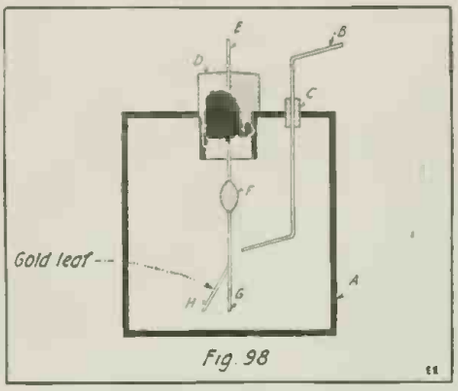


Fig. 98

A Sensitive Model of Gold-Leaf Electroscope Suitable for Use In Radio-Active Measurements.

Experiment 109.

The goldleaf electroscope, one of the oldest electrical measuring instruments known and which was described in the lesson on "Static Electricity," was used merely as a detector of the presence of an electrical charge. This same instrument in a delicate form is used to measure electric currents of very small magnitudes where other instruments fail. In Fig. 98, A is a metal case (a cocoa can serves admirably; in fact an authority on the subject of radio-activity made the statement that he secured better results with a home-made cocoa can electroscope than with the fancy priced, highly polished commercial instruments). A metal rod E (about 1/32 inch in diameter) passes thru an insulating plug D, made of ebonite, amber or sulfur. C and F represents insulation of the same material as D. B and G are metal rods like E, bent as in the figure (hairpin with the enamel scraped off is quite satisfactory). H is a narrow strip of gold or aluminum foil about one and one-half inches long and 1/32 inch wide. (The narrower the strip the more sensitive the electroscope). To cut the aluminum or gold foil the following method has been found best. Place the foil between two sheets of thin paper. Press the edge of a razor flat against the "sandwich" and carefully saw

(*Continued on page* 806)

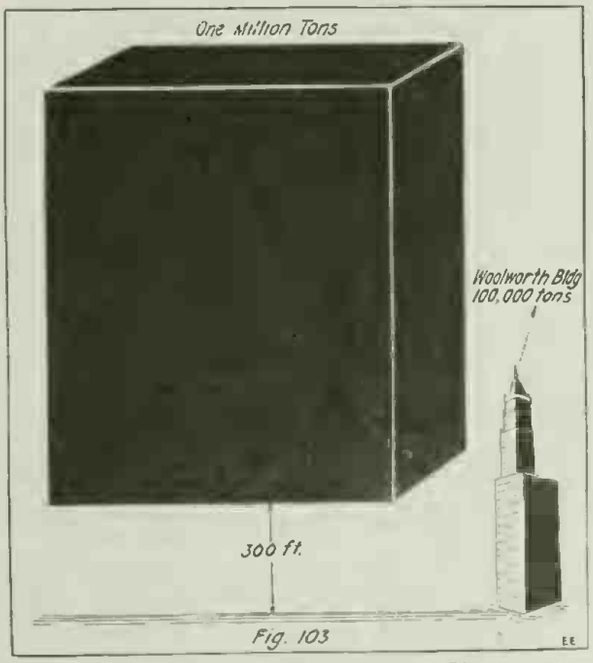


Fig. 103

Almost Unbelievable is the Fact that the Disintegration of 1 Gram of Hydrogen Liberates Enough Energy to Raise 1,000,000 Tons to a Height of 300 Feet.

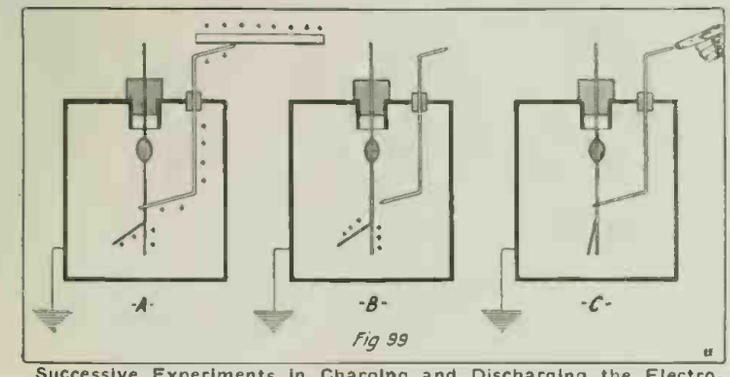


Fig 99

Successive Experiments In Charging and Discharging the Electroscope Used In Radio-Active Measurements.

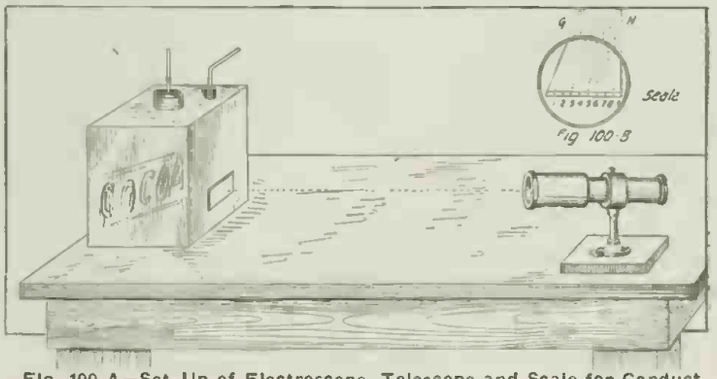


Fig. 100-A—Set-Up of Electroscope, Telescope and Scale for Conducting Radium Measurements.

www.americanradiohistory.com

The RADIO LEAGUE of AMERICA
HONORARY MEMBERS
CAPT. W.H.G. BULLARD, U.S.N. NIKOLA TESLA.
PROF. REGINALD FESSENDEN. DR. LEE DE FOREST.
Manager, H Gernsback

Amateurs Win

Alexander Wireless Bill Is Killed

By H. GERNSBACK

THE Alexander Wireless Bill and its amendment as reported in our last two issues has been killed. On January 15th the Merchant Marine Committee and the House of Representatives gave the Administration's movement toward Government ownership of public utilities a very definite set back. By unanimous vote it tabled the bill which was to authorize the Navy Department to take over and operate permanently all radio stations.

As our readers will remember from our January issue the bill was sponsored and urged by Secretary Daniels. Repesentative Bankhead made a motion to table the bill and Chairman Alexander characterised the proposed plan as "a hopeless task." He added: "In view of the sharp difference of opinion both in the Committee and in the House on this subject, it would be impossible to put the bill thru at this session."

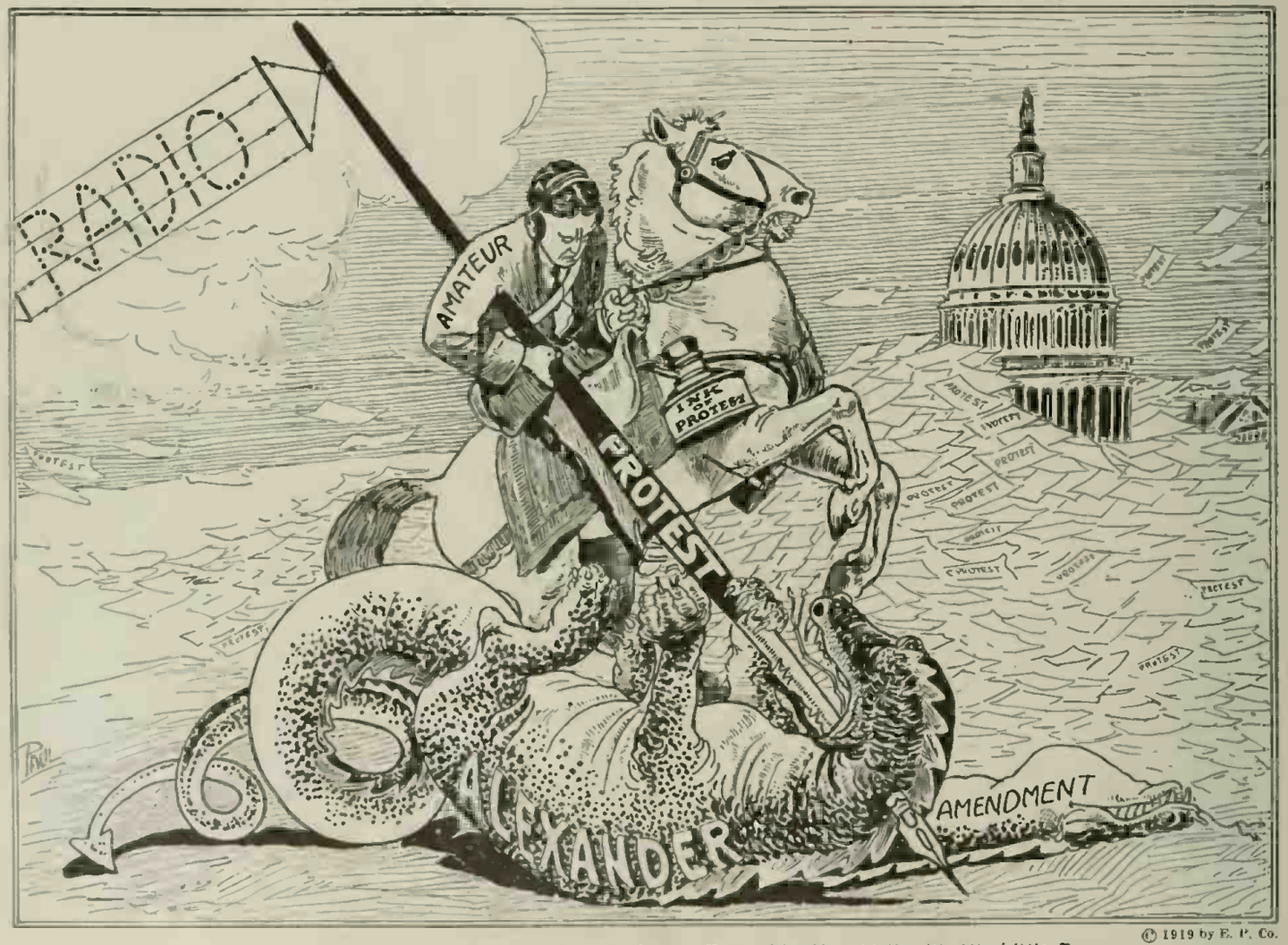
As our readers will remember from our January issue, the original Alexander bill proposed to make all wireless stations Government owned, and the present wireless law, the act of 1912 was to be changed to such an extent that the amateurs were to be eliminated entirely from the Radio field.

The Alexander bill and our views thereof were printed in full in our January issue. As this issue, however, did not appear on the news-stands until the 15th of December, and inasmuch as the hearings on the bill began a few days earlier before Mr. Alexander's Committee at Washington, the ELECTRICAL EXPERIMENTER sent out some 50,000 letters to amateurs apprising them of the impending measure. This movement had its immediate result, and official Washington was deluged with a storm of protesting letters, which not only reached Mr. Alexander's committee but every Congressman and Senator of the United States as well. This unparalleled unity of the American amateurs had an instantanous effect in Washington, and even before the hearing started, a number of amendments, all of which favored the amateur more or less were rushed thru, printed and distributed.

There were at least three amendments of which we have record. One of them, the last one dated December 11 was printed in full in our February issue. Before the hill was definitely killed, however, we had information which tended to show that the Government was not ready to make wireless a Government ownership affair. As far as the amateur was concerned we were not at all disturbed, for we said:

"As a matter of fact as things stand

(*Continued on page* 835)



© 1919 by E. P. Co.

A Modern St. George. Yes, Mr. Alexander, We Cannot Tell a Lie, He Did It with His Little Pen.

www.americanradiohistory.com

America's Greatest War Invention

The Rogers Underground Wireless

(Special Interview to the ELECTRICAL EXPERIMENTER.)

By H. Winfield Secor
(Associate Member Institute Radio Engineers.)

An invention which has been termed the greatest American war achievement is the Rogers underground and sub-sea radio system. The Rogers system does away entirely with aerial wires, and it is only a matter of months now before all aerial wire systems the world over will be pulled down. Wonderful things have been accomplisht by the new Rogers underground system, chief of which is the total elimination of static and the increase of the loudness of received signals, which is often as high as 5000 times the usual strength. Interference, too, is done away with almost entirely now. The Rogers invention is of tremendous importance and revolutionizes our previous ideas on wireless to an extent never dreamt of before. We urge every one interested in radio to read the accompanying authoritative article which discloses the full technical data on the new system for the first time in any periodical.

THE greatest invention in the field of wireless telegraphy since Marconi first placed commercial radio-communication on a firm basis by his historic experiments in Italy, and later in England, is without a shade of doubt this latest triumph of radio research—the "Underground and Sub-sea Wireless", conceived and developed to a working stage by an American scientist and inventor, James Harris Rogers. Mr. Rogers is known as a second Edison, among his towns-people in Hyattsville, Maryland, where he has lived for many years, and now the whole world acclaims him.



It Is Revealed Now That the Navy Department Had Been Using a Powerful Undersea Wireless During the War. The Instruments and System Were Invented by James H. Rogers, of Hyattsville, Md., and were Adopted by the Navy Department as an Invaluable Addition to the Wireless System of the Navy. The Two Lower Photos Show the Inventor, Mr. Rogers, in His Laboratory at Hyattsville.

Who is Mr. Rogers?

James Harris Rogers, practically unknown a few years ago in radio circles, except by a few select radio men who were investigating his invention for the Navy Department, has practically become overnight the center of all attractions in the field of science. Mr. Rogers is a son of the confederacy and a veteran of the great Civil War. He has followed electrical experimenting ever since and has been a strong devotee of radio telegraphy since Marconi performed his first experiments in this new branch of applied science. He is a refined, cultured southern gentleman who makes you feel at home at once; an invariable attribute of all of the truly great. Mr. Rogers was one of the first inventors of the "printing telegraph" and his full-sized working models saw actual commercial service on a circuit between Baltimore and Washington, also in New York, back in 1880. These were seen by the writer and are wonderful pieces of mechanism.

The Rogers laboratory, which comprises several large rooms, is lined on all sides with glass cabinets containing electrical apparatus which he has invented from time to time thru his studious career. A novel and original high frequency generator was another of the devices that greatly interested the writer. It employed a jet of water shunted by a large capacity, the stream of water being connected to a high potential source of direct current. High frequency currents

Top Photo Shows Antenna Wires Being Placed in River by Mr. Rogers' Assistants. The Inventor Has Found that His System Works Just as Well Under Water as Thru the Earth. All of the High Power Stations in the World, from Nauen and Lyons to Honolulu, Are Heard in Mr. Rogers' Laboratory at Hyattsville, Md., Shown in the Center and Lower Views Herewith. The Author of This Article Also Heard the Transatlantic Stations Coming in Loud and Clear. Mr. Rogers' Invention Is the Greatest in the War and Is so Recognized by the Government.

of any range up to the limit of audibility, or about 30,000 cycles per second, could be readily obtained with this apparatus. The writer merely cites these facts to substantiate the standing of Mr. Rogers in the scientific field. Hundreds of other electrical inventions have been made by this modest genius of the quiet little Maryland town of Hyattsville, and the principal outstanding fact of all of his work is that he can show you a working model of each of these inventions, unlike many other inventors whose ideas exist only on paper, and which often fall down, miserably, when actually built and tested.

In this connection it is interesting to consider for a moment that not one of the new wireless "static and interference preventers" proposed to the government radio experts during the war, proved practicable in the least.

Photos by International Film Service

Copyright-1919-by E. P. Co.

www.americanradiohistory.com



Copyright, 1919, by E. P. Co.

The Rogers Undersea Wireless Opens Up an Entirely New Field to Submarines and Ship Communication. Marconi Recently Stated that Submarines Had to Come to the Surface to Intercept Radio Messages, but the Rogers Invention Has Upset All This. On a Recent Test a U.S. Subsea Boat Submerged Off the American Coast to a Depth of 8 Feet and Picked Up Nauen, the German Station. At Depths of 21 Feet Stations with Wave Lengths over 12,000 Meters Were Easily Picked Up. Transmission to Submarines Has Also Been Accomplisht.

Official recognition of Mr. Rogers as the one and only original inventor of "Under-ground and Sub-sea Wireless Communication," was soon forthcoming, and here it is in brief. These two official letters of recognition of Mr. Rogers' wonderful and revolutionizing invention represent but a very small fraction of those he has received from radio engineers of high repute in all parts of the world, congratulating him on his masterly work. The Navy Department has just permitted information on the Rogers system to be given out, and how well they kept their secret during the World War, during which time this system has been in use by the Navy Department, may be judged by the fact that radio men everywhere are amazed at this feat. The distinguished radio savant Prof. George W. Pierce of Harvard University, congratulated Mr. Rogers heartily when he first tested and heard the new system work thru salt water, which he at first thought absolutely impossible.

Hyattsville, Md.,
January 13, 1919.

Dr. Nikola Tesla,
New York City, N. Y.

Dear Dr. Tesla:—

I have just read with great interest your article in the Electrical Experimenter. For years I have been a firm believer in the theory that far distant aerials were actuated thru the medium of the Earth and not thru the ether above, and it is a source of great satisfaction that so illustrious a personage as yourself has held to the same belief. I have never met a scientist who would entertain such a proposition until I demonstrated to them results described in the enclosed paper, illustrating one of the ways I have found for utilizing the energy so clearly and forcibly described by you. I am, nevertheless, confronted by some who will not give up old theories. If you would do me the great honor of writing a few lines upon the scientific feature I would deem it a great favor.

Should you chance to be in Washington at any time I will be highly gratified to have you visit my laboratory and witness the results obtained.

Very sincerely,

(Signed) J. Harris Rogers.

Below we give the two letters of official recognition by the Navy Department of Mr. Rogers' accomplishments, which are all that we have space for.

In response to an inquiry from Clarence J. Owens, director general of the Southern Commercial Congress, Admiral Griffin, U. S. N., chief of the bureau of steam engineering, wrote under date of December 27, 1918, as follows:

"In reply to your question regarding the originator of the underground radio system, you are advised that Mr. J. H. Rogers of Hyattsville, Md., was the originator of this system. There have been other claimants to methods of underground radio signalling, but none were useful, within the Navy Department's knowledge to the extent of being a valuable asset to the general scheme of radio communications. The introduction of Mr. Rogers' receiving system marked the beginning of the use of underground aërials for receiving, to great advantage over raised aërials, and has been valuable to the Navy during the war."

Rear Admiral Strother Smith, then Capt. Smith, wrote Mr. Rogers on December 7, 1917:

"It is a great pleasure to me to feel that I have been instrumental in bringing the result of your work before the Navy Department and assisting somewhat in putting it into actual practise. Out of the many thousand ideas presented you can realize that a very, very small percentage are valuable and it is worth at least a year's work to get one that I feel will give lasting benefit to the service that I take pleasure in serving."

The Navy Department Interested.

Thru Dr. George H. Lamar and Senator Blair Lee the discovery and the status of the patents were brought to the attention of Secretary Daniels of the Navy. Secretary Daniels ordered inquiry into Mr. Rogers' claims, which showed that his invention worked, and requested Secretary Lane to give special consideration to pending patent applications.

Secretary Daniels then submitted the Rogers system to Rear Admiral (then Captain) Strother Smith, who called into consultation Capt. Hooper. These officers made a thoro study of the system and found it practicable. Capt. Hooper ordered it installed at New Orleans first and since then it has been employed at Belmar, N. J.,* and other stations.

* At the time of writing this article the Belmar Trans-Atlantic Receiving Station is still employing the Rogers underground antenna.

For a decade Mr. Rogers has been studying radio subjects, and long before the United States entered the war he had experimented with the problem of ridding aërial communication of this static atmospheric electricity. He disagreed with all authorities who believed that the air, and not the earth and water, was best suited for wireless communication.

At first Mr. Rogers used the earth alone for sending messages to amateurs stationed near by. Using an audion bulb, he then buried a wire from his laboratory and heard Philadelphia and other stations. Further experiments were conducted at a laboratory

To the American Radio Amateur:

WITHIN the next few months peace will be declared and the amateur will be allowed to operate his station as before. Thanks to Mr. James H. Rogers, it will not, however, be necesary for you to put up an aerial again—at least not for receiving. Elevated aerials will be a thing of the past, and well they may.

But ordinarily the amateur would not be permitted to use the underground aerial system on account of Mr. Rogers' fundamental patents. The writer, however, in conversation with Mr. Rogers, prevailed upon him to allow amateurs the free use of his revolutionary, as well as epoch-making invention.

Mr. Rogers thru the ELECTRICAL EXPERIMENTER therefore wishes to announce that he personally has no objection if amateurs use his system privately. It should be understood that the inventor only gives this permission to amateurs as such, and that this permission, of course, does not extend to firms or corporations or to individuals engaged in commercial Radio work.

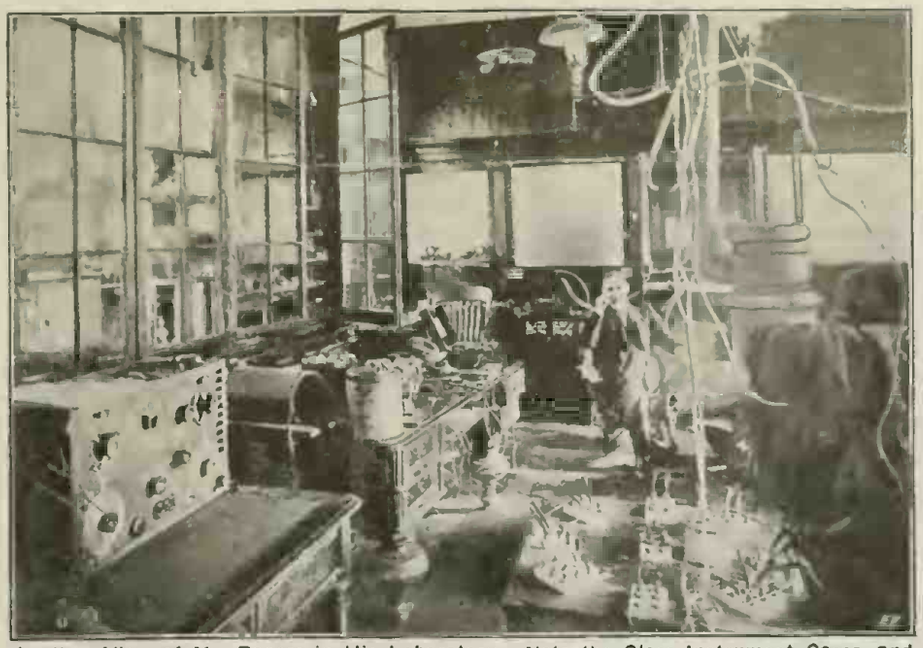
We wish to congratulate our readers upon this important decision of Mr. Rogers, who certainly deserves the everlasting gratitude of all American Radio Amateurs.

H. GERNSBACK.

www.americanradiohistory.com

near Bladensburg, which he calls "Mount Hooper," in honor of Commander Hooper of the Navy, who rendered excellent service in adapting the invention to the needs of the Navy Department.

When Mr. Rogers first stated that messages could be received and sent from submarines when submerged it was unanimously declared to be impossible and the officials of the Bureau of Standards were not alone in this belief, as no less a personage than Marconi declared at a banquet given in his honor in Washington, that when wireless was used on submarines, "it was **necessary for the submarine to come to the top in order to catch the ether waves."**



Another View of Mr. Rogers in His Laboratory. Note the Glass Instrument Cases, and In the Background May Be Seen His Early Printing Telegraph Model.

To demonstrate more clearly the underground system and to show how it could be used in trench warfare, Mr. Rogers constructed an underground station, wholly inclosed beneath the surface of the earth, there being no visual existence of it outside. This place in Prince Georges county was visited by some very noted men, including Dr. Abraham, the head of the French Scientific Commission, who, upon entering the cave at Mount Hooper exprest his amazement and remarked, "the Germans can't get us here." Lieutenant Paternot, of the French Scientific Commission and the radio representative of France, also heard his native stations talking and exprest equal satisfaction, pleasure and amazement.

How He Conceived the Underground System.

The writer asked Mr. Rogers just how he came to form the idea of the "Underground and Subsea Radio." He explained that from his very first study of the method of transmitting radio signals by means of an elevated antenna, the question constantly presented itself to his mind—"If 50 units of power are past into the aërial, then what becomes of the equal amount of energy which passes into the ground?" He became so obscest with this conundrum that he finally asked several prominent radio savants this question. What do you suppose the answer was?—"It is dissipated in the form of heat in the ground," they answered. But still Mr. Rogers thought they were wrong and now he has proved it. Another early idea of his in the theoretical aspect of radio-communication was as follows, and very logical it was, too, as you will agree: He held that if the outer crust of the earth is a *conductor*, and the surrounding atmospheric envelope is an *insulator*, then how infinitely better must the former be for the transmission of any form of electric current.

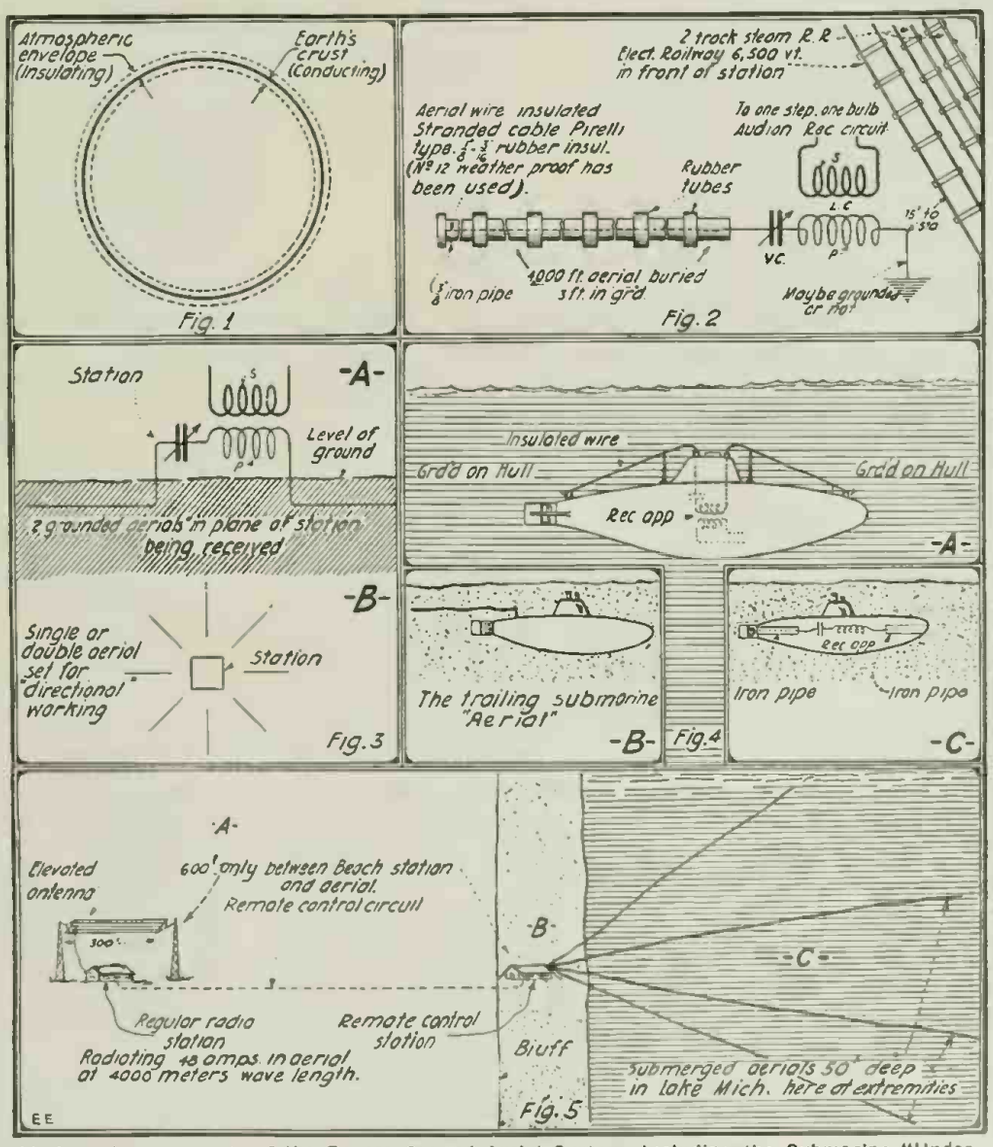
To Mr. Rogers' mind it was more reasonable to suppose that the energy liberated at the base of an aërial was propagated thru the earth as well as thru the ether above, and that an elevated aërial, at great distance, would be actuated by them as effectually as if the waves reached the same point thru the ether above; when the waves thru the earth reached the base of the aërial the potential of the plate would be raised and lowered and the aërial would accordingly be energized. Thus was his basic and original idea conceived and settled upon.

Mr. Rogers' first trial with the underground wireless to nearby radio amateurs began about seven years ago, but his theory of the reason why it must work was formulated over ten years ago. Further, he conjectured that much less power would be required to propagate a wave or current thru the earth's conducting crust, which for one thing has smaller geometrical dimensions, than to propagate it thru the insulating atmospheric envelope alone. See Fig. 1.

The Theory of Operation.

A number of other radical ideas were entertained for several years by Mr. Rogers, and in the course of time he has found that his ideas were correct—it worked! it worked! And now the radio experts far and wide are holding a *post mortem* inquest on their theories and how it all happened. To start with, Mr. Rogers stated, "special credit is due the following gentlemen, who have re-

(*Cont. on page* 832)



Various Arrangements of the Rogers Ground Aerial System, Including the Submarine "Underwater" Antenna.

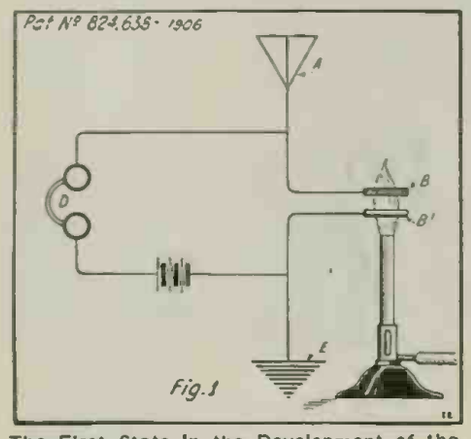
www.americanradiohistory.com

How I Invented the Audion

By Dr. LEE de FOREST

Written exclusively for the Electrical Experimenter

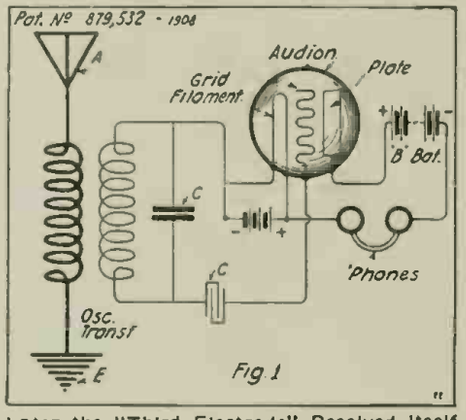
THE first conception of a detector of Hertzian waves which should employ the medium of heated electrodes or heated gas came to me as follows: In the summer of 1900 I was experimenting on a new type of electrolytic



The First State in the Development of the Audion by Dr. Lee de Forest. The Aerial and Ground Were Connected to Two Electrodes Placed in the Flame of a Bunsen Burner, with Successful Results.

detector, doing this work at night in my room in Chicago. The receiving apparatus was placed on a table beneath a Welsbach gas burner. A spark coil which I was using as my source of oscillations was located in a closet about ten feet distant. One night I noticed that whenever I closed the switch of the spark coil by means of a string running across the floor from my table to the coil, there was a decided change in the illumination from the Welsbach burner. The light from the gas mantel increased very perceptibly and resumed its normal low brilliance as soon as the sparking ceased. This phenomena continued and imprest itself strongly upon my attention. My first thought was that I had discovered a new form of detector of Hertzian waves, of extraordinary sensitiveness, and was, naturally, much enthused, as any young investigator would have been under similar circumstances. But upon closer investigation of this novel phenomena I found that when the door of the closet was closed, or almost closed, the effect of the spark upon the gas burner ceased! This proved conclusively that I was dealing with sound waves coming upon a sensitive flame and not with electrical waves.

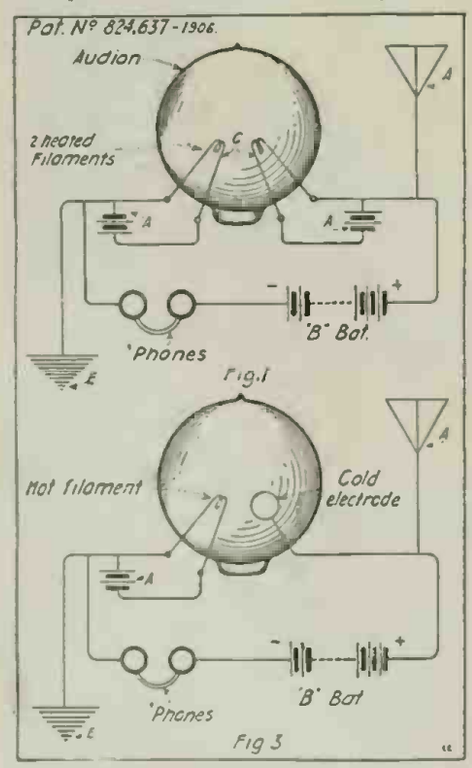
The delusion lasted, however, long enough to force upon my mind the conviction that heated gas molecules were sensitive to high frequency electrical operations, and I determined to investigate further at my first opportunity and actually discover evidence to substantiate my theory. I was unable to do this until the fall of 1902 or '03 when I returned to my gas mantel experiment. I first attempted to investigate the new detector phenomena by using two needles of steel, or platinum, placed close together in the incandescent Welsbach mantel. These



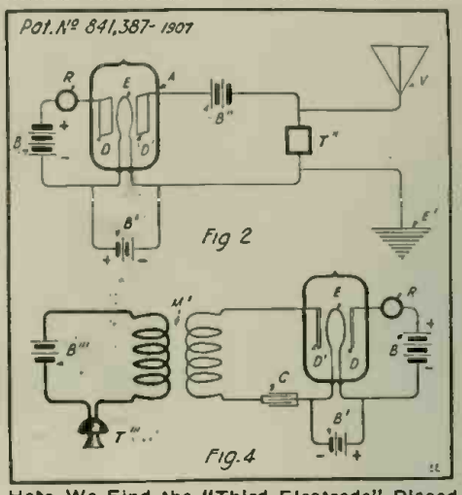
Later the "Third Electrode" Resolved Itself into a Grid, Which Was Placed Between the Wing and Filament, Where It Could Act with the Highest Efficiency. In This Form It Has remained Practically the Same to the Present Time.

two needles were connected to a dry battery and telephone receiver. I was, however, unable to obtain any appreciable current between the two electrodes in the mantel. I then investigated the flame of a Bunsen burner and soon found a point in the outside envelope of the flame where an appreciable current did pass between the two electrodes, making a soft fluttering sound in the telephone receiver. (See Fig. 1, Patent No. 824,638, issued in 1906.) Then, connecting one electrode to an antenna and the other to the earth, I heard for the *first* time signals in the telephone receiver; signals which represented clearly the sound of the transmitting spark. Here at last was actually demonstrated my earnest belief in the existence of this new detector principle. My next step was to enrich the gas flame by putting a lump of potassium or sodium salt in the flame directly below the two platinum electrodes. This increased ionization caused increased flow of battery current, and a corresponding increase in sensitiveness of the new detector. I did considerable work then with various types of Bunsen burner arrangements for permanently enriching the gas flame, etc., and set up a laboratory type of flame detector which was actually used in 1903 for receiving signals from ships down the Harbor of New York.

The inconvenience of supplying a source of gas for the new detector was, of course, obvious, and I sought for other means of obtaining the necessary heated gas and heated electrodes. The electric arc first



Here the Placing of the Two Heated Electrodes in a Vacuum Bulb Is Carried Out, as Well as the Final Adoption of the Cold "Wing." This Device Works Equally Well with Both Electrodes Hot, Thus Disproving Any "Rectification" Theory.

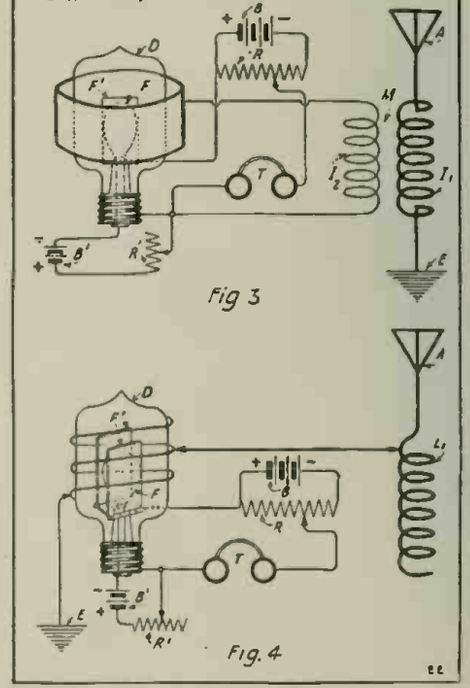


Here We Find the "Third Electrode" Placed Inside the Bulb, Where It Logically Belonged, as Dr. de Forest Points Out. Fig. 4 Shows the First Use of the "Stopping" Condenser.

suggested itself. I anticipated that while this arc would be a detector, it would be exceedingly irregular and noisy in the telephone receiver. This was found to be the fact. The battery fed the arc thru the primary of the transformer, in the secondary of which was connected the telephone receiver, and, altho at times the looked for response to electric waves was thus obtained, the noise in the telephone receiver from the arc was so deafening that the idea was abandoned.

The next plan which suggested itself to me was to use incandescent filaments in an enclosed chamber. This arrangement as well as the gas detector, was illustrated in my patent No. 979,275, which bears the first date of November 4, 1904. This patent ap-

(*Continued on page* 817)



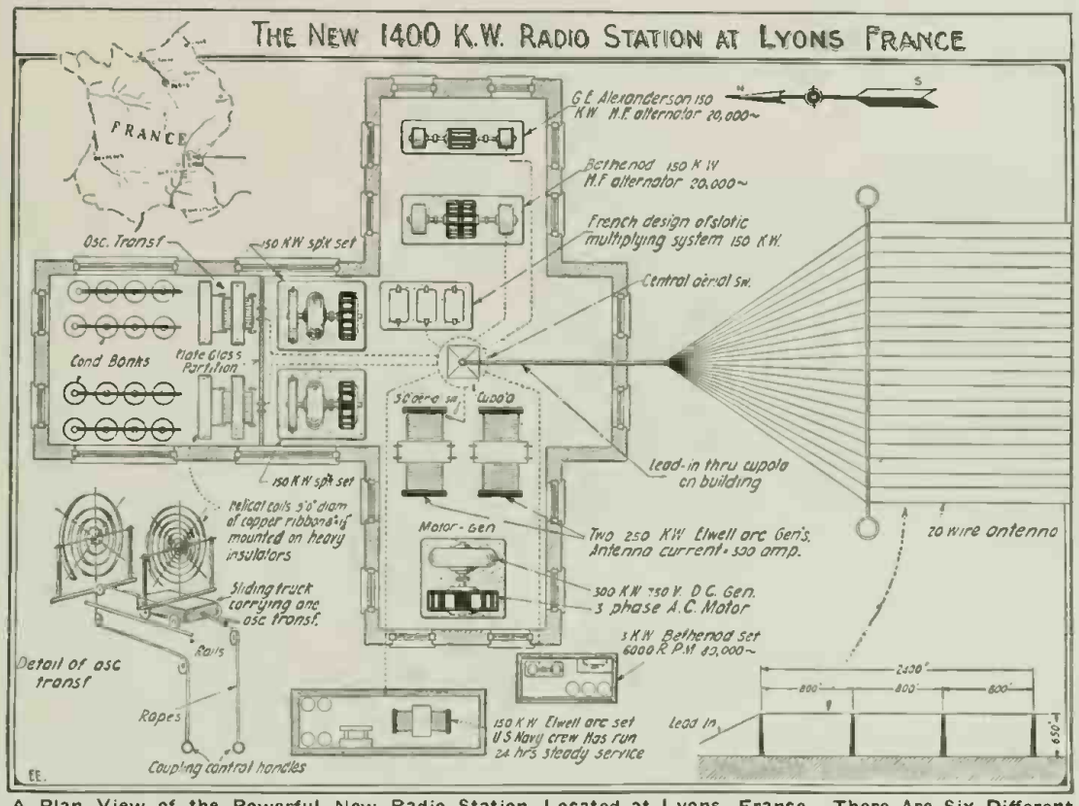
The First "Three Electrode" Audion Had a Piece of Tinfoil Wrapt Around the Outside of the Bulb—a Principle Frequently "Rediscovered," as Was the de Forest Electromagnetic or Coil Electrode, Fig. 4.

www.americanradiohistory.com

Gigantic 1,400 K.W. Radio Station at Lyons, France

ONE of the most powerful wireless stations yet designed is that now nearing completion at Lyons, France, and we are indebted for the following description of this remarkable and extremely high power radio station, representing the very latest advances in radio engineering, to Dr. Lee de Forest, the well-known American radio engineer and scientist who has recently returned from a trip thru Europe. Dr. de Forest stated that apparently no expense was being spared in the design and construction of this now famous Lyons station, and that the engineers were apparently having everything *carte blanche*, for there seems to be no limit to the apparatus installed, and in contemplation for installment at this powerful station.

A glance at the map shows that Lyons lies southeast of Paris, and about half way between Paris and Marseilles. This station has been, and is at the present time, handling all of the official Government radio traffic to the United States, communicating principally with the powerful new naval radio station at Annapolis near Washington, D. C. The Lyons station is in daily communication, and has been in connection with various parts of the Continent, as well as Africa, different countries of Asia, and many other far-flung places in all parts of the globe.



A Plan View of the Powerful New Radio Station Located at Lyons, France. There Are Six Different and Distinct Forms of Transmitters Installed in Duplicate as Shown. The "Receiving Rooms" Are in a Wing of the Building, Not Shown Here, Running Eastward from the Point Where the 150 K. W. Spark Sets Are Situated. This Wing Includes a Laboratory, Tape Punching Room, Quarters for the Personnel and Administration Office.

At first this may sound somewhat exaggerated, but when the great capacity of this radio station and the extremely efficient apparatus used is considered, it will seem all the more reasonable and possible. To begin with, the Lyons station has a very large aërial, comprising twenty strands of phosphor-bronze cable stretching away over a distance of 2,400 feet and supported on eight steel masts, each of which rises to a height of 650 feet. The masts are placed about 800 feet apart. It is interesting to note in this connection, as Dr. de Forest pointed out, that the engineers responsible for the design of this station have found that contrary to the generally accepted idea concerning the directive effect of inverted "L" aërials of this type, that where great distances and long waves are concerned, the comparative efficiency of transmission in any certain direction about the antenna does not differ appreciably. The general direction of the present antenna is north and south, as the arrow shown in the plan view of the station indicates, the free end of the huge antenna pointing toward the south.

The aërial conductors at the station end are fan-tailed together as shown and a large twisted cable forming the lead-in, leads down thru a cupola on top of the building, underneath which there is a large and very elaborate circular antenna switch from which lead separate connecting aërial wires to the various transmitting apparatus, several distinct types of which are installed in this station.

The lay-out of the station buildings has been well planned, and the larger building, containing all of the long distance radio transmitting equipment, is in the form of a cross. West of the large building there are two small structures, a small one containing a 3-K.W. high-frequency generator of the Bethenod (French) type, having a speed of 6,000 r.p.m. operating at an antenna frequency of 80,000 cycles. The building next to this houses a 150-K.W. arc generator of the Elwell type, and this transmitting set has an antenna lead running to the central aërial switch in the main station building. This particular set is of great interest to Americans, as it is the one which has been used in transmitting all of the official Government messages to the United States. It has been operated right along with a United States naval radio crew, and has been very busy night and day. The powerful arc-oscillation generator has been in use continuously, and has often been run *twenty-four hours at a stretch*, only shutting down the arc periodically for renewing the electrodes.

The following description of the main station transmitting equipment, which is being installed in duplicate, is given in the order of its installation, the first apparatus described being the older.

In the long northerly wing of the station of the main building there are installed two 150-K.W. spark sets. These are somewhat similar in design to the well-known Fessenden spark transmitter at Arlington near Washington, D. C., and those who are familiar with that station and the huge condenser and tuning transformer dimensions and equipment there used, will have some idea of what this apparatus looks like. The high tension leads from the step-up transformers, pass thru large plate-glass partitions to the condenser and oscillation transformer room. The condensers are placed in banks and provided with necessary switches, busbars, etc., for connecting them up in series, parallel or in series-parallel, as may be necessary. The oscillation transformers are very interesting as they are huge affairs, each spiral being composed of many turns of heavy copper strip, the dimensions of the strip being 8 *inches wide by ¼ inch thick*. The convolutions of the helix in each case are well supported and installed on large porcelain insulators, and one of the coils on each transformer unit is made movable for adjusting the coupling, or distance between primary and secondary, in the manner here illustrated. As will be seen, the movable primary coil is placed on a small truck mounted on four wheels, which rest on a pair of insulated tracks. The coupling is changed whenever desired, by simply pulling on one or the other of two ropes attached to the carriage in the manner indicated. When a change in inductance is to be made in one of these oscillation transformer windings, it is accomplished by changing the position of one of the lead cables connected to the spirals, the end of the cable being fitted with massive clamps, which may be fastened at any point desired on the spiral.

The eastern wing of the main station will shortly contain two radio frequency alternators, as the plan view shows, one of these being of the General Electric-Alexanderson design, rated at 150 K.W., and the other set being of the Bethenod (French) design, rated at 150 K.W. also. These sets are tuned and adjusted to operate at an antenna frequency of 20,000 cycles. By means of the cleverly arranged antenna switch-gear, either of these sets can be connected up to the antenna. Also, when necessary, two such sets may be connected in parallel to the antenna for extra long range

(*Continued on page* 817)

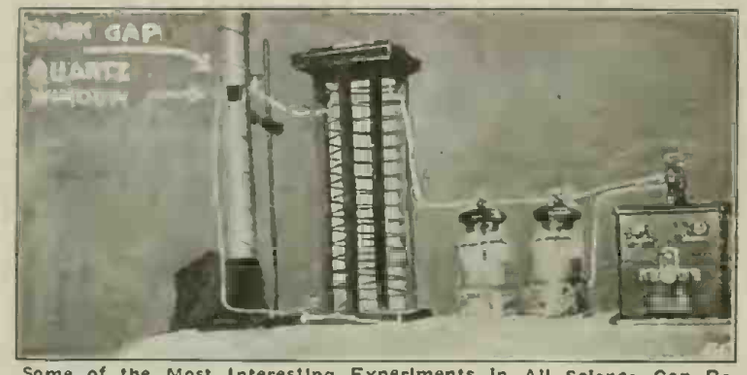
www.americanradiohistory.com



Experiments With Ultra-Violet Light

By J. C. MORRIS, Jr.

ALTHO the majority of experimenters are interested in the subject of X-Rays, little attention has been given to the study of the *ultra-violet rays*. These rays have been extensively studied by Finsen and other investigators and were found to have a wave length of about .0002 mm. This is far too short a wave to be seen by the human eye, but their production is usually accompanied by manifestations of visible light.



Some of the Most Interesting Experiments in All Science Can Be Conducted with Ultra-violet Light. The Simple Apparatus Required for Producing These Rays in Quantity Is Illustrated and Described Herewith. Ultra-violet Rays Will Solve Some of the Great Problems of the Future.

All of the apparatus required to produce these rays is extremely simple and is to be found in nearly every experimenter's workshop. Fig. 1 shows how the apparatus is connected: C. is an induction coil giving a spark 1 inch or more in length; L, is a Leyden jar or other form of high voltage condenser; H, is a coil consisting of 10 or more turns of heavy wire (a good wireless helix will do very well) and G, is the generator of the *ultra-violet rays*. It consists of a spark gap whose terminals are composed of iron or steel nails. A convenient form of generator may be made out of a short length of card-board tubing, thru which the nails are driven. A gap of ⅛ inch must be left between the nails. A small opening must be cut in the tube for the rays to pass thru. A quartz (not glass) window may be placed in the opening, if desired. See photograph. A small spark gap may be placed at X, if desired.

The following are some simple experiments with the *ultra-violet rays*.

Experiment No. 1:—Secure if possible a piece of willemite (which is a natural silicat of zinc). When the willemite is exposed to the ultra-violet rays it will fluoresce with a pale greenish color. This is a test for these rays.

Several other substances besides willemite will fluoresce when exposed to these rays, among these are sodium silicat, fluorescin, aesculin, sulfate of quinin, also platino—barium-cyanid screens, such as are used for X-Ray purposes.

Experiment No. 2:—One of the most peculiar properties of the ultra-violet rays is their ability to ionize air; that is, to make air a partial conductor of electricity. The following three experiments demonstrate this property of these rays.

Make two disks of metal about 5 inches in diameter. Place one of these on top of an electroscope. Suspend the other about ½ inch above the electroscope. Now charge the electroscope with either positive or negative electricity. Focus the ultra-violet rays between the plates. The electroscope will soon be discharged, due to the ionizing (rendering conductive) effects of these rays.

Experiment No. 3:—Start a small induction coil and separate the secondary terminals just beyond the sparking distance. Focus the ultra-violet rays on the spark gap. The spark will now jump the gap, due to the ionizing effects of these rays.

Experiment No. 4:—Take two small metal sheets and separate them a short distance apart. Connect these plates in series with a powerful high voltage battery and a very sensitive galvanometer or telephone receiver. No current now flows, due to the resistance of the air gap. Focus the rays between the plates and a minute current will now flow, due to the ionizing effects of these rays.

Experiment No. 5:—Start the generator of the ultra-violet rays. Place a piece of glass in front of the opening and examine a piece of willemite. It does not fluoresce. Substitute a piece of quartz or of ice in the place of the glass. The piece of willemite will now fluoresce. This experiment shows that *glass is opaque to these rays*, while quartz and ice are transparent to them.

Experiment No. 6:—There are certain substances which are able to transform the short ultra-violet rays into visible rays of light. A Geissler tube is a generator of these rays and may be used to show the fluorescence of certain substances. Make a fairly dilute solution of sulfate of quinin, and add a few drops of sulfuric acid. Partially immerse a Geissler tube into the solution and connect with an induction coil or preferably to the positive pole of a static machine. While the tube is being operated the solution will appear to be light blue in color.

Other substances besides quinin will fluoresce. Some of these are aesculin (from horse chestnut bark), fluorescin, and hydroquinon, such as used in photography.

These are only a few of the many interesting experiments which can be performed with these rays. The photograph is a picture of the author's apparatus for generating these rays. The study of the ultra-violet rays is exceedingly interesting and will amply repay the time spent in making the apparatus. It represents an uncommon field for experiment and one that holds much promise for the future of science.

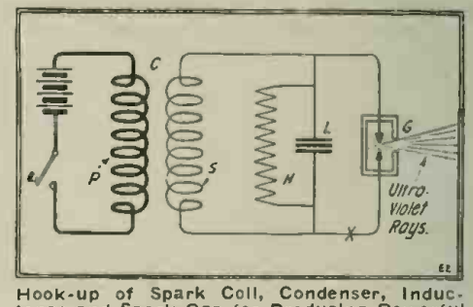
WORKSHOP ACCIDENTS.

It is well to know what steps should be taken in the case of the minor accidents that may happen to handicraftsmen and experimenters in the prosecution of their hobbies. These are mostly in the nature of cuts, scalds, and bruises. It is a good plan to keep a lump of alum handy to stop the bleeding in the case of small cuts. Toilet alum, sold by druggists, is the best, and is frequently used by those who shave themselves.

A simple clean-cut wound should be cleansed in cold water under the tap, which generally stops the bleeding at the same time, after which the sides should be brought together carefully and supported by strips of sticking plaster held in position by a bandage.

Wounds inflicted by rusty nails and other pieces of metal often lead to serious inflammation or blood-poisoning. These ill effects may be prevented by the following very simple remedy. Place a little brown sugar on a fire shovel and heat until it smokes, holding the wound in fumes for several minutes. A few scraps of clean woolen rag will answer the same purpose, but sugar is best. Peroxid of hydrogen and iodin tincture are reliable solutions for treating wounds which involve abrasions.

Some boracic ointment should always be kept available in case of burns and scalds resulting in a raw surface, or a strong solution of washing soda may be used. Severe burns, and in particular those caused by splashes of molten metal, are best treated with raw linseed oil poured over the burn and covered with a pad of lint.



Hook-up of Spark Coil, Condenser, Inductance and Spark Gap for Producing Powerful Ultra-violet Rays.—Fig. 1.

Small splinters of steel or wood are often run into the flesh and cannot be removed with the fingers alone. In the absence of a pair of fine pointed tweezers an ordinary sewing needle may be employed. Heat the end of the needle, or dip it in peroxid of hydrogen, iodin, or carbolic acid and water, to kill any germs on it before touching open cut. Slip the eye of the needle over the protruding end of the splinter, give it a twist to make it grip, and then raise the needle when the splinter will come out as well in most cases.

Contributed by H. J. GRAY.

www.americanradiohistory.com

Wood Finishing for the Amateur

By ARNO A. KLUGE

WHEN the experimenter is constructing a piece of apparatus, whether it be an instrument cabinet or one of Tom Reed's famous clocks, he is confronted with the problem of finishing the woodwork on it, if such there be. We often find that this last process is neglected to a degree where it is a detriment to the appearance of the instrument, and as "looks is everything" to the uninitiated, we should give the matter a little more time and study.

There are a number of general processes used in finishing a piece of wood, namely: Sandpapering, Staining, Filling, Shellacking, Varnishing, Rubbing, and Polishing, in the order in which they occur. Each of these will be treated separately, also any subdivisions which may come under them; but we should bear in mind that it is not always necessary to use all of them, and so the finisher should know the exact processes he is going to use before starting any piece of work. Also, all of the material required should be at hand, so that the work may proceed expeditiously and without waste of time.

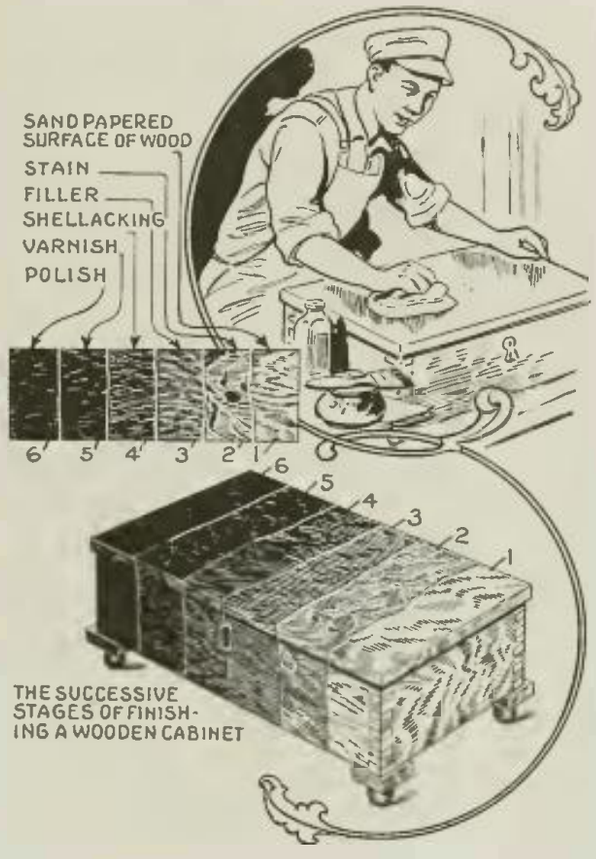
The first operation, that of sandpapering is to give the wood an absolutely smooth surface and prepare it for the filling. It is assumed, of course, that the wood has already been planed reasonably smooth, so that No. 0 sandpaper is about right for the job. A sandpaper block about four inches square and one inch thick should be prepared, taking care that one of the four-inch surfaces is perfectly flat, with no high corners. The piece of sandpaper is placed underneath the block, the surplus sides turned up, and the sandpapering done ACROSS the grain. Never sandpaper with the grain, as this produces tiny grooves on the surface, especially with soft woods.

One other precaution should be noted. Be careful when sandpapering close to the edges, they will be rounded off if you bear down too hard. If desired, a piece of scrap wood whose surface is flush with the work may be laid up against the edge, so that the sandpaper will pass over to this piece when it reaches the edge of the work. After these operations are completed, dusting off is in order, and it should be done thoroly, to remove every particle of dirt from the surface.

We are next ready for staining the wood, if we desire to change its color in any way. Remember, however, that staining is only resorted to when we do not wish to finish it in its natural state, but have decided either to emphasize its own color, or give it another in imitation of some other wood. Most hard woods are more beautiful in their own color than they are in a false dress.

There are two kinds of stains in common use, and both have their faults and good points. These are: Oil stains, in which the pigments are reduced to a workable consistency by the use of turpentine, naphtha, etc.; and water stains, which, as indicated by the name, use water in preparation, and hence must use water-soluble pigments. The main advantage of the oil stains is that they do not raise the grain of the wood, and do not show the laps of the brush strokes upon soft, open grained woods such as white pine, poplar, etc. Upon hard woods, however, they do not penetrate deep enough to be desirable, and water stains are commonly used for such.

Water stains are very penetrating, and if properly made will bring out the grain of the wood very beautifully, instead of clouding it as most oil stains do. Their chief fault lies in the fact that they raise the grain, involving additional sandpapering to obtain a level surface, but this is offset by the additional beauty of the finished product.



This Illustration Shows Clearly the Successive Stages to Be Carried Out in Polishing a Wooden Cabinet. It Must Be Thoroly Sandpapered or Else the Much Desired High Polish Will Be Hard to Attain.

In addition to the two classes of stains just mentioned there are the aniline stains which have practically supplanted all the others. When buying colors for the aniline stains, it is necessary to name the color, as aniline black, aniline red, or whatever it may be. Some good formulas for each class of stains are given herewith, these having been compiled by a cabinet maker of many years' experience, and their accuracy can be vouched for. Ready-made stains can be bought almost as cheaply, however, and if time is an asset, these are advisable.

Mahogany. Boil logwood chips in a closed vessel with twice their bulk of water for several hours; strain, and add a small quantity of chlorid of tin to give it redness. Two coats are necessary

Walnut Permanganat of Potash.....1 ounce
Epsom Salt .....1 ounce
Water .....1 quart

Dissolve, strain, and apply several coats.

Cherry. Reduce the mahogany stain for cherry.

Oak. Asphaltum Gum.....¼ pound
Turpentine .....1 pint

Ebony. Dissolve extract of logwood in wood alcohol to the strength desired, strain, and apply. Develop the color by going over the work with a solution of muriat of iron, made by mixing equal parts of it and alcohol.

Yellow. Turmeric Powder .....1 ounce
Alcohol .....1 pint

Allow this to stand several days, shaking it often. Strain for use, applying several coats.

Aniline Mahogany. Bismark brown.....1 ounce
Water .....3 quarts

The above formula is typical of all aniline stains.

Antique Oak. Dissolve asphaltum in naphtha, making a very thin mixture; the filler used should be the antique filler.

The third step is filling the wood, if staining has been necessary, and by this we endeavor to level up the surface, and get a mirror-like smoothness. It is best to purchase fillers ready-made, as it is difficult to get the proper consistency. They consist of very fine silex stone, in a mixture of half linseed oil and half turpentine, with the proper coloring matter added. After the filler has been applied, and its color begins to change to a dull flat appearance, it is time to rub it off, using a piece of flax or hemp tow for the purpose, and rubbing until the surface is quite smooth. the work should not be allowed to dry thoroly.

After filling, shellacking is resorted to with hardwoods, in order to close up the pores completely, and prevent the sinking in of the varnish, which would otherwise leave tiny pinholes on the varnished surface. Pure grain alcohol shellac, either the orange or the white, should be used, mixed in the following proportions:

Shellac .....½ pound
Grain or wood alcohol..... 1 pint

After allowing the shellac to dry for six or eight hours, sandpaper with No. 00 sandpaper, being careful of the corners, and also to use but little pressure, so as not to cut thru the coat of shellac. With new sandpaper it is best to rub two pieces together several times to remove the danger of scratching.

When applying varnishes a brush suited to the size of the work should be used, and the operation should be performed in a room temperature of at least 70°, to insure free flowing. Altho it is impossible to tell just how to varnish successfully, practise being the only way to learn, a few simple rules may be given. Apply the varnish with the flat of the brush, along the grain; then rub it out crossways to get an even application; finally finish it off with the grain. Care should be taken not to skimp on varnish, and yet at the same time not to put too much on. This is another matter where practise is the only real teacher.

After one coat of varnish has been applied and is thoroly dry, the surface is rubbed smooth, using ground pumice stone and a pad of rubbing felt. The finer grades of pumice stone, as F and FF, are the best, as there is less danger of scratching thru the varnish. One should always rub with the grain and not bear down too hard at the beginning or end of the strokes. Some linseed oil should be at hand as rubbing oil, the felt being dipt into the oil and then into the pumice stone, a quantity of the latter thus adhering to the felt. Cleaning off should be done at once, using soft cotton waste for this purpose. Woods having coarse fibers should not be rubbed until two or more coats of varnish have been applied, waiting each time until the previous coat is dry. This is necessary or the fibers will come up above the surface, thru the varnish.

Having rubbed the surface perfectly smooth we may now give it a high polish, or we may leave it with a "dead" finish. If polishing is elected we may proceed in

(Continued on page 810)

www.americanradiohistory.com

Experimental Chemistry

By ALBERT W. WILSDON

Thirty-Fourth Lesson

SILICON

SILICON is the central element in the mineral world, like carbon is in the animal and vegetable kingdom. Unlike carbon, silicon never occurs in the free state. Next to oxygen, it is the most abundant element. Oxygen is estimated to make up nearly half of the solid crust of the earth, and silicon to constitute about a third more. Its occurrence is chiefly

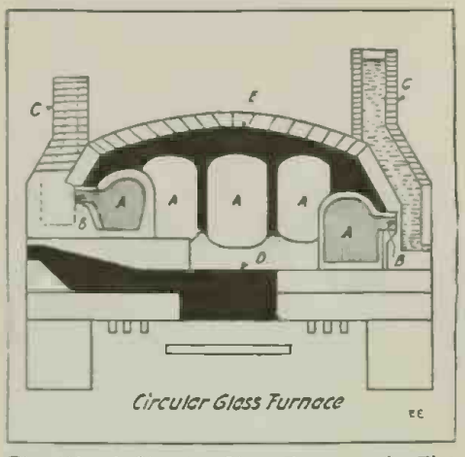


Fig. 160. A Circular Glass Furnace: A—Fire Clay Pots. B—Openings for Introducing Blowpipe. C—Chimney. D—Source of Heat. E—Roof, from Which Heat Is Reflected Downward.

in combination with oxygen in quartz and silicon dioxid (SiO_2). This non-metallic oxid is often further united with some metallic oxid, such as aluminum oxid (Al_2O_3) to form a silicate. It is, further, the chief constituent of nearly all rocks, and consequently, also of the soils which have resulted from the decomposition of rocks. It is also found in ashes of many plants, having assisted to make up their mineral structure. Despite the fact that this element is so widely distributed, the element itself has been, until recently, separated from its compounds only with such great difficulty that it was only a curiosity. By the present methods of reduction it is no longer difficult.

History.

Amorphous silicon was first separated and isolated in 1810 by Berzelius in an impure form. Later, in 1823, he obtained the pure element, by fusing together iron, carbon, and silica (Silicon Dioxid SiO_2). Deville prepared the crystalline variety in 1854. Phipson in 1864 first reduced it by magnesium.

Occurrence.

As previously stated, the element does not occur in the free state. Its affinity for oxygen is so great at a high temperature that in early ages, when the earth was a molten mass, the silicon all combined with oxygen to form silicon dioxid (Silica SiO_2), this later uniting with metallic oxides to form silicates.

Preparation.

Amorphous Silicon is best prepared by mixing equal parts of powdered and well-dried white sand (SiO_2) and magnesium. This mixture is placed in a test tube and heated with a Bunsen flame. The reaction soon begins with a glowing which rapidly extends thruout the entire mixture.

$$Si\ O_2 + 2\ Mg = Si + 2\ Mg\ O$$

The cooled, hardened product is powdered and then washed with dilute Hydrochloric Acid to remove the magnesium oxid. The product thus obtained is an amorphous, brown powder, which, when heated in air ignites and burns with the formation of the dioxid SiO_2.

Silicon is insoluble in water and acids, except hydrofluoric, which dissolves it readily.

The crystalline variety is prepared by fusing sodium silico-fluorid with aluminum, or zinc and sodium:

$$Na_2\ Si\ F_6 + 4\ Na = 4\ Na\ F + Si$$

The liberated silicon dissolves in the fused metal and on cooling crystallizes. The crystals are separated from the mass by treating successively with hydrochloric, boiling nitric, and hydrofluoric acids. Crystallized silicon is also prepared in an electric resistance furnace from pure silica sand and finely pulverized foundry coke.

$$Si\ O_2 + 2\ C = Si + 2\ CO$$

Properties.

The silicon of the silico-fluoric process is in the form of dark, octahedral crystals, possessing a degree of hardness, sufficient to scratch glass. They withstand white heat without igniting and resist the action of all acids except a mixture of hydrofluoric and nitric, which, when hot, dissolves them slowly.

The silicon product of the electric furnace is in the form of crystalline masses of a dark silver lustre. It is quite brittle and melts at 1420°C.

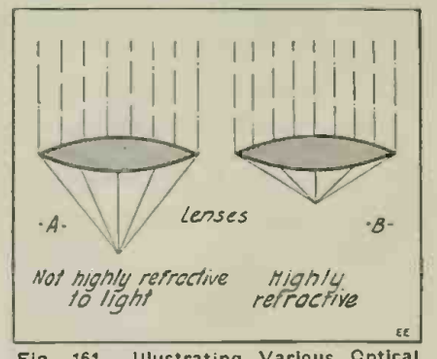


Fig. 161. Illustrating Various Optical Properties of Glass.

Glass.

What a common substance! Among the many necessities of daily life, few manufactured articles are more important than glass. The importance of this substance will be brought home forcibly when we only mention that without it the sciences of Chemistry and Physics and all branches utilizing the microscope and telescope (see Fig. 161) would probably never have been advanced to their present elevation. Bacteriology and its allied studies would have been unexplored, and as a result the lives of many who have been cured by microscopic examinations and subsequent proper treatment would have been sacrificed. Aside from the fact that it is an everyday necessity, being employed among other equally important uses, as a container for the milk which is delivered in the morning, the glasses used for drinking purposes; in rural districts as chimneys for lamps; and in large cities and dwellings for electric lamp and gas lighting. It would tax the reader too much to even for a moment try to imagine what kind of an existence we would have without our glass windows. It would mean that we would have no use for clocks, as our time would be controlled solely by the sun and moon. Imagine if you can such a superstructure as the Woolworth Building, as well as many others, practically a city in itself without windows. It is true that there may have been substitutes, but it is hard to conceive of anything which would compare with glass.

What is this substance which we could hardly do without? Generally speaking, it is an amorphous mixture of the silicates of calcium or lead with those of an alkali (Potassium or Sodium), obtained by fusing sand (Silicon Dioxid), lime or lead oxid with sodium or potassium carbonat. The cheaper grade of glass contains instead of the alkali carbonats a mixture of either one of the sulfates and coal dust. Thus the sulfates are reduced to sulfids, which form silicates with the sand. Upon the composition depends the degree of fusibility, hardness and refractive powers of the glass. Thus we must distinguish between the varied kinds.

Lime (Plate) Glass: This grade is much cheaper, harder and *less* fusible than "lead" glass. It is either a soda or potash-lime glass. The *soda-lime* glass, which is readily fusible, is the commoner sort, such as is used where cheapness is desirable, such as is used for window glass, plate glass, bottles, etc. The *potash-glass*, also known as Bohemian and Crown glass, is a silicate of lime and potassium. This kind fuses only at a high temperature, and is harder, and withstands the action of water and acids better than soda-glass. For this reason it is used extensively for the manufacture of chemical glassware, which must withstand fairly high temperatures without fusing. Potash glass is used for Leyden jars.

Lead (Flint or Crystal) Glass: Litharge (PbO) or red lead replaces the calcium oxid of lime glass. This kind is used for cut-ware, optical glass, such as lenses and prisms, being heavy, possessing great luster and brilliancy.

Replacement of a portion of the lead oxid by thallium oxid or boron tri-oxid, causes the refractive property of the glass to be increased considerably. The boron glass is called *"strass"* and finds use in the manufacture of imitation gems.

The varied colors of glass are obtained by the addition of various metallic oxids or salts. *Blue* glass is made with cobaltic oxid or cupric oxid; *Violet* glass, by using manganese dioxid; *Red* by metallic copper

(*Continued on page* 831)

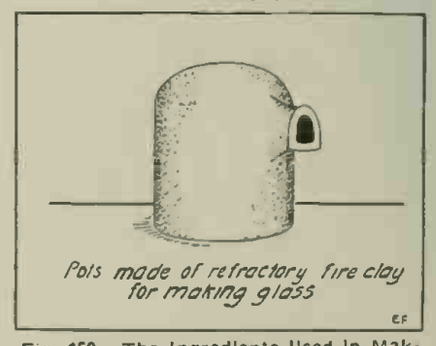
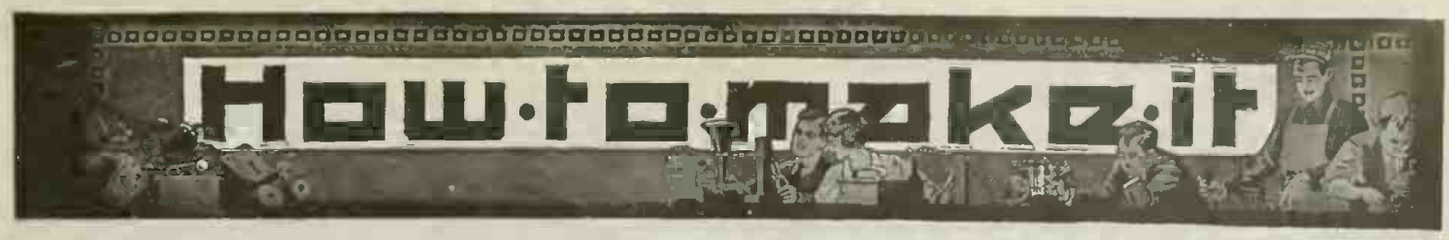


Fig. 159. The Ingredients Used In Making Glass Are Placed In Refractory Fire Clay Pots Such as This, and Then Melted at a Great Heat In a Furnace.

www.americanradiohistory.com



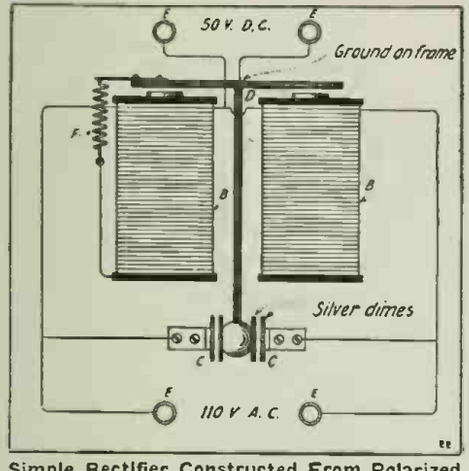
This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 is awarded; for the second best idea a $2.00 prize, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

SECOND PRIZE, $2.00

SIMPLE RECTIFIER MADE FROM POLARIZED RINGER.

The materials required are: a low-resistance polarized telephone bell, two pair of binding posts, preferably rubber-covered, about 3" of ¼" x 1/16" brass or copper strip, and a plain wooden base, 4" x 3", and two silver dimes.

Remove the gongs from the bell and mount it on the base by means of two oblong blocks of wood, to the ends of which are screwed the attachment lugs on the bell; the blocks in turn being screwed to the base. Bend up 1" of each brass strip. To the upper portion solder half of a dime, previously filed to a smooth surface. Solder the other two halves of the dimes onto opposite sides of the hammer; see sketch for arrangement of parts. These two strips must be held down to the base by a pair of small screws. The two pairs of binding posts should be placed at opposite ends of the base. Connect as in wiring diagram.



Simple Rectifier Constructed From Polarized Ringer.

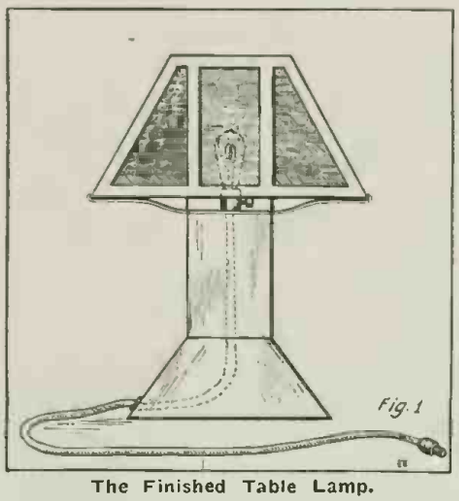
This rectifier will only handle currents from 1 to 9 amperes without dangerously overheating and operates best on 25 cycle frequency. Connect the terminals leading from the coils directly to the 110 volt A. C. current; direct current at about 50 volts D. C. will be obtained at the other terminals, due to auto-transformer action and drop due to resistance of contacts. Lubricate the armature pivots.

Contributed by GEORGE LUNGE.

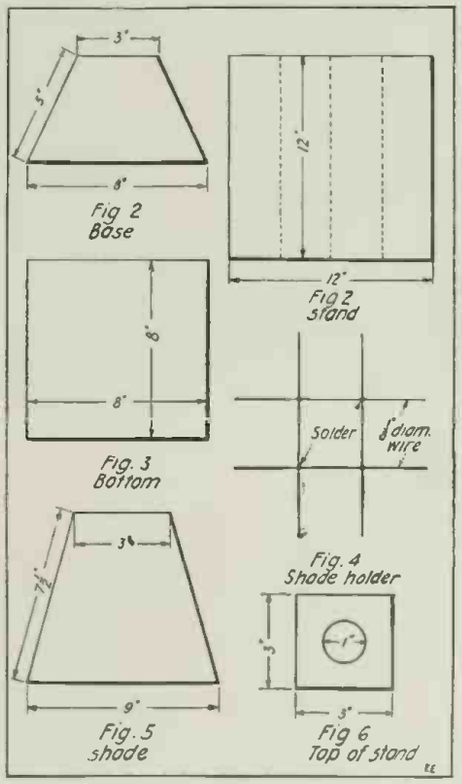
FIRST PRIZE, $3.00

HOW TO MAKE A TABLE LAMP FROM SHEET METAL.

Cut four pieces of sheet iron, brass or copper, as per Fig. 1, solder together and then cut one piece as in Fig. 3, and fasten to this. Then cut one piece like figure 2, and bend as on dotted lines, making a stand three inches square and twelve inches high. Put this thru the opening in the completed base until it strikes bottom, then solder securely; cut a hole for the cord about one inch from the top of the base. Next cut one piece (Fig. 6) for socket and solder socket base securely to this, then wire up, putting wire thru base and soldering top on. For the shade holder cut four pieces of ⅛" iron or brass wire and solder as in Fig. 4. For the shade cut four



The Finished Table Lamp.



It is a Simple Job to Cut Out the Parts for Making the Table Lamp Here Shown. Copper or Brass Gives a Fine Finish.

pieces (Fig. 5) and solder; then fasten to holder. You can glue a piece of felt on the bottom of lamp. A ten-cent can of Mission Green enamel will make an attractive color for the lamp, if it is to be used in the den.

The shade may be made quite artistic at small expense by cutting out the side of the shade in some such pattern as shown. These are backed up by pieces of ground glass cut after the pattern of Fig. 5, or figured glass may be purchased reasonably at any fixture shop. If made of brass the lamp may be polished and lacquered or given an oxidized copper finish. Such a lamp will prove very useful in the camp and bungalow.

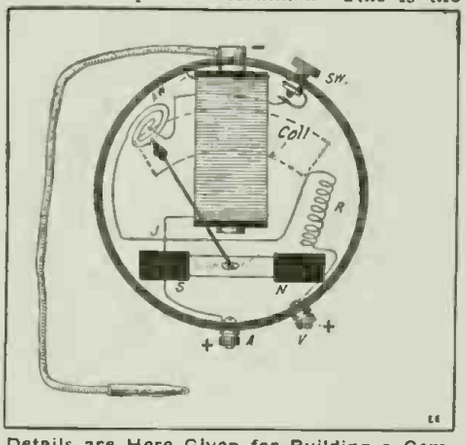
Contributed by M. F. HOLMES.

THIRD PRIZE, $1.00

HOW TO MAKE A COMBINATION VOLT AND AMMETER.

A combination meter can be made from a burned out or otherwise damaged winding of a volt or ammeter of the permanent-magnet pocket type.

Remove the old winding and rewind with No. 26 silk covered or enameled magnet wire, fastening the negative end to the shell or negative terminal, and the other end to the positive terminal. This is the



Details are Here Given for Building a Combination Volt-Ammeter From a Pocket Style Volt Meter or Battery Gage.

weak current reading, such as for old cells, coils, etc.

The volt reading is obtained by connecting a resistance (R) of varied size at J, and terminal V, which is tested by a dry cell reading approximately 1½ volts.

The amperes are now read by connecting a piece of No. 22 or 24 copper wire (A.W.) in shunt with the coil at J and a suitable switch, SW, to the case. The proper length may be found by testing with a cell of known amperage.

Contributed by L. W. CAMERON.

AUTHORS!!!

All matter intended for publication—not only by us, but by any other magazine or newspaper as well—should be written on one side of the paper only and in ink. If it isn't, somebody else must copy part of it off on another sheet before it is given to the printer.

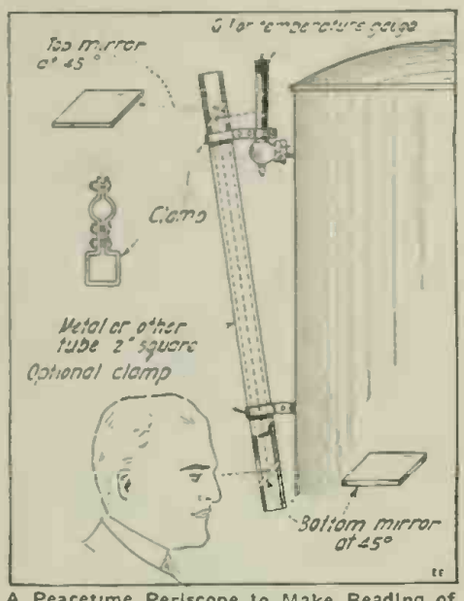
www.americanradiohistory.com

Wrinkles, Recipes Formulas

EDITED BY S. GERNSBACK

HOME-MADE PERISCOPE FOR READING TEMPERATURES AND OIL GAUGES.

The submarine commander has found the periscope invaluable for readily locating en-



A Peacetime Periscope to Make Reading of Scales Easy in Inaccessible Places.

emy vessels and obtaining his bearings under war-time conditions, and any electrician or engine room attendant, who has once used one of these home-made periscopes for reading meters, oil gauges or thermometers in inaccessible places, will never be without one. To make one of these periscopes, procure a piece of round or square metal tubing about two inches across. The tube may be of any length desired. Two small mirrors of suitable size are procured at a ten-cent store, and these are placed at an angle of 45 degrees, one at the bottom of the tube and the other at the top of the tube, in the manner shown. The image of the scale is reflected in the top mirror, thence down the tube onto the face of the lower mirror, and then out thru the opening in the tube to the eye. In some cases, these meter-reading periscopes are fitted with flashlight bulb at the top and a push button and battery on the base of the tube suitably secured in place, in order that the gauge may be illuminated.

MAKING FLEXIBLE-CORD COVERS.

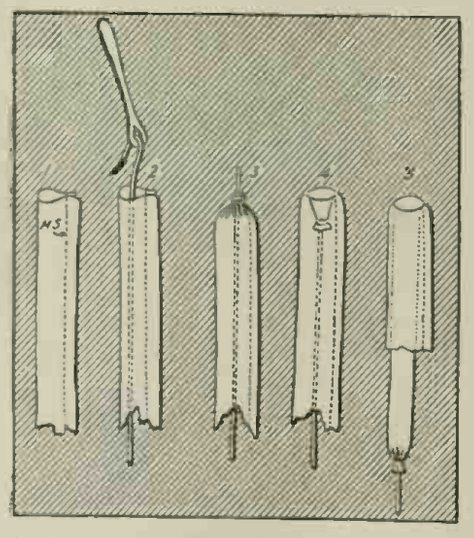
Cut a strip of cloth, any kind and any length, half an inch wide, fold it lengthwise as in Fig. 1, with the *wrong* side out if there is a wrong side, and sew a line of machine stitch down the side as shown. Don't try to sew too near the edge.

Next, run a piece of stout twine thru with a tape needle, as shown in Fig. 2. When thru, gather the upper edge of your cloth tube together, as in Fig. 3, and *sew* it to the piece of twine. Don't try to tie your twine, as that makes rather too large a knot to start thru easily.

Now hold the other end of the twine in one hand (or if your tube is very long, tie it to a door-knob) and with the other hand work the puckered end down inside, with a motion like pulling on a glove-finger, (Fig. 4). Once started, there is not the slightest difficulty.

Fig. 5 shows the end of the operation, with the completed tube coming thru, right side out, with the seam concealed, and with the extra flap serving to stuff the tube and make it plump and round. The conductor, composed of a dozen braided wires from your old Ford secondary, is run thru with the tape needle, and there you are. Cost per yard, exactly $0.00.

I have a particular affection for this invention because I had a dollar on it once —about the only dollar I ever did wring from Science. The stenographer was aiming to replace a broken belt-loop on her velvet coat, and was stumped to know how the tailor had got the seam inside. Recognizing my old process, I was explaining it to her, when the boss came in and bet me a dollar I couldn't do it. The girl made the tube, I ran the string, manipulated a second, and "Psst!" thru it went, like a rat two jumps ahead of the feline. The boss handed over his dollar, while the stenographer said something which in polite



Pst! An Alcove Secret! Our Friend Reed Tells Us How the Tailors Got the Seam Inside.

ladies' language is equivalent to—"Well, I'll be d——d!"

Contributed by THOMAS REED.

ANOTHER STORM GLASS OR BAROSCOPE.

Potassium nitrat.....	Gr. 30
Ammonium chlorid.....	Gr. 36
Absolute alcohol.....	Fl. Dr. 6
Alcohol	Fl. Dr. 6

Put the mixture into a bottle 18 inches in length and ¾ inch in diameter, and cover the mouth with a piece of perforated plaster.

If the weather is to be fair the insoluble matter will settle at the bottom of the tube, while the liquid remains pellucid; but previous to a change for rain, the compound will gradually rise, the fluid remaining transparent. Twenty-four hours before a storm or very high wind the substance will be partly on the surface of the liquid, apparently in the form of a leaf; the fluid in such cases will be very turbid and in a state resembling fermentation.

Contributed by ARTHUR SCHALLER.

NEARLY PERFECT — WHAT 1/1000TH INCH ACCURACY MEANS.

Such is the perfection of modern machinery that 1/1000th of an inch is a large error in metal working, tho a sixty-fourth of an inch was near enough for the craftsman of fifty years ago. Optical goods, like lenses and prisms can now be made with surfaces accurate to 1/50,000th of an inch without undue difficulty, and for the most exacting purposes of scientific research it is possible to make a flat or curved surface to an accuracy of *one millionth of an inch.*

But even such marvelous accuracy as this falls far short of theoretical precision. If the most perfect mirror could be magnified until the molecules became visible, it would appear anything but flat. In fact, when X-rays were discovered this form of radiation appeared not to be subject to regular reflection like a beam of light falling upon a mirror. This has since been found to be due to the fact that the most perfectly polished surface is relatively rough to the exceedingly short waves of X-rays, just as a sheet of paper is rough to ordinary light, and so reflects it diffused.

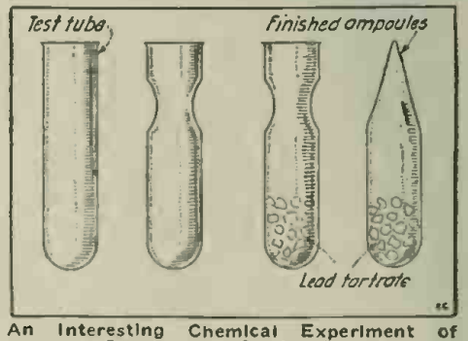
Contributed by H. J. GRAY.

PREPARATION OF PYROMORPHIC CARBON.

Pyromorphic carbon is a substance which takes fire spontaneously. It is prepared from lead tartrat. To prepare the lead tartrat mix solutions of tartaric acid and lead acetat. Lead tartrat is precipitated. This is filtered, washed and dried in the air. Next an ampoule is prepared by drawing out a test tube. (See diagram.) The tartrat is now put in the ampoule and heated until no more white fumes are given off. It is then sealed at the constriction before cooling. After it is thoroly cooled and if the tip is broken off the substance when sprinkled out will burst into flame before reaching the floor.

On heating, lead tartrat decomposes, leaving lead and carbon. These are in such a finely divided state that they absorb oxygen —thereby bursting into flame.

LIGHTING A BUNSEN BURNER WITHOUT MATCHES: If a crystal of potassium chlorat is rubbed on the side of a



An Interesting Chemical Experiment of Spontaneous Combustion.

safety match box, tiny sparks of flame will result. This is due to the combustion of the phophorous on the box with the oxygen of the potassium chlorat.

Contributed by JOE BRENNAN.

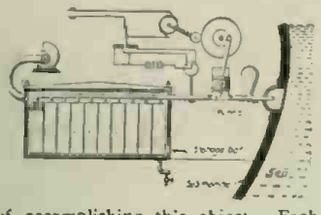
www.americanradiohistory.com



Storage-Battery Ventilation for Submarines

(1,285,659; issued to Bruce Ford)

A means of ventilating the battery cells to the exterior of the shell of a submarine whether submerged or on the surface, and an automatic way

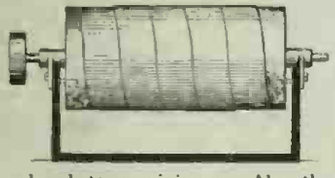


of accomplishing this object. Each one of the cells is closed and a vent pipe is connected to its interior, which is arranged to discharge thru and to the outside of the boat. An arrangement of inlet and outlet valves and an air pump regulates the discharge of the gases, acid, electrolyte, etc., that may escape from the cells by accident. Also a means of air circulation is provided around and between the cells for regulating the battery temperature.

Electrolytic Process

(1,282,262; issued to Matthew M. Merritt)

A new improvement in the manufacture of copper or other metallic sheets by electro-deposition on a rotating cathode. By proper correlation of the proportion of the surface of the cathode which is immersed, to the speed at which the cathode is rotated, the formation of rough deposits on the deposited sheet caused by liberated hydrogen may be

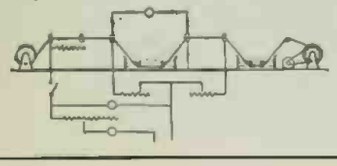


reduced to a minimum. Also the burning of the deposits by the use of a high current density may be eliminated, while maintaining that rapid rate of deposit which results from a high current density. Also the coarsely crystalline formation of the sheet which results from a high amperage during the deposit, may be avoided by the use of an oily or greasy coating over the surface of the mandrel, which is preferably treated with mercury.

Annealing Metal Wire by Electricity

(1,285,887; issued to Herbert Alexander, Wyndham T. Vint and Arthur Imbery)

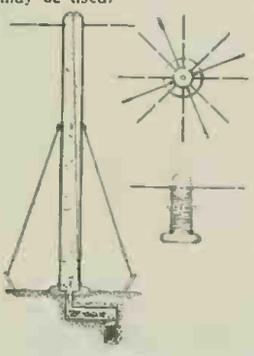
Annealing and tempering of traveling steel and other metal wire has previously been accomplisht by its being made to form a part of an electric circuit, the ohmic resistance of the wire with the requisite amount of current flowing automatically producing the desired heat. This invention improves on this process in that it consists of a means for the gradual heating of the wire when first entering the apparatus or after emerging from a cooling bath therein, or at both stages of the process. A periodicity of over 25 cycles per second is of advantage in overcoming the tendency to the production of any electrolytic phenomena which may occur.



Collapsible Wireless Telegraph Pole

(1,285,940; issued to Leon Chodakowski)

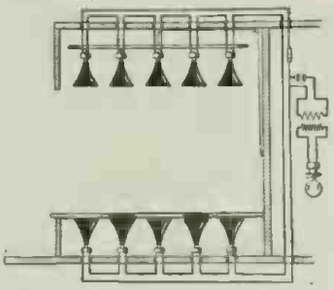
Atta-Boy, Leon! Why didn't you think of this before the war. Now we don't need it, thanks to Mr. Roger's underground radio. A wireless telegraph pole of the collapsible type for elevating the wireless antenna. It consists of a flexible and inflatable bag adapted for arrangement in pole formation when inflated and carrying wires near the top. The device is so made as to be readily filled with gas and emptied as desired. A means of carrying the gas in tanks with the signal corp section may be provided for the filling of the bag, or comprest air may be used.



Means for Recording Sounds

(No. 1,286,259, issued to Thomas A. Edison)

This invention relates to an improved method of recording sounds. Its object is the making of records for talking pictures. Where only a single horn is used to catch the sound waves a very poor impression is received on the record and many of the sound waves are not caught at all. In this invention the sound waves are collected at a plurality of points which are so separated as to extend over the field or scene. It also intensifies the impulses before they reach the recording device. A number of microphones and the receivers are connected in series while the battery and the primaries of the induction coils, corresponding in number to the receivers, are also in series with each other and the micro-

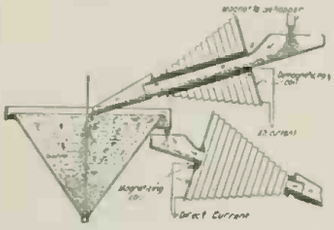


phones. The secondaries of the induction coils are in series with each other and the recorder. Therefore no matter on what part of the stage a performer may be, a recorder will always be near and enable a complete record of the sound waves to be taken.

Apparatus for Treatment of Magnetic Ore

(No. 1,286,247, issued to Edward W. Davis)

A device whereby it is possible to demagnetize magnetite ores, found in certain sections of the country. By means of this process it becomes readily possible to quickly classify the various grades of the ore. A hopper having an open top into which the ore is discharged thru a spout. This hopper also has an inclined conical spout leading from it. A coil encircles this cone thru which an alternating current is past. This conical shape has the effect of gradually reducing the influence of the

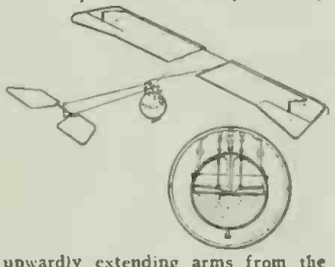


alternating current on the magnetic ore, and also prevents it from reaching a neutral point. The finer particles float away over the edge of the tank by the overflow of excess water and are remagnetized, while the heavier particles settle on the bottom of the tank.

Stabilizer for Flying-Machines

(No. 1,286,860, issued to Frank White)

A simple appliance to be used with any type of airplane for automatically controlling the balancing surfaces of the machine, thereby relieving the aviator to that extent. It comprises a hollow spherical body in two sections, with a liquid-tight joint between the top and bottom. It is adapted to contain water or other liquid, and is suspended by

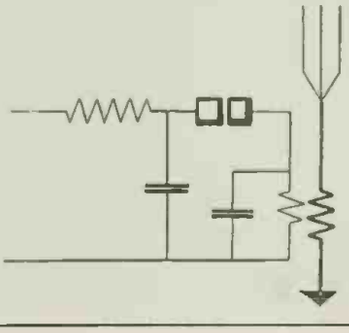


upwardly extending arms from the hangers. The arms are connected by means of pivots so as to enable the body to swing in any normal direction of flight the 'plane might assume. Any shift of this spherical body tends to raise or lower a disc which floats on the surface of the liquid and this shifting disc automatically adjusts the planes and keeps the machine in equilibrium.

Wireless Apparatus and Method Therefor

(1,279,850; issued to William Dubilier)

The apparatus consists of a simple, light weight electromagnetic vibrator intended to produce oscillations. As a closed circuit condition exists at starting the oscillations, a high primary potential is not necessary, and therefore a direct current source of energy of low voltage is sufficient to operate the apparatus. It operates most efficiently when the period of vibration of the spring of the vibrator is in a selected ratio to the natural frequency of the oscillating circuit; that is to say, when such period of vibration

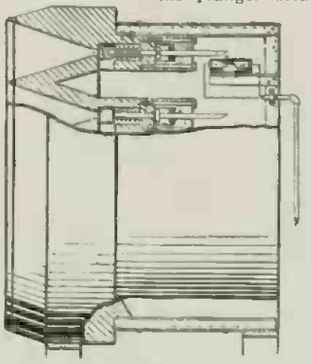


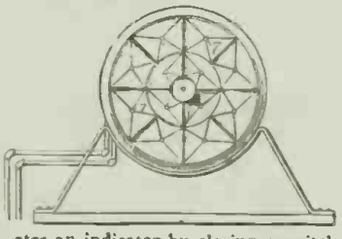
is either equal to or a harmonic of the natural frequency of the oscillating circuit.

Target Apparatus

(1,286,215; issued to Clarence H. Brainard)

Each plunger is so set in the target that it immediately absorbs all the kinetic energy of the bullet on impact and then drops the bullet into a receptacle. At the same time the movement of the plunger actu-



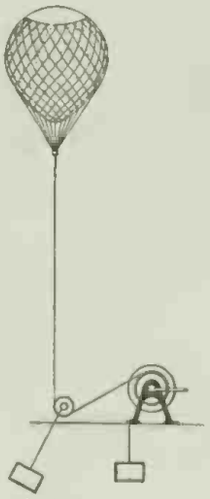


ates an indicator by closing a switch arranged in the path of the moving plunger, and electrically connected in the circuit with one or more annunciators, properly numbered.

Process and Apparatus for Inducing and Stimulating Rainfall

(1,284,982; issued to John G. Ballsillie)

An electrical conductor is used to form a path for the flow of energy between earth and clouds. The lower end of such conductor being connected to the earth and the upper end having a terminal of electrically conductive material. To secure effective connection between earth



and clouds it is necessary to have the upper terminal consisting of a great number of fine metallic points. For practical purposes this upper terminal consists of a mat or fabric sheet of considerable surface, with a great multiplicity of electrically conductive points, and its area is two to ten square yards.

www.americanradiohistory.com



Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light-toned ones. We pay $3.00 prize each month for the best photo. Address the Editor, "With the Amateurs" Dept.

"Amateur Electrical Laboratory" Contest

THIS MONTH'S $3.00 PRIZE WINNER—E. J. J. GOBRECHT

THE accompanying photograph shows the laboratory of this month's prize winner, E. J. J. Gobrecht, who has certainly one of the most interesting that we have had submitted for some time. Everything is systematic, and there is sufficient space to have a place for everything and everything in its place. At the extreme right may be seen an elaborate switchboard containing several knife switches as well as a specially made heavy current rheostat, current meter, switchboard lamp, testing lamps, telephone transmitter, etc. Storage batteries can be charged from this switchboard when desired, and several of them may be seen on the laboratory bench in the background. The table in the foreground contains an electrolytic interrupter operating a spark coil, a pair of home-made Leyden jars and a small Oudin high frequency coil having a primary wound with copper ribbon. Several small dynamos and miscellaneous tuning coils, loose couplers and rheostats are to be seen about the laboratory showing that the owner has been actively interested in the theoretical and practical study of electricity and wireless. The usual collection of "miscellaneous" comprises telephone parts, boxes of screws and nails, wet battery elements, chemicals, etc. A goodly assortment of tools are on hand for the construction of the various apparatus which the author happens to be interested in. Note the beautiful model of a monoplane suspended in front of the central window of the laboratory, also the partly constructed model airplane fuselage on the floor just under the center table. Also do not miss the large sketch of Dr. Nikola Tesla on the rear wall, presumably enlarged and sketched from the supplement given with the "Electrical Experimenter" several years ago. There is a phonograph in the laboratory to stimulate ideas at odd moments when the owner's "think tank" goes dry. This is a good specimen of what the average American boy can do in making up an attractive and useful work-shop in which to try out his ideas and supplement his theoretical studies with the actual application of the principles involved.—E. J. J. Gobrecht, Hanover, Pa.

HONORABLE MENTION (1 Year's Subscription to the "ELECTRICAL EXPERIMENTER")—WM. H. MOORE

I GIVE herewith contents of my laboratory. Among the usual requisites of such a laboratory there are: 1 K.W. high frequency outfit, a Mignon audion cabinet, 15,000 meter coupler, together with smaller couplers, 'phones, storage battery and condensers. I also have a motor-generator set with which I charge my own and other batteries. The chemical division I think, is fairly complete. It contains a retort, pipettes, a burette, flasks, beakers and all reagents necessary for any ordinary experiment or analysis.—also tripod, ring stand, porcelain crucible, evaporating dishes, mortar and pestle, U-tube, drying tubes, conical and cylindrical graduates, hydrometers, balance, etc. The electrical division contains among other things, several motors, magnetos, etc., also an arc light, resistance, step-down transformer, telephone transmitter and that inevitable collection of miscellaneous articles commonly known to the profession as "junk." I also have a set of Marconi-Victor Code Records and receive at a speed of from 15 to 20 words per minute.—Wm. H. Moore, Charleston, W. Va.



www.americanradiohistory.com

Science in Slang

1. From Amber to Juice

By Emerson Easterling

ILLUSTRATED BY THE AUTHOR

A QUEER man you will find him, Captain A. J. Stokes, deep and studious, yet a man of the world of sport and levity. He has nosed into every port in the seven seas and has seen the Amazon River looking east. It is needless to say he is independently wealthy. Yet it is evident that he has a speaking acquaintance with the more serious things of life, and has thumbed the pages of History and Science in his speedy course of life.



"Benny Franklin, the Lightning-rod Kid."

To-night he sat across the fireside from me at the club. In his hand he held a copy of a current electrical periodical. Seeing this, I ventured to ask, "What have you framed up in your noggin as being the right dope on the origin, use, nature and future of Electricity?"

He looked over at me and smiled a quaint smile. "That was just the sort of thing I was thinking of, the nature and future of the something we are wont to call 'Electricity'—but how happened you to ask?"

"Oh, I don't know," I replied; "I was just wondering about it myself—and I just wondered what you entertained as to it."

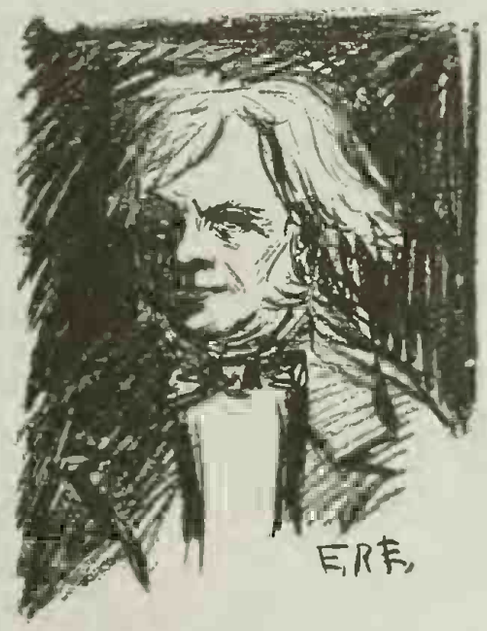


"This Tiled Roof—the Hon. W. Gilbert—Is Guilty of the Term 'Electricity'."

"I have smoked a carload of Havanas over this subject,"—he lit a cigar and lolled back in his chair—"from books and men I have gained some certain amount of knowledge concerning our 'Juice'.

"Way back in the dawn of History, when the dim diffused light of the dawning day of experience made its vague appearance thru the hydrous canopy that surrounded our terrestrial abode, the unknown force manifested itself before unseeing eyes. According to some authorities, we are not informed of any observations until a Thales of Miletus, only six hundred years before Christ, carved his discoveries of the funny things that amber would do when rubbed.

"Also a bird by the name of Theophrastus, who seemed to be an authority on gems, noted that when he shined some of his sparklers on his pant—(oh, excuse me! That duck wore a tablecloth) that the said sparkler would attract small objects like pith balls and lint from his culinary garb. Besides Thales and Rastus and a very few other guys who were 'on', old Jupe himself made the pith balls animated by the frictional performance engendered by lightning.



"Mike Faraday, Who Successfully 'Vamped' Dame Electra Out of a Bunch of Her Darkest Secrets."

"Funny it took so long from Creation before the old timers 'got hep' to those primary examples, isn't it? But I suppose that is what the bunch that will be here years anon will say of we present moderns.

"Of course Cleopatra must have drawn sparks from the red nose of some enamored Gaul when she shuffled across the Persian rug and did a Can-can before the Hun's grandad, some spicey morning on a winter visit up in Gallia. We know that it was static electricity, but the Egyptian Boss didn't. Neither did the Dutchman. As for that bird—it probably struck him as a severe charm of his friend, Miss Ptolemy, esq. Had you been there and slipt her the 'info' that it was what we have christened 'Electricity' that caused the prickling spark to play betwen Her Royal Ilium and Dutch's crimson beak, she would have looked at you as foolishly as could have been possible for such a sagacious female as the daughter of the Nile to look, and perhaps confess that you were talking ragtime to her. She might proffer the chatter, were she in the mood, that as near 'Electricity' as she could come was the Greek noun ηλεκτρον and the Latin *Electrum*, and



"Andy Ampère, Whom Thanks Are Due for Such Latter-day Questions as: 'How Many Amperes Has a Volt?'."

that they meant to her no more nor less than *AMBER!* Here she would probably jerk an amber dodangle from her enchanting locks and sneer, 'How could this sting me here!' clapping her jeweled digits on an also jeweled hip, 'You are dismist from court. Lack of evidence!' Whereupon you would be forced to consider yourself at bay. That was a way Cleo had about her—right or wrong.

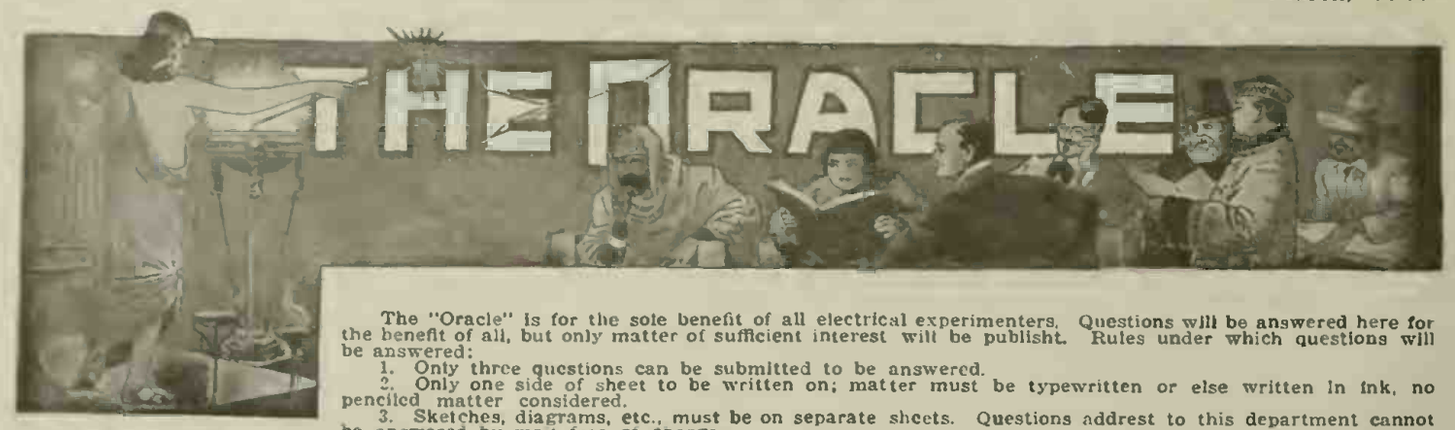
"Nevertheless you would be right and Galvani would not be as skeptical as the Queen. No doubt, he would swallow it whole and believe you outright. Then he would more than likely demonstrate his recent discoveries on the freshly murdered frogs and calves. Of course, the Bologna physician was deluded. We all know that a Prof. from the Pavian University had to set the populace right after Doc's assertion

(*Continued on page* 812)



"Prof. Volta of WET Battery Fame. This Bird Would Have Invented a DRY Battery Sure as Nails, Even If He Had Lived in 'Bone-dry' America."

www.americanradiohistory.com



The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be publisht. Rules under which questions will be answered:

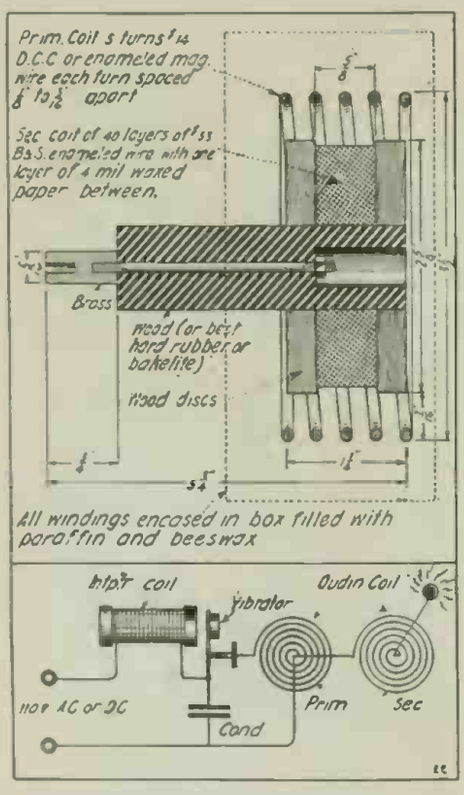
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addrest to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

COLLINS-SANCHEZ HIGH FREQUENCY 3-INCH SPARK APPARATUS.

(983) George Litty, West Phila., Pa., inquires:

Q. 1. In the November, 1915, issue of the ELECTRICAL EXPERIMENTER you publisht an article on "High Frequency Currents and Apparata," by H. Winfield Secor. Fig. 2 shows the circuit of a *Collins-Sanchez* high frequency circuit. I would like to have the following questions answered in the *"Oracle"*:

(1) The resistance of the magnet coil and how to construct it.



This High Frequency Coil Operates on 110 Volts A. C. or D. C. It Produces a 3" Flaming High Frequency Spark. The Interrupter Coil Has an Iron Wire Core 5/8" Diameter by 3½" Long, Wound with a Coil 2½" Long of No. 28 D. C. C. Magnet Wire. Outer Diameter of Coil 13/4". Vibrator Fitted with ½" Diameter Silver Contacts. Condenser 50 Sheets of Tinfoil 2¼" x 3¼", Placed between Mica Sheets 6 Mils Thick and Measuring 3" by 4".

(2) The capacity of the condenser.

(3) The size of the Oudin coil.

A. 1. We give herewith diagram of the Collins-Sanchez high frequency apparata, including the dimensions of the interrupter magnet, the condenser, and the proportions of the Oudin high frequency coil, the latter being best encased in a wax mould thoroly surrounding it.

10,000 METER LOOSE COUPLER.

(984) Paul H. Gebser, Roseville, P. T. Cal., writes for data on a 10,000 meter loose coupler.

A. 1. We give below data regarding the construction of a loose coupler for 10,000 meters:

Primary, 8 x 12" wound full No. 24 s. c. c. wire.

ODD PHOTOS WANTED AT $1.00 EACH!!!

Now is the time to make your Kodak pay for itself in a real practical way. We are after interesting photographs of out-of-the-ordinary electrical, radio and scientific subjects and are willing to pay $1.00 cash for every one we can use. Please bear in mind that for half-tone reproduction in a magazine, a photograph should be particularly sharp and clear. Of course, if a subject happens to interest us particularly well, we can have the photo retouched. For the general run of subjects, however, it does not pay to go to such expense. Therefore, please take pains to properly focus and expose your pictures. It often happens that a really mediocre subject well photographed wins approval over an excellent subject poorly photographed. And don't send us plate or film "negatives"; send unmounted or mounted "prints", preferably a light and dark one.

As to what to photograph: Well, that's hard for us to say. We leave that up to you, and every reader now has the opportunity to become a reporter of the latest things in the realm of Electricity, Radio and Science. But, please remember—it's the "odd, novel or practical stunts" that we are interested in. Every photo submitted should be accompanied by a brief description of 100 to 150 words. Give the "facts"—don't worry about the style. We'll attend to that. Enclose stamps if photos are to be returned and place a piece of cardboard in the envelope with them to prevent mutilation. Look around your town and see what you can find that's interesting.

Address photos to—Editor "Odd Photos", ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York City.

Secondary, 7½ x 12½" wound full No. 30 s. c. c. wire for crystal detector.

For use with audion, wind full with one layer of No. 34 s. c. c. wire.

NITROGEN RADIATOR FOR ELECTRIC HEATING.

(985) Harry B. Genders, Wednesbury, England, asks the Oracle Department:

Q. 1. I would be obliged if you would give me a few particulars regarding the Portable Electric Nitrogen Radiator, as described on page 464 of November, 1918, issue of "E. E." I presume the radiator is simply filled with nitrogen at ordinary atmospheric pressure. I should like to know if an ordinary hot water radiator could be converted to one of the above type? Also would it do if simply filled with air at atmospheric pressure? I suppose the efficiency would not be as great as with nitrogen filling.

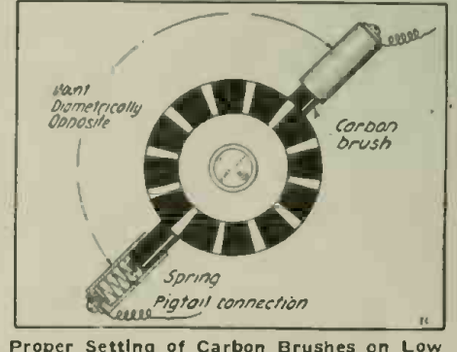
A. 1. With reference to converting an ordinary hot water radiator to an electrically heated type, most probably with a little ingenuity you could do this, but, of course, it will not be as efficient as the nitrogen filled radiator. There are several electrical radiators on the market on the principle of the simple form as you suggest, i.e., comprising nothing more than a suitably protected and insulated electrical heating element, which is caused to either heat up water with which the radiator is filled, or in some other way to produce heat in the ordinary manner.

LOW VOLTAGE, HIGH AMPERAGE DYNAMO BRUSHES.

(986) John Voorhees, Jr., Kennett Square, Pa., says:

Q. 1. I have a low voltage, high amperage dynamo fitted with copper leaf brushes. How can I apply carbon brushes?

A. 1. Concerning the replacement of the copper leaf brushes on your small dynamo by carbon or woven wire brushes, the appended diagram, we believe, will cover your requirements very nicely. Many of these small dynamos are successfully changed over in this way. The brush holders being either of the round or square pattern, should be clamped or in some way secured to the brush holder studs on your present rocker arm. You can obtain the round type brass brush holders complete with springs and brushes from any electrical repair shop or electric fan dealer.



Proper Setting of Carbon Brushes on Low Voltage Dynamo, These Replacing Flat Copper Brushes Which Did Not Prove Satisfactory.

When the round type of brushes are used

(*Continued on page* 802)

www.americanradiohistory.com

FREE Test Lesson In Draftsmanship



Send for this free lesson which explains the Chicago "Tech" method of teaching Draftsmanship by mail. Positions at big salaries are now waiting for competent men. Even draftsmen of limited training and experience are snapped up and paid good salaries. If you are dissatisfied with your opportunities, learn Draftsmanship. Chicago "Tech" will train you in the most practical way in the shortest time. Mail the coupon today and let us tell you about the Chicago "Tech" method. The free lesson will show you how well equipped you are to follow Draftsmanship. Enroll in the course only if you decide that you can take it up to advantage. No cost, no obligation on you to make this investigation. Send the coupon.



$25 to $100 a Week

Draftsmen always command good salaries. And now when American industries are to be called upon to meet vast foreign and increased domestic demands, the opportunities are greater than ever. This is the time for you to prepare for a better position—a higher salary.

Come to the College or

Learn At Home

Hold you present position while training. Our experts will instruct you by mail. Only your spare time is required. You are directly under practical draftsmen and engineers. You are taught exactly the work required in the drafting rooms of big concerns. No time put in on unnecessary studies. This means thorough instruction and early graduation.

Easy Payments

The fees for Chicago "Tech" Courses are very moderate—and you can pay on easy terms. And also, you obtain in a few months what it would take several years to acquire by ordinary methods. You can get an early start. You are soon ready to take a paying position and to quickly get back the cost of your course. Then keep on earning more.

FREE Instruments

Every student of the Chicago "Tech" mail course in Draftsmanship receives this set of instruments, or a cash credit in case he already has a set. These instruments are of the same make and sizes as are used by high salaried experts in drafting rooms of factories, shops, railroads, etc. You use them while learning—then take them right into your practical work.

Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Splendid opportunities open now. Send coupon and get all the facts.

Learn All This in Spare Time

Principles of the Automobile. Every point made clear about the basic principles of propulsion—steam, gas and electric cars. Power transmission systems in pleasure and commercial cars, etc., etc.

Gasoline Engines. All about the different types. A complete course in gas engine construction, operation and repair.

Power Plants and Transmissions. Application of power by 4-6-8-12 cylinder engines. Types of clutches, gears, drives, axles, etc.

Carburetors and Fuel Supply Systems. All methods demonstrated. Fuel values. How to test. Gasoline and air mixtures. Regulation, care and management, etc., etc., etc.

Lubrication and Cooling All about oils and how to test them. Splash and circulating systems. Operation in different cars explained. Diagrams and tables. Cooling systems completely illustrated, etc.

Batteries. Electrical principles explained. Instructive diagrams of wiring and connections. Coils, condensers, vibrators, etc., etc.

Magneto Ignition. Principles and practical operation of various types and systems with diagrams. Generation of current. Field, armature, high and low tension, all explained. Complete in every point.

Starting and Lighting Systems. All modern methods. Starters—spark, mechanical, air, acetylene, electric, battery—shown in detail with diagrams and full explanations. Charging. Motor and Generator adjustments, etc., etc.

Know How to Find and Fix Troubles

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men and men who know how to inspect cars. This course makes you proficient. Prepares you to take a job as an expert. Not enough competent men now available.

WRITE Send the coupon and get catalog and all information about the Course, the small fee and the easy terms. All this sent on request. Mail coupon now.

Send the Coupon—Now

The sooner you are prepared the sooner you will be holding a job that pays a large salary and opens the way to advancement. Many executives, general managers and superintendents began as draftsmen.

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send you the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything.

The coupon will bring the Test Lesson, free. Also information about the profession of Draftsmanship and detailed facts about Chicago "Tech" methods, the fees, terms, etc. Mark with X the branch you are interested in—or if in doubt about which course to take, write a letter stating facts about yourself and asking our advice which will be freely given. Mail either the coupon or letter today.

CHICAGO TECHNICAL COLLEGE,
345 Chicago "Tech" Building, Chicago

Without obligation to me, please send me your FREE Test Lesson and other interesting literature covering the subject indicated below.
Mark X opposite work in which you are especially interested.

- ☐ Architectural Drafting
- ☐ Machine Drafting
- ☐ Electrical Drafting
- ☐ Structural Drafting
- ☐ Sheet Metal Drafting
- ☐ Builders' Course
- ☐ Plan-Reading—Building
- ☐ Plan-Reading—Shop Men
- ☐ Estimating
- ☐ Surveying
- ☐ Map Drafting
- ☐ Autos and Gas Engines

Name.....

Address.....

City.....State.....

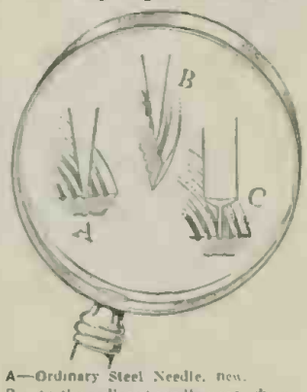
College or Home Study? State which.....

Chicago Technical College 345 Chicago "Tech" Bldg. Chicago, Ill.

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

Preserve Your Phonograph Records!



A—Ordinary Steel Needle, new.
B—As the ordinary needle wears down, owing to its taper form, it can no longer fit the record groove perfectly and has a tendency to wear the record.
C—Sonora Needle having parallel sides, ALWAYS fits record groove exactly and lengthens the record life.

THE INSTRUMENT OF QUALITY
Sonora
CLEAR AS A BELL

Semi-Permanent Silvered NEEDLES
Replace steel needles!
They play 50 to 100 times without wearing out.
Use Sonora Needles for mellower tone, greater economy, convenience and for longer record life.
Loud—Medium—Soft
30c. per card of 5
At all dealers or write
Sonora Phonograph Sales Company, Inc.
GEORGE E. BRIGHTSON, President
Executive Offices:
279 Broadway, Dept. G, New York
Use Sonora Needles on all makes of steel needle records
CAUTION! Beware of similarly constructed needles of inferior quality.

Build Your Own PHONOGRAPH,
It's Easy With Our Help
SAVE OVER HALF
A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fine profit building phonographs for your friends.
Write Today for Our Free Idea Print Offer. Agents wanted for our ready built Choraleons.
CHORALEON CO.
703 Mooger Bldg., Elkhart, Ind.



FREE

$20
Violin, Hawaiian Guitar
Ukulele, Guitar, Mandolin, Cornet or Banjo
Wonderful new system of teaching note music by mail. To first pupils in each locality, we'll give a $20 superb Violin, Mandolin, Ukulele, Guitar, Hawaiian Guitar, Cornet or Banjo absolutely free. Very small charge for lessons only expense. We guarantee success or no charge. Complete outfit free. Write at once—no obligation.
SLINGERLAND SCHOOL OF MUSIC, Dept. 422, CHICAGO, ILL.

LANGUAGES QUICKLY LEARNED ON ALL PHONOGRAPHS

"Like learning a tone—and as easy." Our Disc Records repeat the correct accent and pronunciation until you know it. Family and friends enjoy language study by the
LANGUAGE-PHONE METHOD
And Rosenthal's Practical Linguistry
War has created unlimited opportunities for those who know languages. Prepare now to better your position or increase your business. Used and recommended by educators in leading colleges. Write for booklet and Free Trial Offer.
SPANISH, FRENCH ITALIAN, C.T.C.
THE LANGUAGE PHONE METHOD
931 Putnam Building, 2 W. 45th St., N.Y.

THE ORACLE.

(*Continued from page* 800)

a sufficient number of them should be employed to take care of the comparatively heavy current of these low voltage machines. Sometimes two or three can be placed in a row on most of the small commutators. Also a very good brush for this machine, and one of the very best that the Editor of this Department has come in contact with in his extensive motor repair experience, is that having a special graftite-carbon brush body about 1½" wide by ⅜" thick, with a woven wire core or center.

WINDINGS FOR SMALL A. C. INDUCTION MOTOR.

(987) Harry Ostness, River Falls, Wis., asks:

Q. 1. The diagram herewith shows an induction motor which I wish to wind so as to operate satisfactorily on 110 volts, 60 cycles, A. C. Can you give me data for starting and running coils?

A. 1. With regard to your query concerning the rewinding of a small 12 pole A. C. induction motor, we are pleased to give you the following sugestions on your problem:

To start with you might try winding each of the stator poles with a coil composed of four layers of No. 20 D. C. C. magnet wire. These coils are best wound on a form in a small winding jig or in the lathe, and tied by means of four springs, one in each corner of the form so as to hold the coil in shape. In repair shop practise, these coils are sometimes wound on a form in the manner mentioned, and afterward taped with white cotton or linen tape, using narrow tape in this instance, or if only a wide tape can be obtained, then this should be split. The coils may be given a coat of black asphaltum, but in most cases a piece of *fish paper* is placed around the pole-piece and the coil then placed over this, and after all the coils are in place, the windings are treated with a liberal coat of orange shellac. All of these *running* coils should be connected to give alternate north and south poles.

Regarding the *starting* coils, these may be composed of about 20 turns of No. 26 D. C. C. magnet wire, wound on a form so as to slip over one side of the pole-face. Then all coils are connected up in series to give alternate north and south poles. It may be said that the running coils and the starting coils are connected up in two circuits; the starting coils being invariably provided with an automatic centrifugal switch mounted on the shaft of the rotor so as to open the circuit as soon as the motor has attained synchronous speed.

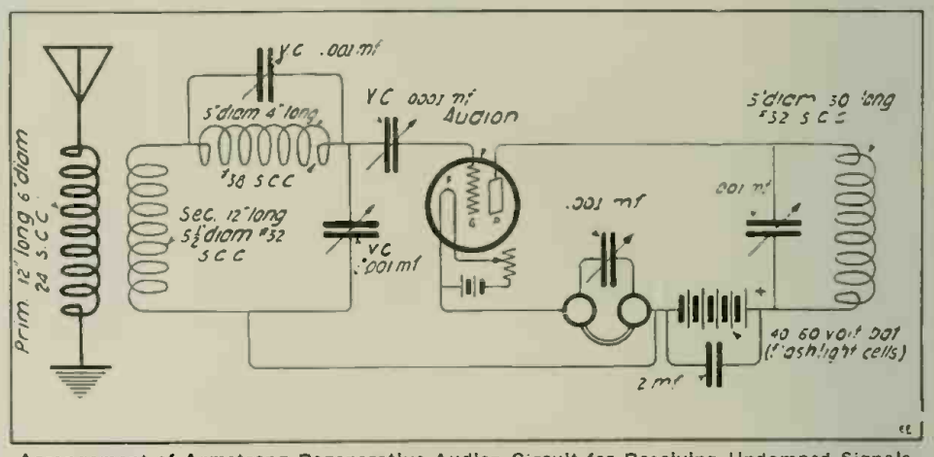
In this conection, we believe you will do very well to try the copper or brass *shading plates* which are also extensively employed. These are used on a number of the commercial A. C. induction motors below ¼ h.p. in size. They are about ⅛" thick and have a slot in them so as to fit over the half-projection of the pole shoe. One or two laminations on either side of the pole shoe are then bent over and hammered down to retain the plate in position. The rotor will revolve in the direction of the plates; to reverse the direction of the rotor, the plates should be placed on the other half-projection of the pole shoe so as to face in the opposite direction, or else the stator frame should be reversed in position. All of the shading plates, of course, must be placed on the same relative side of the stator poles in any case. To reverse the direction of a motor supplied with a starting winding instead of shading plates, the leads connecting this circuit to the 110 volt supply are reversed.

THE ARMSTRONG AUDION CIRCUIT.

(988) John M. Burrell, Pittsburgh, Pa., asks for:

Q. 1. Data on condensers, inductances, etc., for the "Armstrong" regenerative audion circuit.

A. 1. Herewith is a typical Armstrong regenerative receiving circuit. As all dimensions are given in the diagram, we deem it unnecessary to go into further details.



Arrangement of Armstrong Regenerative Audion Circuit for Receiving Undamped Signals. The Dimensions of Inductances and Capacities Are Given in the Figure.

ARC WELDING QUERIES.

(989) Wm. S.——, Torrington, Conn., writes:

Q. 1. Can arc welding be done with regular city lighting circuit of 110 volts A. C. rectified to D. C.? Would common iron wire resistance be sufficient or would a special low voltage transformer be necessary?

Q. 2. Can oxygen be produced by the electrolysis of water by 110 volt D. C.? Would a solution of acid be necessary to act as a conductor? Would the oxygen be pure enough to use for welding, brazing or burning out carbon in motors? Could any useful amount be had?

A. 1. Concerning arc welding you will find very valuable information on this work contained in a recent paper by Mr. Horner on the electric welding of steel ships read before the Philadelphia Section of the American Institute of Electrical Engineers. Copy of this paper can be obtained by mentioning the subject and the author, and writing to the Secretary, Mr. F. L. Hutchinson, A. I. E. E., 33 W. 39th Street, New York City.

Also you will find a very good article on this subject in the December issue of the ELECTRICAL EXPERIMENTER. A typical arc welding outfit is illustrated and described therein, including A. C. motor and D. C.

(*Continued on page* 804)

www.americanradiohistory.com

"Humanize" Your Talking Machine



If you have been using an ordinary reproducer on your phonograph or talking machine, you have been missing the *real* music. You have failed to hear the beautiful overtones which musicians listen for—you have heard but a poor imitation of the composition as originally played or sung by the artist. The true tone coloring is not—*can not be*—faithfully reproduced by ordinary reproducers.

It took ten years of hard study and constant experimenting to develop and perfect the *one* reproducer that *does faithfully* bring to life all there is in the record. It is called the

Ellis "Music-Master" Reproducer

Now being used by thousands of music-lover owners of talking machines—and every one of them enthusiastic in praise of its wonderful merits

Below we reproduce just a few of the thousands of unsolicited testimonial letters we have received. Read them—they are more convincing than anything we could tell you.

What Satisfied Users Say

MR. J. H. ELLIS,
Milwaukee, Wis.
My Dear Mr. Ellis:—
It is delightful to listen to records played with your "Music-Master" Reproducer; it brings out certain niceties and details I bad decided could not be recorded or else not reproduced.
Your reproducer certainly is a marvel.
Last week when Galli Curci sang here with the Chicago Opera Company it was necessary for me to explain to one of my advanced students that it was not Galli Curci, in person, singing in your laboratory next to our "Studios" but one of her records played with your "Music-Master" reproducer.
This proves that the little invention speaks for itself which should be very gratifying to you.
Wishing you success, I remain,
Very truly yours.
FLEETWOOD A. DIEFENTHAELER, *Director.*

A Chicago customer says—
"Your latest Ellis "Music-Master" Reproducer reached me several days ago and I have tried it out in every shape and form and it is simply a revelation, a wonder, a thing of beauty and a joy forever. I am delighted beyond my fondest dreams. I tried one of Caruso's hardest records with the loud steel needle, also my hardest band records and never a blur or discordant note.
"I spend my spare time enjoying the marvels of the "Music-Master" and the longer I use it the harder it is to stop. We have never enjoyed our records as completely."

One enthusiastic user says—
"There is more music in my records than I imagined possible until I discovered it by means of your Reproducer."

Another user says—
"The "Music-Master" Reproducer brings out the musical and tone coloring true to Life."

And another—
"The reproduction of the human voice is wonderful and the rendition of violin as true to the artist's performance as when making the record even to the down touch of the bow."

Still another says—
"I would not sell my Ellis "Music-Master" for a thousand dollars unless I first got another equally good."

J. H. ELLIS, ***Patentee and Manufacturer***
P. O. Box 882 MILWAUKEE. WIS.

You must hear the "Music-Master" to appreciate its great merit

Words cannot convey to you an adequate idea of how much this wonderful little device will do to improve the playing of records. You must see it—hear it—compare the effect with any and all other reproducers you know of; then you will understand why every music-lover owner of a phonograph who hears the "Music-Master" Reproducer wants to own one.

For all machines—
Plays all Records

No matter what style, size or make of talking machine you have if it uses disc records you can use the Ellis "Music-Master" and enjoy the *real* music. The "Music-Master" is easily put on any machine—it does not harm the records; in fact it prolongs their life, because it is much lighter in weight than other reproducers.

Write Today for Full Details

Fill out and mail the coupon below. If you will also enclose 10c in stamps, I will send you a valuable little booklet entitled "Pointers on the Care of Talking Machines and Records." But, send the coupon for full details about the "Music-Master" Reproducer whether or not you wish the booklet.

MAIL THIS COUPON NOW!

J. H. ELLIS,
P. O. Box 882, Milwaukee, Wis.

☐ Please send me full information about the Ellis "Music-Master" Reproducer.

☐ I enclose 10c in stamps. Please send me your booklet "Pointers on the care of Talking Machines and Records."

Name .....

Address .....

City .....State .....

www.americanradiohistory.com

If You Need Training Read This Guarantee

We guarantee at any time during the first year of your enrollment to refund the entire amount paid if immediately upon the completion of 10 examinations you notify the school you are not satisfied with the Course

SOUNDS convincing, doesn't it? Better still, it means if we make good, YOU MUST. More than that, it show's we're confident in our ability to fit you for the Big Job—and the pay you'd like to get. If you want to succeed, but are handicapped by the lack of training, NOW is the time to make us MAKE GOOD. We can't come to you—but the Coupon below will bring us together in such a way that you can't lose a cent. We're ready to make good. YOU CAN IF YOU WANT TO.

NO STRING TO OUR OFFER

There's no quibbling about the American School guarantee. *You're either satisfied or you are not.* After the tenth examination, if you feel that you are not getting practical, money-making instruction, **knowledge you can cash in on,** simply notify us you are not satisfied with the Course and you are not out one cent. We accept students on no other basis but that of satisfaction or money back.

IT'S YOUR MOVE

You've read our Guarantee—you know that training will pave the way for promotion and better pay—you know you can't hope to really get anywhere without specialized instruction—so why not GET IT? The first move for a bigger and better future is to check and mail the Coupon. We'll promptly mail you Free Bulletin and full details of Money-Back Guarantee.

AMERICAN SCHOOL
OF CORRESPONDENCE
Dept. G7443 CHICAGO, U. S. A.

TRAINING THE KEY TO SUCCESS
Explain how I can qualify for the position checked. ASC

....High School Course	....Shop Superintendent
....Electrical Engineer	....Lawyer
....Telephone Engineer	....Business Manager
....Architect	....Auditor
....Draftsman and Designer	....Certified Public Accountant
....Building Contractor	....Stenographer
....Structural Engineer	....Bookkeeper
....Mechanical Engineer	....Fire Insurance Adjuster
....Civil Engineer	....Sanitary Engineer
....Steam Engineer	....Automobile Engineer

Name .....

Address .....

ELECTRICAL ENGINEERING IN ONE YEAR

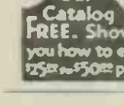
training again open to civilians. Over 3000 men trained for electrical industries in experience of more than a quarter of a century. For men of ambition and limited time. Condensed course in Electrical enables graduates to secure good positions and promotions. Theoretical and Practical Electricity, Mathematics, Steam and Gas Engines, Mechanical Drawing. Students construct dynamos, install wiring and test electrical machinery. Course with diploma, complete.



Thoroughly equipped fireproof dormitories, dining hall, laboratories, shops. Write for catalog. 27th year opens October 1, 1919

BLISS ELECTRICAL SCHOOL
260 Takoma Avenue, Washington, D. C.

GO INTO MOVING PICTURE BUSINESS



Small Capital Starts You

Our Catalog FREE. Shows you how to earn $25 to $50 per day

on our easy payment plan. Begin now and get your share. We sell everything. Write today.

Atlas Moving Picture Co.
Dept. 49 538 S. Dearborn St. Chicago

THE ORACLE.

(*Continued from page* 802)

generator, as well as regulating inductances for controlling the arc voltage, which is about sixty to seventy volts usually.

A. 2. With reference to producing electrolytic oxygen from water, would advise that this is done right along commercially, and full information as to the apparatus used may be obtained by communicating with the International Oxygen Company, New York City.

This method of producing oxygen (as well as hydrogen) by passing a direct current thru vats containing water is used in the Army Balloon Corps; the lighter or hydrogen gas being used in this case for filling the balloons while the oxygen is used for oxy-acetylene welding outfits, flame throwers, etc.

The method of producing the gas consists in increasing the conductivity of the water by adding sodium bicarbonat or sulfuric acid, and a series of multiple and alternately charged, perforated metal plates are immersed in the water, one set of plates being positive and the other negative. Hydrogen gas collects at the cathode or negative pole, and oxygen gas at the anode or positive pole. You would do well in this connection to look up any chemistry book and also refer to some of the back lessons of the "Experimental Chemistry" course publisht monthly in the ELECTRICAL EXPERIMENTER, where this electrolytic apparatus has been described.

The production of the two gases causes the decomposition of the water into its constituent elements due to the passage of current thru the water. The large electrolytic generator used at the Army Balloon School at Fort Omaha, uses bicarbonate of soda. The weight of the oxygen gas liberated by a certain quantity of electricity will be about eight times that of the hydrogen gas, but the oxygen gas will occupy only one-half the space that the hydrogen gas occupies, since a given volume of hydrogen gas is approximately one-sixteenth as heavy as the same volume of oxygen gas, and as a result the volume of gas collected in the negative electrode chamber will be practically twice the volume of gas collected in the positive electrode chamber.



THE MAINTENANCE OF WIRELESS TELEGRAPH APPARATUS, by Percy W. Harris. Cloth bound, pocket size, 4¾ inches by 7¼ inches. 127 pages, illustrated. Publisht by The Wireless Press, Ltd., London. Price 90 cents.

A handy pocket manual primarily intended for the radio operator aboard ship who usually handles Marconi equipment and as such it serves its purpose. Much of the material has been covered in many other previous works on this subject so that a partial list of the contents will serve to give an idea of the ground covered. General information, such as the care of the wireless cabin, taking over the apparatus, inspections, etc. Preparing installations for laying up, transmitting apparatus, marine switchboards and their care, motor starters, converters, keys, transformers, condensers, disc dischargers, receiving apparatus, the care of the same, also the replacing of parts, the aerial and its fittings, the lead-in and the care of insulators.

A very complete chapter on the storage battery is included, which explains how to take care of the battery while in actual use, also some remarks on storing away the battery if it is to be taken out of service for any length of time. A brief concluding chapter treats on the Marconi wavemeter and its adaption to the measurements aboard ship, such as the wave length of the transmitted and incoming wave lengths.

This book is very brief in its explanations and presupposes on the part of the reader a previous knowledge of the theory of radio circuits and apparatus. Similar books have appeared on this side of the Atlantic which have been much broader in scope so far as the commercial ship radio equipment is concerned at any rate.

MODERN WIRING DIAGRAMS AND DESCRIPTIONS FOR ELECTRICAL WORKERS. by Horstmann & Tousley. 298 pages, 207 illustrations, size 6¾ x 4½ inches. Cloth bound $1.00, leather bound $1.50. Publisht by Frederick J. Drake & Company, Chicago, Ill.

This work forms a tried and true friend of the electrician and wireman. There are over two hundred diagrams of electrical apparatus covering every conceivable device with which the every-day electrician will come in contact with and be called upon to connect up, including diagrams and connections for various types of bell and telephone circuits, including the inter-communicating system so widely used in residences and offices. One section deals with connections of telegraph instruments and diagrams are given showing the connections for the electrical writing instrument known as the "Telautograph." Other sections deal with the connections of X-ray and gas lighting apparatus, primary batteries, storage cells, locating faults on circuits, electric lighting circuits and arrangements for two and three-way switching, house and office building wiring, theater lighting, etc., etc.

Other descriptive chapters, together with complete wiring connections, are given covering arc lamps, the Nernst lamp, the Cooper-Hewitt lamp, etc. Recording wattmeter hook-ups are given as well as "demand meters"; diagrams, also circuits for shunt and compound-wound motors, automatic starters, drum controller connections, street car hook-ups, electric automobile circuits, direct current and alternating current dynamo and switchboard connections, the action and connection of motor-generator compensators, transformers, switchboards, ground detectors, storage battery charging panels—with and without boosters, testing of circuit troubles and the use of the Wheatstone bridge, wiring tables giving the size of wire for various loads and circuit runs, et cetera. The closing chapter treats on electric signs, flashers and display lighting.

THE BOY'S BOOK OF SUBMARINES, by A. Frederick Collins. Cloth covers, illustrated, 220 pages, size 5 x 7½ inches. Publisht by Frederick A. Stokes Company, New York. Price $1.35.

A most interesting exploring trip into the How and Why of the submarine in plain everyday language that we may all read and understand. The important part played by this work is that it gives the uninitiated a clear and comprehensive digest of just how the "terror of the seas" operates and functions.

From the theory to the completed submarine each detail is carefully explained as the following list of contents shows.

The First of the Submarines—How to Make and Work a Model Submarine—How a real Submarine is Made and Works—The Heart of the Submarine—Making and Shooting the Torpedo—Making the Submarine Deadlier—The Wonderful "Eye" of the Submarine—The Marvelous Tongue and Ears of the Submarine—The Crew of the Submarine—How the Submarine Attacks—The New Submarine Chasers, the Last Word in Submarines.

The chapter devoted to the periscope is very thoro and clearly illustrates the principle on which it works. Directions are given for the construction of a model periscope much on the line of those in practical use.

Methods of signaling play an important part in the successful operations of the under-sea boat and these various means are given a great deal of attention. Particularly we might mention Radio—Semaphore—The Submarine Bell—and the conductivity or under-water "Wircless" which operates on a system of copper plates—induction coils, phones and a current source.

It is a very neat volume and the author has evidently done his best to enable the layman and experimenting youngster to grasp the mysteries of the U-Boat. Deserving of mention is the chapter on how to construct a real live working model that will make all these principles clear.

MILITARY SIGNAL CORPS MANUAL, by J. Andrew White. Cloth bound. 562 pages, 260 illustrations, size 5 x 7½ inches. Publisht by Wireless Press, Inc., New York. 1918. Price $1.50.

An interesting and practical volume which has undoubtedly been of great aid to all Signal Corps men during the war and which will find a place in peacetime activities of the Army.

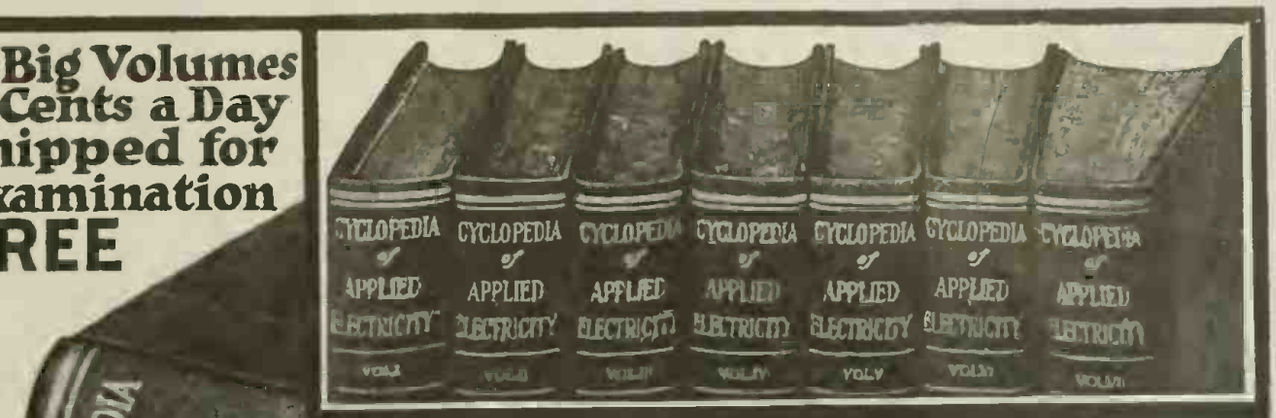
Each and every detail, such as personnel, organization, drill instruction, various components of the different branches of a corps are described fully so that a beginner has a wealth of information at hand. Nothing is too small to escape mention, nothing is omitted.

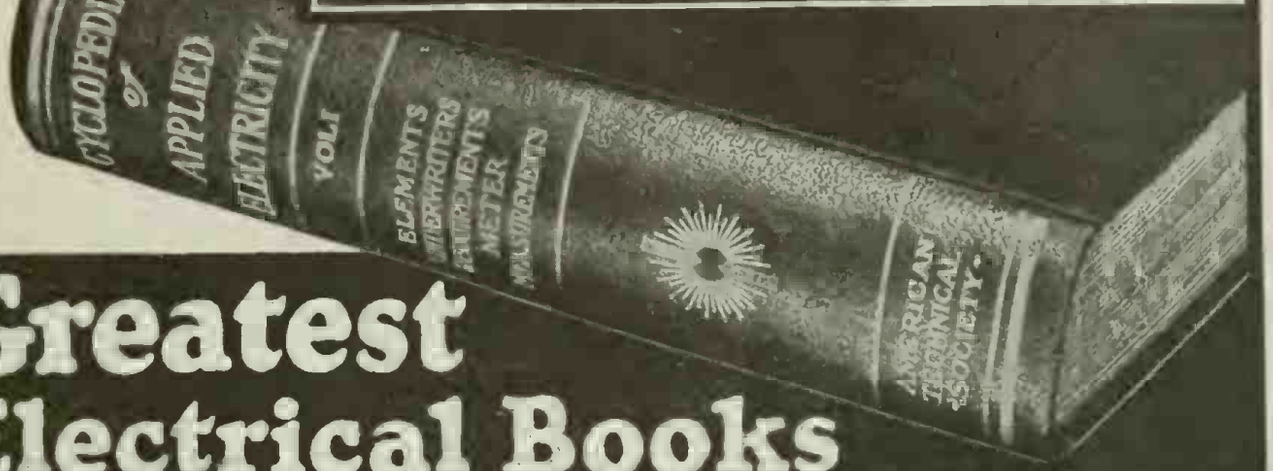
A partial list of the contents will serve to give the scope of this work—The Signal Corps' relation to the line of the Army—Aircraft—Government and Administration—Commands and Signals—Physical Training—Instruction with Arms—The Company Mounted and Dismounted—Field Signal Troops—The Wire Company—The Radio Company—Telegraph Company—Reviews—Inspection—Manual of the Saber. A most complete chapter is devoted to technical instruction and apparatus, covering fundamentals of electro-magnetism, bat-

(*Continued on page* 829)

www.americanradiohistory.com

7 Big Volumes 7 Cents a Day Shipped for Examination FREE





Greatest Electrical Books Now Brought to Your Home!

Partial Contents

Vol. I. *Elements of Electricity:* Magnets--Electromagnets. The Electric Current: Resistance--Underwriters Requirements--Power Stations and Equipments--Outside Wiring--High Tension--Special Installations--*Electrical Measurements:* Instruments--Measuring Methods: Resistance Insulation--Distribution Systems--Watt-Hour Meters: Construction, Installation, Testing.

Vol. II. *Dynamo Electric Machinery:* Magneto Electric Induction--Generators--Construction--Practical Design. *Types of Generators and Motors:* Direct and Alternating Generators and Motors. Motor Generators--Induction Motors.

Vol. III. *Direct Current Motors:* Efficiency--Torque--Speed--Power--Multi-Voltage Systems. *Management of Dynamos and Motors:* D. C. and A. C. Plants--*Lighting:* Incandescent Lamps--Tungsten Lamps--Nitrogen Filled and Mercury Vapor--Arc Lamps--Residence--Photometry.

Vol. IV. *Alternating Current Machinery:* Simple Alternator--Instruments--Polyphase Systems--Armature Windings--Transformers--Rectifiers--Motor Generators.

Vol. V. *Power Transmission:* Conductors--Distributing Systems--Voltage Regulation--Underground Construction--*Electric Railways:* Car Equipment--Maintenance--Power Plants--Signal Systems.

Vol. VI. *Power Stations:* Plant Location--Electrical Equipment--*Switchboards:* Wiring Diagrams of Connections--Switchboard Apparatus. *Storage Batteries:* Types--Charging and Discharging--Troubles and Remedies--Small Battery installations. *Applied Electrochemistry:* Metal Refining and Plating--Chemicals--Electric Furnaces--High Tension Work.

Vol. VII. *Modern Land Telegraphy. Wireless Telegraphy and Telephony. Electric Elevators. Electric Heating. Welding.*

Note:--This is but a partial list of contents. The set contains every electrical subject known!

7 Big Volumes—Written by 27 Great Authorities—Yours for 7 Cents a Day

THE hardest way to learn Electricity is through your *own experience.* The *easiest* way to learn is through the experience that *others have paid for in time and money.* Here in practical, easy-to-understand form, you get the benefit of what *27 greatest electrical* authorities in America and all over the world have learned, and you get this vast fund of experience in convenient book form, so that you can read and study in your own home in your spare time.

This is the greatest opportunity of your life to become an electrical engineer, sub-station operator, dynamo tender, or to get any one of the other big-pay jobs in the electrical field. For less than you spend for tobacco or movies, you can train yourself to step up to the jobs paying $2,500 to $5,000 a year.

Shipped on Free Examination

No Money in Advance

Just glance at the partial list of contents of these 7 volumes in the panel at the left. Think how much there is for you in this great home-study library of electricity. Then write at once for the books themselves. Examine them in your own home for a week. Send them back if you are not satisfied. But if you decide to own this pay-raising set, send only $2 and then only $2 a month until the special half price is paid. Examine the books—see how they take you through every detail of each special branch of electricity. See how they give you all the necessary tables and formulas in simple, untechnical form. Note the frequent test questions which enable you to *examine yourself.* Note the 2,600 illustrations, full page plates, diagrams, etc. You be the judge of their value to you!

HALF PRICE—NOW

For a limited time we are offering this remarkable self instructor Electrical library at half price. Regular price $35—special price $19.80 on easy terms of only 7 cents a day. With each set we include a year's Consulting Service Membership free—worth $12. The 7 volumes contain 3,000 pages, each 7 x 10 inches, bound in American Morocco, Gold Stamped.

Mail Coupon—Send No Money

If you are interested in electricity you need these books. You will prize them for the new, up-to-date information they give you on every phase of electrical work. We ship the 7 volumes right to your home on your simple request. Send no money until you *are satisfied* after 7 days free examination. Put your name and address on the coupon now and send at once before this offer is withdrawn.

AMERICAN TECHNICAL SOCIETY
Dept. E3383, Chicago, U. S. A.

Mail This Coupon Now

AMERICAN TECHNICAL SOCIETY
Dept. E3383, Chicago, U. S. A.

Please send Cyclopedia of Applied Electricity for seven days' examination. I to pay shipping charges. I will send $2 within seven days and $2 a month until I have paid $19.80 or notify you and hold the books subject to your order. Title not to pass until fully paid.

Name .....

Address .....

Reference .....

www.americanradiohistory.com

Let Me train YOU in AVIATION



Captain George Fredrick Campbell, Formerly Third Ace of the Royal Flying Corps. Chief Instructor National Aero Institute

This is the real game for the He-Man, the fellow with the red blood in his veins. Aviation has been the dominant factor in war and will be the greatest industry in peace. The young man who masters this profession may be one of the pilots of the

AIRPLANE FAST MAIL

between Chicago and New York! One hundred and fifty miles an hour and better! The country demands trained men for work in the air and on the ground.

LET ME TRAIN YOU

for one of these big paying jobs. Two airplane concerns agree to take our Mechanics, Engineers, Inspectors, etc. Why don't you decide right now to take my

Home Course in Aviation under my direction. I will give you the inside facts about this great industry. Send today for our **FREE BOOK** and I will write you a personal letter along with it. Address as follows:

CAPT. GEO. F. CAMPBELL. Chief Instructor, National Aero Institute. Dept. 7443. Morton Building, Chicago, Ill.

---Fill out this Coupon and mail To-day---

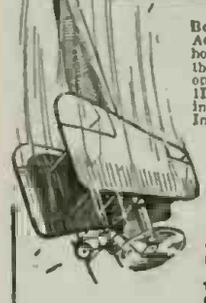
Capt. George F. Campbell, Chief Instructor.
National Aero Institute. Dept. 7443. Morton Building. Chicago, Ill.

Dear Sir: Please send me absolutely free and prepaid your book on the Science of Aviation, and full particulars of your mail course in the Principles of Aviation.

Name .....

Address .....

BOYS Build and Fly Your Own Training Plane



Train yourself in Aviation. Be an Amateur Aviator with an Aeroplane of your own. Learn how Aeroplanes are built; learn the principles of construction, operation and control. We sell IDEAL Accurate Scale Drawings, and Building and Flying Instructions which show you how to build a perfect Model Aeroplane, 3 ft. size, that will rise from the ground by its own power and fly like a big one. Send now for the Drawings and Instructions for the one you want to build.

Drawings and Instructions for
Curtiss Military Tractor
Biariot Monoplane
Nieuport Monoplane
Taube Mooplane
Curtiss Flying Boat
Wright Biplane
Cecil Peoli Racer
25c EACH
Set of Seven $1.50 postpaid

Ideal Model Aeroplane Catalog 5c—None Free
Tells about Model Aeroplanes, Racing Aeroplanes, Flying Toys, and parts and supplies to build them with. 48 pages. Sent only upon receipt of 5 cents.
IDEAL AEROPLANE & SUPPLY COMPANY
76-82 West Broadway New York City

35 MILES PER HOUR

Is Record Of This Car

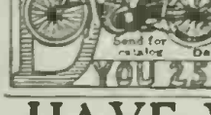


Built by a boy from Junior parts furnished by us. Any boy can build this car. Parts very cheap. Send 26 cents for blue prints and price list of parts showing how to build this speedy little car.

SYPHER MFG. CO.
158 Warren Street
TOLEDO, OHIO.

DENINGER WILL SAVE

$40 **BIG MONEY SAVINGS FOR YOU**



Used and rebuilt motorcycles, single and twins, $25 to $100. Used bicycles, $5.00; tandems, $10. All machines guaranteed in good working order. New bicycles and motorcycles at Factory prices. You save dealers' profits. Motorcycle and automobile tires too, $3.00. Complete line of parts and supplies.

Send for catalog Deninger Cycle Co., Rochester, N.Y.

YOU 25 TO 50 DOLLARS

HAVE *You* SENT

for our booklet No. 4, giving diagrams and experiments with the Steco Button? See our large ad. pg. 822
STECO. 2118-2136 N. Clark St., Chicago, Ill.

Experimental Physics

(*Continued from page* 785)

back and forth. A sulfur bead for insulation such as F, in figure 98, is best made as follows:

Heat a small quantity of stick sulfur in a clean evaporating dish until the sulfur melts. When it becomes a clear liquid amber in color, dip the end of the rod G into it. Withdraw the rod and allow the sulfur to harden. Repeat this operation until the bead has grown to the desired size.

Experiment 110.

In conducting experiments with the electroscope all parts except the gold leaf system should be connected with the earth; since any part insulated is likely to become charged slightly and owing to the extreme sensitivity of the instrument, the gold leaf system would thereby be disturbed.

We will now proceed with the fundamental experiment of charging and discharging the electroscope. Rub an ebonite rod or ordinary fountain pen with cat's fur or flannel or your coat sleeve (or a glass rod with silk.) Bring this charged rod in contact with bent rod B, at the same time turning B so that it touches the rod G. Now by means of the charged rod charge will travel thru the conductor B to G and therefore G and the gold leaf, having the same charge, will repel each other. Since the rod G is rigidly fastened and the leaf H is not, H will spring away from G. Now by means of the charged rod bend rod C away to position of figure 99-B. Since G and H are insulated from the rest of the electroscope the charge cannot leave and the electroscope is now *charged*. To *discharge* touch the finger to the bent rod and bring the rod into contact with the gold leaf system H-G. The charge will pass to the finger and thru the body to the earth.

Experiment 111.

After the electroscope has been charged and allowed to stand awhile we find that it loses its charge slowly but surely. The rate at which the charge is lost, is called the *natural* leak of the electroscope. To measure the natural leak, set up a telescope pointing at the window of the electroscope as in figure 100-A. A paper scale may be attached in the electroscope behind the gold leaf system so that the field of view of the telescope, will appear as in figure 100-B. Take readings of the telescope at equal intervals of time and the average will give a good approximation of the natural leak.

Experiment 112.

We cannot determine the presence of radio-active substances in a compound or mixture by chemical means, because these substances are found in such small quantities. We may, however, detect their presence as Becquerel did by the use of the photographic plate or by the use of the electroscope, by which method Madame Curie discovered Radium. (See Experiment No. 108). Let us recall the passage of electricity thru a liquid. The liquid ionizes and we call it an *Electrolyte*. In a similar manner, a gas ionizes, the velocity of the ions in the gas being tremendously greater than that of the ions in the electrolyte. This explains the natural leak of the electroscope, i. e., the air is somewhat ionized, depending upon atmospheric and other conditions.

Place the electroscope near the stove or radiator. We find that the natural leak of the electroscope is the same, i. e., heat does not cause any additional ionization of the air. If however a Bunsen flame is placed

(*Continued on page* 808)

TABLE 102.

Uranium-Radium Series.

Substance	Kind of Radiation	Period of Half Decay
Uranium 1	α	5,000,000,000 years
Uranium 2	α	200,000 years
Uranium x	β, γ	24 3/5 days
(Uranium y)	β	1¼ days
Ionium	α	200,000 years
Radium	α, β	2,000 years
Radium Emanation	α	3¾ days
Radium A	α	3 minutes
Radium B	β, γ	26¾ minutes
Radium C_1	α, β, γ	19½ minutes
(Radium C_2)	β	1.4 minutes
Radium D	β	16½ years
Radium E	β, γ	5 days
Radium F (Polonium)	α	136 days

Thorium Series.

Thorium	α	13,000,000,000 years
Mesothorium 1	rayless	5½ years
Mesothorium 2	β, γ	6½ hours
Radiothorium	α	737 days
Thorium x	α	3¾ days
Thorium Emanation	α	53 seconds
Thorium A	α	1/7 second
Thorium B	β	10 3/5 hours
Thorium C_1	α, β	60 minutes
(Thorium C_2)	α	very short
Thorium D	β, γ	3 1/10 minutes

Actinium Series.

Actinium	rayless	unknown
Radio-Actinium	α, β	19½ days
Actinium x	α, β	10½ days
Actinium Emanation	α	3 9/10 seconds
Actinium A	α	2/1000 second
Actinium B	β	36 3/10 seconds
Actinium C	α	2 5/100 minutes
Actinium D	β, γ	4¾ minutes

www.americanradiohistory.com

The Man Who *Wouldn't* Stay Down



He was putting in long hours at monotonous unskilled work. His small pay scarcely lasted from one week to the next. Pleasures were few and far between and he couldn't save a cent.

He was down—but he *wouldn't stay there!* He saw other men promoted, and he made up his mind that what they could do *he* could do. Then he found the *reason* they were promoted was because they had special training—an expert knowledge of some one line. So he made up his mind that *he* would get that kind of training.

He marked and mailed to Scranton a coupon like the one below. That was his first step upward. It brought him just the information he was looking for. He found he could get the training he needed right at home in the hours after supper. From that time on he spent part of his spare time studying.

The first reward was not long in coming—an increase in salary. Then came another. Then he was made Foreman. Now he is Superintendent with an income that means independence and all the comforts and pleasures that make life worth living.

It just shows what a man with ambition can do. And this man is only one out of hundreds of thousands who have climbed the same steps to success with the help of the International Correspondence Schools.

What about *you?*

Are you satisfied merely to hang on where you are or would you, too, like to have a real job and real money? It's entirely up to you. You don't *have* to stay down. You *can* climb to the position you want in the work you like best. Yes, you can! The I. C. S. is ready and anxious to come to you, wherever you are, with the very help you need.

Surely when you have an opportunity that means so much, you can't afford to let another priceless hour pass without at least finding out about it. And the way to do that is easy—without cost, without obligating yourself in any way, mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6178, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ ELECTRICAL ENGINEER
- ☐ Electrician
- ☐ Electric Wiring
- ☐ Electric Lighting
- ☐ Electric Car Running
- ☐ Heavy Electric Traction
- ☐ Electrical Draftsman
- ☐ Electric Machine Designer
- ☐ Telegraph Expert
- ☐ Practical Telephony
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Toolmaker
- ☐ Machine Shop Practice
- ☐ Gas Engineer
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MINE FOREMAN OR ENGINEER
- ☐ ARCHITECT
- ☐ Architectural Draftsman
- ☐ PLUMBING AND HEATING
- ☐ Sheet Metal Worker
- ☐ Ship Draftsman
- ☐ CHEMICAL ENGINEER
- ☐ SALESMANSHIP
- ☐ ADVERTISING MAN
- ☐ Show Card Writer
- ☐ Outdoor Sign Painter
- ☐ RAILROADER
- ☐ ILLUSTRATOR
- ☐ DESIGNER
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Public Accountant
- ☐ Traffic Management
- ☐ Commercial Law
- ☐ GOOD ENGLISH
- ☐ Common School Subjects
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ STATIONARY ENGINEER
- ☐ Textile Overseer or Supt.
- ☐ AGRICULTURE
- ☐ Navigator
- ☐ Poultry Raising
- ☐ AUTOMOBILES
- ☐ Spanish
- ☐ French
- ☐ Italian

Name _____
Occupation & Employer _____
Street and No. _____
City _____ State _____

www.americanradiohistory.com

Big Money for Boys!



Learn ELECTRICITY

There is a wonderful opportunity right now for boys who like electricity. Boys who are ambitious and will train themselves in spare time can step into positions just as soon as they are ready. Good salaries are offered to start with splendid chances for rapid promotion.

For 27 years the International Correspondence Schools have been training boys for success in electricity and over 200 other subjects. They will help you prepare right at home for a position in the line of electrical work you like best—or in any other work that appeals to you. Thousands of boys, through I. C. S. training, have stepped into fine jobs, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least, and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6179, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

ELECTRICAL ENGINEER	CHEMICAL ENGINEER
Electrician	SALESMANSHIP
Electric Wiring	ADVERTISING MAN
Electric Lighting	Window Trimmer
Electric Car Running	Show Card Writer
Heavy Electric Traction	Outdoor Sign Painter
Electrical Draftsman	RAILROADER
Electric Machine Designer	ILLUSTRATOR
Telegraph Expert	DESIGNER
Practical Telephony	BOOKKEEPER
MECHANICAL ENGINEER	Stenographer and Typist
Mechanical Draftsman	Cert. Pub. Accountant
Ship Draftsman	Traffic Management
Machine Shop Practice	Commercial Law
Toolmaker	GOOD ENGLISH
Gas Engineer	STATIONARY ENGINEER
CIVIL ENGINEER	CIVIL SERVICE
Surveying and Mapping	Railway Mail Clerk
MINE FOREMAN OR ENG'R	Textile Overseer or Supt.
ARCHITECT	AGRICULTURE
Architectural Draftsman	Navigator / Spanish
PLUMBING AND HEATING	Poultry Raising / French
Sheet Metal Worker	Automobiles / Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____

30 DAYS FREE TRIAL



and *freight prepaid* on a new 1919 "RANGER" bicycle. Write at once for our *big catalog* and *special offers*. Take your choice from 44 styles, colors and sizes in the famous "RANGER" line.

Marvelous improvements. Extraordinary values in our 1919 price offers. You cannot *afford to buy* without getting our *latest propositions* and Factory-to-Rider prices.

Boys, be a "Rider Agent" and make big money taking orders for bicycles and supplies. Get our *liberal terms* on a sample to introduce the new "RANGER".

TIRES, equipment, sundries and everything in the bicycle line at *half usual prices*. *Write Today.*

Ranger Electric Lighted Motorbike

MEAD CYCLE COMPANY Dept. O-107 Chicago



RAISE BELGIAN HARES For U.S.

HUGE PROFITS easily and pleasantly made. We furnish stock and pay you $6.00 a pair and express charges for all you raise. Contract and book "Fortunes in Hares", by mail Free.

NATIONAL FOOD & FUR ASSOCIATION
Dept. 116 MILWAUKEE, WISC.

EXPERIMENTAL PHYSICS.

(*Continued from page 806*)

near the electroscope, we find that the electroscope discharges rapidly. The Bunsen flame ionizes the air very rapidly. A small quantity of radio-active material will discharge the electroscope very rapidly, showing that *radio-active materials have the ability to IONIZE the air.* The larger the amount of radio-active material the faster the rate of discharge of the electroscope. A pinch of Uranium Oxid in the electroscope chamber, will ionize the air so rapidly that the leaf will fall practically instantaneously!

Experiment 113.

A third test for the presence of most radio-active substances is the *"Fluorescence Effect"*—which some of them have upon certain compounds, especially *Zinc Sulfid.* Any of the substances which give off alpha radiations (see figure 102) will cause a zinc sulfid screen to fluoresce. If the screen is observed thru a sufficiently high power magnifying lens, or microscope (say ten or fifteen diameters magnification), the continuous soft glow of the zinc sulfid seen by the naked eye becomes, on magnification, hundreds of tiny flashes of light, not unlike the sparks obtained by striking flint and steel together. Figure 101 shows the *Spinthariscope*, which can be easily made by the reader. A is small metal tube with a hole, S, in its cap. E and F are lenses. C is the fluorescent screen on the cap of tube B. D is a small particle of the radio-active substance. A practical use of the fluorescent effect of alpha particles is familiar to all of us in the *radium paints, luminous dials*, et cetera. These compounds consist of specially prepared zinc sulfid, mixed with about 2,000 parts of radium bromid, or a radio-active compound having an equivalent of alpha-ray activity. Altho the period of half decay of radium itself is approximately 2,000 years, see table 102, the luminosity of the compound falls off, due to the fact that the *zinc sulfid loses its power to luminesce*, but not because the radium gives out. Some specifications for luminous paint, as for government work, stipulate that the zinc sulfid and radio-active substance shall be mixed in such proportions that the average useful life of the paint will be from 8 to 10 years.

The discovery of radio-activity has given us a vast field for research and as a result the physicist has been able to make subatomic investigations. Atoms are constantly exploding and shoot out as fragments, the alpha and beta particles. Altho the energy liberated by these explosions is fairly large, no diminution in the weight of the radio-active substance has been detected after the liberation of the energy. J. J. Thomson computed that the disintegration of one gram of hydrogen would liberate sufficient energy to raise a million tons 300 feet. See Fig. 103. If only this energy could be trapt, and recent research shows the possibility of it, Garfield and his coal-house gang would lose their job, for who would use ten tons of coal when one gram of hydrogen would give an equivalent heating value. Table 102 gives interesting data concerning the radio-active substances. In each series the first substance gives the second on disintegration and the second the third, etc. The second column gives the kind of radiation given off by the respective substances and the last column tells how long it takes for the substance to disintegrate to half of the original amount. This half-period means that after 2,000 years, for instance, one-half of the substance in question will have disintegrated. After 4,000 years, one-half of the remainder will have disintegrated or disappeared, etc., etc. The total life of pure Radium is computed from this law to be about 22,000 years.

(*To be continued*)

HISTORIC ELECTRIC SWITCHBOARD AND DYNAMO.

(*Continued from page 778*)

field magnet type with surface wound armatures. There are quite a number of these generators still in existence in various parts of the country, and in tribute to their designer, it should be said that they perform their duty very well indeed, considering the time at which they were built, for thirty to thirty-five years in the electrical industry has, we might almost say, witnest the entire development of the whole scheme of electrical generation, transmission and utilization of power, under the directorship of such men as Edison, Thomson, Houston, Tesla, Westinghouse and Sprague.

The wooden switch-board, shown in the photograph, contains four box-type field rheostats, and it is peculiar to note that they are mounted on the face of the board instead of in the rear, as in present day practise.—*Photo by Richard Nelson.*

THE TESLA EGG OF COLUMBUS.

(*Continued from page 775*)

Tesla had other surprises for his audiences, which were even more wonderful. So, for instance, the coil on three legs, visible in the foreground, was used to operate wireless motors, lamps and other devices, and the spiral coil in the background served to show extraordinary high potential phenomena, as streamers of great length.

ULTRAVIOLET ENERGY AND ITS USE.

By M. Luckiesh, Physicist, Nela Research Laboratory.

Since the discovery of ultraviolet rays, more than a century ago, their production and properties have been subjected to a great deal of investigation. However, notwithstanding the extensive literature on the subject we must agree with Sheppard, who says in his book on Photo-chemistry:

"We are only at the beginning of the conscious utilization of the powers of light, as distinct from the unconscious enjoyment of them."

Owing to the many unique properties of these invisible rays, they are extremely valuable in certain scientific investigations, tests, and industrial processes, and it appears certain, that with the progress of the development of sources of ultraviolet rays, and of media transparent to them, the usefulness of ultraviolet energy will be rapidly extended. The problems in which these unique properties may be utilized are manifold.

As to Sources:—There are many sources of ultraviolet energy, but few are powerful enough to be widely useful. The ideal source, which emits a continuous nonbanded spectrum of high intensity thruout the entire ultraviolet region, does not exist. Some of the sources are here ranked in order: magnetite arc, old mercury arc, new mercury arc, and carbon arc.

The blue flame arc emits ultraviolet energy very strongly. It is a simple matter to construct an arc which will emit ultraviolet energy strongly, provided hand-control is satisfactory. An iron rod and a carbon rod may be employed successfully for the two poles, however two iron rods may answer the purpose very well. These poles may be kept cool effectively by means of heavy brass or copper sleeves, which may be wound along the iron rods as the latter are consumed.

Uses of Ultraviolet Rays:—Ionization of air; powerful bactericidal agent; kill germs in water; effect upon animal tissue to bronze the skin. In industrial processes such as acetylene and arc welding, which are attended by powerful ultraviolet energy, there is a demand for eye-protecting glasses.

www.americanradiohistory.com

Try It Free At Our Expense Send No Money


For the Busy Business Man


For the Ambitious Young Woman


For the Lawyer


For the Bookkeeper


For the Alert Salesman

EVIDENCE OF ITS MERIT

F. G. Cooper, famous Cartoonist of Collier's, writes: "Within a few days after receiving your set of lessons I made all the notes in my pocket note-book in Paragon Shorthand. I had no previous knowledge of any shorthand. Weeks afterward I can read my Paragon notes. It strikes me that this is quite a recommendation for your system."

SECRETARY

"Paragon Shorthand is highly satisfactory in every way. I can read my writing readily, and I write the system with perfect ease as fast as one usually talks. Only two months after I learned the first lesson I was able to write 150 words a minute."

(Miss) Dolly Sparks
Stens. to Secretary of State of Florida

WITH UNCLE SAM

"It took me one week to master Paragon. My speed in 1 month was 80 words per minute."

Bruno Bonquis, 1330 F St., N. W., Washington, D. C.

WITH RAILROAD

"While employed on the local street railway lines as conductor, with exceptionally long hours, I managed to find an hour or two each day to study Paragon Shorthand, from the lessons alone and without the aid of any teacher. At the end of two months I was writing 155 words a minute on new matter and obtained a position. I am with the above railroad company at a nice salary. Paragon is very rapid, practical and easy to read after it is written."

Harold W. Hively,
1525 Ottawa Street,
South Bend, Ind.

STENOGRAPHERS

"My sister and I learned Paragon Shorthand from the lessons alone, without any teacher. She is now stenographer to the Kuhn Irrigated Land Company, and I am with the Westinghouse Co."

(Mrs.) Clara Trick Willson,
Pittsburgh, Pa.

HON. EUGENE B. ESTES
Boston, Mass.

"From your lessons alone—the home study course—I learned the entire Paragon System of shorthand in seven days. Any person of common education can master the Paragon System and by practice acquire speed. Paragon is ahead of any other system I have ever seen."

IN HIGH SCHOOL

"I received your Paragon Shorthand Course and have mastered it all in the time you said I could, just the evenings of seven days, and the evenings were not very long as we were interesting all the time. I think it is the only thing and will recommend it to other High School Students and also friends."

Milo F. Dean,
Fairview, Mont.

Paragon is also being taught in the High Schools of Alton, Ill., Lafayette, Ind., Johnstown, Pa., Atlanta, Ga., and elsewhere.

COURT REPORTING

"I have been the Official Court Reporter for the Ninth Judicial District of Louisiana for a number of years using Paragon Shorthand exclusively. Some years ago I learned this system in seven lessons. With Paragon Shorthand I am able to do any kind of work with as great rapidity as the occasion may demand."

J. Martian Hamley
Lake Providence, La

Learn Paragon Shorthand in 7 Days

Send No Money—Just The Coupon

Sent on 7 Days FREE TRIAL

Positively at No Obligation to Yourself

You know how often you have wished that you could write shorthand. You realized what it meant to busy executives and to business beginners—in efficiency, advancement and increased earning power.

But like thousands of others you dreaded the long, weary months of study, the memory tax, the mental strain and the high cost, in time and money, of the old systems.

Now you can have your wish. Because, all that you dreaded is done away with in the Paragon Method of Shorthand. Instead of committing to memory something like 4000 word-signs and contractions, which in other systems largely depend for their meaning upon the position they occupy, you have only 26 word-signs to learn in Paragon. The entire system consists of

The Paragon Alphabet: **Six prefix contractions:**
Twenty-six simple word-signs: **One general rule for abbreviations.**

THAT IS ALL. The simple explanations and exercises are divided into seven lessons, the principles of which one can grasp in one evening. Speed will develop pleasantly as you make daily use of your quickly acquired knowledge.

This is the Paragon System. Thousands have learned the 7 lessons in 7 evenings. See for yourself how perfectly simple it is. Stop right here and study the specimen lesson shown above at the right.

Now you see how easy it must be to learn Paragon and how quickly one can equip himself with this great modern instrument of Efficiency.

Everybody Can Use Shorthand

Our records show that in addition to the thousands of young men and women who need shorthand as a help in their business careers, other thousands—business men, professional men, students, clergymen and literary folk—would like to know Paragon Shorthand as a time saving convenience. Still others—fathers and mothers—would like to give their sons and daughters this wonderful advantage in order that they may be able to be self-supporting any time it may be necessary.

Many of these persons who have not a direct need for shorthand but want it as an instrument of efficiency and a daily time saver would buy the complete course of Paragon Shorthand at a popular selling price.

A Valuable Accomplishment Quickly Learned

Thousands of young, ambitious men and women who have failed to learn the old, complicated forms of shorthand have learned Paragon with ease. They have since become court stenographers, reporters, assistants to business heads and in many cases executives of prominent concerns and institutions. Thousands of grateful letters now in our files attest these facts. Those printed at the left are typical.

MORE EVIDENCE OF ITS MERIT

J. A. Wm. Wiersig, Principal of Luth. Evang. School, Brighton, Col., writes:

"Your system is, indeed, a short and simple one. I mastered it in less than five hours. I am now ready to practice for speed. Your system certainly deserves being advertised, and I shall certainly do my share when opportunity offers."

Try This Lesson Now

Take the ordinary longhand letter *d*. Eliminate everything but the long downstroke and there will remain /. This is the Paragon symbol for D. It is always written downward.

From the longhand letter *e* rub out everything except the upper part—the circle—and you will have the Paragon E o

Write this circle at the beginning of / and you will have Ed /

By letting the circle remain open it will be a hook, and this hook stands for A. Thus / will be Ad. Add another A at the end thus / and you will have a girl's name, Ada.

From *o* eliminate the initial and final strokes and O will remain which is the Paragon symbol for O.

For the longhand *m* which is made of 7 strokes, you use this one horizontal stroke —

Therefore, —o would be Me.

Now continue the E across the M, so as to add D—thus / and you will have Med. Now add the large circle O and you will have / (medo), which is meadow, with the silent A and W omitted.

You now have 5 of the characters. There are only 26 in all. Then you memorize 26 simple word signs, 6 prefix contractions and one general rule for abbreviations. That is all.

Paragon is Used Everywhere

Paragon is used in the offices of the largest firms and corporations in the world such as Standard Oil Company, United States Steel Corporation and the great Railway Systems.

You have reached the point where you must know shorthand to do yourself justice and compete with others—as a busy executive or as a beginner in business.

You know how it is. Two good men apply for a position—one knows shorthand and the other does not—the shorthand man wins every time. And the same applies to young women.

Remember how many of the biggest men in America got their start because they could write shorthand—Frank A. Vanderlip, George B. Cortelyou, William Loeb, Jr., Edward Bok and other men of highest achievement.

Shorthand Writers Wanted

Never before has American business felt so keenly the shortage of capable shorthand writers. Big business houses are looking everywhere for shorthand writers and are ready to pay any salary within reason to get the service they must have. Salaries are steadily advancing—and yet the demand for shorthand writers has not been supplied.

Only $5 If You Keep It

Think of it. For $5 you can have a complete education in shorthand, a life-long help—not only for yourself but for your wife or children or any other relative.

You can have exactly the same course that has been taught for 25 years by its inventor personally by mail at the regular fee of $25. With 7 lessons and the ingenious self-examination method devised by the inventor you can learn Paragon at home in seven evenings.

Send No Money—Try It FREE

Try it at our expense first. Simply fill out the coupon below and mail it to us. After you receive the Course, study it for 7 evenings, and if you believe you can be without this valuable knowledge any longer, mail it back to us and you will owe nothing. Send in the coupon or write a letter today.

Paragon Institute, Home Study Department, 601 Broad Street, Suite 350, Newark, N. J.

PARAGON INSTITUTE, HOME STUDY DEPARTMENT
601 Broad Street, Suite 350, Newark, N. J.

You may send me the Complete Course of PARAGON Shorthand with the distinct understanding that I have 7 days after its receipt to either remail the Course to you or send you $5.00.

Name

Business

Address

Electrical Experimenter 3-19

www.americanradiohistory.com



Tobacco Habit BANISHED in 48 to 72 Hours

No craving for tobacco in any form when you begin taking Tobacco Redeemer. Don't try to quit the tobacco habit unaided. It's a losing fight against heavy odds and means a serious shock to the nervous system. Let the tobacco habit quit YOU. It will quit you, if you will just take Tobacco Redeemer, according to directions for two or three days. It is a most marvelously quick and thoroughly reliable remedy for the tobacco habit.

Not a Substitute

Tobacco Redeemer contains no habit-forming drugs of any kind. It is in no sense a substitute for tobacco. After finishing the treatment you have absolutely no desire to use tobacco again or to continue the use of the remedy. It makes not a particle of difference how long you have been using tobacco, how much you use or in what form you use it—whether you smoke cigars, cigarettes, pipe, chew plug or fine cut or use snuff, Tobacco Redeemer will positively banish every trace of desire in from 48 to 72 hours. This we absolutely guarantee in every case or money refunded.

Write today for our free booklet showing the deadly effect of tobacco upon the human system and positive proof that Tobacco Redeemer will quickly free you of the habit.

Newell Pharmacal Company.
Dept. 521 St. Louis, Mo.

"I Would Not Part with it for $10,000"



So writes an enthusiastic, grateful customer. In like manner testify over 100,000 people who have worn it. Conserve your body and life *first*.

The Natural Body Brace

Overcomes WEAKNESS and ORGANIC AILMENTS of WOMEN AND MEN. Develops erect, graceful figure. Brings restful relief, comfort, ability to do things, health and strength.

Wear It 30 Days Free at Our Expense

For Children Also

Does away with the strain and pain of standing and walking; replaces and supports misplaced internal organs; reduces enlarged abdomen; straightens and strengthens the back; corrects stooping shoulders; develops lungs, chest and bust; relieves backache, curvatures, nervousness, ruptures, constipation. Comfortable and easy to wear.

Keep Yourself Fit

Write today for illustrated booklet, measurement blank, etc., and read our very liberal proposition.

HOWARD C. RASH, Pres. Natural Body Brace Co.
286 Rash Building SALINA, KANSAS

Don't Wear a Truss



BROOKS' APPLIANCE, the modern scientific invention, the wonderful new discovery that relieves rupture will be sent on trial. No obnoxious springs or pads. Has automatic Air Cushions. Binds and draws the broken parts together as you would a broken limb. No salves. No lies. Durable, cheap.

Sent on trial to prove it. Protected by U. S. Patents. Catalogue and measure blanks mailed free. Send name and address today.

C. E. BROOKS, 203B State Street, Marshall, Mich.

Send To-day for the
"Electrical Worker's Friend"

An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting A.C. motors. Special at $3.50

Or write for full particulars of this valuable book.

J. SMITH & SON
1524 LOWRIE ST., N.S., PITTSBURGH, PA.

SORTING TOBACCO LEAVES BY ELECTRICITY.

(*Continued from page 770*)

duplicate of the first section, except that here a permanent stop is provided in the path of movement, which will prevent any leaf from returning to the starting point, but deposit it in the box provided for the longest leaves.

All boxes, ten at each side of the machine, are standing on a kind of steps, so that each one is, according to the incline of the covers, a little below the foregoing one. As the other side of the machine is but a duplicate, the device being a double action machine, there are ten boxes for ten different sizes of leaves at each side, or 20 boxes altogether.

The contact segments on the table are movable, and the machine can thus be so finely adjusted that it will not only measure and sort the leaves by *inches* as required, but even up to a *quarter of an inch* if so desired. The machine is driven by an electric motor, arranged below the table and not visible in the illustration, and by means of an electric regulator the speed of the machine can be regulated to meet the speed with which an operator is able to place leaves upon the feeding belt.

33 ASSEMBLED LOCOMOTIVES ON ONE SHIP.

(*Continued from page 765*)

expert locomotive engineers for assembling and it took the better part of a week before even one engine was complete. The locomotives had to be in complete running order here in the shops, as well as having all the parts of the machine carefully marked before being disassembled on this side of the pond. All this entailed many days of extra and unnecessary work—especially when time was at a premium. Those and many other delays occurred so that at one time there were thirteen ships loaded with *knocked down* locomotives in ports in France waiting for the discharge of their cargoes.

This was the situation confronting the Shipping Control Committee on January, 1918. The locomotive problem was immediately discust in detail to see if there was not some way by which the complete locomotives could be sent across the ocean intact.

The steamships Feltore, Cubore, and Santore, each 468 feet long, with three great holds and five hatches, the smallest of which was 33 feet by 37 feet and the largest 39 feet by 37 feet, were then prest into service. Each ship had a cargo capacity of 11,000 tons and was fitted with electric turbines capable of driving the ship at a speed of ten knots.

On May first loading started, and the holds of the steamer Feltore were floored off with five layers of railroad rails and splices to secure a firm foundation and also to protect the hull of the ship. Next day a railroad float came alongside with eight assembled locomotives ready for the trip.

The problem of lifting these great locomotives into the hold of the ship was solved by requisitioning one of the largest cranes in the world capable of lifting 150,500 pounds in bulk. The derrick captain took his stand on the deck of the steamer and by the use of electric signals directed every movement of the crane. And so without a single hitch, each and every one of these steel-bound monsters of the rails, was lowered and set on heavy oak planks; after which tons of compresst bales of hay and bags of oats were packed around them. And so seven days after the start of this great trip, there were on the wharves at Brest, France, 33 large assembled locomotives and tenders, 2,400 tons of rails and splices, 2,300 tons of hay, 600 tons of oats, and fifty-three motor trucks.

WOOD FINISHING FOR THE AMATEUR.

(*Continued from page 793*)

either of two ways, which are known among wood finishers as the "quick" and the "slow" methods of polishing.

The quick method is as follows: Dip a handful of raw cotton into a mixture of half peanut oil (refined cottonseed oil will do), and half alcohol, and rub the surface with a rotary motion, which will give a fine lustre in a short time.

The better of the two is the slow process. After the work has been brought to the dead finish mentioned above, put on an extra coat of finishing varnish, allow it to dry, and rub down again with FF pumice stone, cleaning up carefully. Then rub ground rotten stone over the surface with a soft chamois skin, using a circular motion, and when this is dry, rub it off with the palm of the hand.

There are several other kinds of polishing, notably wax polishing and oil polishing, which may be used if desired. In wax polishing the polish is put on at the same stage that the varnish would have been applied, using any method convenient to get the wax on the work. Perhaps the best way is to warm the wax and apply it with a brush, the same as varnish. This gives an even coat of wax, which is then polished with a hand cloth. There are a number of manufactured waxes on the market, any of which will give the desired results. The chief objection to wax polishing is that it mars very easily, but it is also renewed very easily, hence this is not such a serious objection for many kinds of work.

Oil polishing is the most durable of any, and therefore is often used for table tops, counters, etc. The process is very simple, but heartbreaking. It consists of applying either raw or boiled linseed oil upon the surface, and then rubbing it until a polish is secured. The polishing is done by means of a piece of felt wrapt around a heavy block, to give it weight.

This is about all that need be said about the various processes used in wood finishing, but a brief description of the various kinds of woods commonly used by the experimenter would not be out of place. A perusal of the list will often help determine the kind of wood required for any particular piece of work.

Birch.—Black birch takes on a fine polish, as it is close grained. Its natural color is light, so it is usually stained in imitation of black walnut or mahogany. Owing to its close grain, a filler is not absolutely necessary, but when staining this wood to imitate some other, a properly colored filler gives it a better coloration.

Cherry.—This wood is very close grained, and will take a high polish. It has little tendency to warp, and because of its close grain filling is not necessary, and shellacking will prepare it for any of the finest polishes.

Oak.—Oak is the "King of woods", and is very useful. It has a medium openness of grain, and *must always be filled before shellacking.* Almost any sort of polish may be used for finishing oak, one of the most beautiful being the "antique" method, a formula for which has already been given. The linseed oil polishing will also make an excellent and durable finish. There is but one objection to this wood for wireless apparatus, which has made it unjustly unpopular, and that is that the acid in the wood has a peculiar effect upon hard rubber panels.

Mahogany.—If expense were not an objection in most cases, mahogany would be an ideal wood for every purpose. It is coarse grained, requiring a filler, but is sus-

(*Continued on page 812*)

www.americanradiohistory.com



Let Us Tell You How To Make a Big Success in CHIROPRACTIC

Advanced Science of Spinal Adjustment

Mail the coupon below, right now—today—and let us tell you all about the remarkable opportunities there are for ambitious men and women in this great, new profession of Chiropractic.

You are, of course, aware that drugless healing is steadily advancing in public favor. Chiropractic has come to the front so rapidly during the past few years that it is today recognized as the most advanced, most scientific, and most successful of drugless healing methods. It is calling to its ranks men and women from every walk of life—and there is abundant evidence that they are making good in a big way in this new and uncrowded field.

Mail the coupon and we will send you full information—tell you how there is a splendid chance for you to build a successful career as a Doctor of Chiropractic.

Learn At Home In Spare Time

The American University method of teaching Chiropractic enables you to study by mail or in class and obtain a complete education in the shortest time consistent with thoroughness, while you hold your present position. And you can pay on easy terms. A splendid faculty will personally instruct you in the basic principles and in the most approved methods for relieving Headache, Indigestion, Lumbago, Epilepsy, Pleurisy, Constipation, Rheumatism, Asthma, Neuralgia, Neuritis, Catarrh, Fevers, Jaundice, Dyspepsia, Paralysis, etc. No special preliminary study is needed. You will graduate with the degree of Doctor of Chiropractic, receive a handsome diploma and be ready at once to open your office.

$3,000 To $5,000 a Year

Remarkable Free Charts Offer

We want men and women seriously intending to take up professional careers in Drugless Healing to have these charts. Their actual value is $31.50. But on our offer they come free. There are 22 in all, printed in colors. Send the coupon below to get all the facts about our offer.

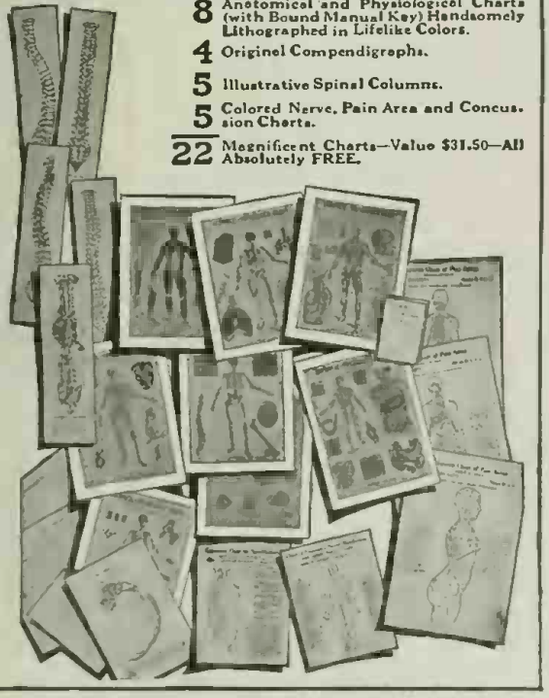
8 Anatomical and Physiological Charts (with Bound Manual Key) Handsomely Lithographed in Lifelike Colors.

4 Original Compendigraphs.

5 Illustrative Spinal Columns.

5 Colored Nerve, Pain Area and Concussion Charts.

22 Magnificent Charts—Value $31.50—All Absolutely FREE.



There are many instances of Chiropractors earning from $3,000 to $5,000 a year. Some upwards of $10,000 Dr. M. D. Moore, of Kentucky, reports an income of $9,000 a year. Dr. L. H. Roche, New Jersey, $5,000; Dr. Hanna, of Florida, over $5,000 yearly.

The success of Chiropractors in many cases has come so quickly as to be almost startling—almost like the accidental discovery of a gold mine. And yet, it is not to be wondered at when you consider the scientific accuracy of Chiropractic methods, the really remarkable results of a beneficial character in the treatment of both acute and chronic cases that have been affected through these methods, the rapid increase in the number of people who show a decided preference for Chiropractic over any other treatment for their bodily ills and the comparatively few Chiropractors that are now in the field.

Your Opportunity

If others have achieved such remarkable successes is there any reason why you should not do as well or even better?

Why not get out of the rut and qualify now for this splendid profession that offers such remarkable possibilities for making you prosperous and independent? No matter where you live, if you are ambitious to make money, increase your social standing and be a "somebody" in the world, our course in Chiropractic will point the way for the attainment of your ambition. Never has there been a more opportune time than now, for never has the demand for competent Doctors of Chiropractic been so great as it is today.

READ What These Doctors of Chiropractic Say:

"My Charges Are $25.00 for 13 Treatments"

American University:
My practice averages ten patients a day, of which many are women. My charges per course are $25 per 13 treatments. The number of treatments varies from one to two courses in stubborn cases. Minor cases take from 6 to 10 treatments. I have your school at heart and will boost it all I can.
DR. W. H. WEDELL, M. T. D., D. C.
N. Y.

Heartily Recommends Course Charges $2.00 per Treatment

American University:
I have no hesitation in recommending your course in Chiropractic to anyone contemplating such a course, as it is thoroughly practical, well-written, interesting and valuable to the new student and a valuable adjunct to any drugless healer. I receive $2 for all treatments.
DR. ANNIE B. McDERMOTT, N. J.

"I Am Proud of Your Chiropractic Course"

American University:
Our regular price for such work is $2. Treat on an average of about eight a day, and give all the way from 12 to 24 treatments, which depends on how obstinate the case is. Some are cured with only five or six treatments. I am proud of your Chiropractic course.
DR. W. H. WOOD, Missouri.

SEND

the coupon today. Don't delay. Do not think that your chances for building a successful career are less than others who are succeeding in the practice of this great profession. Just let us give you all the facts—then judge for yourself. Mailing the coupon places you under no obligation of any kind whatever. All we ask is the opportunity to prove to you that what we tell you is the absolute truth. We have the facts to prove it—facts which you will find mighty interesting. Just send the coupon or a post card for our beautiful new illustrated 72-page book and full particulars of our remarkable Free Charts Offer. Mail coupon or write today SURE.

AMERICAN UNIVERSITY Manierre Bldg. Dept. 409 **Chicago, Ill.**

AMERICAN UNIVERSITY
Manierre Bldg., Dept. 409 Chicago, Ill.

Without cost or obligation send me by mail, your new illustrated, 72-page book and your Free Charts Offer.

Name.....

Address.....

City..... State.....

www.americanradiohistory.com

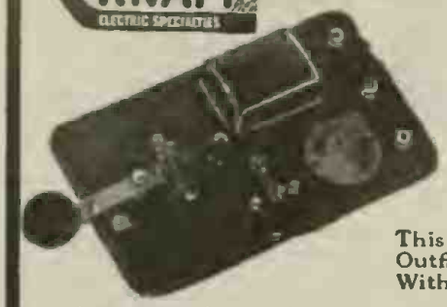
Learn Telegraphy-Wireless

Right In Your Own Home, in your spare time

Remarkable opportunities are offered experienced wireless operators and telegraphers. The demand is greater than the supply—steady positions at increased pay and rapid advancement are assured.

DEPENDABLE KNAPP ELECTRIC SPECIALTIES

Combination Wireless-Telegraphy Outfit



will soon make you an accomplished operator. Teaches Light and Sound Signals, both Radio and Morse. Outfit consists of exceptionally fine Telegraph Key, Buzzer, 3 Binding Posts, Lamp, Lamp Socket and Control Switch —all mounted on a highly finished base. Two outfits can be operated at considerable distance apart for sending and receiving practice.

$3.00

This Same Outfit Without Lamp $2.50

Order to-day. Or your dealer can secure it for you. Descriptive circular and catalog of celebrated Knapp Motors and Electrical Specialties from 10c up mailed free on request.

Knapp Electric & Novelty Co.
523 West 51st Street New York City



KNAPP LEADER
Radiates real power-plant efficiency. Two Speeds and Reverse.
Price, Complete, $3.50

CORE WIRE

We have been fortunate in securing thru auction several tons of guaranteed pure, double annealed Norway Iron Core Wire and are selling this wire to "Experimenter" readers

AT PRE-WAR PRICES 20cts LB.

This wire is just the thing for spark coils, transformers, etc., and it is, of course, a very much more superior product than the usual iron wire. We absolutely guarantee the quality.

If you ever thought of building a spark coil, transformer, or similar apparatus, now is the chance to get the right material for it. As far as we know this is the only lot of Iron Norway Core Wire in the hands of any dealer at the present time, and none can be gotten until after the war.

We have only two sizes left:

26 INCHES 36 INCHES

Thickness about No. 21 B and S

If either of these sizes should be too long we advise cutting the wire down yourself by means of shears. It will pay you to do so as real Norway Iron Wire, sold by a few dealers last year, brought from 40c to 50c a pound. American core wire now sells for from 30c upwards per pound.

As long as the supply lasts we offer this wire as described above to our customers at the very low price of 20c a pound. Order at once.

ELECTRO IMPORTING CO., 231 Fulton St., N. Y. C.



Get your wireless stations

In Readiness Now.

Be prepared and avoid delay.

DUCK'S big 300 page Wireless and Electric Catalog is now, as it always has been, the largest and most complete and dependable Wireless Catalog published. Mailed for 12c in stamps or coin. Not sent otherwise.

Everything in wireless *worth while* is listed in this catalog. The experienced amateur will tell you to see our catalog before buying. You are thereby insured against an unwise purchase. It is the *Beacon Light* to guide you right in the selection of your wireless apparatus. No bigger or better values are obtainable elsewhere.

If you have our catalog No. 11, you have our latest catalog. Do not write for another. Send for a revised price list. It is yours for the asking.

THE WILLIAM B. DUCK CO., 230-232 Superior St., Toledo, Ohio

"NACL" Buzzer and Signaling Set

$5.50 Complete



Clapp-Eastham high frequency buzzer

A VERY COMPACT SET

Excellent for practice as key is correct height from table. Can be used for signalling by flashes over a long distance, also for a test buzzer or flash-light.

L. B. SALT, Van Brunt Ave., Dedham, Mass.

WOOD FINISHING FOR THE AMATEURS.

(*Continued from page* 810)

ceptible of a fine polish, which makes it much in demand.

Maple.—Hard maple is close grained and requires no filler, but soft maple is just the opposite and hence is of little value. It looks best in its natural color, very light, which is preferably obtained by the use of white shellac and the very whitest ivory varnish to be found. Hard maple takes the finest polish of any of the woods.

Black Walnut.—This is a dark-colored wood, rather open grained, requiring a filler to match its color, but no stain. One good coat of orange shellac will suffice to level its surface previous to polishing.

Pine, Poplar, etc.—These soft woods are open grained and easily worked. Having little beauty of their own they are usually stained, but we should remember that oil stains are the best to use, owing to the difficulty of getting an even coat. Shellac will do very well as a varnish for these soft woods, being applied on top of a liquid filler.

In conclusion it is to be hoped that anyone attempting to do wood finishing will do the wood justice and conscientiously perform all the operations required. Everyone has preferences as to the finish liked best, but after a study of the foregoing it should not be difficult to select the right one.

FORMER KAISER CONSTANTLY IN TOUCH WITH BERLIN.

The former Kaiser is believed to be constantly in communication with Germany. It is reported that a wireless station has been erected on top of Count von Bentinck's castle, and that German airplanes frequently fly over the estate, dropping messages.

SCIENCE IN SLANG

(*Continued from page* 799)

that it was the inherent what-you-may-call-it in the deceased animal and not the contact of the two dissimilar metals on the nerve and muscle, and the chemical action created thereof, that caused the amphibious corpse to do the post-mortem Hula.

"Even at that the Dago doctor opened up a lot of dope that the terrestrians were dead to, and laid another foundation rock for the next of the scientific gang to add to. And now we have galvanic current instead of homeric, as would be the case had the blind ditty writer pulled the stunt.

"Then Count Professor Allesandro Volta, B. S., enlightened himself with Couronne de Tasses (no, not demi-tasses) and piles, and condensing electroscopes, not to speak of the other heterogeneous paraphernalia that would make a Hebrew junk dealer itch in the palms. Well, Aleck stamped his cognomen in the pages of electrical history, as well as on fuse plugs and such other electrical stuff that has the potential inscribed on it.

"Here comes along André Marie Ampère and drops the aching public a string of facts tabulating a stack of laws governing the flow of the 'juice' and propounding with such effect that we now waltz into the store and order the fuses that we shot—or rather to replace the ones we shot—by the ampere (unless we buy them by the dozen).

"So it goes. Watt then bounces into the limelight and does his act and exit. Then, when they are sure he is dead, some favoring gink—generally a Prof.—names something after him. In this case it happened to be the great what-is-it. So, too, we get ohms and farads—see; Mike's handle was too long for laboratory use so the printers just stuck in the first half dozen characters and let it go at that. Likewise we amputated

www.americanradiohistory.com

the 'a' in Volta's name when we translated it into sure-enough language. You know we humans that have descended from the Angles and Saxons got a little more efficient and sawed off the sing-song trailers some time after Chaucer wrote 'Whyne that olde Aprille why the its shores sote' and sang it like a Swede, and say 'When the sweet showers of April' just like we say volt instead of volta.

"Since Bill Gilbert, way back in the fifteen hundreds, christened the phenomena that made amber famous 'Electricity' and dumped it onto the English-speaking people we have had names, terms, epithets, descriptions, designations, and appellations galore for its numerous manifestations; yet with all the wonders of the genii we are no nearer the solution of the something we call 'Juice'. We have a fair working knowledge of what it is *not*, and how it affects various substances — including *homos*.

"Jimmy Clerk Maxwell, the bonny 'Skoatchmahn' (accent on the first syllable), let loose with a gob of new stuff that have been pacemakers for a raft of scientific birds to follow up on. Jim's dope on the gas and light—while not the kind that affect the meter men—have apparently been agreed to in the main—even since he gave the proverbial bucket the fatal rap, and can't argue back at us.

"Naturally, as time ticks off, some wise guy, who has the advantage of the ones before by being behind, springs new stuff now and then.

"The Swedish Prof. who is almost guilty for the electron theory of matter, does not blankly contradict the dope now out on molecules and atoms and ions. The latest is only a new sprout on the tree of knowledge.

"Of course Madame Curie, when she got to meddling with pitchblende, nearly uprooted the chemical tree of knowledge with her 'Radium'. Naturally, as new dope shows up, we have to show the door to a lot of the old stuff, but when some guy slips us something from observation it turns out to be almost right in its percentage. The next guy looks a little farther and hands us a little more of the same thing, generally.

"Old Ben Franklin got the fluid idea—a lot of it right. Then as a little more of eternity reels off, converting the present into the past, the 'fluid' idea went 'fluey', and we conceived the phenomena as a vibration, of molecules, atoms, ions, and finally electrons. Some of the wise guineas have the vibrations all mapt out as colliding, circling, and vari-speeded particles of *almost nothing*, making up everything we are acquainted with and a lot that we are not. The only difference between the skull of your dome and the macadam on the road in front of your house is the difference in speed or direction or path. You don't need to take that as an insult—I could have used my own head for example, but my modesty forbids.

"As we sit over an electric heater we have to hand it to old man Joule. And after we are run over gracelessly by one of those 'noiseless electrics' we may be excused for giving Mike Faraday the verbal journey to Dante's pleasure resort for a delightless season of eternity, for it was old Mike that made the first electric motor mote. This old boy had a lot to do with induced currents, and from his inductions and deductions that transformer out on yonder pole was made a pot instead of an engine boiler or crowbar.

"Of course we'll not pass old boy Nick Tesla up—the 'high frequency kid'. His alternating current stuff and three phase dope—remember that trash the engineers howled 'It can't be done' at? Funny tho—our best motors are the three phase kind now.

"When alternating current flops down the



Learn Public Speaking

10 LESSONS FREE

Write — quick — for particulars of this extraordinary offer; an opportunity you will never forget if you take advantage of it. Ten lessons in effective public speaking absolutely FREE to those who act promptly, to introduce our course in localities where it is not already known.

We teach you by mail to become a powerful and convincing speaker—to influence and dominate the decisions of one man or an audience of a thousand. We have trained hundreds and helped them to increase their earnings and their popularity. Learn, in your spare time at home, how to overcome "stage fright" and conquer fear of others; how to enlarge your vocabulary; how to develop self-confidence and the qualities of leadership; how to RULE others by the power of your speech alone; how to train your memory. Our

WHAT THE COURSE TEACHES YOU.

How to talk before your club or lodge;
How to address board meetings;
How to propose and respond to toasts;
How to make a political speech;
How to tell entertaining stories;
How to make after-dinner speeches;
How to converse interestingly;
How to write better letters;
How to sell more goods;
How to train your memory;
How to enlarge your vocabulary;
How to develop self-confidence;
How to acquire a winning personality;
How to strengthen your will power and ambition;
How to become a clear, accurate thinker;
How to develop your power of concentration;
How to be the master of any situation.

New Easy Method

perfected and taught only by Prof. R. E. Pattison Kline, former Dean of the Public Speaking Department of the Columbia College of Expression, can be learned in 15 minutes a day. Prof. Kline is one of the foremost authorities in the country on public speaking and mental development. Do not let this chance escape you.

Offer Limited

Send This Free Coupon Now

This Special Offer of TEN LESSONS FREE is made strictly for advertising purposes and will be withdrawn without notice. Write now, before it expires, and receive full particulars with enrollment blank by return mail. No obligations of any kind. Just tear off and mail this free coupon—or a postal will do.

FREE LESSONS COUPON

North American Institute,
7443 Manhattan Bldg., Chicago

I am interested in your course in Effective Public Speaking and your offer of ten lessons free. Please send full particulars. It is understood that this request places me under no obligation of any kind.

.....

.....

www.americanradiohistory.com

CUT YOUR OWN HAIR



If you can COMB your hair, you can CUT your own hair with this marvelous invention. You can cut your hair any length you desire, short or long, and finish the job as nicely as any barber in one-fourth the time before your own mirror, with the

UTILITY Hair Cutter

You can keep your hair well trimmed for a lifetime with this marvelous invention for actually **less than any good barber would charge you for a single hair cut.** Very easy to manipulate. Use it just like a comb, pushing it through the hair, downward, in the direction the hair lays. It is impossible to leave any "nicks" or "cat steps" in your hair, as there is a special Guard that guides the cutter blade evenly over the scalp.

35c POSTPAID

Extra Blades: 5cts. Each 50c the Doz.

Cut Children's Hair

at home and save time, trouble and expense of taking them to the barber shop. It works so easily and the job is done so quickly that the children enjoy having their hair cut. The adjustment feature, whereby the blade can be set to cut the hair to any desired length—short, medium, or long—makes it possible to do as perfect work as the barber, not to mention the tremendous saving.

As a Safety Razor You can use the Utility Trimmer as an ordinary Safety Razor, and it will give you as good a shave as the most expensive Razor you can buy You can shave the face or neck, or finish around the temples.

EASY TO HONE AND STROP BLADES

No trouble at all to keep the blades sharp. Just reverse the blade in the holder and proceed to strop as with an ordinary razor Extra Blades are always obtainable and cost only 5 cents each, or 50 cents the dozen.

USEFUL FOR MANY OTHER PURPOSES

There are many other uses for the Utility Cutter that will suggest themselves to you. Ladies use it for removing hair from under the arms and elsewhere. It is perfectly safe, and cannot cut the skin. One customer wrote us that he found it just the thing for cutting corns, while housewives and dressmakers say there is nothing better for ripping seams and making buttonholes.

AGENTS AND DEALERS GET OUR PROPOSITION

This is one of the rare occasions when you are able to connect up with a really "Sell on Sight" article. Something that every man and woman will buy on sight, because it actually saves them money. Agents are coining money Why not you? Handsome package, weighs but a trifle. Write at once for terms on the Trimmers and extra Blades.

JOHNSON SMITH & COMPANY
Dept. RK 54 W. Lake Street CHICAGO











YOU HAVE A BEAUTIFUL FACE

BUT YOUR NOSE?

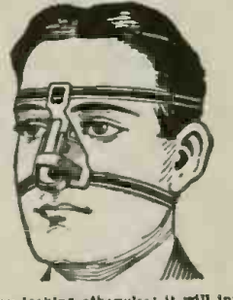


BEFORE



AFTER





IN THIS DAY AND AGE attention to your appearance is an absolute necessity if you expect to make the most out of life. Not only should you wish to appear as attractive as possible, for your own self-satisfaction, which is alone well worth your efforts, but you will find the world in general judging you greatly, if not wholly, by your "looks," therefore it pays to "look your best" at all times.

Permit no one to see you looking otherwise: it will injure your welfare! Upon the impression you constantly make rests the failure or success of your life. Which is to be your ultimate destiny? My new *Nose-Shaper*, "TRADE" (Model 24) corrects now ill-shaped noses without operation, quickly, safely and permanently. Is pleasant and does not interfere with one's daily occupation, being worn at night.

Write today for free booklet, which tells you how to correct ill-shaped noses without cost if not satisfactory

M. TRILETY, Face Specialist **1038 Ackerman Bldg., Binghamton, N. Y.**

Save Auto Repair Bills

Every car-owner should learn how to avoid *engine and all other auto troubles* and how to cure them by reading the *"Trouble Department"* of the AUTOMOBILE DEALER AND REPAIRER, a 100-page illustrated magazine, and the only journal in the world especially devoted to the practical and mechanical side of motoring. Our EXPERT SERVICE Department is free to all subscribers. You can ask questions and get answers promptly about any difficulty with your car. One article in one number was worth $25 to one car-owner. Send 25 cents in stamps or silver for three months' trial subscription to MOTOR VEHICLE PUBLISHING COMPANY, 735 Murray Street, New York.

line, along comes a lot of other by-product stuff. A load of new hypothetics and another load of theories to explain them. You know when you hook up some plants in parallel that there enters into the circuit a condition known as 'harmonics' that juggles the peak around and cuts it off, and goes negative when the generators are trying to make a positive impression on the line. Alternating current is great stuff and the guy that can get reactance and impedance kicking right and pull the wattless current off the line don't need to worry about such prosaic things as room rent and meal tickets.

"Steinmetz has this alternating current stuff pretty well under his hat and can tell you just what will happen, and when and why. If you ask 'Steiny' how he figures it he will tell you with a paper and pencil—if he did not do it in his head; but when the figures run into ten or more columns he generally reaches for his pencil. With his calculus he calculates the two-stepping oscillatory currents correctly thru his heavy cigar smoke.

"Surely we all know what Tommy Edison has done to us in the line of sidewalks and phonographs, in stock tickers and electric lights, in street railways and chemistry. That old duck works overtime seven days to the week and sleeps with his hat and shoes on, with a copy of Clerk Maxwell's dictionary for a pillow. Yes, Tom is a bright boy.

"To-day, after all the headlights and sidelights on history, we know more about, and less of, the so-called 'electric' force that causes our incandescent globes to glow and the amber to attract pith balls than our progenitors who wore fig leaves and bedspreads.

"Perhaps some day a man—maybe a woman—will come along and kick the mud out from the electrical puddle and let us see what a 'watt' really is. At least we will find more things that the mysterious force is the cause of. We may add to our frictional, static, dynamic and other present forms we have so far classified yet more. High frequency may be the way to it—it may not. We realize that we merely collect or cause to flow in our set paths the 'juice' we use, we do not create it. In a way we are unbelievably crude in our field of electricity. A lot escapes us, a lot leaks, as it were, and we get the use of a very small amount for the work we put into it and get out. Yet it is the most, or one of the most efficient forms of energy that we now have at our disposal. Perhaps some one will stumble on to some other source than dynamos and batteries for our supply—it may be a sort of collector or etheric accumulator. Thru electricity we may overcome gravitation. The conditions that would make possible are unlimited. Of course, that is supposition, but 'wireless' and the World War were all suppositions a few years ago.

"Speaking of wireless, Hertz looked over our heads and saw something we had overlooked since Galvani's 'return shock' on the frog's hind kicks. Then Marconi and others, notably De Forest, boosted the proposition along, so that now, with the audion amplifier, we transmit music, both chin and instrumental, for miles and miles on thin ether. Whether next we will transmit or merely collect energy for power I don't know, but I would not be surprised at either.

"Some scientists tell us that once our present planet was a whirling mass of nebulae. Later it concentrated into a rough globular mass. This was known as the Azoic Age. At this time its minerals and water were thrown off at a great distance in a gaseous state. As these cooled they formed rings or films surrounding the earth. Later these rings descended upon the earth, periodically. Thus the earth past thru the Paleazoic and Carboniferous

www.americanradiohistory.com

epochs, after which fell the remaining mineral rings, and animal life came into evidence. Then the last canopy, of hundred per cent. proof water descended, and we had the big washout known as the 'flood', where a man by the name Noah—who was *his* press-agent?—made his big hit with the historians.

"Now these science hypotheticians tell us that there is yet another ring, an electrical canopy, that, when it descends will destroy all microbes and other infamous micro-organisms—Mr. Flu included in the first row. Taking that into consideration we would be a healthier flock of mortals—but fermentation is caused by our minute friend-enemies; and no fermentation means natural prohibition. How would you like that? Besides upsetting the brewers and bakers and what else not including bacchic celebrations, it would probably upset our present electrical system, and likewise rules and laws. That is the Valian theory of the thing, and there are whole reams of other dope by other thinkers and numbskulls, but this Valian hunch hits me as plausible, and a lot of the other ding-dongs sound to me as if the author had had one too many under his belt.

"If the ring were to tumble—we would be in the same fix with the antediluvians as to the liquor question. The great liquor question would no longer be 'What drink will you have?' but 'When will the ring rise again?'

"By the way, I have a quart in my room," Stokes hinted as we arose to leave, "And you can never tell when that ring may fall."

AN AMPHIBIAN LAND, WATER AND AIR HYDROPLANE.

(*Continued from page 773*)

ranged along the center line of the superstructure on the exterior are a plurality of planes, which are maintained in the proper position by means of guy rods. Horizontal rudders are arranged in opposite pairs, each consisting of a series of blades mounted upon central shafts. All of the rudders and propellers are controllable by the aviator from within the cab, and by actuating the various rudder and plane controls, it is thus possible for the operator to cause the craft to fly on a level keel, or to turn at any desired angle, either upward or downward.

This amphibious airship is caused to fly thru the air by means of a pair of powerful propeller blades disposed on opposite sides of the gas bag frame as shown, and at the center of the ballonet superstructure. These propeller blades are driven by the motor situated within the car by means of bevel gears. Coney Island and the rest of the amusement parks threaten to take all of our spare nickels and dimes this summer, with such irresistible and fascinating diversions as this before us.

CONCRETE WIRELESS MAST IN CHINA.

A mast of concrete 150 feet above the wall of the Tartar City, near Chienman, has been erected for the United States naval wireless. The column is 18 inches in diameter at the base and 12 inches at the top. Its weight is approximately 30,000 pounds, and it includes 2,500 pounds of reinforcing steel and 160 cubic feet of concrete. Twelve guys, fastened to four anchor blocks, secure the mast. The work was completed in seven weeks.

HARVARD RADIO SCHOOL TO BE REMOVED.

The naval radio school in Cambridge, in which nearly 5,000 sailors are under instruction, is to be removed to the Great Lakes Naval Training Station by April 1.

How I Increased My Earnings From $2 to $200 a Day!

The Remarkable Story of a Young Man's Experience After Reading a Wonderful Book, as Told by Himself

SOME people say it takes money to make money—others complain that they never made money because they never had any luck. When one is up against the stern reality of making both ends meet, it is natural to feel that if they only had a little money, or a little luck, they wouldn't have to worry about their bread and butter, and rent, and clothes.

A short time ago I, too, felt that way. I was a bill clerk earning only $12 a week, and I used to worry myself sick about my future.

To-day—it seems like a dream—all my financial troubles are over—my weekly income instead is about $1,000—more than I know how to spend. I own two automobiles and have a chauffeur to drive me around. My children go to private schools. I have just purchased, for cash, a $25,000 home. I go hunting, fishing, motoring and traveling, whenever I care to. I live in a new kind of world.

Possible to Anyone

Let me say in all sincerity that what I have done, I believe any one can do. I am only an average man—not "brilliant"—have never gone to college—my education is limited. I know at least a hundred men who know more than I, who are better educated and better informed—yet not one of them has made as much money as I have, their earnings probably averaging less than $50 weekly. I mention this to show that earning capacity is not governed by the extent of a man's education—to encourage those who have not had the advantage of a comprehensive education.

What, then, is the secret of my success? Let me tell you how it came about.

How I Discovered Myself

One day, about three years ago, something happened that woke me up to what was wrong with me. It was necessary for me to make a decision on a matter which was of little consequence. I knew in my heart what was the right thing to do, but something held me back. I said one thing, then another; I decided one way, then another. I couldn't for the life of me make the decision I knew was right.

I lay awake most of that night thinking about the matter—not because it was of any great importance in itself, but because I was beginning to discover *what was wrong with me.* Along towards dawn I resolved to make an experiment. I decided to cultivate my will power, believing that if I did this I would not hesitate about making decisions—that when I had an idea I would have sufficient confidence in myself to "put it over"—that I would not be afraid of myself, of things or of others. I felt that if I could smash my ideas across I would soon make my presence felt. I knew that heretofore I had always begged for success—had always stood, hat in hand, depending on others to give me the things I desired. In short, I was controlled by the will of others. Henceforth, I determined to have a strong will of my own—*to demand and command what I wanted.*

With this new purpose in mind I applied myself to finding out something more about will power. Finally I encountered a book written by Professor Frank Channing Haddock. I was astonished to read his statement. "The will is just as susceptible of development as the muscles of the body!" It is almost needless to say that I at once began to practise the exercises formulated by Dr. Haddock, and I need not recount the extraordinary results that I obtained almost from the first day. I have already indicated the success that my developed power of will has made for me.

But it may be thought that my case is exceptional. Let me again assure you that I am but an average man, with no superdeveloped powers, save that of my own will. And to further prove my contention, let me say that since Prof. Haddock's lessons, rules and exercises have been published, I have come across hundreds of other cases where strengthened will power has brought success and fortune to people who were failures, has enabled thousands to overcome drink and other vices, almost overnight—has helped overcome sickness and nervousness, has transformed unhappy, envious, discontented people into dominating personalities filled with the joy of living.

What You Can Do

I have been authorzied by the publishers of Prof. Haddock's methods to say that any reader who cares to examine his startling book on will power may do so without sending any money in advance. In other words, if after a week's reading you do not feel that "Power of Will" is worth $3, the sum asked, return it and you will owe nothing. When you receive your copy for examination you will be interested in the studies on The law of great thinking; How to develop analytical power; How to guard against errors in thought; How to drive from the mind unwholesome thoughts; How to develop fearlessness; How to use the mind in sickness; How to acquire a dominating personality, and hundreds of other similar personal power studies.

It is interesting to note that among the 250,000 owners of "Power of Will" are such prominent men as Judge Ben B. Lindsey; Supreme Court Justice Parker; Wu Ting Fang, ex-U. S. Chinese Ambassador; Senator T. B. Calron; Gov. McKelvie of Nebraska; Assistant Postmaster-General Britt; General Manager Christeson, of Wells Fargo Express Co.; E. St. Elmo Lewis; Senator Arthur Capper of Kansas, and thousands of equal prominence.

As a first step in will training, I would suggest immediate action in this matter before you. Use the blank form below, or write a letter addressing it to the Pelton Publishing Company, 30F Wilcox Block, Meriden, Conn., and the book will come by return mail. This one act may mean the turning point of your life, as it has meant to me and to so many others.

FELTON PUBLISHING COMPANY,
30F Wilcox Block, Meriden, Conn.

I will examine a copy of "Power of Will" at your risk. I agree to remit $3 or remail the book in 5 days.

Name .....

Address .....

www.americanradiohistory.com

Announcement

The Moorhead Laboratories, the largest exclusive manufacturers of Vacuum Valves in the world, have been busily engaged during the war in supplying Vacuum Tubes to the British and United States Governments.

They will have manufactured and tested a large quantity of these Vacuum Bulbs to meet the requirements of the amateur and experimental trade as soon as the ban is lifted.

All these Valves are licensed under the

FLEMING PATENT

owned by the Marconi Company, and protected by several pending patents.

We are the distributing agents of the Moorhead Laboratories, and you can obtain from us the same high grade Detector, built to Government specifications and supplied to the above mentioned Governments as standard equipment.

We will give you the most prompt and satisfactory service that it is possible to render.

Send your name and address to us, and we will forward you an interesting booklet describing the Moorhead Valves and other Apparatus for both receiving and transmitting.

Yours for efficiency

Pacific Laboratories Sales Department

510 PACIFIC BUILDING **San Francisco, Calif.**

www.americanradiohistory.com

Gigantic 1,400 K.W. Radio Station at Lyons, France

(*Continued from page 791*)

work, it having been found readily possible to synchronize two such high-speed radio-frequency alternators at the works of the General Electric Company, some years ago.

North of the main antenna switch platform at the center of the station, there is a French design of static frequency multiplying system rated at 150 K.W. This set operates on the principle of the transformer frequency-changing principle, as developed by Joly and Arco.

Next we come to the western wing of the station, and here there are two of the largest arc oscillation generators ever built. They were designed by Mr. C. F. Elwell, formerly chief engineer of the Federal Telegraph Company of San Francisco, Cal., who first developed the Poulsen arc system to large powers, and each of these gigantic arcs are rated at 250 K.W. Either of these arc generators may be connected to the antenna thru the central antenna switch-gear, the lead wire running to the arc sets terminating in a massive single-pole, double-throw change-over switch, about five feet in length, which permits the instant connection of either set to the antenna.

Either of these powerful arc sets can be operated from the 300-K.W., 750-volt, direct-current motor-generator set, shown in the plan view and situated just west of the arc apparatus itself. This motor-generator comprises a three-phase alternating-current motor, direct-connected to a 750-volt, direct-current, 300-K.W. generator, which supplies the necessary high voltage direct current for operating the arcs. Dr. de Forest states that in his opinion, these large arc generators represent one of the very finest developments in radio transmitters that have yet been conceived and perfected. They have a distinct advantage over radio frequency alternators in that quick changes in wave length or frequency can be rapidly obtained, merely by changing the inductance and capacity in the oscillatory circuits connected to the arc itself. The radio frequency alternator is very reliable, and develops its full power in a very constant and reliable manner, but it is difficult, at least with the present design of this machine, to obtain with speed and efficiency a considerable change in the range of wave lengths and frequency, yet as Dr. de Forest has intimated, they are very efficient and desirable where the proper operating conditions are available, such as where but one or two wave lengths only are desired. The arc generator, on the other hand, is very simple and rugged in design, and requires but very little attention, even when operated over twenty-four-hour non-stop periods, which is often the case nowadays at many of the Government stations which are using arc sets, and many of which are in very successful operation in some of the largest stations of the United States as well as in Europe at the present time.

All of the transmitters at the Lyons station operate on long wave lengths, as the reader will perceive from the antenna frequency values given above, and the undamped wave system is used in all except the spark sets. The receiving apparatus is very elaborate, and has been installed in sound-proof receiving rooms, so as to realize the very highest efficiency in the receipt of long distance signals. The French radio engineers are using nothing but three electrode audions in all of their work, and one of their bulbs will be illustrated and described in the April issue. The French receiving sets make use of two or more amplifier bulbs, and when necessary a six-stage amplifier is used, which boosts the strength of signal received 1,000,000 times. Some of the clever work accomplished by the French Army and Navy radio experts during the war, with these powerful audion amplifiers can readily be imagined, and it is a matter of record that many valuable radio as well as regular telephonic and telegraphic wire messages of the Germans were tapt by French stations equipt with these powerful amplifiers.

The power for the Lyons radio station is transmitted for a long distance from a hydro-electric plant. The receiving apparatus was built by the Compagnie Generale Radiotelegraphique, whose shops are near Paris. The detector is, of course, the French type of audion. They employ a six-step audion amplifier, using the same standard type of bulb both for detecting and amplifying.

The ground connection of the station consists of a large number of copper wires radiating from the station and buried about two meters (6½ feet) below the surface of the earth. Many of these wires terminate in copper plates.

HOW I INVENTED THE AUDION.

(*Continued from page 790*)

plication was not filed until the following February. The drawings, Figs. 2 and 6, of this patent show the incandescent or glow members both in the air, and sealed within a closed chamber.

It will be noted now that I approached the general problem of this new type of detector from an entirely different angle from that commonly supposed to-day. In the first place I always employed a battery, and this original battery was what is now universally called the "B battery." My source of electric current for heating purposes was second, and secondary, so that the vociferous contention of the advocates of the Fleming valve that the audion evolved from the Fleming valve, and was originally the Fleming valve with the "B battery" added as an afterthought, is entirely untrue.

It was now a very obvious development of the evolution thus far described, to partially exhaust the glass envelope containing the two incandescent electrodes, or filaments, so as to increase the conductivity of the space between them.

But Fig. 5 of this patent, showing the inclosed filament in a vacuum bulb, is interesting from another consideration because it contains the *first embryonic germ* of the later "grid" or *third electrode*. It was realized from the very first that a certain proportion of the high frequency energy from the antenna could be lost thru the bypath circuit supplied by the battery and telephone receiver. In order to prevent this the arrangement shown in Fig. 5 was tried out, wherein the local and high frequency circuits are kept separate. In this arrangement, as actually tried in the gas flame, no actual advantage was observed, because the high frequency electrodes were necessarily some slight distance from the path conducting the direct current, and hence the effect of the high frequency currents upon the ions carrying the local current was weakened.

During the years of 1904 and '05 my duties kept me almost continually away from my laboratory, in travelling about the country directing the installation of numerous radio stations; consequently there was little opportunity for prosecuting this development work, and carrying out the designs and sketches which I made from time to time. In fact, it was not until 1905 that a lamp manufacturer was found to undertake the construction of the various experimental forms of lamps which I had designed as a successor to the flame or arc detector. I was familiar in 1905 with Prof. Fleming's work on the subject of the "Edi-

Telephone Men Use These a WEEK FREE

ACCEPT this **free** offer and use these great up-to-date books on the telephone in your own home or shop a whole week free.

We will send you all four volumes bound in genuine red morocco leather, 1728 pages and 2000 pictures, without one cent in advance.

Cyclopedia of TELEPHONY AND TELEGRAPHY

Everything about the telephone is explained in them in simple and plain language—theory—practice—operation—from the first experimental line to the modern equipment and complicated switchboards. Not one detail has been overlooked. Every vital fact that you need to make you an expert is in them.

Free Consulting Service

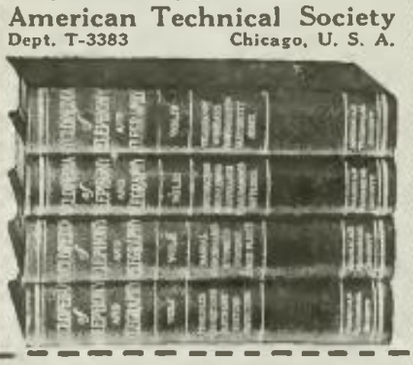
If you wish to keep the books on our easy terms of $2.00 a month, we will include FREE a year's Consulting Membership in the American Technical Society, and you can have the services of our engineers and experts for one year as often as you wish to write in—ask for their help on any subject within the scope of books.

Send the Coupon Now

Don't send any money. Just mail the coupon properly filled out and the books will come to you at once by express collect. Keep them a whole week and use them as if they were your own. Send them back to us if you want to, but give them a trial anyway, and if you keep them send us only $2.00. You can send the balance of the special $12.80 price the same way—$2.00 each month.

Give yourself a chance to make some real money—right now. Send the coupon before you turn this page.

American Technical Society
Dept. T-3383 Chicago, U. S. A.



American Technical Society, Dept. T-3383, Chicago

Please send me a set of Telephony and Telegraphy in 4 volumes, express collect. I will send you $2.00 in 7 days and $2.00 each month until I have paid $12.80. If I don't want to keep the books I will return them to you in one week and will owe you nothing.

Name .....

Address .....

Reference .....

Learn Watchwork, Jewelrywork and Engraving Optics and instrument repair. A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL, Dept. E., Bradley Institute, Peoria, Ill., for latest catalog.

www.americanradiohistory.com

Mesco Telegraph Practice Set

For Learning Telegraph Codes



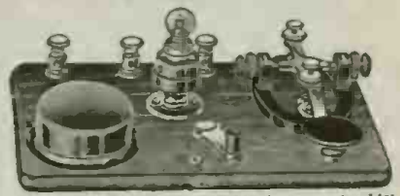
The Practice Set comprises a regular telegraph key, without circuit breaker, a special high pitch buzzer, one cell Red Seal Dry Battery, and four feet of green silk covered flexible cord.

The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes.

List No.		Price
342	Telegraph Practice Set, with Battery and Cord	$3.24

Weighs 4 lbs. packed.
Price does not include postage.

MESCO Combination Practice Set for learning the Morse and Continental Visual and Audible Codes



This outfit is the only reliable instrument which will enable students to become proficient operators in the U. S. Naval Service, because it is equipped with a buzzer and miniature lamp enabling the user to master both the visual and audible signals quickly.

List No. 52—Practice Set with Red Seal Battery and Cord $4.05
Weighs 4 lbs. packed. Price does not include postage.

Send for the New Edition of Our Catalog W28

It is pocket size, contains 248 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

Send for the Catalog Now

Manhattan Electrical Supply Co., Inc.

NEW YORK: 17 Park Place | CHICAGO: 114 S. Wells St. | ST. LOUIS: 1106 Pine St.
San Francisco Office: 604 Mission St.

CLEARTONE PHONOGRAPHS
$4.00 to $200.00 Retail



Needles $4.50 per thousand in lots of 500,000. Motors $1.35 to $14.75 each. Tone Arms and Reproducers $1.20 to $6.75 per set. Main Springs 20c to 50c each. Records, Needles, Sapphire Points and Parts at reasonable prices.
Write for our 84 page catalogue, the only one of its kind in America, illustrating 33 different styles of Talking Machines and over 500 different Phonographic Parts.
LUCKY 13 PHONOGRAPH COMPANY
Export Dept. 46B E. 12th St., N. Y., U.S.A.

A STEFFEY MOTOR



on your wheel will convert it into a practical and successful high grade motorcycle that will cost you less to operate than the more expensive machines. Write at once and secure lowest factory prices. Excellent opportunity for agents. Send stamp.
STEFFEY MFG. CO., Dept. E. 5025 Brown St., Phila. Pa.

HAVE *You* SENT

for our booklet No. 4, giving diagrams and experiments with the Steco Button? See our large ad. pg. 822
STECO. 2134 N. Clark St., Chicago, Ill.

STAMPS

50 diff. Belgium (large bi-color), Chico, Jamaica, Portugal, Venezuela, etc., 10c; 100 diff., nice packet, 20c; 1,000 well mixed, 40c; 100 var. U. S., 50c; 1,000 hinges, 10c; Agts. wanted, 50%. List free. I buy stamps. L. B. Dover, Overland, Mo.

son Effect" as utilized for the rectification of high frequency oscillations, or currents. This was interesting to me only as an evidence of growing activity along lines similar to those of my new detector. I was familiar, of course, with the phenomena originally discovered by Edison, and investigated and developed by Howell, Fleming, Wehnelt, et al; but from the very first of my work with radio detectors I always had in mind a *relay*, in the true sense of the word, *not a rectifier;* in other words, a detector in which the energy of the audible signal was supplied from a local battery. This local energy being merely controlled or released by the incoming signal. It had always been obvious to me that such a device should be more efficient than any form of rectifier where the signal indication is effected *only* by the energy actually received thru the antenna.

Fig. 1, Patent No. 824,637, is an obviously practical development of Fig. 5 of my first patent, No. 979,275. In this figure two incandescent filaments are sealed in the glass bulb, and each lighted from its own "A" battery. Here, as always, the original separate "B" battery is shown.

This figure is interesting to many, who until recently, if even now, have never heard that an audion of this type works equally well whether both electrodes are incandescent, or whether one is incandescent and the other cold. It might be well to point out now in this connection that during the patent trial—the Fleming valve vs. the Audion—a demonstration was made before the court where all three electrodes were in the form of filaments, where each could be heated to incandescence by a separate battery. The demonstration showed that when this device was connected up as an audion that either outside filament could be used as the "plate" electrode indifferently, and the signals were of the same intensity whether two electrodes were cold or all three hot. The purpose of this test was to demonstrate beyond all cavil the falseness of the assumption that *rectification* plays in any way an important or essential part in the operation of the three electrode audion.

Fig. 3 of the above mentioned patent No. 824,637 shows the next obvious step in the evolution of the audion i.e., doing away with the unnecessary battery for heating one of the electrodes. It was obvious, of course, that so long as the "B" battery was properly connected so that its positive pole led to the cold electrode, there was no necessity or advantage in heating this second electrode. The audion in this form—one hot and one cold electrode, and the "B" battery connected with this positive terminal to the cold electrode, was used for some months, and shows a sensitiveness as a detector, superior to that of the electrolytic detector, and far superior to that of the Fleming valve rectifier. We had, thanks to the "B" battery which was invariably employed, a genuine *relay* or *trigger action* of the high frequency oscillations upon the normal current-carrying ions, or electrons, passing between the two electrodes.

As everyone familiar with incandescent lamp or X-ray bulb phenomena knows, the proportions of current passing between two electrodes therein (one or both being hot) carried by ions or carried by thermions, depends chiefly upon the degree of exhaustion of the bulb. The gradual preponderance of thermionic conduction over ionic conduction has been gradually increasing as the art has progrest with improvements in pumps, knowledge of the fine points of exhaustion, etc. Thus it has always been impossible to lay a finger upon a certain date or upon any audion type of device, and say, "This marks the distinction between an ionic, or gascous detector, and a thermionic detector." It is in fact impossible to prove even to-day when audions or oscillions are exhausted to the highest degree that the conductivity is *entirely electronic.*

Super-Sensitive Microphone ONLY $7.50



This instrument is offered at an extremely low price. It is excellent for building your own amplifier. Can also be used in many experiments where a sensitive microphone is required.

Detectagraph, $15

This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord, Receiver, Headband, Case and Battery.

Send for One Today and Convince Yourself.



Detectagraph $15



THE $15 MICROPHO DEAF-PHONE

is a super-sensitive instrument which has been developed to meet the demands for a practical and efficient hearing device at an extremely low price. It is equal to any $35 instrument made and superior to most of them. The outfit consists of One Super-Sensitive Transmitter with cord connector; One Super-Sensitive Ear Piece with small black cord; One Black Single Headband; Black Case and Two Batteries. WRITE TODAY FOR FREE BOOKLET

G. BOISSONNAULT CO.
26 CORTLANDT STREET NEW YORK
Makers of Super-Sensitive Microphone Apparatus

Not Toys But Real Apparatus

the same as used by all operating companies. You had better send us your order immediately to insure prompt delivery, as this equipment will not last long at these prices.

110 Volt Generators	3 bars, each	$3.00
	4 bars, each	4.00
	5 or 6 bars, each	5.00
Telephone transmitters with arms, each		.75
Good ringers complete with bells, each		.50
Telephone receivers, each		.75
Condensors, all sizes, each		.50
Real complete common battery telephones, wall type with 1600 Ohm ringers, each		4.50
Slightly used dry cells, per dozen		1.25
Large, powerful magnets, while they last, each		.50

Please send money-order or cash with your order
ELECTRICAL SPECIALTY COMPANY
128 South Eleventh Street, Philadelphia, Pa.

WANTED
IMMEDIATELY

Civilian wireless and land line operators are in great demand, owing to the government special classification.

Our classes will quickly qualify you. Excellent dormitory facilities for out of town students.

Write for booklet giving full particulars about
The Best Radio School in New York City

East Side Branch Lenox 6051
Y. M. C. A.
86th St. and Lexington Ave. New York

ARNOLD NAVY MODEL LOOSE COUPLER



I beg to advise my friends and customers that I am back in the Wireless Game at the old address, where I hope to be favored with a visit and your much valued patronage.

J. F. ARNOLD
327 East 119th St., N. Y. City
Established 1910

WIRELESS TELEGRAPHY

Our 14 weeks course prepares you for MERCHANT MARINE paying $110 per month and expenses. RADIO INSPECTORS receive $1,200 to $3,500 per year. Our instructors are licensed by U. S. government; school fully equipped and largest of its kind in America. Tuition small and payable weekly. We guarantee to qualify you. Board and room in Washington at reasonable rates while taking the course. Particulars on request. SERVICE RADIO SCHOOL, 902 Pa. Ave. N. W., Washington, D. C.

www.americanradiohistory.com

In the spring and summer of 1906 I had opportunity to spend a good deal of time on the audion problem, and was always seeking to improve its efficiency. Keeping in mind then the disadvantage of directly connecting the high frequency circuit with the local circuits, and harking back to the four electrode gas-flame detector above mentioned, I sought to keep one electrode of the high frequency circuit distinct from the two electrodes of the local current. Obviously the most simple experiment was to *wrap a piece of tinfoil around the outside of the glass bulb and connect this to one end of the secondary transformer of my receiver.* The other end of the transformer was connected to the filament, it being obviously unnecessary to employ four electrodes to effect the end desired. Exactly this arrangement, with the third electrode around the outside of the bulb, is shown in Fig. 3 of patent No. 841,386, which was filed in August, 1906. It will probably be recalled that this outside electrode has been very recently "re-discovered" with considerable eclat and acclaim! I also at this time wrapt a coil of wire around the bulb, connecting one end of this to the antenna and the other to the ground, seeking thus to effect the ionic conductivity between the inner electrodes by electro-magnetic influence from the high frequency oscillations passing around this helix. See Fig. 4, patent No. 841,386.

The arrangement of the external tinfoil belt may therefore be called the *parent of the third electrode.* It showed a decided improvement in the sensitiveness of the detector, as I had anticipated. I recognized that by this arrangement I had in effect a condenser between the filament connection and a hypothetical third electrode, which consisted of the conducting layer of gas located on the interior walls of the bulb, the other arm of this condenser being the tinfoil belt outside the glass. I recognized also that this was a very inefficient and indirect way of impressing the effect of the high frequency oscillations upon the conducting medium between the filament and plate. The third electrode should therefore be placed inside the bulb. I immediately instructed McCandless & Company to make such a bulb. The first type of this third electrode was in the form of a plate, located on the opposite side of the filament from the "B" battery plate. This arrangement showed the increased efficiency and sensitiveness anticipated. It is shown in Figs. 2 and 4 of patent No. 841,387, filed October, 1906. This is the audion amplifier and telephone relay patent. Fig. 2 of this patent is interesting as showing also for the first time a third battery ("B") in the external circuit between the third electrode and the filament. T in this figure represents the high frequency transformer.

In Fig. 4, where this battery is omitted, is shown for the first time the grid stopping condenser C. In studying this type of three electrode bulb, I recognized that the third electrode was not yet in its most efficient position. It should be placed directly in the path of the ionic or thermionic stream, passing from filament to plate, where the high frequency electric charges imprest on the electrode could best affect this stream. But if placed directly between two electrodes, a solid plate, of course, would constitute practically a complete barrier. Hence I devised the *grid* or *perforated screen structure.* In fact, the first audion where the third electrode was placed between the filament and plate utilized the wire bent in grid form which is familiar to every amateur or user of the audion prior to 1914.

This type of third electrode so located was so marked an improvement over the preceding three-electrode bulb, that shortly thereafter a patent was applied for on it. This was issued in February, 1908, No. 879,532. See Fig. 1 where the complete receiving arrangement and the grid audion is clearly shown.



Brandes "Superior" Head Set, complete with head band, $6. A professional set within the means of every amateur. 2000 ohms.

BRANDES
Wireless Head Sets

Anticipate the demand that will set in as soon as the Government lifts its ban on amateur wireless stations.

Order your BRANDES WIRELESS HEAD SET TODAY.

Be ready for better wireless results than you ever had before. The *matched tone* of the two Brandes diaphrams make this possible.

Every Brandes head set is sold under a positive money-back guarantee that it is superior to any other receiver at its price in clearness, sensitiveness, and range.

Order a Brandes Head Set today—or send 4c for Booklet E with complete description of Brandes receivers.

C. BRANDES, Inc.

Wireless Receiver Specialists

Room 814 32 Union Square New York City

Complete line of Brandes receivers for those in Western States and Pacific Coast. Catalogue E on request.

Balboa Building FORD KING SAN FRANCISCO, CAL.

Radio Amateurs!

Buy parts and make your own sets. Large stock of radio materials left on our hands because of canceled Government contracts!

An opportunity for buying high grade materials at bargain prices.

Guaranteed Galena Crystals, everything for coils, switches, knobs, resistances - insulating materials, condenser plates and parts, Litzendraht and magnet wires, contact points, head bands.

Also Manufacturers of Complete Receivers, Condensers, Variometers, Inductances, Oscillion Transmitters.

DE FOREST RADIO TEL. & TEL. CO.

1391 SEDGWICK AVENUE NEW YORK CITY

www.americanradiohistory.com

MURDOCK
Radio Receivers



Noted for their extreme sensitiveness and unfailing dependability. At the very reasonable prices, they are the best receiver value in the world.

Buy now for present and future needs.

Other Apparatus of Equal Merit Available for Experimenters, Schools, and Colleges.

Ask for Bulletin No. 18.

WM. J. MURDOCK CO.
55 Carter St.
Chelsea, Mass.

Wireless Individual instruction continues under the general supervision of E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Co.

Y. M. C. A. TELEGRAPH SCHOOL
Marcy Ave., near Broadway, Brooklyn, N. Y.

SELENIUM CELLS

Guaranteed 99% pure selenium

Made by people who know their business, for the most difficult work, requiring very sensitive, quick acting cells. Standard cells, $5 each. Special cells to order.

THE SELENIUM LABORATORIES,
New York Offices. 56 West 45th St.

Recharge your old dry Batteries

No Chemicals: Method Easy. Sent on receipt of 25c Coin. C. E. MILLER, 164 Riverside Drive, Northampton, Mass.

The audion remained in this form for six years. During that time its merits became gradually recognized in Europe as well as here, and it was not long before the little stranger was, like its predecessor, the two electrode brother with "B" battery, adopted into the Marconi family, and like its predecessor re-christened the "Fleming Valve." As soon as the audion amplifier had been developed for long distance telephone service by the engineers of the Western Electric Company, and installed on most of the long distance lines of the A. T. & T. Co., we find certain English publications adopting it also into the Fleming valve family; and now after the three-electrode device has demonstrated its utility as a radio transmitter of absolutely constant undamped waves and made possible trans-oceanic telephony, we learn that this big brother which I first named the Oscillion, is also the Fleming valve. Not even "junior" or "senior" is used to distinguish one from the other in this rapidly growing Fleming valve family.

The art founded on the three-electrode audion has grown of late years with enormous strides. The great war has produced a tremendous intensity of development for various military purposes and it cannot be disputed that the engineers of the Western Electric Company have taken a foremost position, and much of the present-day efficiency of the detector and amplifier has been due to their efforts, spurred on as they were by the difficult demands and specifications of our Signal Corps officers and engineers. It is estimated that there has been constructed for the U. S. Signal Corps during the war between 200,000 and 300,000 audion and amplifier bulbs, and at least 50,000 small oscillators. In Great Britain wartime production has probably equaled or exceeded the above; while in France we are informed that during the last two years of the war, the audion production has averaged about *5,000 per day!* The French bulb is particularly interesting as being efficient and suitable in all three uses, detector, amplifier and oscillator. For such purposes, of course, a compromise in efficiency was inevitable, and maximum efficiency in either of these three branches has been somewhat sacrificed.

Considerable discussion has lately arisen as to the first use of the audion as an oscillator or source of alternating current. This matter is now being thrashed out in a multiple interference procedure in the U. S. Patent Office. But the evidence so far indicates that the writer's application of this property of the audion in the spring of 1912, marked the first use of the audion as a generator of undamped electrical currents. In view of recent developments, particularly the highly interesting announcements of President Vail of the A. T. & T. Co., regarding multiplex wire telephony and telegraphy over a single conductor pair, it may be prophesied that the application of the audion as a generator of alternating currents will be fully as useful as that of detector and amplifier.

There is, in the writer's opinion, no doubt but that if the development of radio is not now made a Government monopoly, it will not be long before commercial trans-oceanic wireless telephony will be effected. This work, whether the generator be a bank of oscillions or a high frequency alternator, will be made possible only thru the extraordinary amplifying properties of the audion, when used as telephone repeater or relay.

The simplicity of the oscillion transmitter in small sizes, coupled with the extraordinary sensitiveness of the "zero beat" audion detector or amplifier of received high frequency energy, warrants the belief

(*Continued on page* 831)



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle massage. Can be used with or without electric current.

All users of the **Lek-Tro-Shav** speak well of it

A barber says—"Have shaved for years and have never used any shaving device near its equal."
A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."
No. 1 Made for use from Light Socket.
No. 2 Made for use from Dry Battery.
Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.

VIBRATING ELECTRIC RAZOR CO.
Dept. 122. Omaha, Nebr.

PHYSICIANS

THE SKINDERVIKEN TRANSMITTER BUTTON

Is absolutely unequalled for stethoscope work. It will improve your present stethoscope fully 50% and enable you to make a far better and more accurate examination. Simple to install—you can make the change in a few minutes' time. Full directions with every button.

Price $1.00 Each

Or write for full particulars and special information of value to physicians.

Skinderviken Telephone Equipment Co.
Abbreviated Address
STECO-2118-2136 N. Clark St. CHICAGO

TELEGRAPHY AND RADIO
DAY AND EVENING CLASSES
SEND FOR PROSPECTUS
IN SUBJECT INTERESTED
EASTERN RADIO INSTITUTE
899-B Boylston St. Boston, Mass.

110 V. TRANSFORMER
8 Volts Secondary **ONLY $1.00**

A reliable transformer for all experimental work, ringing bells, etc. Consumes so little power it will not move ordinary meter. $1.00, postpaid. Cord and plug, 50c extra.
Transformer No. 10, giving 8, 12 and 18 volts secondary, with plug, $2.00 postpaid. Order from this ad.
EMPIRE TRANSFORMER CO.
Dept. 11 2214 Sedgwick St., CHICAGO

MARKO
STORAGE BATTERIES
ARE GOOD—TRY ONE
Paul M. Marko & Co., Inc.
1402-1412 Atlantic Ave.
Brooklyn, N. Y.

MARCONI INSTITUTE
Wireless, Aviation, Electricity, Navigation, Mathematics
Series of STANDARD PRACTICAL BOOKS
Send for free catalogue
WIRELESS PRESS Inc 33 ELM ST NEW YORK

www.americanradiohistory.com

LATEST STYLE IN FLASHLIGHTS.

(*Continued from page 767*)

the entire set of meter dials are instantaneously photographed on a film. When the meter-reader gets back to the office, the exposed roll film is removed from the camera and a new roll inserted. The film is then developed and the hills made out from the record photographed thereon.

Down on the farm we find another interesting use of the flashlight, tho Uncle Josh will swear that the old barn lantern is much better, and this is in the *testing of eggs* for fertility and freshness. Several attachments have been produced, or one can easily be made from a piece of cardboard, aluminum or tin, in the shape shown in the accompanying illustration, Fig. 7, so that a strong beam of light is thrown against the egg, as it is placed in the opening in the candling screen. In this connection it is interesting to note that by holding a flashlight bulb against the hand or against the finger that it is possible to locate foreign bodies in the finger. The illumination is very intense, and will act almost like an X-ray.

Figure eight shows a doctor's *head lamp* fitted up in an emergency or for regular use from a pocket flashlight. The battery is connected with a piece of flexible twin-cord to the lamp bulb, which is preferably mounted in a small receptacle secured to a piece of fiber, and which in turn is wired or sewed to a strip of elastic webbing. A small buckle can be secured to the free ends of the webbed band, so as to hold it in place on the head in any desired position. A polisht nickel reflector is held in place by the lamp when screwed into the socket, as indicated.

Another clever use for flashlights is in the form of a *desk signal*, and this scheme is outlined at Fig. 9. It has been tried out with great success in several offices. A diagram is given for a three-wire return call system. The beauty of the flashlight call system is that it does not give such a nervous shock to a person as the ordinary buzzer or bell, and it is also very simple and quick to install. Any one can install such a signal system in a few minutes' time. Ordinary bell wire or some flexible lamp cord is used for connecting the two stations together, and the internal connections made to the flashlight battery are clearly shown in the diagram. Where two or more flashlights are used on one desk, the lenses may be of different colors, so that the party calling is indicated more quickly.

Figure ten shows one form of *electric clocklight*. Of course, most ordinary mortals find the pocket flashlight very useful about the bedroom, and invariably keep one under their pillow, so that it is only necessary to flash it on the clock or watch and ascertain the time whenever desired, but in some instances it proves more convenient or desirable to have the lamp bulb mounted on the clock base as here shown. Those desiring to utilize this scheme can easily do so, and all that is necessary is the ordinary flashlight, the proper length of flexible twin-cord and a push-button, preferably of the pear-shaped variety.

Figure eleven illustrates one out of about ten thousand possibilities in electric flashlight advertising and tie-pin novelties. The illuminated "stove pipe" and shirt bosom shown, were not merely sketched by the artist, but were actually used for several years in New York City, and tickled the heart of many a youngster as well as grown-up. The man fitted with this illuminated silk hat and shirt bosom was quite a common figure on Broadway at one time, and created one of the most novel surprises progressive advertising ever initiated. Needless to say, the best results are obtained with such an arrangement when the lights are flashed on and off at short intervals. In the present case the hat became illuminated first and then the shirt bosom, the arrow in the front of the hat sign causing the onlooker to glance downward invariably, and at that psychological moment,— lo and behold! the shirt bosom blazed forth in all its red-and-white-striped-glory, to the effect that "Killem-quick's" whisky was the only stuff that had the "punch"—it did'nt say it was a deadly punch, to be sure.

The illustration at Fig. 12, shows a very ingenious and most useful instrument utilizing the flashlight principle and known as the *inspectoscope*. As the illustration shows, the inspectoscope comprises a tube either of fixt length, or else made telescopic, at the lower end of which there is a mirror placed at an angle of 45 degrees, while at the upper end of the tube a small flashlight case and its battery are mounted. The lamp at the bottom of the tube receives current thru the metal tube, and the other side of the circuit is completed thru a single insulated wire leading up to the flashlight battery, the button switch on the battery case being used to light the lamp. This instrument has been found extremely efficacious in reading name-plates on motors and other machinery where they happen to be in inaccessible locations, such as close to a wall, etc. Many other practical and ingenious uses of the flashlight will suggest themselves to the reader, and it is doubtful if there has ever been any one invention in the electrical field that has become more universally adapted than the pocket flashlight.

POPULAR ASTRONOMY.

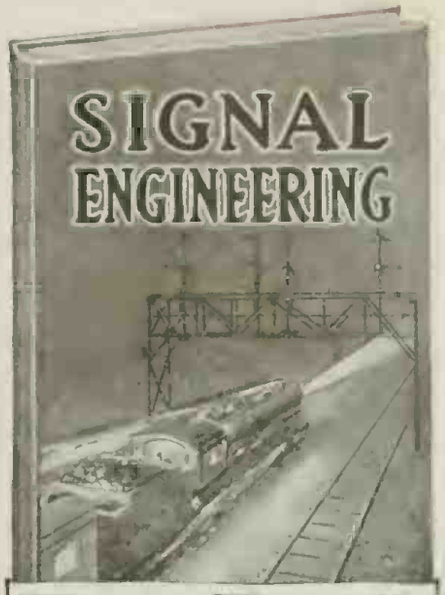
(*Continued from page 781*)

the planet is best seen. Its flattening at the poles, which is nearly ten per cent of its equatorial diameter gives it a decidedly oval appearance at this time. Ordinarily one of the hemispheres of Saturn is partly or entirely concealed by the rings so that the oblate form is not so noticeable. After the temporary disappearance of the rings in 1920 the earth will pass from a position below the rings to one above them. The northern surface of the rings and the northern hemisphere of Saturn will come more and more into view after this date, the southern surface of the rings being invisible and less and less of the southern hemisphere of the planet being seen until the rings once more approach their widest opening about seven years later. From this time on until the earth is once more in the plane of the rings, after another quarter revolution of the planet, the elevation of the earth above the rings becomes less and less and the width of the system decreases in proportion to its length. It was this change in the tilt and visibility of the rings that so perplexed Galileo when he attempted to make out the nature of these appendages of Saturn with his crude telescope of insufficient magnifying power. So great was his bewilderment when the rings finally disappeared that he cried out in despair that Saturn must have swallowed his children, according to the legend. He finally became so exasperated with the results of his observations that he gave up observing the planet. The true nature of these appendages of Saturn remained a mystery until Huyghens solved the problem in 1655, some time after the death of Galileo.

In addition to the rings, Saturn has nine satellites named in the order of their distance outward from the planet: Mimas, Enceladus, Tethys, Dione, Rhea, Titan, Hyperion, Iapetus and Phoebe. The last mentioned satellite was discovered by W. H. Pickering in 1899. It aroused great interest at the time because it was the first satellite to be discovered with "retrograde" motion in its orbit. Two satellites of Jupiter since discovered revolve in the same direction around their primary.

The satellites of Saturn approximate to

(*Continued on page 823*)



FreeBook
on Signal Engineering

THOUSANDS of miles of railroad must be equipped with block signal systems. To superintend these installations and to maintain the systems now in use thousands of men are necessary. *Golden opportunities are now offered.* Every ambitious man should write for the free book on Signal Engineering.

If you join the army or navy before you have completed the course, further payments will be postponed until you return.

Men Are Needed!

At the present time, less than one-fourth of the passenger lines in the country are equipped with automatic block signal systems—and when you read that the day is fast coming when the law will compel railroads to install them, you will realize what remarkable opportunities are offered to ambitious men in the profession of Signal Engineering. The work is big—broad—high salaries are paid. $250.00 a month is an ordinary salary for a Signal Engineer. Write for particulars.

Send the Coupon

Put your name and address in the coupon, or a letter or post card *now* and get the free book about Signal Engineering. Too, we will tell you how you can get the training that you need in order to become a Signal Engineer. You will be under no obligation in writing for the book.

Department of Signaling
Dept. 1793
1810 Wilson Ave.
Ravenswood Station
Chicago, Ill.

Department of Signaling
Dept. 1793 1810 Wilson Ave.—Ravenswood Station
Chicago, Ill.

Gentlemen:—Please send me absolutely free and prepaid your big new book on Signal Engineering. Also full particulars about your great special free outfit offer. It is understood that I assume no obligations of any kind.

Name.....
Address.....
Age .....Occupation.....

Why Pay Full Prices for Diamonds



Write Today for Special Bargain Bulletin

DIAMOND Banking is the business of a million dollar firm nearly 3/4 century old. *We lend money*, accepting high-grade diamonds, etc., as security. When loans remain unpaid we must sell to get our money. Most amazing bargains proved by customers' letters. Diamonds, Rings, Pins, Brooches, Pendants, etc., at prices we challenge you to match at 60 per cent more, sent for absolutely free examination.

Write for JOS. DeRoy Bulletin

Radically different from ordinary catalogs. Send your name today and we will send you our bulletin of bargains showing hundreds of unpaid loans. It is absolutely free.

Jos. DeRoy & Sons 8048 DeRoy Building
Only Opposite Post Office Pittsburg, Pa.

Learn in 6 Evenings



"Talk as fast as you like, I am taking it down in K. I. Shorthand."

SHORTHAND Simplified
Learn Easily at Home

Practical *K. I. Shorthand;* quickly learned. You attain speed easily. Great saving in time and expense. Guarantee and *30 days' trial* given. Home study. Many endorsements. Used in Government service, in corporations, schools, professional and business offices, private use, etc. Brochure and specimen lesson *FREE.*

KING INSTITUTE, ED-300, Station F, New York, N. Y.

www.americanradiohistory.com

SKINDERVIKEN TRANSMITTER BUTTON

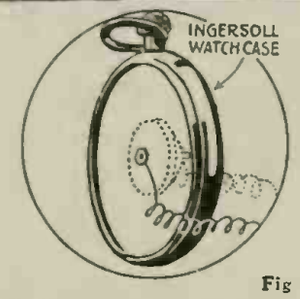


Fig 1

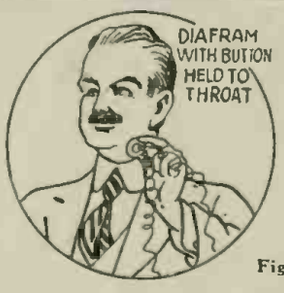


Fig. 2



Fig. 3

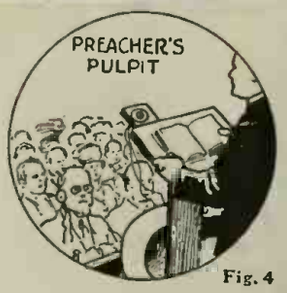
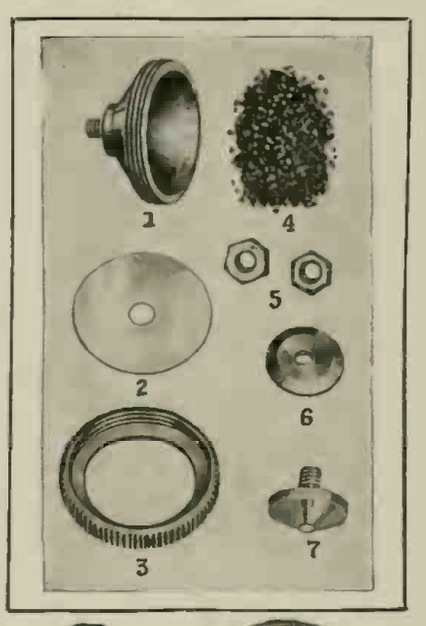


Fig. 4

THE SKINDERVIKEN TRANSMITTER BUTTON presents the latest advance in microphones and marks a revolution in transmitter construction. It works on an entirely new principle, takes up practically no room, and marks the end of all telephone transmitter troubles.

The SKINDERVIKEN TRANSMITTER BUTTON can be placed in any position and it will talk loudly and distinctly and is at the same time extraordinarily sensitive. It was primarily designed to replace the old damaged or burnt-out transmitter. Simply unscrew and remove the telephone transmitter front, disconnect the two inside wires, unscrew and remove the bridge and the old electrode. There remains only the diafram. These wires are then connected with the Skinderviken button, the latter screwed to the diafram, and after screwing the old transmitter housing together again, the telephone is ready for work.

ELECTRICAL EXPERIMENTER readers will be particularly interested in all the different experiments that can be performed with the Skinderviken Button. Fig. 1 shows the Skinderviken button attached to the back of an Ingersoll watch case. When speaking towards the inside of the case, it will be found that the voice is reproduced clearly and loudly,







$1.00 Prepaid

This shows how button is attached to ordinary telephone transmitter.

Fig. 2 shows another interesting stunt. By attaching the button to a tin diafram about the size of half a dollar, and by holding the diafram at the side of the throat, as shown, speech can be transmitted with surprising clarity. Fig. 3 illustrates the same arrangement placed on the chest as shown. In this position the transmitter will talk clearly and loudly. Fig. 4 shows an arrangement whereby the Skinderviken button is attached on a thin wood board at the preacher's pulpit. His voice is clearly transmitted so that people hard of hearing can readily hear the sermon. Fig. 5 shows how a very sensitive Detectophone can be made by placing one of the buttons in the center of a lithographed cardboard picture, so that only the small brass nut shows. The large surface of the picture acts as a big diafram, and the voice is well reproduced. Fig. 6 shows an interesting stunt, whereby a hole is drilled in the side of a thin glass water-tumbler; the sides of the glass thus acting as a diafram, the voice is clearly transmitted. Fig. 7 shows a simple match box Detectophone. The Skinderviken button is concealed inside of the box, only the small brass nut showing on the outside. This can be camouflaged as well. This device talks well. Fig. 8 shows how to transmit phonograph music at a distance merely by drilling a small hole in the phonograph arm and attaching the Skinderviken button; a very favorite experiment with all experimenters.

We have such unlimited confidence in the Skinderviken Transmitter Button that we make the following remarkable offer. Send us one dollar ($1.00) for which we will mail one button prepaid. If you do not wish to keep it, return it within five days and your money will be refunded. Boys! send stamp for booklet No. 4. It gives diagrams and experiments using the Skinderviken Transmitter Button, and prices of telephone equipment.

ALSO ALL KINDS OF TELEPHONE PARTS FOR EXPERIMENTERS
at prices far below the actual cost of manufacture



Fig. 5



Fig. 6

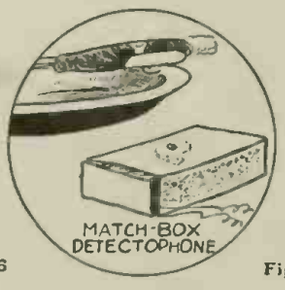


Fig. 7

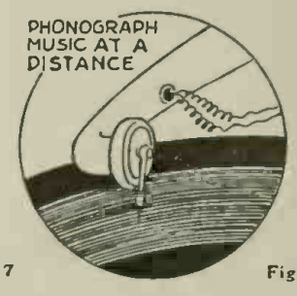


Fig. 8

Skinderviken Telephone Equipment Co. Address us as STECO, 2118-2136 N. Clark St., Chicago, Ill.

www.americanradiohistory.com

POPULAR ASTRONOMY.

(*Continued from page* 821)

those of Jupiter in size and exactly equal them in number. The largest, Titan, is three thousand miles in diameter and can be seen with the smallest telescopes. With a four-inch telescope five of the satellites can be easily found tho they are not as interesting to observe as the satellites of Jupiter because they are on the average four hundred million miles more distant. The time they require to make one journey around Saturn varies from nearly twenty-three hours for Mimas, the nearest, to approximately five hundred and twenty-four days for Phoebe, the most distant.

Like Jupiter, Saturn is marked by belts parallel to the equator tho they appear more indistinct than those of Jupiter on account of the greater distance of Saturn. Saturn also resembles Jupiter in its physical composition which is largely, if not entirely, gaseous and in the extremely short period of rotation on its axis which is approxmately ten hours. In more ways than one Saturn is a very unusual planet. In addition to possessing an enormous ring system it is the lightest of all the planets, its density being only sixty-three hundredths that of water, and it is the most oblate, its



Fig. II Shows (On a Scale Reduced Ten Times From That of Fig. I) the Orbits of the Outer Satellites. Even on This Reduced Scale It Is Impossible to Represent the Orbit of Phoebe, the Most Distant, Which Is Three and Six-Tenths Times More Distant Than Japetus.

flattening at the poles amounting nearly to one-tenth of its diameter. Its equator is more highly inclined to its orbit than is the case with any other planet, not even excepting the earth and Mars. For this reason its seasonal changes are very great, in marked contrast to Jupiter whose equator lies very nearly in the plane of its orbit. Since Saturn is so far away from the sun that it receives only one-ninetieth as much light and heat per unit area as the earth, its outer gaseous surface must be extremely cold unless considerable heat is conveyed to the surface from within its hot interior.

Prof. Lowell concluded from certain observations made at Flagstaff, Ariz., that Saturn is composed of layers of different densities and that the inner layers are more flattened at the poles and rotate faster than the outer layers. Marked variations in the color and brightness of the ball of the planet have been noted from time to time. In 1916 observers of Saturn described the planet as pinkish-brown and conspicuously darker than the brighter portions of the rings. The ringed planet may now be found in the constellation of Leo not very far from the star Regulus at the end of the handle of "The Sickle." It is more than twice as bright as Regulus and of a yellowish tinge. As it was in opposition to the sun on February 14, it is now most favorably placed for observation, being visible all thru the night.

"THE BORDER WIRELESS" AND "THE HUN WITHIN."

(*Continued from page* 768)

cause of his hatred for Prussian autocracy and who has become intensely American. His son Karl, however, whose nature is cold, is pro-German despite his father's protests, and after being educated in Germany he returns home just before Germany involves the world in war.

Near the Wagner home lives an invalid, with her daughter, Beth, a charming patriotic girl. The girl's father at his death begs Wagner to watch over Beth and she seems devoted to Karl; he offers no protest. Frank Douglas, a schoolmate of Beth's, is devotedly attached to her and her seeming preference for Karl causes him great anxiety. Beth is living in the Wagner home and there meets Grippen, a German spy, who is assisted by Leone, known as the "Lynx," a German Secret Service agent, and Krug, a spy, who is a sailor on a transport. Douglas enters the United States Secret Service as operative and is trailing Leone.

At dinner, young Wagner takes the oath binding himself to the service of the Kaiser. It is determined by Grippen and his agents to destroy American shipping and when war is declared by the United States against Germany, Grippen resolves to destroy transports conveying troops to France. Beth is seated in an easy chair one night when she overhears Leone tell Karl that Krug has planted a bomb, secreted in a thermos bottle, on board a transport, and that it has been timed to explode at midnight on the date of sailing of the vessel.

Shocked at this proof of the perfidy of the man she believed she loves, Beth upbraids Karl, whereupon he binds and gags her and then conveys her to the mountains where Grippen's lair is located. Douglas is trailing the spies persistently and they decide to get rid of him. He is kidnapt and when his senses leave him, the spies throw him out of an automobile into a creek. This revives him and he makes his way with difficulty to the spy rendezvous where he discovers that Beth is a prisoner.

He eludes the guard and obtains access to Beth who tells him of the attempt to be made to destroy the transport. He has a fierce battle with the guards, but manages to place Beth in an automobile and start at full speed to warn the authorities of the transport's peril. They reach the Wagner home after Karl's departure and when the father hears of his son's traitorous conduct he is frantic with rage. The *telephone* having been put out of commission by Karl, Beth leaves for a *wireless station* near by.

Karl returns home and when his father upraids him, he shoots him. A mob gathers outside and Karl is about to be lynched when a troop of cavalry saves him. He and Grippen are taken in custody for trial. Meanwhile Beth and Douglas reach the wireless station and altho the bomb is to explode at midnight, the operator at ten minutes of that hour, has failed to get in touch with the transport.

Krug is about to jump overboard to escape the fate he and his confederates have prepared for the troops aboard the transport, when Beth's wireless message is received and he is apprehended. The bomb is discovered at one minute of twelve o'clock and it explodes as it is hurled into the water. The elder Wagner recovers from his wound and Beth and Douglas plight their troth.

THOSE PASSIONATE "THREE WEEKS" AGAIN.

Ever read many electrical advertisements? Here's a gem, culled from a South Carolina newspaper by Seymour Paul, of the U. S. Field Artillery Depot, Camp Jackson. Thanks, Seymour, call again. And, say, while we think of it, you ought to see the hundreds of letters we receive in which the words "oscillating" and "faulty" are mis-spelled and [illegible]. What's the use—they [illegible] ing it.

FOR SALE—Westing[illegible] lating 40 cycle fan, [illegible] Am leaving city. [illegible]dg.



"I Got the Job!"

"I'm to be Manager of my Department starting Monday. The boss said he had been watching all the men. When he found I had been studying at home with the International Correspondence Schools he knew I had the right stuff in me—that I was bound to make good. Now we can move over to that house on Oakland Avenue and you can have a maid and take things easy. I tell you, Nell, taking that course with the I. C. S. was the best thing I ever did."

Spare-time study with the I. C. S. is winning promotions for thousands of men and bringing happiness to thousands of homes all over the world. In offices, shops, stores, mines, mills and on railroads, I. C. S. trained men are stepping up to big jobs, over the heads of older men, past those whose only qualification is long service.

There is a Job Ahead of YOU

Some man is going to be picked for it. The boss can't take chances. When he selects the one to hold it he is going to choose a trained man with sound, practical knowledge of the work. Get busy right now and put yourself in line for that promotion. You can do it in spare time in your own home through the International Correspondence Schools, just as nearly two million men have done in the last twenty-seven years, just as more than 100,000 men are doing today.

The first step these men took was to mark and mail this coupon. Make *your* start the same way—and make it right now.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6181, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- ELECTRICAL ENGINEER
- Electrician
- Electric Wiring
- Electric Lighting
- Electric Car Running
- Heavy Electric Traction
- Electrical Draftsman
- Electric Machine Designer
- Telegraph Expert
- Practical Telephony
- MECHANICAL ENGINEER
- Mechanical Draftsman
- Ship Draftsman
- Machine Shop Practice
- Toolmaker
- Gas Engineer
- CIVIL ENGINEER
- Surveying and Mapping
- MINE FOREM'N OR ENG'R
- ARCHITECT
- Architectural Draftsman
- PLUMBING AND HEATING
- Sheet Metal Worker
- CHEMICAL ENGINEER
- SALESMANSHIP
- ADVERTISING MAN
- Window Trimmer
- Show Card Writer
- Outdoor Sign Painter
- RAILROADER
- ILLUSTRATOR
- DESIGNER
- BOOKKEEPER
- Stenographer and Typist
- Cert. Pub. Accountant
- Traffic Management
- Commercial Law
- GOOD ENGLISH
- STATIONARY ENGINEER
- CIVIL SERVICE
- Railway Mail Clerk
- Textile Overseer or Supt.
- AGRICULTURE
- Navigator
- Poultry Raising
- Automobiles
- Spanish
- French
- Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____



WANTED — Railway Mail Clerks

Age 16 to 40
$1100 to $2000 Year
Common Education Sufficient
Sure pay. Life job.

Franklin Institute
Dept. C101
Rochester, N. Y.

Sirs: Send me, without charge, (1) sample Railway Mail Clerk examination questions; (2) list of places of all U. S. coming examinations; (3) government jobs now open; (4) book describing them.

Name_____

Address_____

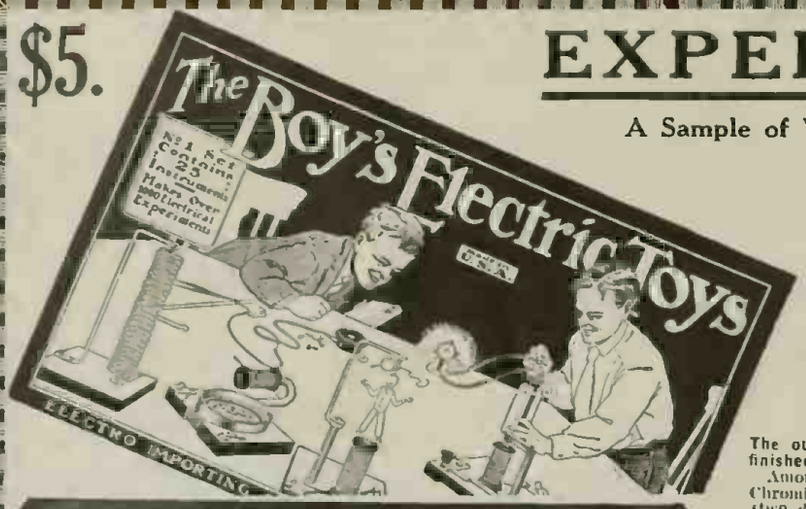
FREE COUPON!

PATENTS Patent Practice and Procedure, and Law Points for Inventors
VICTOR J. EVANS & CO., Patent Attorneys
United States patents made in all cases before preparing applications
Pittsburgh Offices: 514 Empire Bldg. Philadelphia 135 S. B
Loyalty Highest References Prompt Attention Rea
Main Offices: 779 Ninth Street, N. W., Washington, D.C.

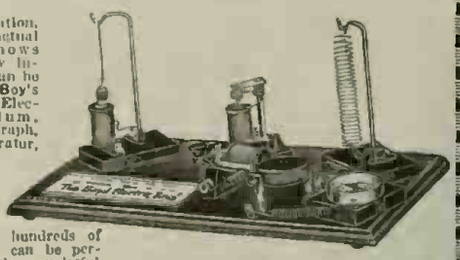
TYPEWRITERS
SAVE $25 TO $50 on well-known "Young Process," new or rented. Rental applies if desired. Write for full details and guarantee
YOUNG TYPEWRITER CO., Dept. 815, Chicago

www.americanradiohistory.com

$5. EXPERIMENTERS!



A Sample of What You Can Do With This Outfit



This illustration, made from an actual photograph, shows only a very few instruments that can be made with the **Boy's Electric Toys**: Electric Pendulum, Electric Telegraph, Current Generator, Electric Dancing Spiral, Galvanometer, Space does not permit us to show the hundreds of experiments that can be performed with this wonderful outfit.

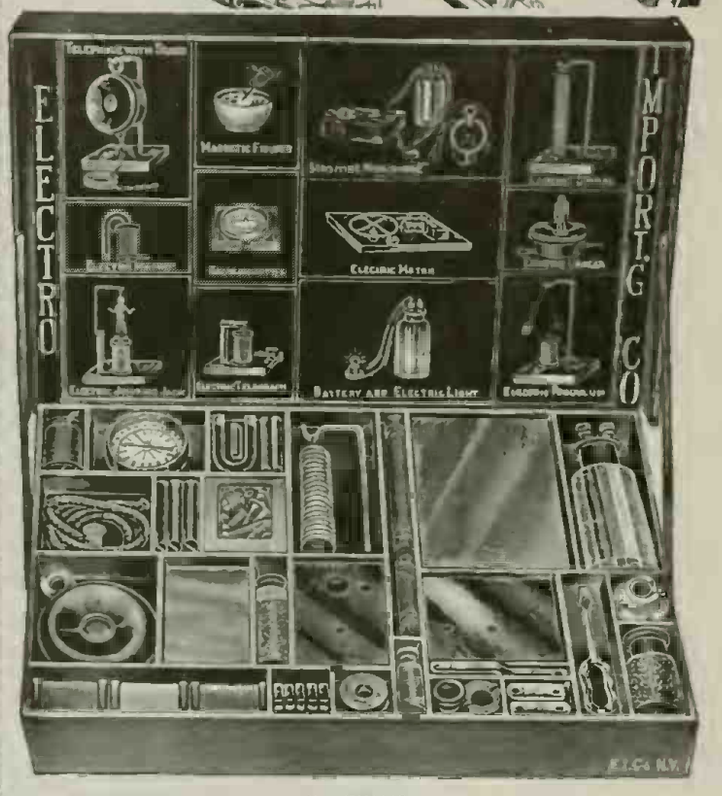
The outfit contains 114 separate pieces of material and 24 pieces of finished articles ready to use at once.

Among the finished material the following parts are included: Chromic salts for battery, lamp socket, bottle of mercury, core wire (two different lengths), a bottle of iron filings, three spools of wire, carbons, a quantity of machine screws, flexible cord, two wood bases, glass plate, paraffine paper, binding posts, screw-driver, etc., etc. The instruction book is so clear that anyone can make the apparatus without trouble, and besides a section of the instruction book is taken up with the fundamentals of electricity to acquaint the layman with all important facts in electricity in a simple manner.

We guarantee satisfaction.

The size over all of the outfit is 14x9x2¾. Shipping weight, 8 lbs. **No. EX2002 "The Boy's Electric Toys." outfit as described.** **$5.00**

IMMEDIATE SHIPMENTS



No. EX2002

"THE BOY'S ELECTRIC TOYS" contains enough material TO MAKE AND COMPLETE OVER TWENTY-FIVE DIFFERENT ELECTRICAL APPARATUS without any other tools, except a screw-driver furnished with the outfit. The box contains the following complete instruments and apparatus which are already assembled:

Student's chromic plunge battery, compass-galvanometer, solenoid, telephone receiver, electric lamp. Enough various parts, wire, etc., are furnished to make the following apparatus:

Electromagnet, electric cannon, magnetic pictures, dancing spiral, electric hammer, galvanometer, voltmeter, hook for telephone receiver, condenser, sensitive microphone, short distance wireless telephone, test storage battery, shocking coil, complete telegraph set, electric riveting machine, electric buzzer, dancing fishes, singing telephone, mysterious dancing man, electric jumping jack, magnetic geometric figures, rheostat, erratic pendulum, electric butterfly, thermo electric motor, visual telegraph, etc., etc.

This does not by any means exhaust the list, but a great many more apparatus can be built actually and effectually.

With the instruction book which we furnish, one hundred experiments that can be made with this outfit are listed, nearly all of these being illustrated with superb illustrations. No other materials, goods or supplies are necessary to perform any of the one hundred experiments or to make any of the 25 apparatus. Everything can be constructed and accomplished by means of this outfit, two hands, and a screw-driver. (Continued in next column)

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 19 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 228 Big Pages, 240 Illustrations, 500 instruments and apparatus, etc. Has **"Treatise on Wireless Telegraphy."** 20 FREE coupons for our 160-page **FREE** Wireless Course in 20 lessons. **FREE** Cyclopedia No. 19 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.



Fig. 5

erviken Telephone Equipment Co.

The "Electro" Radiotone
HIGH FREQUENCY SILENT TEST BUZZER



This instrument gives a wonderful high pitched **MUSICAL NOTE** in the receivers, impossible to obtain with the ordinary test buzzer. The **RADIOTONE** is built along entirely new lines; it is **NOT** an ordinary buzzer, reconstructed in some manner. The **RADIOTONE** has a single fine steel reed vibrating at a remarkably high speed, adjusted to its most efficient frequency at the factory. Hard silver contacts are used to make the instrument last practically forever.

Yes, the **RADIOTONE** is **SILENT.** In fact, it is so silent that you must place your ear on top of it to hear its beautiful musical note.

You will be astounded at the wonderfully clear, 500 cycle note, sounding sharply in your receivers. **To learn the codes there is absolutely nothing like it.** With the radiotone, a key and one dry cell and ANY telephone, a fine learner's set is had. Two or more such sets in series will afford no end of pleasure for intercommunication work. **Shipping Weight 1 lb.**

Radiotone as described.....each **$.90**

IMMEDIATE SHIPMENTS

The "Electro" Telegraph



is not a toy, but a practical, honestly built telegraph outfit, which not only sounds but works like the big commercial instruments. By studying the code for 30 days you can become a first-class telegraph operator. Such operators are in big demand now. Outfit consists of TWO complete telegraph instruments each measuring 3½ x 2½ x 2¼. All metal parts are highly nickel plated, including key lever. Note hard rubber knob. Telegraph Code Chart, telegraph blanks and connecting wire comes with set, but no batteries. Outfit works on 2 dry cells (one cell for each instrument). The "Electro" is the ONLY Outfit that works both ways, each station can call; no switches, no extra. Nothing to get out of order. Guaranteed to please You or Money back. **Price Complete as illustrated (TWO INSTRUMENTS).... $1.25**

Shipping Weight, 2 lbs.

IMMEDIATE SHIPMENTS

The "Electro" Codophone (*Patents Pending*)

$1.50

What this remarkable instrument is and does.



The "Electro" **Codophone** is positively the only instrument made that will imitate a 500 cycle note exactly as heard in a Wireless receiver. The hand-talking receiver equipped with a horn, talks so loud that **you can hear the sound all over the room,** even if there is a lot of other noise.

THAT'S NOT ALL. By lessening or lightening the receiver cap, a tone from the lowest, softest quality, up to the loudest and highest screaming sound can be had in a few seconds.

FOR INTERCOMMUNICATION. Using two dry cells for each instrument, two **Codophones** when connected with one wire and return ground, can be used for intercommunication between two houses one-half mile apart.

One outfit alone replaces the old-fashioned learner's telegraph set, consisting of key and sounder.

The "Electro" **Codophone** is a handsome, well made instrument, fool proof, and built for hard work. Contacts are of hard silver ⅛ inch in diameter, that will outlast the instrument.

There is also a neat code chart and full directions **enabling any intelligent young man or girl to learn the codes within 30 days, practising one-half hour a day.**

Size: 6¾ x 3 x 2⅝." Shipping weight, 2 lbs. **$1.50**

The "Electro" Codophone as described, complete.....

ELECTRO IMPORTING CO., 231 Fulton Street NEW YORK

www.americanradiohistory.com

PATENT ADVICE





Edited by H. GERNSBACK

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries address to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are publisht here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTICE TO CORRESPONDENTS

Questions on Patent Advice are answered in this department every month, and naturally each question must take its turn. We have received so many letters during the past months that it is absolutely impossible for us to answer them all in the "Experimenter." Thus, for instance, the answers appearing in this issue are of letters going back as far as July, 1918. We would therefore urge our correspondents to bear this in mind, and if an answer is wanted quickly, correspondents should make themselves acquainted with the rules printed above.

Resistance Measuring Instrument.

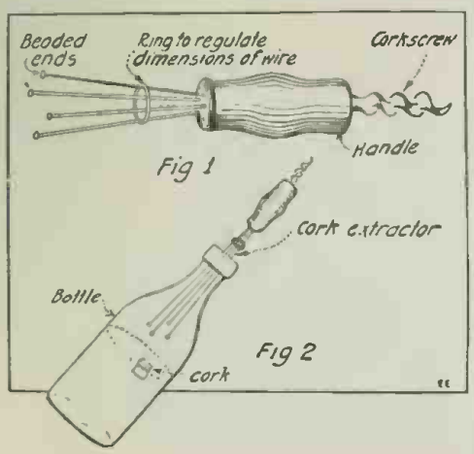
(305) John E. Wheatley, Roachdale, Ind., has invented a device for measuring resistance directly. The device was designed to replace the voltmeter-ammeter resistance circuit and Wheatstone bridge for measuring distances. Our correspondent states the case correctly that both of these methods are intricate and usually require some calculation and too much time. Our correspondent further discloses the construction of his instrument which has a scale working like an ordinary meter, so that the resistance can be read off directly without the necessity of calculation, etc.

A. While there are direct reading ohm-meters on the market, the device in question certainly has unusual merit; and if it can be marketed cheap enough, say for anywhere from fifteen to twenty dollars, we believe that there is a big market for such an instrument. We think a patent can be obtained.

Combination Cork Screw and Cork Extractor.

(316) Dan Lingo, Huntington, Ark., submits an idea of a combination cork screw and cork extractor, and our illustration shows the idea, which consists of a handle, cork screw on one end and beaded wire ends with the ring, at the other side. The *modus operandi* is shown in Fig. No. 2. With a device of this kind as is well-known the cork can be extracted very readily once it was pushed inside of the bottle.

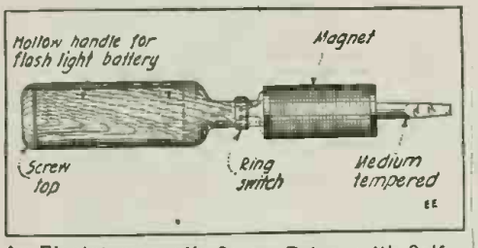
A. The idea is a good one, and while there is of course nothing new as far as the two utensils are concerned, the combination of the two into one is undoubtedly a good feature. To our mind, if the wires could be pushed inside of the handle, out of the way, it would be an added feature of merit. We believe a patent can be obtained on a device of this kind.



Clever Combination Cork Screw and Cork Extractor.

Electro-Magnetic Screw Driver.

(317) Vernan Clements, Elmwood, Nebraksa, submits a clever device which he terms an "electro-magnetic screw driver." The sketch shows the idea which consists of a screw driver with electro-magnet, the latter being energized by a battery held in the hollow handle. Current is supplied to the magnet by means of a switch ring. Our advice is asked.



An Electro-magnetic Screw Driver with Self-contained Battery in Handle.

A. This at first blush seems a good idea, and if the screw driver is only used for a few seconds at a time, which it probably would, it possibly will work satisfactorily, for the magnetism is only used to pick up a screw and hold it long enough until the latter is set; then the current is *supposed* to be turned off. We say *supposed*, but it probably never is. The user would most likely forget to turn off the switch, with the result that the small battery would run down very shortly, and this is where the trouble lies. Otherwise, however, we see no fundamental objection. We are not quite certain if a patent can be obtained, as it seems to us we have seen a similar idea once before. Search in the patent office would, to our mind, amply repay our correspondent.

Trolley Wheel.

(308) Russell A. Adams, Battle Creek, Mich., has sent sketch and description of a trolley wheel.

U.S. PATENTS

SEND FOR THIS FORM

Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception," sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

LANCASTER & ALLWINE

255 OURAY BLDG.,
WASHINGTON, D. C.

PATENTS COPYRIGHTS TRADE MARKS DESIGNS

U.S. PATENTS MAKE IDEAS PAY

Our facilities for securing patents enable us to give prompt and reliable service at reasonable rates. Inventors are invited to write to us regarding questions appertaining to securing patent protection. All matters receive prompt attention. Send sketch for preliminary examination.

Books free on request.

A. M. BUCK & CO.
Patent Attorneys
205 Second National Bank Bldg., Washington D.C.

Competent Patent Service
By a Former Examining Official of the U. S. Patent Office
NORMAN T. WHITAKER
Lawyer and Engineer
480 Whitaker Bldg. Washington, D. C.
INQUIRIES INVITED

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE OF CONCEPTION". This should be signed and witnessed and if returned to us together with model or sketch and description of the invention we will give our opinion as to its patentable nature.

Our Illustrated Guide Book, HOW TO OBTAIN A PATENT, sent Free on request. Contains full instructions regarding Patents, Trade-Marks, Foreign Patents, Our Methods, Terms and 100 Mechanical Movements illustrated and described. Articles on Patent Practice and Procedure, and Law Points for inventors.

An actual search of United States patents made in all cases before preparing application for patent.

Electrical Cases a Specialty Highest References Prompt Attention Reasonable Terms

FREE COUPON!
VICTOR J. EVANS & CO., Patent Attorneys
New York Offices: 1001 to 1007 Woolworth Bldg. Pittsburgh Offices: 514 Empire Bldg. Philadelphia Offices: 135 S. Broad St.
Main Offices: 779 Ninth Street, N. W., Washington, D.C.
Name ..... Address .....

www.americanradiohistory.com



TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts, frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
164 Owen Building, Washington, D. C.
2276-8 Woolworth Bldg., New York City

PATENTS

INVENTORS: Send us sketches or a model of your invention and a description of the device for advice in regard to the best way of obtaining patent protection. Our practical experience covers a period of twenty years. Our hand-book on patents is sent free on request. All communications strictly confidential. Write us today.

TALBERT & TALBERT
Patent Lawyers
4287 Talbert Bldg. Washington, D. C.

PATENTS

LACEY & LACEY

Attorneys-at-Law—Patent Practice Exclusively
Solicitors of
U. S. and Foreign Patents
Trade-Marks, Copyrights

639 F Street, N. W., Washington, D. C.

Write Us for Our Inventors' Book
PATENT-SENSE
ESTABLISHED 1869

Patents Promptly Procured

Send sketch or model for actual search of U. S. Patents. Highest references. Personal service. Moderate fees. Write for Free Patent Book.

GEORGE P. KIMMEL, Patent Lawyer
99-R Oriental Bldg. Washington, D. C.

Electricians Get up-to-date in House Wiring! Save Time, Money, Labor and Material by using our 93 Genuine Blue Print Drawings, containing all the latest diagrams and connections known in house wiring—every diagram and connection as-to-the-minute as used by first class electricians for wiring Bells, Burglar Alarms, Lights, Annunciators, Fire Alarms and Electric Gas Lighting. These drawings are bound in the form of a flexible book 9 x 12, for convenience in using on the job. Send for them, and if they don't make you more efficient as a wireman and save you many times their cost as a contractor, return them and money will be refunded—you can't afford to be without them. One Dollar postpaid. Send for circulars on other sets of drawings.

PATENT SPECIALTY COMPANY
P. O. Box No. 893 San Francisco, Cal.

PATENTS

Inventors Invited to Write for Information and Particulars
Highest References. Best Results.
Promptness Assured.
WATSON E. COLEMAN
Patent Lawyer
624 F Street N. W. Washington, D. C.

which is supposed to stay on the wire, a solution often thought of by inventors. Our correspondent tries to overcome the objectional feature of a wire jumping trolley by using two side shoes, pressing against the upper circumference of the trolley wire. Several other ingenious points are also shown in this idea.

A. Nothing fundamentally new is contained in this idea, and our opinion is that inventors should steer clear of trolley wheel improvements. There are literally thousands of such patents, and not one of them to our mind has ever been adopted by any of the traction companies. For many reasons the electric railway people seem to think that the old copper wheel is still the best. It is the same as the old-fashioned telephone receiver, which has been on our telephones for the past generations. While thousands upon thousands of patents—real good ones, too—have been issued, for some reason or other, the old receiver is still on the job and probably will be for many years to come. Our advice to inventors is to leave trolley wheels alone, and guide their ingenuity and inventiveness into other and more productive channels.

FIVE CONVERSATIONS OVER ONE WIRE.

(*Continued from page 766*)

thus gives the voice wave an identity of its own and at the end of the journey the waves are sorted and directed into their proper channels to be delivered as formed originally.

But how do these five telephone currents pass over the circuit simultaneously without becoming all mixed up, you ask. "Imagine, for example," said Mr. Gherardi, "a composite photograph, in which each of five subjects is photographed in a *different* color, one red, one blue, one green, one orange and one violet. In the composite picture the colors as well as the features are blended, but when you look at it thru colored glasses, each picture may be distinguished from the others. Thru red glasses the red photograph is shown, thru blue glasses the blue photograph comes up most clearly, and so on."

There are several other analogies in physics, which will bring out the working action of the control and filtering of these "carrier" currents. First there is ordinary sunlight. A beam of this white light is made up of a composite bundle of six primary colors, each color representing a different and distinct vibration frequency of the ether particles. Thus we find that the beam of white light is first produced or formed in the sun, where many different chemicals are in a state of combustion—each with a spectrum color of its own; all combine and form white light—the sun's rays. These composite rays, combining six predominating ether wave frequencies or colors—red, orange, yellow, green, blue, and violet—(not to mention a host of other intermediate shades of colors with their corresponding and distinct frequencies*), are transmitted thru the intervening ether to our earth. Now, if we take a glass prism, see figure "A," and pass a beam of sunlight (white light) thru it as shown, then we will see the composite colors corresponding to the different frequencies projected on the sheet at the left, in the order named.

A second phase of this experiment, familiar to every high-school boy, is that of the "synthesis of light", illustrated at figure "B". Here we have a beautiful analogy to the multiplex telephone which can be easily demonstrated. A beam of white light (sunlight) of many frequencies, is past thru the first prism, but as it emerges after being filtered by prism No. 1 the separated frequencies (colors) are recombined by prism No. 2, and formed into a "composite medium of transmission", such as that which traverses the telephone wire when the five telephone currents are applied to it.

A simple diagram for duplex telephony by the Squier's system is here shown. Major-General G. O. Squier proposed his multiplex telephone and telegraph system in 1911. He applied wireless currents to wire systems and thus it was called Squier's "wired wireless". His invention had the

* See Wood's "Physical Optics", page 11, for table of different wave lengths (inverse of frequencies) of various colors.

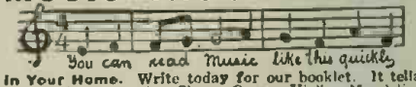
AK TABLETS FOR Grippe Cold in the Head
Headaches
Neuralgias
Spanish Influenza
Women's Aches and Ills
Rheumatic and Sciatic Pains
Ask Your Druggist for A-K Tablets
If he cannot supply you, write us
Small Size 10c (AK Fac-Simile) Dozen Size 25c
See Monogram AK on the Genuine
The Antikamala Remedy Company
St. Louis, Mo.

MY NEW BOOK
"Muscular Development"
will tell you how to get a wonderful muscular development like mine, perfect health, abundance of vitality and great strength as I have.


EARLE E. LIEDERMAN
Why not look as healthy and be as strong as I am?

The results of my system are shown on my own person and that is recommendation enough. To give every one the opportunity to profit by what I have learned, I will mail my book, for a limited time only, on receipt of
10c Stamps or Coin
This wonderful book will help you. It is profusely illustrated and contains pictures of many of the world's strongest men whom I have trained. Send for it to-day. Right now, while it is on your mind.
EARLE LIEDERMAN, Dept. 206, 203 Broadway, N. Y.

Build Your Own PHONOGRAPH
PARTS FOR ANY STYLE MACHINE
Build your own cabinets
We show you how
Circulars and Instructions 10c.
Motors, Reproducers, etc. sold
Electro Mechanical Parts Co.
Dept. E 160 No. Wells St., Chicago, Ill.

MUSIC TAUGHT FREE

You can read Music like this quickly
In Your Home. Write today for our booklet. It tells how to learn to play Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced pupils. American School of Music, 57 Lakeside Bldg., Chicago

GET ON THE VAUDEVILLE STAGE

I tell you how. Fascinating profession for either sex. Big salaries. Experience unnecessary. Splendid engagements always waiting. Opportunity for travel. Theatrical agents and authorities endorse my methods. Thirty years' experience as manager and performer. Illustrated book "All About Vaudeville" sent FREE. Frederick La Delle, Sta. 246 Jackson, Mich.

NEW SCIENTIFIC WONDER
"X-RAY" CURIO


PRICE 12c, SILVER ONLY—BIG FUN
BOYS You apparently see thru Clothes, Wood, Stone, any object. Sees Bones in Flesh.
A Magic Trick Novelty given FREE with each X-Ray.
MARVEL MFG. CO., Dept. 52, New Haven, Conn.

www.americanradiohistory.com

germ of the present multiple telephone in it. There were a number of high frequency generators (radio telephone transmitters) connected across the common telephone system, one way being shown, and a corresponding number of tunable radio receiving stations connected across the same pair of wires. Thus each radio frequency current (30,000 cycles and higher, so as to be inaudible) would be picked off the line and past thru its own particular and properly tuned receptor. The universal operating characteristics of the audion type of vacuum relay as devised by Dr. Lee de Forest solved the problem of making such a system adaptable to the use of the public.

Credit for the pioneer work accomplisht by these men is given in the signed statement announcing the successful solution of the multiplex telephone problem addrest to Hon. Albert S. Burleson, Postmaster General, Washington, D. C., by Theodore N. Vail, President of the A. T. & T. Co., on December 11, 1918, which includes the following citation:—

"From the earliest days of both the telephone and the telegraph, there have been almost numberless attempts by inventors, scientists, and engineers to develop methods for the multiplex transmission of messages. It was while working on the problem of multiplex telegraphy that Dr. Bell had his first conception of the structure of the original telephone. Now the organization, which is continuously working to perfect the telephone and to extend its usefulness, has accomplisht not only multiplex telephony, but also multiplex telegraphy and has solved the telegraph problem upon which Dr. Bell was working over forty years ago.

"While heretofore no substantial practical results had been obtained notwithstanding the efforts which have been directed to this problem, some proposals made by the earlier workers in this particular field have naturally proved suggestive in the successful solution of the problem. I have in mind particularly a suggestion made by Major General George O. Squier, Chief Signal Officer of the United States Army, about ten years ago and which at the time attracted very general attention.

"Furthermore, while working in entirely different fields and with a different objective, Dr. Lee de Forest a number of years ago invented a wireless device known as the audion which by our improvements and adaptation we have made an important part of our system."

We all know, or at least have heard, that there are ranges of frequencies, both electrical and mechanical, that are beyond the limits of perception by any of our five senses. But telephone engineers have found out that currents of high frequency, for example, obey the same laws as currents of low frequency, and they have found out further that these high frequencies have a particular liking for circuits specially dimensioned to receive them, and that each particular high frequency, or range of high frequency, if given a chance to choose between a number of different circuits, will select the one best adapted to its needs, and travel down it in preference to all other circuits.

Now it is possible by the multiplex method to utilize a single pair of wires for five conversations, while two pairs of wires, which heretofore had a maximum of three conversations with the aid of the "phantom," may now be multiplexed to carry *ten* simultaneous conversations. This amounts to an increase of more than *threefold* in the telephonic carrying capacity of the wires as compared with the best methods previously known to the art, and an increase of *fivefold* in the capacity under conditions where the phantom circuit just alluded to is not employed.

The new multiplex system makes use of alternating currents whose frequencies oc-

Can YOU Honestly Ask Any Girl To Marry You?



LIONEL STRONGFORT

"Dr. Sargent of Harvard, declared that Strongfort is unquestionably the finest specimen of physical development ever seen."

CAN you marry any girl, without making her the victim of the meanest kind of deceit a man is capable of? *Are you fit to be a husband*, fit to make the girl you love the mother of children who will inherit YOUR traits of body and mind? *Think*, and think hard, before you ask her to give her body and soul into your keeping, unless you are FIT. You know what the Law of Heredity is—there's no beating it: what YOU are when you become a father your children ARE bound to be.

Make Yourself Fit to Be a Father

If you are skinny, undeveloped, weak, watery-blooded, *build yourself up before you marry*, so your children will not be rickety imitations of yourself. If you are dyspetic, bilious, constipated, or the victim of any other chronic ailment, such as youthful errors, vital losses and consequential impotency, get rid of these handicaps; don't take the risk of passing them on, in an exaggerated form, to the helpless little children you will bring into the world. You can't commit a worse CRIME than to make a sweet, pure, trusting girl the mother of weak, ailing, defective children who will be a sorrow to her and a reproach to you as long as you both live.

Have Healthy, Happy Children

You can do it: you can make yourself healthy, strong, vigorous, full of LIFE and the joy of living, and capable of transmitting that health and strength and happiness to children who will be full of rollicking fun, a comfort and a blessing to you and to the girl you marry. No matter how low down you have got in the human scale, and no matter how you got there, YOU CAN COME BACK, if you go about it the right way.

I don't care how much druggist's dope or patent piffle you may have tried without success; three hundred years ago the greatest brain in England wrote "Throw Physic to the Dogs"—and Shakespeare knew, as every doctor knows today, that physic isn't the kind of food that makes men strong and vital, that fills them full of overflowing life and energy and spirit.

Get Strong in Nature's Way

Give old Mother Nature a chance to cure your ailments and build you up, by living in the way she meant you to live, and you'll be amazed in a few weeks' time at the improvement in yourself. There's no guesswork about it, there's no doubt about what she can do for you; and there isn't any other way: Nature's way is the ONLY way many men on the ragged edge of being thrown into the everlasting scrapheap of humanity can EVER get back the health and strength and vigor and vitality of a MAN.

I KNOW: I've tried it, not only on myself—and I am called the strongest man in the world today—but also on thousands of miserably ailing, weak, downcast, discouraged men, suffering from early indiscretions, vital losses and other troubles, that are the result of these ailments, who found their first ray of hope and comfort and quick improvement in the system of **Strongfortism** that I teach. **I will help YOU**, as I have helped them, and as I am helping other men in every quarter of the civilized world today. I will show you how to shuffle off your ailments, how to develop your muscles, reinvigorate your vital organs, steady your nerves, clear your brain; how to become, in a short time, a 100 per cent Man and take the place in the world you ought to hold.

Send for My Free Book

I have put the results of my life's study, research and experimentation on the subject of man's vitality and vigor into a book called **"Promotion and Conservation of Health, Strength and Mental Energy."** It will tell you all about Strongfortism, show you how thousands of men who had lost their grip were able to become red-blooded, vigorous citizens again, and point out the way—the simple, easy, natural, quick way in which YOU can gain and retain health and strength and the ability to enjoy life. Send three 2c stamps to cover postage and packing and I will mail a copy to your address at once.

LIONEL STRONGFORT

Physical and Health Specialist

809 Park Bldg., Newark, N. J.

FREE CONSULTATION COUPON

Mr. Lionel Strongfort, Newark, N. J.—Please send me your book, **"PROMOTION AND CONSERVATION OF HEALTH, STRENGTH AND MENTAL ENERGY,"** for postage of which I enclose three 2 cent stamps. I have marked (X) before the subject in which I am interested. (809)

. . Colds	. . Insomnia	. . Youthful Errors
. . Catarrh	. . Short Wind	. . Vital Losses
. . Asthma	. . Flat Feet	. . Impotency
. . Obesity	. . Stomach Disorders	. . Rupture
. . Headache	Constipation	. . Heart Weakness
. . Thinness	. . Torpid Liver	. . Poor Circulation
. . Rupture	. . Biliousness	. . Skin Disorders
. . Lumbago	. . Indigestion	. . Round Shoulders
. . Neuritis	. . Nervousness	. . Lung Troubles
. . Neuralgia	. . Poor Memory	. . Increased Height
. . Flat Chest	. . Rheumatism	. . Stoop Shoulders
. . Deformity (describe)	. . Despondency	. . Muscular Development

NAME.....

AGE..... OCCUPATION.....

STREET.....

CITY..... STATE.....

Write Plainly

www.americanradiohistory.com

1/4 H.P., 110 volts, A.C. 60 cycle, single phase, 1750 R.P.M.

MOTORS



We have 1000 NEW WASHING MACHINE MOTORS. These are of standard manufacture and carry the regular factory guarantee. Shipped in original boxes. Complete as cut.

Bought from Bankruptcy Stock

Suitable for operating Coffee Grinders, Cream Seperators, Bottle Washers, Air Compressors Small Lathes, Etc.

Mail $3.00 cash or Money Order. We will send C.O.D. subject to full examination.
MONEY BACK GUARANTEE

$18.50 EACH
Special Quantity Prices Regular Value $34

MANUFACTURERS' DISTRIBUTER

CHAS. H. JOHNSTON - West End - Pittsburgh, Pa.

BARGAINS in Small Motors and Generators Write for Catalogue

The Breakers

Atlantic City's Newest Fire-Proof Hotel

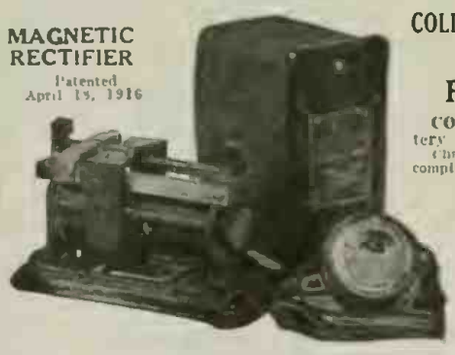


Ocean Front. Unusually attractive during the Autumn and Winter seasons.

American and European Plans

Luxurious lobbies, spacious verandas and sun parlors overlooking the ocean. Charming afternoon musicales and evening concerts. A palatial residence for those seeking rest and recreation. Sea water baths. Fireproof garage. Illustrated booklet sent on request.

MAGNETIC RECTIFIER
Patented April 18, 1916



COLD WEATHER WON'T BOTHER YOUR STARTER
If you keep your battery charged up with an

F-F BATTERY BOOSTER

CONNECT to any lamp socket without removing battery from car or breaking any electrical connections. Changes alternating to direct charging current, and will completely fill your battery over night.

The Private Garage types cost only $24.00 and come complete with long cord and plug to fit any lamp socket, ammeter, which tells what current is flowing into the battery and charging wires fitted with clips, to snap on the battery terminals.

Thousands in use giving satisfaction.

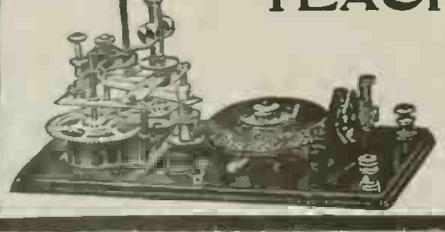
Write today for Bulletin No. 12, or send us your order. Money back if you want it.

The France Manufacturing Company
Cleveland, Ohio

"THERE'S MONEY IN IT"

AT HOME LEARN TELEGRAPHY AT HOME
MORSE AND WIRELESS

TEACH YOURSELF



In half the usual time, at trifling cost, with the wonderful Automatic Transmitter. THE OMNIGRAPH. Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would.

Adopted by U. S. Gov't. 4 styles. Catalogue free.

OMNIGRAPH MFG. CO.
39L Cortlandt St. New York

What 15c will bring You from the Nation's Capital

Washington, the home of the Pathfinder, is the nerve center of civilization; history is being made at this world capitol. The Pathfinder's illustrated weekly review gives you a clear, impartial and correct diagnosis of public affairs during these strenuous, epoch-making days.

The little matter of 15c in stamps or coin will bring you the Pathfinder 13 weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth and only the truth; now in its 26th year. This paper fills the bill without emptying the purse; it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you would appreciate a paper which puts everything clearly, fairly, briefly—here it is. Send 15c to show that you might like such a paper, and we will send the Pathfinder on probation 13 weeks. The 15c does not repay us, but we are glad to invest in new friends. The Pathfinder, Box 76, Washington, D. C.

cupy a range between the frequencies of the ordinary telephone currents, which are those of the human voice, and the lowest frequencies which are used in wireless communication. This frequency range has not heretofore been commercially used. It is interesting to note that under favorable conditions the whole range is audible to many and the lower part of the range is audible to any one with normal hearing. It is found that frequencies within this range are high enough to be used as "carriers" of ordinary telephone currents and yet with proper arrangements can be transmitted over long telephone lines without the large transmission losses and large interference between circuits which would be brought in by higher frequencies.

Each *additional* circuit in the new system makes use of some frequency within this range. At the sending end of each circuit the ordinary telephone currents are made to modulate this "carrier" frequency by means of an audion tube so that the amount of carrier frequency sent out on the line varies with the amplitude of the ordinary telephone currents. At the receiving end the carrier current is put into a demodulating circuit, which includes another audion, and which then gives out the original telephone current.

The different circuits are kept separate at each end by inserting in each circuit a combination of impedances which make up an electrical "filter." This transmits the range of frequencies peculiar to that circuit and stops all other frequencies. An important difference should be noted here between this system and wireless systems in that in wireless working it has been generally sufficient to send and receive in "tuned" circuits. In the multiplex system, however, tuned circuits would not be sufficient since each telephone channel occupies a range of frequencies of about 2,500 cycles and any circuit tuned to these comparatively low frequencies would be too selective to receive such a range in the proper manner.

Vacuum tubes (audions) are used in the modulating and demodulating circuits and are also used as amplifiers in the transmitting and receiving branches and at intermediate points along the line where necessary to prevent the currents from becoming too highly attenuated.

In regard to the increased telegraphic capacity afforded, Mr. Gherardi stated:—"The advantages of the system when applied to telegraphy as well as to telephony were clearly shown in our tests. We found that we can combine our system with the printing telegraph so as to secure the full advantages of the latter and the full advantages of the multiplex system in reducing wire requirements. Using our multiplex system with the ordinary hand operated telegraph instrument, connected with a telephone circuit, we can send from 1,500 to 1,600 words in a minute. When the multiplex system is connected with the printing telegraph, we can send from 4,000 to 5,000 words in 60 seconds."

GOLD AND SILVER LOCATED WITH SOUND WAVES.

(*Continued from page 769*)

the ore bodies. For example, if the distance between the record made on the oscillograph, R—O_1, by the transformer on depressing the key K, and the record made by the arrival of the sound directly along the line Q, which would be the first sound to record itself after the depression of the key, is five inches—then *one inch* on the photographic record corresponds to *one mile* in distance, since drill hole A is located five miles from the drill hole D. This establishes the standard of measurement on the oscillograph.

Now for example, if the length between the key depression record and the record made at D, by the sound reflected at P is

www.americanradiohistory.com

9 inches, it is evident that the sound proceeding from O and reflected at P, and finally reaching D, has traveled 9 miles. If, again, the length between the key depression record on the oscillograph, R—O_1 and the record made by the sound sent out from O, and reflected back from J, Fig. 2, is 8 inches, then it follows that the ore body I, is located approximately 4 miles from the point A. The ore deposit therefore lies at the intersection of the sphere described about O, with a radius of 4 miles, with the sphere described about D_1 with radius 9 minus 4, i. e., 5 miles.

There are a number of ways outlined in Prof. Fessenden's description of his invention, which may be utilized for locating the exact point on the line of intersection where the ore bodies are located. As he points out, it is possible to find this point of intersection by merely determining the time elapsing between the key depression record and the echo record made by reflection, say at J, Fig. 2, together with a determination of the direction from which the echo is received. The extent of the ore body can be obtained by readings taken by transferring the oscillator O, to the other drill holes and taking readings on the oscillographs on sending out sound waves at these drill holes.

Prof. Fessenden also describes special apparatus for determining accurately the direction of the sound received, which employs two of his oscillators connected together, differentially. This scheme of locating ore deposits may sound a little hazy or improbable at first glance, but the theory can be readily tried out by means of a small siren and a reflector or two, together with some auxiliary apparatus which any electrical experimenter can readily devise, the difference in such an experiment being that the sound waves will then be detected, reflected or refracted in air, whereas in applying this system to the locating of buried ore deposits, the sound waves have to travel thru rock and soil as well as water, in which mediums the velocities of sound propagation varies considerably. The velocity of sound propagation thru water is about four times as great as that thru air, or approximately 1,100 feet per second for air and 4,700 feet per second for water.

BOOK REVIEW.

(*Continued from page* 804)

teries, theory of telephone and field buzzer circuits—with many diagrams. The section devoted to radio is practically a reprint in whole from "Radiotelegraphy" as published by the signal division of the U. S. Army—but which, of course, must needs finds its place in a work of this kind, and serves to cover all that need be known by a radio man of the signal corps.

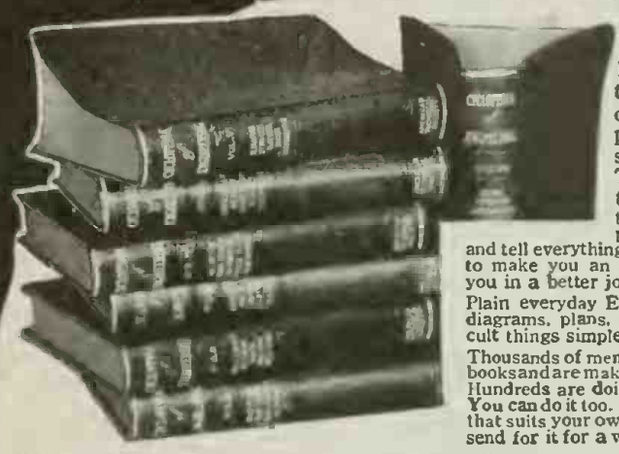
Two closing chapters are devoted to methods of handling traffic, various codes—secret ciphers—Wigwagging—Signaling with lamps—searchlights—sun or heliograph and the Semaphore. Signal troops in the field—Laying out camps, Map reading and the general function that the Signal Corps fills in both war and peace—general field duty and coast defense.

The volume is dedicated to Major-General George O. Squier, Chief Signal Officer, U. S. Army, whose assistance made the book possible. It is an ideal manual and has all the usually needful information possible incorporated between its covers and should prove an essential to all enlisted men seeking promotion as well as to the layman who is interested in this important branch of the Army's work.

THE BLUEJACKET'S MANUAL, by Lieutenant Norman R. Van Der Veer, U. S. N. Cloth covers, 808 pages, profusely illustrated, size 4¼ x 6¼ inches. Price $1.00. Publisht by Edwin N. Appleton, New York, 1918.

This work is the official reference and study manual used by all naval men. The various operations and practices in naval life are thoroly described and suitably illustrated. The treatment is divided into several parts and again sub-divided so that by reference to the special indexes given in the front of the volume, the student can readily locate certain sections of the text concerning special positions, such as those concerned with ordinary seamen, subjects which chief petty officers should know, and the subjects which men of special ratings should know. This work has been officially past by the Secretary of the Navy.

These Books Will Put You in a Better Job



See the Free Trial offer below and mail the coupon for one of these pay-raising sets of books. They are written by some of the greatest experts in each line and tell everything you need know to make you an expert and put you in a better job.

Plain everyday English, pictures, diagrams, plans, etc., make difficult things simple as A-B-C.

Thousands of men have used these books and are making more money. Hundreds are doing it every day. You can do it too. Pick out the set that suits your own work best and send for it for a week's free trial.

Your Choice Only 50 Cents a Week

Carpentry and Contracting
Five volumes, 2138 pages and more than 400 illustrations. Prepares for Contractor, Building Superintendent and Carpenter Foreman. Regular price, $25.00. Special price, $17.80.

Civil Engineering
Nine volumes, 3900 pages and 3000 illustrations, plates and diagrams. Prepares for Civil or Structural Engineer, Transitman, Estimator, Designer or Chief Draftsman. Regular price, $45.00. Special price, $29.80.

Telephony and Telegraphy
Four volumes, 1723 pages and 2000 illustrations, plates and diagrams. Prepares for Telephone Engineer, Wire Chief, Exchange Manager, Trouble Man or Telegrapher. Regular price, $20.00. Special price, $12.80.

Steam and Gas Engineering
Seven volumes, 3300 pages and 2500 illustrations, plates, diagrams, etc. Prepares for Stationary, Marine or Locomotive Engineer or Fireman. Regular price, $35.00. Special price, $21.80.

Automobile Engineering
Five volumes, 2400 pages and 2000 illustrations. Prepares for Garage Foreman, Automobile Mechanic or Chauffeur. Invaluable to car owners. Regular price, $25.00. Special price, $17.80.

Machine Shop Practice
Six volumes, 2300 pages and 2500 illustrations. Prepares for Machine Shop Superintendent or Foreman, Foundryman, Pattern Maker, Tool Designer or Tool Maker. Regular price, $30.00. Special price, $19.80.

Sanitary, Heating and Ventilating Engin'ring
Four volumes, 1454 pages and more than 1400 illustrations, etc. Prepares for Sanitary Engineer, Heating and Ventilating Engineer, Master Plumber or Plumber. Regular price, $20.00, Special price, $13.80.

Mechanical and Architectural Drawing
Four volumes, 1578 pages and more than one thousand illustrations. Prepares for Architectural or Mechanical Draftsman. Regular price, $20.00. Special price, only $14.80.

Law and Practice
(with Reading Course in 25 bound pamphlets). Thirteen volumes, 6000 pages and 24 illustrations. Prepares for all Bar Examinations. A wonderful aid to business men. Regular price, $72.00. Special price, $39.80.

Practical Accounting
Four volumes, 1840 pages and 800 illustrations, plates and diagrams. C. P. A. questions and practical problems. Prepares for Accountant, Bookkeeper or Cost Clerk. Regular price, $20.00. Special price, $12.80.

Electrical Engineering
Seven volumes, 3000 pages and 2600 illustrations, plates and diagrams. Prepares for Electrical Engineer, Power Plant Superintendent, Substation Operator or Electrician. Regular price, $35.00. Special price, $19.80.

Accountancy and Business Management
Ten volumes, 3630 pages and 1987 illustrations, forms, etc. Prepares for Certified Public Accountant, Auditor, Office Manager, Accountant, Credit Man or Bookkeeper. Regular price, $50.00. Special price, $24.80.

Don't Send Money

and mail it. We will ship the books at once by express collect right to your own home and you can have them a whole week to use as you please. Give them every test you can think of—show them to your friends and get their opinion. Then ship them back at our expense if you don't want to keep them. If you do want the books to help put you in a better job, just send us $2.00. You can send the balance of the special reduced price the same way—$2.00 a month. (50 cents a week.) Send the coupon now! Before you turn this page.

The coupon is all you need. Just fill out

7 Days FREE Trial Coupon

AMERICAN TECHNICAL SOCIETY
Dept. X-3383, Chicago, Ill.

Special Offer

To those who mail this coupon promptly we will give absolutely free a year's membership in the American Technical Society with every set of books.

This will enable you to consult our engineers and experts on any problem connected with your work. It usually sells for $12.00 but it will be given free while a limited amount of memberships remain open.

American Technical Society, Dept. X-3383, Chicago, Ill.

Please send me set of..... for 7 days' examination, shipping charges collect. I will examine the books thoroughly and, if satisfied, will send $2 within 7 days and $2 each month until I have paid the special price of..... If I decide not to keep the books, I will return them by express at your expense. Title not to pass to me until the set is fully paid for.

Name .....

Address .....

Reference .....

www.americanradiohistory.com

Wireless Taught By Mail

Merchant Marine Needs THOUSANDS of Operators

Men also needed for big Land Wireless Stations—Aerial Mail Service—Railroad and Telegraph companies. Salaries up to $250 a month. Excellent opportunities to win promotion to Radio Engineer—Inspector—or mechanic. Chance to travel the world over or locate at Land Station in America.



Complete Course by Mail in Ten Weeks

Our students actually pass the commercial examination in Ten Weeks or less. Start studying NOW in spare time at home. We send you Complete Set Practice Instruments for receiving and sending messages, while studying our course. We help you secure position in any branch of Commercial or Government Radio Service. Write TODAY for Free Particulars. A postal will do.

NATIONAL RADIO INSTITUTE

Dept. 70 Washington, D. C.

ACCEPT THESE BOOKS FREE



These two 100-page books, each containing from 88 to 90 illustrations, are sold by us regularly at 25c a piece. In connection with this most remarkable offer you can now get them **ABSOLUTELY FREE**, for a *very limited time*.

SINCE we published these two books, over 8,000 of each have been sold. If you are a wireless experimenter, you can ill afford to be without these two latest authoritative works, published by the one concern in America, that knows what the "How-to-make-it Fiend" really wants. In these two hand books are concentrated the most important, up-to-date wireless instruments and directions how to make them. They are by far the most successful wireless books of the season. Size of each book is 5x7 inches, substantially bound on a good book paper. The covers are in two colors. We really can not praise these works too highly. You will be delighted with them.

EXPERIMENTER PUB. CO., 233 Fulton St., New York

Gentlemen:

On your absolute guarantee that your two big Wireless Handbooks are just as described by you, you may send me same *FREE*. All charges prepaid. You are to send me these books at once, and enter my name for a full year's subscription to the *Electrical Experimenter*, 12 numbers, for which I enclose *$2.00, the price of the Electrical Experimenter alone.

My name is.....

My address is.....

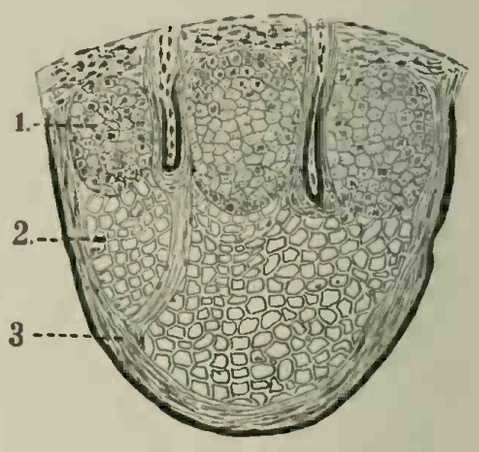
3-19 *Canada and Foreign Countries, $2.50.

The layman will find in this book all kinds of information concerning naval affairs such as the different sizes and mountings of naval guns, how and what ropes are used for, including the tying of all kinds of rope knots, discussion on modern battleships and other vessels with profile drawings thru the various decks, details concerning pay of enlisted men and officers, also procedure in the matter of enlistments, discharges and court martials, small arms such as the automatic pistol and high power rifles, etc. Other sections deal with the handling of small boats, sails, signals of all kinds, deck seamanship, the compass, log and lead, marching formations, artillery marksmanship, etc. The signal flags for the international code, etc., are printed in colors. The book is well printed and bound, and proves a very good reference volume on the complete detail of naval discipline and all of the operations connected with the handling of naval affairs.

SEARCHLIGHTS OF THE DEEP.

(*Continued from page 772*)

Each light organ contains a number of tiny glands which secrete the light-producing fluid and all glands empty into a con-



Luminous Organ: (1) Lenses Which Concentrate the Light. (2) Glands Which Secrete the Lighting Fluid. (3) Reflector, In Back of Which Is Situated the Black Opaque Membrane.

cave cavity. The action of this fluid can be likened to the effect of the liquid in a wet battery on the electrodes. It acts as a stimulus. A further proof of the chemical action of some of these organs can be found on certain fish which only produce light when the secreted fluid is in contact with the water. Light can therefore be given off after the fish has died. Other species produce their light only thru intercellular action; this of course does not constitute a chemical reaction.

The reflector consists of a silvered or pig-

"THE NATIONAL AUTHORITY ON ELECTRIC WIRING FOR TWENTY-FIVE YEARS"



ALL YOU NEED TO KNOW ABOUT WIRING

IS IN THE LATEST EDITION OF

"STANDARD WIRING"

This year's edition, completely revised to date, is the only accurate book on electric light and power wiring and construction published.

The National Electrical Code, with all its new rules, is explained and illustrated. 52 of the latest and simplest tables which show, at a glance, just what size of wire is needed for any kind and size of lighting or motor installation, for any voltage, current and drop desired for any system. Direct Current, Alternating Current, single, two or three-phase. The latest Code Rules on grounding required on all work.

How to install and operate generators, motors and every kind of wiring device with diagrams of connections. Special chapters on Illumination, House Wiring, Electrical Units and their Equivalents. The latest lamp data. Proper symbols to use to indicate outlets, etc., etc.

It Will Make You an Expert Wireman

Leather Cover - Pocket Size - 375 Pages - Price $1.50

SENT TO ANY ADDRESS, POSTPAID, ON RECEIPT OF PRICE

H. C. CUSHING, Jr. 8 West 40th St. NEW YORK

www.americanradiohistory.com

mented tissue, which reflects the light outward. An opaque tissue situated just behind the reflector prevents the light from entering the body.

Lenses, which are often present, tend to concentrate and throw the light forward. These lenses consist of a transparent cartilage covered with a transparent skin. In addition some fish even have *shutters* with which they can turn off their light at will.

Many deep sea fish have in addition to their principal organ of light many minor ones, which give the surrounding waters an iridescent glow. As the fish swim along these many varicolored scintillating lights give off a phosphorescent effect. These flickering will-o'-the-wisps of the deep are chased by openmouthed terrors that follow a searchlight at the tip of their own nose.

The lights with all their many shades of color, patterns, and places of attachment are primarily used for the identification of the species and the sexes. They are of secondary importance in the aid they give for the search of food, in which case they are undoubtedly used to attract, dazzle, and entrap its prey. Oh! yes. They are some little *Vampires* all by themselves.

But in order to see the phosphorescent glimmer of a fish at a distance, the eyes have been peculiarly modified. The greatest possible number of rays of light given off by a point are absorbed by the eye, and this is effected by either enlarging the eye as a whole or by enlarging only the lens and removing the retina to a distance. In this way the eyes have become cylindrical.

It is not the deep sea fish alone that possess organs of light. Some varieties of fish inhabiting the well lighted part of the ocean have them as well. These, which are commonly called "lantern fish," emit, at rhythmic intervals, a greenish-white light. A shutter, which is an opaque membrane similar to that found on a camera, is pushed or pulled over the light organ. This effectually conceals the rays. Two small varieties comprising the Anomalopidae inhabit the Malay archipelago at the Sunda islands, while a third variety has recently been discovered near Jamaica.

Our front cover shows three very interesting species of deep sea fish. The fish illustrated at the top is *Gigantura chuni, A Br.* The fish in the center with the peculiar elongated nose-piece is *Gigantactis vanhoeffeni, A. Br.* While the bottom fish is *Stylophthalmus pardoxus. A. Br.*

These are not very large fish, as one might think, and the illustrations on our front cover are about half size. In other words, the fish are only about twice as large as shown on our cover. The fish illustrated at the top is also slightly luminous around its body, as can be seen. One of the most curious of these fish without doubt is the middle fish. Why Nature should have equipt it with such a long nose-piece, the end of which is luminous, is not well understood as yet, as we know very little about these fish. The interesting part about the lower fish is that it has luminous organs all along its sides, while the eyes themselves are but slightly luminous. It is curious that the eyes themselves are not in sockets as is usually found the case with nearly all other animals, but that they extend several inches from the head.

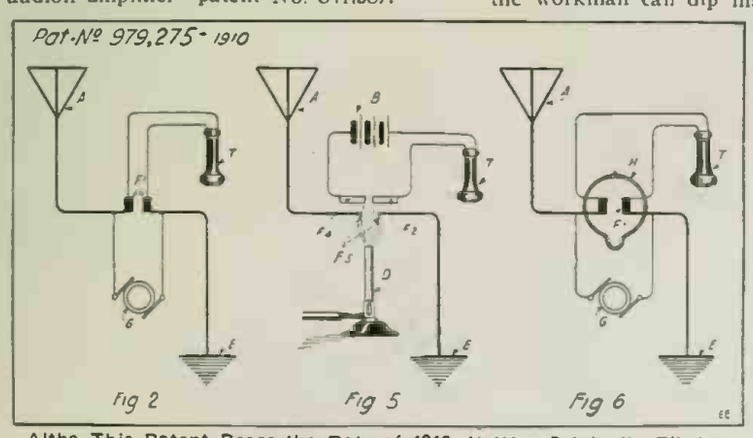
[*Editor's Note: The curious deep sea fish shown on our front cover were prepared from color drawings made by Dr. Bade himself. He in turn worked from the actual fish brought from the deep when making his drawings.*]

HOW I INVENTED THE AUDION.

(*Continued from page 820*)

that before long the wireless telephone will be installed on thousands of vessels, supplementing, and in many cases, supplanting the wireless telegraph. In addition there is an enormous number of small vessels where a wireless telephone installation is more feasible.

As indicative of the growth of the Audion Art, the number of patents issued on various devices and circuits dependent thereon, gives a pretty fair key: Up to 1912 there had been issued about 20 patents, all filed subsequent to 1904. To-day there are over 100 United States patents on the Audion Art, and the number is very rapidly growing. Regardless of what name may be applied to the device patented, practically everyone of these patents since 1906 shows the three electrode bulb. They may all therefore be properly described as the outgrowth of the ideas first shown in the audion amplifier—patent No. 841,387.



Altho This Patent Bears the Date of 1910, It Was Originally Filed in 1904, and Is One of the Basic Patents in All Audion Development. It Shows the First Use of Incandescent Filaments in an Enclosed Chamber, and, Moreover, It Includes at Fig. 5 the First Evidence of the Third Electrode or "Grid" Conception. Here, as Will Be Evident, Is the First Plan for Separating the Antenna Circuit from the Local Circuit.

EXPERIMENTAL CHEMISTRY.

(*Continued from page 794*)

cuprous oxid, or gold; *Yellowish-green*, by uranium oxid; *Green*, by chromic or cupric oxids; *Milk or Opal* glass is made by the addition of bone-ash, tin or zinc oxids. The green color of the common window glass or bottle glass is caused by the presence of ferrous oxid in the sand; this discoloration may be removed by addition of manganese dioxid in the make-up. This serves to oxidize the ferrous to ferric oxid, which imparts a yellow tint, being neutralized by the violet produced by the manganese as a complimentary color.

Pure white sand is mixed with the metallic oxids required, in the proportion which experience has shown gives the best results, and some old glass, called "cullet", is added to improve the quality. The mixture is then put into pots as shown in Fig. 159. These pots are made of the most refractory fire-clay, and are placed in a circular furnace with openings thru which the workman can dip his long iron blowpipe into the pots. Fig. 160 shows such a furnace in cross-section.

The fuel now used is mostly gaseous, and an intense heat is maintained for hours, till the substances are completely fused and mixed. The glassworker dips his blowpipe—a hollow iron rod 5 or 6 feet long, into the fused mass, removes a small portion, rolls it on a smooth iron

Mechanical Engineering



Learn at Home!

THE Government and employers everywhere are looking for men with mechanical ability. Splendid salaries and rapid advancement are offered.

There is an easy, delightful way in which you can learn right at home in spare time. For 27 years the International Correspondence Schools have been giving men and women just the training they need for success in mechanical engineering and more than 200 other subjects. Hundreds of thousands have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6180, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

ELECTRICAL ENGINEER	CHEMICAL ENGINEER
Electrician	SALESMANSHIP
Electric Wiring	ADVERTISING MAN
Electric Lighting	Window Trimmer
Electric Car Running	Show Card Writer
Heavy Electric Traction	Outdoor Sign Painter
Electrical Draftsman	RAILROADER
Electric Machine Designer	ILLUSTRATOR
Telegraph Expert	DESIGNER
Practical Telephony	BOOKKEEPER
MECHANICAL ENGINEER	Stenographer and Typist
Mechanical Draftsman	Cert. Pub. Accountant
Ship Draftsman	Traffic Management
Machine Shop Practice	Commercial Law
Toolmaker	GOOD ENGLISH
Gas Engineer	STATIONARY ENGINEER
CIVIL ENGINEER	CIVIL SERVICE
Surveying and Mapping	Railway Mail Clerk
MINE FOREM'N OR ENG'R	Textile Overseer or Supt.
ARCHITECT	AGRICULTURE
Architectural Draftsman	Navigator — Spanish
PLUMBING AND HEATING	Poultry Raising — French
Sheet Metal Worker	Automobiles — Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____

CONSULT US When in need of definite and reliable data concerning any trade formula or industrial process. We are ever on the alert and closely following the development of the industrial arts in all its branches. Each formula or process furnished by this Bureau is supplemented by detailed instructions for its manipulation, thereby doing away with any guesswork on the part of the inexperienced person. We also can advise you, if desired, where the ingredients which enter into any process can be obtained.

The formulae listed below will serve briefly to show the field we cover:

1. Process for producing "Verde Antique" or Green Finish on copper, bronze or brass articles.
2. Fire Extinguishing Compound (powder form)
3. Varnish Remover preparation, effective on either wood or metals.
4. Polish for Automobile bodies.
5. Cleaning Compound for wall paper and shades, etc. (block or cake form).
6. Brazing Compound for use in repairing cast-iron parts.

The standard price for each formula issued by us is Thirty-five cents. Letters of inquiry welcomed. Informative literature sent upon request.

INDUSTRIAL METHODS BUREAU
320 Fifth Avenue, New York, N. Y.

Get This Car

And the AGENCY In YOUR Territory



Drive a new 1919 Birch SUPER-FOUR and make good money selling Birch cars to your friends and neighbors. They are fully guaranteed. Prompt shipments. Write quick for full information.

36 h.p., 115 inch W.B., 32x3½ tires

BIRCH MOTOR CARS Dept. 325 61 E. Madison St. CHICAGO - ILLINOIS

www.americanradiohistory.com

$1,000 Reward

Big rewards are frequently offered throughout the country—many are standing right now—for the catching of criminals. Finger print experts have the best chance of winning these great rewards. For the finger print system is the most reliable and effective means of identification known. You can be a finger print expert. Send the coupon and find out how you can master this new and fascinating profession in your spare time at home. Don't miss this big opportunity. Send coupon today and get our free book.

Be a Finger Print Expert!

Not only in the police departments, but in government institutions, banks, railroads, insurance companies and other large industries, finger print systems are being installed under the guidance of finger print experts. You can earn from $25.00 to $50.00 a week. Right now there is an urgent, unfulfilled demand for experts.

FREE Book on Finger Prints

Send the coupon now for our valuable book telling all about finger prints and their uses; and about the big opportunities in the profession. It tells how you can learn in a short time at home. **Special limited offer now.** Get this free book and full particulars while it lasts. Send the coupon at once.

University of Applied Science
Desk 1703, 1772 Wilson Ave., Chicago

Please send me absolutely free and prepaid your new book on finger prints. Also particulars of your special limited offer. I assume no obligations whatever.

Name.....

Address.....

Age.....Occupation.....

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 180 Big Pages, 500 Illustrations, 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy," 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons, FREE Cyclopedia No. 20 measures 7x5¾". Weight ½ lb. Beautiful stiff covers.

WIRELESS

Send 6 cents in stamps or coin for which we will send our latest Cyclopedia Catalog No. 20 as described.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

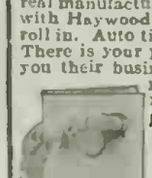


You Can Earn $250 A MONTH With This NEW MACHINE

Many are doing $3,000 a year and better with this new machine. You can too. You need no experience. We teach you FREE in one simple lesson. Start right at home. Everywhere there's plenty of money and big cash profits waiting for ambitious men.

THIS IS THE BUSINESS FOR YOU

A business all of your own. Requires little capital and grows fast into a real factory—a real manufacturer. Open a Tire Repair Shop with Haywood Equipment. Let the money roll in. Auto tires need mending constantly. There is your profit. Owners eager to give you their business. It means a saving of money to them, and big cash returns for you.



JUST MAIL THE COUPON FOR THIS FREE BOOK

A valuable guide to power and wealth. It gives the complete details. How to start. How to succeed. Tells all about your opportunity. Shows how easy the work can be done. Shows the big profit in this new field. Write for it today. A postcard will do. Get your FREE copy.

Haywood Tire and Equipment Company
1210 Capitol Ave.
Indianapolis, Ind.

Gentlemen: Please send me your book as you promise. I to do. This of course does not obligate me in any way.

HAYWOOD TIRE & EQUIPMENT COMPANY
1210 Capitol Ave.
INDIANAPOLIS
INDIANA

Name _____

Address _____

surface, swings it around in the air, blowing meanwhile thru the rod, cuts it with shears, curves and bends it at will, welds it, and thus fashions it as desired into flasks, lamp shades, etc. For such uses as bottles the glass is run into molds. For other purposes, such as lamp bulbs, chemical flasks and apparatus it is blown. For still other kinds it is rolled, as window glass. In order that glass objects will not break easily, they must undergo a process of *annealing*, that is slowly *cooled*, so that the molecules may arrange themselves in a natural way.

Pottery and Porcelain.

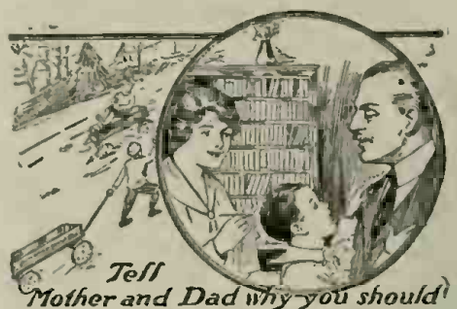
Genuine porcelain and chinaware are manufactured from a fine white clay, *Kaolin*,—resulting from the disintegration of feldspathic rocks,—and silica. After being fashioned the porcelain is "fired," then glazed and refired. One mode of glazing consists in dipping the object into a powder of feldspar and silica suspended in vinegar, and then fusing. Jugs, drain pans, and coarse earthenware are glazed by volatilizing sodium chlorid in an oven, which holds the porous material. The glaze goes into the pores of the ware, with which it partially combines to form sodium and aluminum silicates. If on being heated the ware and glaze expand uniformly the glaze will not crack. Flower pots and other porous pottery illustrate clay that has been moulded and baked, *but not glazed*. Bricks are baked clay.

THE ROGERS UNDERGROUND WIRELESS.

(*Continued from page 789*)

mained enthusiastic and sincere in all the tests and installations made of my under-ground radio system thru all the trials and disappointments of its development, even when the system seemed to prove unworkable. Their perseverance and high skill in the radio art has hastened the official endorsement and the installation of the buried and submerged antenna." Commander A. Hoyt Taylor, D.Sc., U. S. N.; Dr. L. W. Austin, of the Bureau of Standards; Admiral Strother Smith, U. S. N.; Commander Hooper, U. S. N.; G. H. Clark, Expert Radio Aid, U. S. N.; Dr. George W. Pierce, of Harvard University; and Ensign A. Crossley, U. S. N., who has been actively engaged on the installation of the Rogers system at the Great Lakes Naval Radio Station, besides New Orleans, New London, Conn. (test station, now abandoned), and Norfolk, Va.

Like many other great inventions the exact mode of operation is hard to ascertain and define. The views of Mr. Rogers on the operation of this wireless system are briefly defined as follows:—First, that the electric energy liberated at the base of an antenna will be propagated thru the earth even in the absence of etheric space waves above, if such a condition were possible, and which in reality does occur when great distances are signalled over, so he believes. Second, that the propagation of earth waves no more depend upon the ether waves above the surface of the earth than these etheric space waves depend upon the earth waves. Further, that both waves are propagated simultaneously, one above and the other below the surface of the earth, and that at the initial start each is dependent upon the other, altho thereafter neither is dependent upon the other. Furthermore, Mr. Rogers believes that the ether waves gradually die out in intensity in proportion to the earth's curvature, and the distance over which they are propagated, and that at great distances the ether space waves do not have any appreciable effect upon receiving appliances, and that these are energized solely by the energy transmitted thru the earth.



Tell Mother and Dad why you should own an **Auto-Wheel**

TELL them that

every real boy should own an Auto-Wheel Coaster or an Auto-Wheel Convertible Roadster because they're the best wagons ever built for work or play. Wheels have roller bearings, steel axles and tires, and the spokes are oval like an auto.

Send for FREE Felt Pennant

Write us the names of three coaster wagon dealers, mentioning which one handles the AUTO-WHEEL, and we'll send you a beautiful Felt Pennant, FREE.

Organize an Auto-Wheel Coaster Club

Each member receives a beautiful cap. The captain receives a special cap. Write now for booklet telling all about the Auto-Wheel Coaster Clubs of the U. S., and how to organize a local branch. Address,

Buffalo Sled Company
163 Schenck St., N. Tonawanda, N. Y.
(In Canada: Preston, Ont.)



Telegraph Pictures
BY ELECTRICITY

A complete set of two machines of this marvelous equipment for only $19.50. Instructive, mystifying and useful. This picture of President Wilson was telegraphed by these machines. Will transmit pictures, maps, drawings and hand writing. Picture telegraphing is the coming science. Write today.



J. LEISHMAN CO. Dept. T. Ogden, Utah

CARNOTITE

(Radium Mineral.) The American Pitchblende found in Colorado, from which *Radium* is extracted.

A generous piece, enough to conduct experiments, such as affecting photographic plates thru opaque material (similar to X-Ray pictures), first made by Sir W. Crookes and Mme. Curie, is furnished in neat, wooden box.

URANIUM
(Radio-Active)

Containing about 35% of pure Uranium; also Radium and Vanadium. One of the most rare and interesting minerals. Twenty milligrams are furnished in glass vial protected by lead cover.

One box of *Carnotite* and one vial of *Uranium Ore* as described above sent prepaid..... 50c

SIDNEY SPECIALTY CO.
233 Fulton St., New York City

REX WIRELESS OUTFIT 50c.

The only dependable wireless outfit at a low price. It is not a toy, and with little practice you can send and receive clear messages anywhere as quick as lightning. Each outfit is for 2 stations with Morse and Continental codes, instructions, etc. We will also include our picture code attachment which will enable you to send and receive pictures, photographs, etc., by wireless. The complete Rex Wireless Outfit ready to operate for 50c. Order at once. Supply is limited.

ABRAMS BROS. 1305 S. Peoria St., Chicago.

INDEX to Volumes 1, 2, 3, 4, 5
ELECTRICAL EXPERIMENTER

Contains 24 pages and shows every article of interest that has been published since the inception of the magazine up to and including April, 1918. It is absolutely indispensable to everybody interested in any kind of electrical research work.

Postpaid 15c

Experimenter Publishing Co., 231 Fulton St., N. Y. C.

HAVE *You* SENT

for our booklet No. 4, giving diagrams and experiments with the Steco Button? See our large ad. pg. 822

STECO. 2134 N. Clark St., Chicago, Ill.



INSYDE TYRES Inner Armor
for Auto Tires. Double mileage, prevent blowouts and punctures. Easily applied to any tire. Thousands sold. Details free. Agents wanted.
Amer. Accessories Co., Dept. 53, Cincinnati

www.americanradiohistory.com

These ground currents travel with the speed of light and are picked up at the receiving station. The space waves persist for an appreciable distance, which accounts for air-plane to air-plane and air-plane-to-earth radio-communciation, but it is the belief of Mr. Rogers that in such long distance radio transmission as half-way around the globe (12,000 miles) that it is the ground wave current that does the work, and that the free space wave above the surface of the earth never reaches the station, due to the high resistance of the atmospheric envelope.

One of the Naval experts present mentioned that it has been found, that the penetration of the ground wave component increases with an increase in wave length. This is an important fact and helps to explain the operation of this new radio system, with its aërials buried in the ground. He also mentioned that "Radio to Mars" or other planets would be impossible, if we are to believe in the well-known "Heaviside" ionization layer, surrounding the earth at a height computed at from 30 to 50 miles, for no etheric wave can pass this layer without being reflected back to the earth, or at least restrained within this passageway.

Rogers System Eliminates "Static" and "Interference".

Mr. Rogers stated that his underground antenna, in itself, did not solve entirely the static or interference problem, but it made the nearest approach to this ideal condition —the goal of all radio engineers—than had ever been accomplisht before. This problem has, thanks to a new arrangement perfected by Commander A. Hoyt Taylor, D.Sc., been solved and *static and interference have been practically totally eliminated, for all-year-around radio service.* Think what an advance this means! Further, *there is no rise and fall in the signal strength during the night or day, at any time of the year, due to the sun's ionization effect, as is the case where elevated antennae are employed.* The U. S. Naval reports and tests made with the Rogers' ground aërial in comparison with the usual form of elevated aërial, several of which are appended herewith, show the incomparable efficiency of this new radio system.

What the Facts Show.

First we will mention the test which Mr. Rogers and a naval officer conducted for the writer. The apparatus used in these tests are shown in the accompanying photographs. They included several large tuning inductances, variable condensers, a one-step audion amplifier (single Audiotron bulb only!) and two pairs of Baldwin 'phones (telephone receivers). This apparatus was connected up to one of Mr. Rogers' latest buried antennas—a single rubber covered, stranded copper cable, about the size of a small ignition cable, extending westward for a distance of 4,000 feet, so as to be in a plane with the high power European radio stations. *This cable is encased in iron pipe (gas pipe)*, each 20 foot section of which is insulated from the abutting sections by means of a rubber hose (garden hose) slipt over the pipe ends for a few inches. This is buried in a dirt trench about 3 feet deep, filled in with soil. The cable is insulated at the free end and is connected up as in Fig. 2. The rubber covered wire alone has been used in all sub-aqueous tests, and gives fine results when simply buried in the ground, the decay not being so rapid as probably would be imagined. This latest aërial in the iron pipe is a new development and experiments are still going on with it. It works wonderfully well. The 4,000 foot aërial here described is best suited to receiving wave lengths of 6,000 to 16,000 meters. For shorter wave lengths aërials of smaller dimensions are employed.



www.americanradiohistory.com

"Here's the 'Lyons' station in France," said Mr. Rogers. A turn of the knob on the specially calibrated condenser, and there was "Lyons" (France)—sure enough. *Static and interference were unheard.* Next the great stations across the broad Atlantic, at Nauen, Germany; Carnarvon, Wales (England); and Rome, Italy, were heard with equal loudness and clarity. This laboratory station, which has been used by the Navy Department during the war, has picked up practically all the high power stations on the globe. American stations were then picked up by changing the wave length, and finally a test was made on a short (250 feet in length) buried ground antenna, adapted to receiving wave lengths of 200 to 800 meters. Wireless telephone messages were picked up from Washington, a distance of about seven miles. It is most interesting to note at this juncture, as the Naval tests at Norfolk, Va., on a similar aërial have shown, that a radio message from an airplane cannot be picked up on the underground aërial, until the 'plane is directly over the station. This would seem to prove two things—first, that the short waves sent out by the airplane radio set do not penetrate into the ground very far, if at all,—and second, that airplane radio transmission and reception are effected solely by etheric waves.

Referring to Figures 3 and 4, we find several interesting points. Fig. 3-A, shows how a double ground aërial is sometimes connected. Also, as in the case of Mr. Rogers' test station, several sets of these buried antennae are best employed, distributed about the station as shown in Fig. 3-B.

The Rogers underground antenna system has been used at the Belmar, N. J., station during the war with most gratifying results, as reported by the Navy Department, and its successful and unfailing operation during the twenty-four hours of the day, resulted in trebling and quadrupling the capacity of this great trans-Atlantic highway of intelligence communication. The official reports in connection with the work accomplished with the underground Rogers system at Belmar state that not a single word of communication was lost during the reception of thousands of important official messages from Europe. The station at Tuckerton, N. J., has also been equipt with the Rogers underground aërial system and all of the larger stations of the Allied Powers in Europe have been copied successfully thru the 24 hours, at this point also.

Submarine Wireless.

Perhaps the most interesting tests of all are those which were made on *submerged* submarines *in salt water!* The aerial in this case was of heavily insulated stranded cable, stretched from stem to stern as Fig. 4-A illustrates. The two aërials were brought down thru the conning tower and joined to the receiving apparatus. A second form of aërial is illustrated at Fig. 4-B, where the insulated aërial wires are placed in iron pipes within the submarine. Here are the results of some of these tests, which do not include the transmitting tests to the submarine, from a ground antenna on shore. When submerged 8 feet, the German station at Nauen was picked up by the submarine while lying off the American coast! *Submarines have, in other official tests, picked up distant stations when submerged 21 feet, on a wave length of* 12,600 *meters or greater wave lengths.*

One of the naval officers, who has had much to do with the testing of the Rogers' system, stated that experience had demonstrated that *in fresh water the submerged antenna may be placed at any depth.* Salt water acts differently, but the aërial may be submerged any desired depth for wave lengths above 10,000 meters.

The same officer, who has made a close study of all American and European work in radio, explained how the best work ever done in radio was accomplisht at the Great Lakes Naval Station, on the shore of Lake Michigan. Fig. 5 gives the general arrangement of this station. The test station was on the beach and acted as a "remote control" station for the standard station at A. The shortest distance between a "receiving and control station" in the naval radio service heretofore has been 36 *miles.* Here a distance of 600 feet only, separate the elevated aërial of the main station from the submerged Rogers antenna terminating at the test station, B. Said he, "Now let the inventors of 'static and interference' preventers trot out their little pets, and show what they can DO! Here's what this station *actually did on schedule service: With* 48 *amperes, at* 4,000 *meters wave length, being radiated in the elevated main antenna—the beach station,* ONLY 600 FEET AWAY, *was picking up Nauen on* 12,600 *meters, and New Orleans on* 5,000 *meters, without any interference or static —all on the Rogers sub-aqueous aërials.* These were rubber-covered cables spreading in different directions, any one of which could be used, and laying 50 feet deep in the water at their outer extremities.

Imagine such a wonderful performance! But this is not all. The official tests show that the station at Cavite, P. I., 8,100 miles away, was received regularly on the Rogers sub-aqueous aërials at the Lake Michigan Station, *on schedule service,* at 11 A. M. and 5:30 P. M. daily, the working periods of that station.

Transmitting On Underground Aerials.

Tests were made by the naval experts, as well as by Mr. Rogers in his very first experiments in transmission from a ground or under-water antenna. *These were all successful.* It is only a matter of properly insulating the antenna so that it will not break down under the high potential applied to it by the transmitter. The early tests by the inventor were made with a one inch spark coil to the Bureau of Standards Radio Laboratory, a distance of seven miles. *the received signals having an audibilty of* 2,000, *i.e.,* 2,000 *times the strength of a clear, readable signal.* The audibility of the signals at the Washington Navy Yard

The Burgess BLUE BOOK

for all Practical Men and Electrical Students

(See review of this book by Editor in December issue of your Electrical Experimenter page 568)



I have prepared a pocket-size note book especially for the practical man and those who are taking up the study of electricity. It contains drawings and diagrams of electrical machinery and connections, over two hundred formulas for calculations, and problems worked out showing how the formulas are used. This data is taken from my personal note book, which was made while on different kinds of work, and I am sure it will be found of value to anyone engaged in the electrical business.

The drawings of connections for electrical apparatus include Motor Starters and Starting Boxes, Overload and Underload Release Boxes, Reversible Types, Elevator Controllers, Tank Controllers, Starters for Printing Press Motors, Automatic Controllers, Variable Field Type, Controllers for Mine Locomotives, Street Car Controllers, Connections for reversing Switches, Motor and Dynamo Rules and Rules for Speed Regulation. Also, Connections for Induction Motors and Starters, Delta and Star Connections and Connections for Auto Transformers, and Transformers for Lighting and Power Purposes. The drawings also show all kinds of lighting circuits, including special controls where Three and Four Way Switches are used.

The work on Calculations consist of Simple Electrical Mathematics, Electrical Units, Electrical Connections, Calculating Unknown Resistances, Calculation of Current in Branches of Parallel Circuits, How to Figure Weight of Wire, Wire Gauge Rules, Ohm's Law, Watt's Law, Information regarding Wire used for Electrical Purposes, Wire Calculations, Wiring Calculations, Illumination Calculations, Shunt Instruments and How to Calculate Resistance of Shunts, Power Calculations, Efficiency Calculations, Measuring Unknown Resistances, Dynamo and Dynamo Troubles, Motors and Motor Troubles, and Calculating Size of Pulleys.

Also Alternating Current Calculations in finding Impedance, Reactance, Inductance, Frequency, Alternations, Speed of Alternators and Motors, Number of Poles in Alternators or Motors, Conductance, Susceptance, Admittance, Angle of Lag and Power Factor, and formulas for use with Line Transformers.

The Burgess BLUE BOOK Will Be Shipped, Postpaid, on Receipt of *$1.00*

Order today—send dollar bill, money order or check. I guarantee satisfaction or will return your money if you decide not to keep the book after using it for five days.

BURGESS ENGINEERING CO., YORKE BURGESS, *Consulting Engineer*
747 East 42nd Street Chicago, Illinois

www.americanradiohistory.com



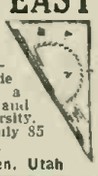
Swing 4 in., 11 in. between centers, 17 in. total length. Shipping weight 13 lbs. Bed of lathe is machined. Workmanship first-class. Equipped with wood turning chuck. Can be fitted with 3 in. face plate and drill chuck as special equipment. Order one today. Price $5.00 cash with order. SYPHER MFG. CO., DEPT. C TOLEDO, OHIO



BUSH CAR—FREE

This Five Passenger 37 H. P. car, 116 in. whl. base. All bearings Timken, Delco Ign.—Dyneto Stg. and Ltg. Write at once for my great Free Offer and 48-page catalog. Agents wanted to drive and demonstrate. Territory open. Prompt shipments. Big money. Cars guaranteed or money back. 1919 cars ready. Address J. H. Bush, President. Dept. 616
BUSH MOTOR CO., Bush Temple, Chicago, Illinois

MATHEMATICS MADE EASY



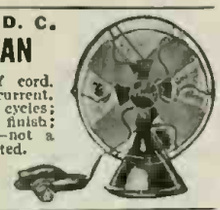
The Arcascope—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 85 cents Postpaid. Order today before you forget.
Dept. 8. L. J. LEISHMAN CO., Ogden, Utah

DEAFNESS IS MISERY



I know because I was Deaf and had Head Noises for over 30 years. My invisible Anti-septic Ear Drums restored my hearing and stopped Head Noises, and will do it for you. They are Tiny Megaphones. Cannot be seen when worn. Easy to put in, easy to take out. Are "Unseen Comforts." Inexpensive. Write for Booklet and my sworn statement of how I recovered my hearing. A. O. LEONARD
Suite 369 70 5th Ave., N. Y. City

Combination A. C. and D. C.
Eight Inch DESK FAN



detachable plug and 8 ft. of cord. Will operate on A.C. or D.C. current, 100 to 125 volts, 30 to 60 cycles; weight 10 lbs.; black enamel finish; height 11½ in. A real fan—not a toy. Price $6.50. Agents wanted.
THE TWENO CO.
150 Chambers St., New York



THE NEW MIDGET SLIDE RULE

has many exclusive features. It will add and subtract fractions and give decimal equivalents. It will also multiply, divide, add and subtract, solve problems involving any root or power (excepting—1) and will give Logarithms and the Sines, Tangents, Cosines and Cotangents of all angles. Made of metal. Size 3 1-4 inches. Send for free circulars. Price with complete instructions $1.00
Your money back if you are not satisfied.
GILSON SLIDE RULE CO., Niles, Mich.



SMALL ENGINES

Perfected Gasoline Engines—½, 1 and 1½ h. p.—for Farm and Shop use. Price, $27.50 and up. Also
WASHING MACHINES
We ship on trial. Send for Booklet and Special Offer.
SIEVERKROPP ENGINE CO.
1401—19th St., Racine, Wis.
STARTER for FORD CARS

"BETTER KODAK PICTURES"

is the title of our new catalogue on Developing, Printing, Enlarging, Copying, and Hand Color Work. Send for one today Free and we will include a copy of Photo Craft Magazine.
Address Photo Craft, Drawer 388, Ann Arbor, Mich.

You can be quickly cured, if you
STAMMER

Send 10 cents coin or stamps for 70-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering for 20 years.
Benjamin N. Bogue, 752 Bogue Building, Indianapolis



Printing Cheap

Cards, circulars, labels, book, paper. Press $5. Larger $20 Job press $85 up. Save money. Print for others, big profit. All easy, rules sent. Write factory for press catalog, TYPE, cards, paper. THE PRESS CO. D-47 Meriden, Conn.

was 1,000. The transmitting tests at the Great Lakes Naval Station were made at first with a low power Oscillion bulb transmitter and later with a Clapp-Eastham hytone set. An elevated amateur style antenna of two wires was strung up between two houses 38 miles away. Clear signals were received with an audibility strength of 2,000. The ignition cable used for the aerial finally punctured, but *even then* the signals received were four times louder than the best amateur transmitter could send on a regular aerial, as tests proved.

Official U. S. Naval Tests of Underground Reception, at Naval Station, New Orleans, La., During 1917.

Excerpts.

In general, (relating to the Rogers' system) the point of interest lies in the use of wires buried in the ground, for both the transmitting and the receiving antenna. For instance, in receiving, a wire buried one foot below the surface of the earth extends for several hundred feet south of the receiving station, and a similar wire north, the receiver being located between the pairs of wires. The ordinary receiver was used. With this arrangement, signals from Darien, Nauen, and all Atlantic stations were received.

Tests at New Orleans Station.

Federal receiver used on main antenna, Western Electric receiver used on underground antenna, 1,400 feet buried wire. (The figures refer to audibility.)

	Main Antenna		Underground Antenna		
Station	Wave Length	Sig. aud.	Static aud.	Sig. aud.	Static aud.
San Diego	9800	1200	1000	750	15
Arlington	7500	2000	3000	1500	50

Impossible to read Arlington on the elevated antenna on account of static interference. United Fruit Company station of New Orleans interfered with signals from Arlington on main antenna, *but offered no interference* on underground antenna.

Test on message from U. S. S. "Are-

(*Continued on page* 839)

ALEXANDER WIRELESS BILL IS KILLED.

(*Continued from page* 786)

today we are not at all excited even about the amendment of the Alexander Bill for we have good and sufficient reasons to believe that the Alexander Bill amended has little chance to become a law."

That our judgment was correct is borne out by the fact that the bill was actually killed a month later. Many interesting things came to light during the hearings before Mr. Alexander in the latter part of December. A number of well-meaning amateurs, small and large, professional and otherwise, had flocked to Washington to give testimony and to protest against the Alexander Bill. However, before they arrived in Washington, a flood of protesting letters from amateurs had descended upon the national capital, and it was found that their services were not at all needed, for before their arrival several amendments had already been gotten up and were in print.

It is not our intention to belittle the genuine efforts made by these amateurs who went to Washington in person to fight for the cause, but we do not think that in the testimony given as publisht in the printed records, anything new was shown or any evidence given that was not already known by the Committee. It brought out, however, the interesting fact over and over that the 1912 bill was elastic enough to cover any emergency as far as the radio



We guarantee at any time during the first year of your enrollment to refund the entire amount paid if immediately upon the completion of ten examinations you notify the school you are not satisfied with your Course.

DARE YOU GUARANTEE YOUR SERVICE?

Will you guarantee your service to your employer as we guarantee our service to you? CAN you? Think it over. Think what "absolute satisfaction" means in dollars and cents—*if you can deliver it.* Guaranteed service is simply the difference between "getting by" and GETTING ON. If you are only "getting by," if you aren't increasing your earning power, or if you can't guarantee your service, then you need and should get *specialized training.*

WE GUARANTEE Our Training

Make no mistake about that! When we undertake to make you a skilled worker in your line, we absolutely and unreservedly guarantee to satisfy you insofar as quality and thoroughness of training go. We accept students on no other basis but that of *satisfaction or money back.* 25 years' experience enables us to stand back of our work. We know HOW well enough to guarantee our service to you. You risk nothing by enrolling. You can't lose a cent. Our training will enable you to guarantee your service *because of your training.* That means the position you want, and bigger pay.

Training Decides Pay

There's no question about it. You get paid for what you can DO. That depends on what you KNOW. Increase your knowledge with one of our practical Courses and your earning power increases accordingly. You can train at home in your spare time—backed by the assurance that we guarantee to satisfy you. There are no strings to that offer. Let us send you our Free Bulletin and full details. Check and mail the coupon TODAY.

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. N-7443 Chicago, U. S. A.

TRAINING THE KEY TO SUCCESS

Please send me booklet and tell me how I can fit myself for the position marked X

.....High School Course	.....Shop Superintendent
.....Electrical Engineer	.....Lawyer
.....Telephone Engineer	.....Business Manager
.....Architect	.....Auditor
.....Draftsman	.....Certified Public Acc'nt
.....Building Contractor	.....Stenographer
.....Structural Engineer	.....Bookkeeper
.....Mechanical Engineer	.....Fire Ins. Adjuster
.....Civil Engineer	.....Sanitary Engineer
.....Steam Engineer	.....Automobile Engineer

Name .....

Address .....



ZIP-ZIP Patented Sept. 3rd, 1918

The Greatest 50 Ct. Article on the Market. Shipped right from the factory the same day we receive your order. The Prong is made of beautiful metal; never break or wear out; scientifically made and best workmanship. The rubbers are elastic and lasting, with plenty of pep and force. Zip-Zip, complete, only 50c prepaid. Be sure the name Zip-Zip and our address appear on the article you buy. Order from us or any Sporting Goods Store in your city. Send Stamps, Coin or Money Order.
AUTOMATIC RUBBER CO.
COLUMBIA, S. C.

PICK YOURS QUICK!

'Way Less Than Manufacturer's Price



Speak quick—for these rebuilt Underwoods are getting scarce. *U. S. Govt. bought 100,000 Underwoods.* Genuine Visible Underwoods at big saving. 5-Year Guarantee. Try it 10 DAYS FREE. Rent or buy. Write quick for Offer No. 164.
Typewriter Emporium, 34-36 W. Lake St., Chicago

www.americanradiohistory.com

½ SAVED
GET OUR
BIG BOOK

DO Your Own PLUMBING AND HEATING at low cost

Send for our big 250 page Handy-Man book catalog, with separate wholesale discount sheet. Every engineer, contractor, electrician or householder needs it. Shows over 10,000 fixtures and supplies in plumbing and heating at wholesale, also shows how to save skilled labor, hard work and unnecessary material by means of

NEW-CUT-TO-FIT-METHOD

This instructive book shows and helps you select the PROPER PLUMBING, WATER SUPPLY SYSTEM, HOT WATER OR STEAM PLANT and besides being our catalog it has many practical plans, diagrams, sketches, elevations, etc., showing you how to do the work this newer, original, practical, economical CUT-TO-FIT WAY. Any handy man with a few ordinary tools can easily do the work with the aid of this BIG

INSTRUCTIVE HANDY-MAN BOOK

To avoid sending this big, valuable, well-bound book broadcast to disinterested parties, we request a temporary deposit of 25c, which we will refund on first order, or if dissatisfied, upon the immediate return of the book. Could anything be more fair? Write for your copy today

Our $500,000 plants behind our guarantee

HARDIN-LAVIN COMPANY
4510-20 Cottage Grove Ave. Chicago

The ANDERSON Steam Vulcanizer

Anderson's Flexible Conformation Device, upon which an ordinary monkey wrench exerts tons of pressure, forces thousands of little rubber rivets into the tire's fabric, to be cooked in by our superheated dry steam system.

We guarantee to make practical vulcanizers out of men from 20 to 70 years old. $235 and 5 to 10 days in one of our many State Vulcanizing Schools will start you in this profitable business, or send us $20 for permit to enter our closest school to learn vulcanizing. We give you a guarantee; we return your $20 any time thereafter if you buy a vulcanizer of us.

The Anderson Steam Vulcanizer Co.,
23 Williams Bldg., Indianapolis, Ind.
Mfrs. of the Famous Anderson Steam Vulcanizer. Owners of the Anderson method of vulcanizing.

Learn Mechanical Drawing
Earn $35 to $100 a week

Thousands of Draftsmen needed for reconstruction work. We teach you quickly and thoroughly at home, in spare time—furnish complete Drawing Outfit FREE—and help you secure position when qualified. No previous training necessary. You can quickly qualify for big position. Write for Free Book.

COLUMBIA SCHOOL OF DRAFTING.
Dept. 972, 14th and T St. Washington, D. C.

THIS BUNGALOW CAN BE BUILT FOR $900

This and many others in my new book, Building Plans for Modern Homes, will save you hundreds of dollars. One of the most complete and comprehensive books of plans ever published by any architect. Fifth edition just off the press. Two hundred and fifty floor plans and photographs of bungalows, etc., costing from $300 up; gives sizes and cost to build. Sent postpaid for $1.00

FREDERICK H. GOWING
ARCHITECT
18 Tremont St., Bos., Mass

I Used to Draw Like This

NOW PAID $100 FOR ONE DRAWING

You can become an artist, illustrator or cartoonist even if you now have no talent. Earn $25 to $100 per week. Write for Free Outfit offer and beautiful new book, "HOW TO BECOME AN ARTIST." Address

WASHINGTON SCHOOL OF ART., Inc.
1400 H Street N. W. Washington, D.C.

LEARN WATCH REPAIRING

You can learn by our modern and original system of instruction every part of the Watch Repairing Trade at home as good or better than at a shop. You can earn money while learning and secure a well paying position or start in business after completing our course of instruction. Good watch repairers are always in demand and earn from $20 to $35 per week. For particulars apply to the

Milwaukee School of Watchmaking, 166 Mason St., Milwaukee, Wis.

amateur is concerned, and this is a good thing. We had maintained right along and we stated so in our January and February issues, that no amendment nor new law was at all required. We had no suggestions to make, the old law was good enough, and we said so,—if any change at all was to be made, we were for the Padgett bill, which left the amateur just exactly where he was before the new bill came up. Naturally we are glad to see that our judgment proved right, for official Washington thought so, too. The old law is good enough, it covers every possible phase of the amateur, and we do not think that any legislator could do better than the Radio Act of 1912.

An interesting side light of the disturbed state of mind of the visiting Washington radio amateurs appeared to be their unanimous holy fear of the United States Navy. They all seemed to be obsest, any, panic-struck that the Navy Department was out to kill the amateurs, which as a matter of fact, the Navy, speaking generally, was not.

We believe that our opinion is shared by those who know the inside facts, that the Alexander Bill as originally framed was a hasty measure, because at the time it probably was thought that Government ownership for radio was ripe, and that such a measure could be rushed thru in haste. The sponsors of the bill, however, made two fundamental mistakes: First, the country was and is not ripe for public ownership as yet. Second, it was found that several hundred thousand red-blooded American citizens, better known as Radio Amateurs, cannot be wiped off the earth by means of a blue pencil. Such methods might have had a small chance before the war, but after what we have gone thru in democratizing the world and freedom for everybody, there never was a ghost of a chance of the measure succeeding. Several senators and congressmen voiced their opinion on this point in no uncertain tones, and we are certain that if the bill should come up again during the next few years, which by the way we doubt, it will experience exactly the same fate.

Another mistake, which, however, is made by a great many people outside of Washington is that for some curious reason the amateurs at large has always been looked upon as a boy in his knickers. Even well informed Washington was greatly surprised to receive letters from "young" amateurs 60 and 70 years old, and these "boys" were just as vehement in their protests as the young man of 20. Then the amateurs in uniform were legion, and their parents voiced their sons' sentiments, being that the sons themselves were perhaps in France or elsewhere. Further, the great horde of amateurs known as jewelers made themselves heard lustily.

There are today thousands of jewelers located all over this broad land, whose business it is to serve their community by giving them the right time. They also require daily time signals in their business. This time service was given free to them by Uncle Sam every day by the time signals sent out by Arlington and other powerful Government stations. These amateurs under the original Alexander bill would have been killed just the same as their brethren who pursue wireless more or less for instructional purposes, and you may be sure that these jewelers were loud in their complaints.

Our amateurs are to be congratulated in their solitary fight which they put up for their rights, and we congratulate them upon their thoro victory.

There is, however, one serious point which we desire to broach, and that is the following:

When we first heard that a new wireless measure was to be rushed thru Congress,—which if it had actually past, would have killed American radio amateurism,—we took it up ourselves to broach the important news to every amateur on record.

The RADIO LEAGUE OF AMERICA, which was organized three years ago was formed for just such a purpose, viz., to keep the amateurs together and to ward off unfair legislation. Unfortunately, only about 20,000 amateurs had been registered with the League, altho it does not cost one cent to join the League. So when we came to write the letters to all the amateurs we only had 20,000 names of the League, while the other names were made up from various lists which we had in our office, and which lists were not at all reliable on account of removals of amateurs, etc.

We wish to take this occasion to urge every amateur to fill out the blank printed at the end of this article and join the League at once. *It does not cost a cent to do so,* except three-cent postage with which to mail this blank. You immediately become a member, and any important news can then be transmitted to you immediately without delay. It should be apparent to every amateur that being a member of the *Radio League of America* can only benefit him, and inasmuch as there are no dues or fees to be paid, there is absolutely no good reason why every amateur should not be in it.

Peace will soon be declared by the President and then everybody will be allowed again to operate his or their stations, and being a member in this well-established League of national scope and reputation can only benefit the owner of the radio station. Then, too, every amateur owes it to his Government that in time of peril his services can be drawn upon and his station used, and only by having a central body which has all such information can radio amateurism in the United States grow to its fullest and greatest importance.

Application for Membership in the Radio League of America

I, THE UNDERSIGNED, a Radio Amateur, am the owner of a Wireless Station. My station has been in use since..... and I herewith desire to apply for membership in the RADIO LEAGUE OF AMERICA. I understand that the Radio League of America is a National Scientific Organization for the pursuit of the Radio Arts. I will not be called upon to pay membership fees, or dues, and once enrolled I am to share in all the privileges of a regular member.

Upon receipt of this form properly filled out you are to send me your eight-page booklet describing the purpose of the League, rules, etc.

Name.....

City.....

State.....

Date.....191

Mail this blank to Radio League of America, 231 Fulton St., New York City.
3-19

www.americanradiohistory.com

Editor, ELECTRICAL EXPERIMENTER,
233 Fulton Street,
New York, N. Y.

SIR:

It has been noted by this office that on page 707 of the February issue of the "Electrical Experimenter" you printed certain proposed amendments to a bill for Government Ownership of Radio Communication. On page 735 in an article entitled "Radio Amateurs Discussed Officially" you stated that this amendment was drafted by Lieutenant J. C. Cooper, Jr., U. S. N. R. F. You have evidently been misinformed. The amendment printed by you was not drafted by the Navy Department and was not discussed before the House Committee at the hearings.

The amendment actually drafted by Lieutenant Cooper and discussed before the Committee appears in the testimony of Captain Todd on page 39 of the Official Report of the Hearings before the House Committee on Merchant Marine and Fisheries on H. R. 13159, and is as follows:

"Insert after line 6, page 2, the following:

" 'The term "amateur station" means a station used for private practice or experiment in radio communication and not operated for profit in either receiving or sending radio signals.'

"Insert in line 14, page 2, after 'training-school stations' the following: 'and amateur stations.'

"Strike out the sentence beginning in line 1, page 3, and ending in line 6, page 3, and in lieu thereof insert the following:

" 'This section shall not apply to stations belonging to the Government of the United States or the Government of the Philippine Islands, or to experiment stations, technical and training-school stations, and amateur stations, licensed as provided by the act to regulate radio communication, approved August thirteenth, nineteen hundred and twelve: *Provided*, That when such amateur stations are licensed for receiving purposes only no operator's license shall be required for the operator in charge of or operating such station; but when such amateur station is licensed for transmitting also the license shall require that the operator of such station shall hold a license showing his ability to send and receive at least twenty-five words per minute in the Continental Morse code: *And further provided*, That the license for such transmitting station may limit the power input to one-half kilowatt in case of amateur stations within one hundred miles of the Atlantic or Pacific Ocean, the Gulf of Mexico, or the Great Lakes, and to one-quarter kilowatt within five miles of a Government receiving station. Amateur stations so licensed shall not use any wave length exceeding two hundred and fifty meters nor less than one hundred and fifty meters except by special authority in the license contained.' "

In order that the information given your readers may be correct, it is requested that you publish this letter in your March issue of the "Electrical Experimenter."

For your further information, there is being forwarded to you under separate cover a full printed copy of the Hearings before the Committee.

Very respectfully,
(Signed) E. B. WOODWORTH,
Commander, U. S. Navy,
Acting Director Naval Communications.

The amendment drafted by Lieutenant Cooper was scheduled to run in our February issue. At the last moment, due to lack of space, it was crowded out. The amendment printed in our February issue was proposed by Mr. Watson as published by us.—Editor.



MAKE MONEY
REPAIRING TIRES

The high cost and limited supply of tires makes it necessary for motorists to conserve their tires and get maximum mileage. Present conditions offer tire repair men a big opportunity to make money. Experienced help not necessary.

With this Shaler Electric Vulcanizer you can make money easy. It heats from city electric light current —*has automatic heat control*—no danger of fire or explosions.

Will mend any style or size of tire—both casing and inner tube. Handles 12 casings and 200 tubes a day. Anybody can operate it, and turn out perfect work. Price $65.00 complete —Subject to Trade Discount.

Write at once for catalog of our complete line of Shaler Vulcanizers. Steam or Electric for Repair Shops and quick selling models for motorists.

C. A. SHALER CO., 2202 Fourth St., Waupun, Wis.



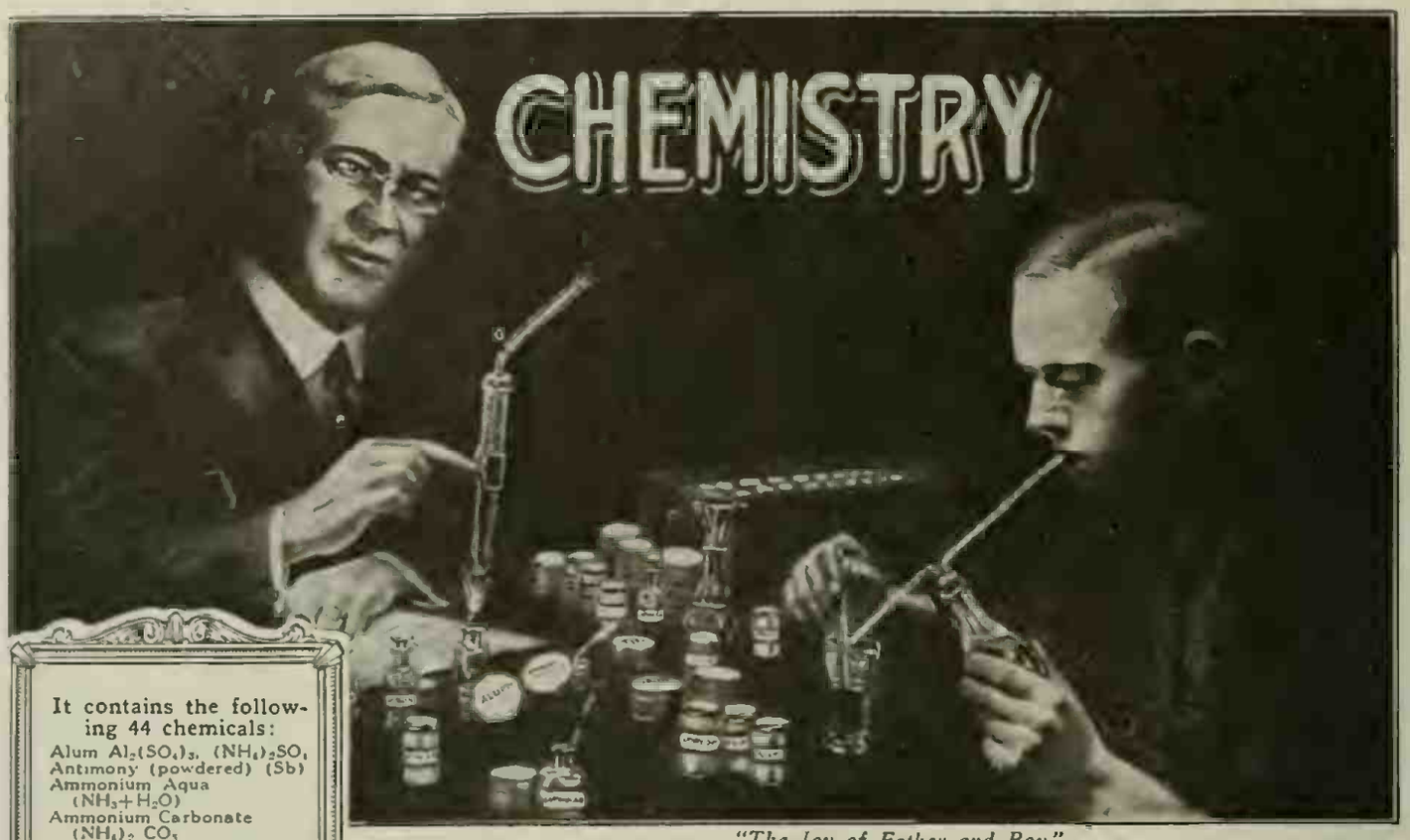


TYPEWRITER SENSATION
PROMPT SHIPMENT.

$4.00 per month buys a beautifully reconstructed, latest model visible typewriter, with back spacer, decimal tabulator, two-color ribbon, etc. Every late style feature and modern operating device. Sent on approval. Catalogue and special prices free.

Harry A. Smith, 738, 218 N. Wells St., Chicago, Ill.

www.americanradiohistory.com



"The Joy of Father and Boy."

THE E. I. Co. CHEMICAL LABORATORY

We present herewith to our friends our new **E. I. Co. Chemical Laboratory** which contains real chemicals and apparata to perform real chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a **Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.**

It contains the following 44 chemicals:

Alum $Al_2(SO_4)_3$, $(NH_4)_2SO_4$
Antimony (powdered) (Sb)
Ammonium Aqua (NH_3+H_2O)
Ammonium Carbonate $(NH_4)_2\ CO_3$
Ammonium Chloride (NH_4Cl)
Ammonium Sulphate $(NH_4)_2\ SO_4$
Barium Chloride ($BaCl_2$)
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride ($CaCl_2$)
Calcium Oxide (CaO)
Calcium Sulphate ($CaSO_4 2H_2O$)
Charcoal (Carbon) (C)
Chloride of Zinc ($ZnCl_2$)
Copper Sulphate ($CuSO_4$)
Ferrous Sulphate ($FeSO_4$)
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5(OH)_3$
Hydrochloric Acid (HCl)
Iodine (I)
Iron Chloride ($FeCl_2$)
Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
Magnesium Carbonate ($MgCO_3$)
Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
Nickel Chloride ($NiCl_2$)
Oxalic Acid ($H_2C_2O_4$)
Sodium Bicarbonate ($NaHCO_3$)
Sodium Borate ($NaBO_2$)
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate ($NaNO_3$)
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride ($SnCl_2$)
Sulphate of Nickel ($NiSO_4$)
Sulphate of Zinc ($ZnSO_4$)
Sulphuric Acid (H_2SO_4)
Tin (Granulated) (Sn)
Zinc (Metal) (Zn)
Zinc Carbonate ($ZnCO_3$)

The following apparata are furnished:

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube
Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure
Glass Tubing
One book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

DESCRIPTION OF THE OUTFIT:

The outfit consists of forty-four (44) Chemicals all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) enough to make dozens of experiments with each. See list of Chemicals herewith.

The apparata furnished are all of the best obtainable make and of standard laboratory size and shape. A list of the 17 pieces of apparata furnished with this outfit is printed also herewith.

The Instruction book is a real Chemistry Course for the Beginner.

Some of the Contents are: Division of Matter: This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc.

Chemical Nomenclature. This explains in simple language the derivation of the chemical names of the Elements and their compounds.

There is a chapter on Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters Aphorisms, etc.

A good part of the book is devoted to:

Weights and Measures. The Metric System, the English system and the U. S. system are fully explained.

The following tables are furnished:

Symbols and Atomic weights of the Elements.

Measures of Weights, Volume, Capacity and Length.

Per Cent solutions.

Conversion of Measure expressed in parts.

Poisons and their antidotes.

Technical and common name of chemical substances.

Formulas for Cleaning various substances, etc., etc.

Among the 100 Experiments are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to make Chlorine Gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

Altho all chemicals have nearly doubled in price, we have decided not to raise the price of this outfit for the present.

The price is still $5.00

Shipping Weight 10 lbs.

(Can be shipped by Express only.) Send your order today to:

TRADE MARK **THE ELECTRO IMPORTING CO., Mfrs.** TRADE MARK

231 FULTON STREET NEW YORK CITY

SEE OUR FULL PAGE AD ON PAGE 824 FOR FREE CYCLOPEDIA

www.americanradiohistory.com

THE ROGERS UNDERGROUND WIRELESS.

(*Continued from page* 835)

thusa" at sea about 150 miles from New Orleans.

Main Antenna		Underground Antenna (500' composite)	
Sig	Static	Sig	Static
400	5000	300	15

The "Arethusa" had been trying to get thru a naval despatch which could not be copied on elevated antenna on account of serious static interference. The despatch was taken on the underground antenna, and *every word copied correctly.*

At 9 P. M., April 7, 1917, it was possible to copy signals from Tuckerton with ease, while static on the elevated antenna made it impossible to read any arc signals.

The following results were obtained with spark signals:

Three hundred foot wires in parallel, ten feet apart, a .002 m.f. condenser in series with primary coil of a Telefunken receiver to obtain 600 meters.

Date	Station	W. L.	Sig. Aud Ground Antenna	Static Aud Ground Antenna	Sig Aud Main Antenna	Static Aud Main Antenna
Apr. 2	Point Isabel	600	15			
Apr. 2	Tampa	600	200	0		3000
Apr. 2	Port Arthur	600	150	0		3000
Apr. 2	Pensacola	1200	20	0	100	150
Apr. 2	Ft. Sam Houston		150			

Of particular interest is the fact that when static *prevents* reception on the main antenna, reception can be continued on the underground antenna. *This has even been done during a severe lightning storm, when the main antenna would have been dangerous without grounding.* Reception is also directional and permits of avoiding interference to some extent by using wire "off direction" of an interfering station.

Strays: Strays are as a rule practically absent. Occasional loud cracks widely separated are received. (Ed. note. This has since been overcome.) These isolated strays, altho frequently loud, do not interfere in the least with the reception of signals. On two occasions, strays have risen to an audibility in excess of 5,000 on these separate cracks, but even in this case, reception of signals, altho a little difficult, *was not interrupted.* On these two occasions it was necessary to *ground* both of the (elevated) aërials at the main station.

Considering the matter of strays, it can be said that on four or five occasions during one week, which was one marked by tremendous storms in the Great Lakes region, that strays rose to an audibility in excess of 10,000 at the beach station. Even in this case, however, signals from boats within 100 miles and from shore stations, such as Ludington, Milwaukee and Manitowoc, were usually readable, because the strays while very loud, were nowhere near as numerous as on the elevated aërial. Durthese periods a messenger was kept at the beach station to carry up messages to the main station, which could not receive these signals on account of the strays.

There seems to be no appreciable advantage in using more than one wire—No. 12 weather proof insulated.

The experiments at Great Lakes confirm the work of the Bureau of Standards on the importance of adequate insulation of the wire. If the wires are grounded at the ends, it does not necessarily make much difference unless they are adjusted to the optimum wire length; but if properly adjusted to this length, grounding of the wires, either intentionally or accidentally, produces a diminuation of the signals, which, however, even with the intentional grounding of the two ends, still leaves them 50% of their maximum value. Therefore, while the question of insulation is important, it does not mean that the system will fail entirely if the insulation becomes faulty.

MY INVENTIONS.

(*Continued from page* 776)

cover. Suddenly my legs went up in the air. In the same instant there was a flash in my brain, the nerves responded, the muscles contracted, I swung thru 180 degrees and landed on my hands. I resumed my walk as tho nothing had happened when the stranger caught up with me. "How old are you?" he asked, surveying me critically. "Oh, about fifty-nine," I replied. "What of it?" "Well," said he, "I have seen a cat do this but never a man." About a month since I wanted to order new eyeglasses and went to an oculist who put me thru the usual tests. He lookt at me incredulously as I read off with ease the smallest print at considerable distance. But when I told him that I was past sixty he gasped in astonishment. Friends of mine often remark that my suits fit me like gloves but they do not know that all my clothing is made to measurements which were taken nearly 35 years ago and never changed. During this same period my weight has not varied one pound.

In this connection I may tell a funny story. One evening, in the winter of 1885, Mr. Edison, Edward H. Johnson, the President of the Edison Illuminating Company, Mr. Batchellor, Manager of the works, and myself entered a little place opposite 65 Fifth Avenue where the offices of the company were located. Someone suggested guessing weights and I was induced to step on a scale. Edison felt me all over and said: "Tesla weighs 152 lbs. to an ounce," and he guest it exactly. Stript I weighed 142 lbs. and that is still my weight. I whispered to Mr. Johnson: "How is it possible that Edison could guess my weight so closely?" "Well," he said, lowering his voice, "I will tell you, confidentially, but you must not say anything. He was employed for a long time in a Chicago slaughter-house where he weighed thousands of hogs every day! That's why." My friend, the Hon. Chauncey M. Depew, tells of an Englishman on whom he sprung one of his original anecdotes and who listened with a puzzled expression but—a year later—laughed out loud. I will frankly confess it took me longer than that to appreciate Johnson's joke.

Now, my well being is simply the result of a careful and measured mode of living and perhaps the most astonishing thing is that three times in my youth I was rendered by illness a hopeless physical wreck and given up by physicians. More than this, thru ignorance and lightheartedness, I got into all sorts of difficulties, dangers and scrapes from which I extricated myself as by enchantment. I was almost drowned a dozen times; was nearly boiled alive and just mist being cremated. I was entombed, lost and frozen. I had hair-breadth escapes from mad dogs, hogs, and other wild animals. I past thru dreadful diseases and met with all kinds of odd mishaps and that I am hale and hearty today seems like a miracle. But as I recall these incidents to my mind I feel convinced that my preservation was not altogether accidental.

An inventor's endeavor is essentially lifesaving. Whether he harnesses forces, improves devices, or provides new comforts and conveniences, he is adding to the safety of our existence. He is also better qualified than the average individual to protect himself in peril, for he is observant and resourceful. If I had no other evidence that I was, in a measure, possest of such qualities I would find it in these personal experiences. The reader will be able to judge for himself if I mention one or two instances. On one occasion, when about 14 years old, I wanted to scare some friends who were bathing with me. My plan was to dive under a long floating structure and slip out quietly at the other end. Swimming and diving came to me as naturally as to a

LISTEN TO ME!



Be A CERTIFICATED ELECTRICIAN

THIS IS YOUR CHANCE OF A LIFE TIME

I am Chief Engineer of the great Chicago Engineering Works. I am in close official touch with the electrical world. I know how badly we need trained electricians who can take charge of important work as experts. Right now there is such a need for executive electricians that I am making a special effort to help meet the demand. I am publishing this special announcement to secure a certain number of ambitious men whom I will personally train by mail for the wonderful opportunities that are open.

I WILL MAKE YOU a Trained Electrician

I don't care how young or old you are, just as long as you can read and write and have a spark of ambition. I don't care where you live or what you do. I don't care if you don't know a blessed thing about electricity. Just give me a little of your spare time for a short period and I'll show you the quick way to success in electricity. You can qualify to earn **$36 to $100 a week** with opportunities for greater earnings.

I Train You by Mail!

Your spare time will do. No interference with your regular duties. I understand just what you must know and I have devised a wonderful way of instructing by mail. I positively guarantee your satisfaction.

Free Wonderful Electrical Outfit

Absolutely free. Not a penny cost to you now or later. To those who act at once I will give a wonderful set of Electrical Equipment with my compliments. Write me at once. I have only a limited number of sets to be given free. Drop me a post card or letter.

Write! You will have to act quick to get in on this opportunity. Write me today for full particulars. Drop me a post card. ***Write Now.***

CHIEF ENGINEER COOKE,
Chicago Engineering Works,
Dept. 523
441 Cass Street, Chicago, Illinois

www.americanradiohistory.com



BE A BOY CHEMIST

Test water, foods and other things you use and wear. Make soap, ink, dye; fire-proof cloth and wood, and work hundreds of useful, fascinating experiments just like a real chemist. Perform weird, puzzling tricks of chemical magic. You can, with "CHEMCRAFT". Outfits contain all chemicals and laboratory supplies to work each experiment many times; also a Manual of Instruction. "CHEMCRAFT" is absolutely harmless; made by a practical chemist and is scientifically correct.

Chemcraft No. 1—$1.50
West of Mississippi River and in Canada—$2.00
Chemcraft No. 2—$3.00
West of Mississippi River and in Canada—$3.50
Chemcraft No. 3—$5.00
West of Mississippi River and in Canada—$6.00

Be sure you get "CHEMCRAFT," the original and most complete and scientific chemical outfit. Ask for it by name at your Toy Store, or send price and we will deliver direct prepaid.

THE PORTER CHEMICAL CO.
Industrial Bldg., W. Washington St.
Hagerstown Maryland

House Lighting Plants

$225 to $2100



Write for Catalog, giving name of your electrical dealer. Agents Wanted.

Dynamos, Motors

all sizes. Battery Chargers and Motor Generator Sets. $25. to $120. Hydro-Electric Generators. Which catalog do you want?

SPECIAL—Holtzer-Cabot 110 Volt Hand Generators, while they last, only $5. Order from this ad.

WATSON ELECTRIC CO., Dept. 13, Gas Bldg. Chicago.

SOLDIERS, CADETS & MILITARY SCHOOLS ATTENTION

Service Stripes—Gold, Silver, Red, Blue & Green (Reg.) 20c per Stripe
Gold & Silver Stars—Metal or Embroidered (Reg.) 25c Each
Overseas Caps—Wool (Army Reg.) $1.00 Each
Cuff Leggings—"Waterproof" 15 oz. O. D. Duck (Reg.) $1.55 pr.
Cuff Leggings—Light Color O. D. Duck, 20 oz. (Reg.) $1.75 pr.
Semaphore Flags—14x14 inches, Red & White Bunting 75c pr.

Special Caps, Uniforms, Belts and Insignia. Camping and Hiking equipment. Cadet, Military School and Boy Scout supplies.

Above sent, postpaid, upon receipt of price. Kindly mention name of school, organization or branch of service.
Cadet Equipment Co., 727 Vieton Ave., New York City



BIG BUNCH OF FUN 10c

1 New Airship Game with Airships, 1 Chess and Checker Board and men, 1 Chinese Dip-se-lu-la, 1 Set Dominoes, 12 Other Games, 19 Lessons in Magic, 12 Money Making Secrets, Wireless Code, 18 Pictures Pretty Girls, 3 Puzzles, & New Ford Joke Book. All for 10c with large Catalogue.

Dept. 72
American Toy Co., Lowell, Mass., U. S. A.

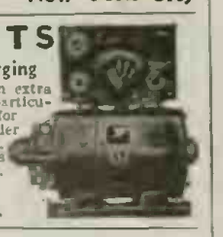
Feldman's "Geyser" Electric Water Heater

Instantaneous Hot Water

FELDMAN MFG. CO.
1500 Times Bldg. New York City

BIG PROFITS

for you in HB Battery Charging



Others clear $100 to $200 a month extra profit. So can you. Write for particulars or send $15 first payment for HB 500 watt Charger on trial under absolute money-back guarantee. Balance in 9 monthly payments of $20 each. No risk. Order today.

Hobart Brothers Company,
Box 3E. Troy, Ohio.



If you play quaint, dreamy Hawaiian music or latest songs on the Ukulele you will be wanted everywhere. We teach by mail 20 simple lessons; give you free a genuine Hawaiian Ukulele, music, everything—no extras. Ask us to send the story of Hawaiian music. You will love it. No obligation—absolutely free.

The Hawaiian Institute of Music
1400 Broadway, Suite 1103, New York

duck and I was confident that I could perform the feat. Accordingly I plunged into the water and, when out of view, turned around and proceeded rapidly towards the opposite side. Thinking that I was safely beyond the structure, I rose to the surface but to my dismay struck a beam. Of course, I quickly dived and forged ahead with rapid strokes until my breath was beginning to give out. Rising for the second time, my head came again in contact with a beam. Now I was becoming desperate. However, summoning all my energy, I made a third frantic attempt but the result was the same. The torture of suppressed breathing was getting unendurable, my brain was reeling and I felt myself sinking. At that moment, when my situation seemed absolutely hopeless, I experienced one of those flashes of light and the structure above me appeared before my vision. I either discerned or guest that there was a little space between the surface of the water and the boards resting on the beams and, with consciousness nearly gone, I floated up, prest my mouth close to the planks and managed to inhale a little air, unfortunately mingled with a spray of water which nearly choked me. Several times I repeated this procedure as in a dream until my heart, which was racing at a terrible rate, quieted down and I gained composure. After that I made a number of unsuccessful dives, having completely lost the sense of direction, but finally succeeded in getting out of the trap when my friends had already given me up and were fishing for my body.

That bathing season was spoiled for me thru recklessness but I soon forgot the lesson and only two years later I fell into a worse predicament. There was a large flour mill with a dam across the river near the city where I was studying at that time. As a rule the height of the water was only two or three inches above the dam and to swim out to it was a sport not very dangerous in which I often indulged. One day I went alone to the river to enjoy myself as usual. When I was a short distance from the masonry, however, I was horrified to observe that the water had risen and was carrying me along swiftly. I tried to get away but it was too late. Luckily, tho, I saved myself from being swept over by taking hold of the wall with both hands. The pressure against my chest was great and I was barely able to keep my head above the surface. Not a soul was in sight and my voice was lost in the roar of the fall. Slowly and gradually I became exhausted and unable to withstand the strain longer. Just as I was about to let go, to be dashed against the rocks below, I saw in a flash of light a familiar diagram illustrating the hydraulic principle that the pressure of a fluid in motion is proportionate to the area exposed, and automatically I turned on my left side. As if by magic the pressure was reduced and I found it comparatively easy in that position to resist the force of the stream. But the danger still confronted me. I knew that sooner or later I would be carried down, as it was not possible for any help to reach me in time, even if I attracted attention. I am ambidextrous now but then I was left-handed and had comparatively little strength in my right arm. For this reason I did not dare to turn on the other side to rest and nothing remained but to slowly push my body along the dam. I had to get away from the mill towards which my face was turned as the current there was much swifter and deeper. It was a long and painful ordeal and I came near to failing at its very end for I was confronted with a depression in the masonry. I managed to get over with the last ounce of my force and fell in a swoon when I reached the bank, where I was found. I had torn virtually all the skin from my left side and it took several weeks before the fever subsided and I was well. These are only two

HEL-MET THE KAISER



Send one to your boy in camp; all the boys will want them. Anyone against the Kaiser or Germany should wear this pin. Same size as picture. Handsome metal, black letters. Will wear for years. Men and women wear them — causes laughter wherever seen.

Price 10 Cents



Voice Thrower 10c

Learn to throw your voice into a TRUNK, under the bed, out in the hall or anywhere. Lots of FUN fooling the Teacher, Janitor, Policeman, Parents, Neighbors, or Friends.

THE VENTRILO

is a little instrument that fits into the mouth out of sight. BOYS or GIRLS can use it. NEVER FAILS! A 32-page book on Ventriloquism sent with the VENTRILO for TEN Cents.

NEW FORD JOKE BOOK 1919

All the latest jokes on the Ford auto. Hundreds of them, and all good ones. Spring a new one on your neighbors.

Large book with colored cover by mail, 10c.



Devil Resigns to the Kaiser



Everyone who reads this book is wild over it. Contains the following:—The Kaiser's Dream, A Letter from the Devil to the Kaiser, Kaiser's Prayer, How Satan Resigns to the King of Devils, The Kaiser, etc. Many other stories, jokes, etc., about the German Emperor. Book mailed 10 cents, postage 2 cents extra.

ROGEN X-RAY



Price 10 Cents

HERE, BOYS, is just what you want. With this instrument you can apparently see through clothes, see the bones in your fingers. Think of the fun you can have with it. Sample, by mail, TEN CENTS.



SKULL RING

Here is a handsome, up-to-date Ring, representing a Skull and Cross-bones. Has stones in the eyes and looks something frightful. Women won't like it, but for men or boys it is a great novelty. Sample, by mail, 15c.



Gee! What a Wad!

This is STAGE MONEY

Looks like the GENUINE STUFF. Some Green backs and some Yellow backs. Create a BIG sensation among your friends. The girls will all be after you when they see the wad. BIG roll of 15 pieces by mail, 10 cents.



Boys Own Toy Maker

and Nine Other Books for 10c

Tells how to make a Telephone, Magic Lantern, Kites, Sail Boat, Stilts, Electric Telegraph, Pop Gun, Red Fire, Galvanic Battery and many other things. This book, with nine other interesting books, mailed for 10c.



ENCHANTED BARREL

The Most Wonderful Pocket Trick Made

CHANGE A CENT INTO A DIME

Ask your friend to drop a dime in the barrel. When he takes it out, Behold! It is a CENT. You make 9 cents every time you fool them. Never fails. They cannot get on to it. Sample barrel, with directions, only.... 10c

Any three of the above articles for 25c or any six for 50c

Royal Novelty Co. 250 EAST AVENUE SOUTH NORWALK, CONN.



Better Your Position

Prepare for a permanent position. Railway Traffic Inspectors are always in line for advancement. No age limit—only common school education. Mighty good salary and expenses. A Railway Traffic Inspector safeguards the lives of the public and protects his company's interests—an important position. He's paid to travel and observe. Works only with railroad officials—that's why he's bound to gain a position of trust. Hundreds needed right now—thousands later. Study for only three months—we'll arrange for the position. Delay never secured anyone a better position—so act immediately. Booklet D 21 tells all—write today. Address

Standard Business Training Inst.
BUFFALO, N. Y.

www.americanradiohistory.com

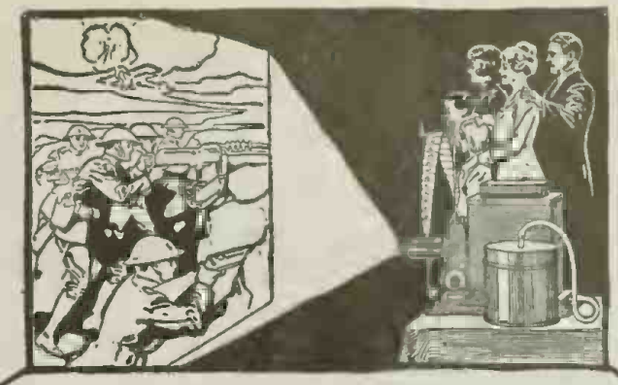
of many instances but they may be sufficient to show that had it not been for the inventor's instinct I would not have lived to tell this tale.

Interested people have often asked me how and when I began to invent. This I can only answer from my present recollection in the light of which the first attempt I recall was rather ambitious for it involved the invention of an *apparatus* and a *method*. In the former I was anticipated but the latter was original. It happened in this way. One of my playmates had come into the possession of a hook and fishing-tackle which created quite an excitement in the village, and the next morning all started out to catch frogs. I was left alone and deserted owing to a quarrel with this boy. I had never seen a real hook and pictured it as something wonderful, endowed with peculiar qualities, and was despairing not to be one of the party. Urged by necessity, I somehow got hold of a piece of soft iron wire, hammered the end to a sharp point between two stones, bent it into shape, and fastened it to a strong string. I then cut a rod, gathered some bait, and went down to the brook where there were frogs in abundance. But I could not catch any and was almost discouraged when it occurred to me to dangle the empty hook in front of a frog sitting on a stump. At first he collapsed but by and by his eyes bulged out and became bloodshot, he swelled to twice his normal size and made a vicious snap at the hook. Immediately I pulled him up. I tried the same thing again and again and the method proved infallible. When my comrades, who in spite of their fine outfit had caught nothing, came to me they were green with envy. For a long time I kept my secret and enjoyed the monopoly but finally yielded to the spirit of Christmas. Every boy could then do the same and the following summer brought disaster to the frogs.

In my next attempt I seem to have acted under the first instinctive impulse which later dominated me—to harness the energies of nature to the service of man. I did this thru the medium of May-bugs—or June-bugs as they are called in America—which were a veritable pest in that country and sometimes broke the branches of trees by the sheer weight of their bodies. The bushes were black with them. I would attach as many as four of them to a cross-piece, rotably arranged on a thin spindle, and transmit the motion of the same to a large disc and so derive considerable "power." These creatures were remarkably efficient, for once they were started they had no sense to stop and continued whirling for hours and hours and the hotter it was the harder they worked. All went well until a strange boy came to the place. He was the son of a retired officer in the Austrian Army. That urchin ate May-bugs alive and enjoyed them as tho they were the finest blue-point oysters. That disgusting sight terminated my endeavors in this promising field and I have never since been able to touch a May-bug or any other insect for that matter.

After that, I believe, I undertook to take apart and assemble the clocks of my grandfather. In the former operation I was always successful but often failed in the latter. So it came that he brought my work to a sudden halt in a manner not too delicate and it took thirty years before I tackled another clockwork again. Shortly thereafter I went into the manufacture of a kind of pop-gun which comprised a hollow tube, a piston, and two plugs of hemp. When firing the gun, the piston was prest against the stomach and the tube was pushed back quickly with both hands. The air between the plugs was comprest and raised to high temperature and one of them was expelled with a loud report. The art consisted in selecting a tube of the proper taper from the hollow stalks which were

(Continued on page 843)



Moving Picture Machine

A REAL moving picture machine that uses the same films as the big movie theaters all over the country and you can get it ***absolutely free*** with a box of film besides.

FREE

Have a movie show right in your own home. Entertain your friends and relatives. Charge admission and make easy spending money. You never had a chance like this before and it may not be repeated again. Send your name on the coupon NOW!

Boys! Girls! Act Quick!

Send your name on the coupon below or a post card will do—but you must do this right now, this very minute. I will send you 12 beautifully colored patriotic pictures. Every one who sees them wants them. Full of action, showing our brave soldiers and sailors performing their heroic duties in the trenches and at home. All you have to do is distribute these pictures on a special 35c offer among the people you know. This will take you just a few hours. They go like hot cakes, everybody wants them. When you have distributed the 12 pictures I will immediately send you FREE and Prepaid this Genuine Moving Picture Machine Complete with a box of film. Don't miss this wonderful offer.

Send This Coupon Right NOW!

Don't wait another minute. It may be too late if you wait. Send your name on a postal card if you want to—but do it right now—AT ONCE!

Movie Man 180 No. Wabash Ave. Dept 7443 Chicago

To Mr. Movie Man
Dept 7443 -180 N. Wabash Ave., Chicago

I want to get a Moving Picture Machine FREE by your easy plan. Please send me the Patriotic Pictures and full details of your Big Offer.

Name.....

St. or R. F. D.....

Town..... State.....

The House of Taylor



400 Baths
600 Rooms

HOTEL MARTINIQUE

BROADWAY, 33D STREET, NEW YORK
One Block from Pennsylvania Station.

Equally Convenient for Amusements, Shopping or Business

157 Pleasant Rooms, with Private Bath, $2.50 PER DAY.

257 Excellent Rooms, with Private Bath, facing street, southern exposure, $3.00 PER DAY.

Also Attractive Rooms from $1.50.
The Restaurant Prices Are Most Moderate.



1-50 H. P. Motor $4.00 complete as shown

If you are in need of a small motor for experimental purposes, this is your chance to get one at a very low price. Wound for 110 volt A. C. or D. C. Built exactly the same as a large motor; twenty-two section commutator, laminated field and armature construction, drum wound armature.

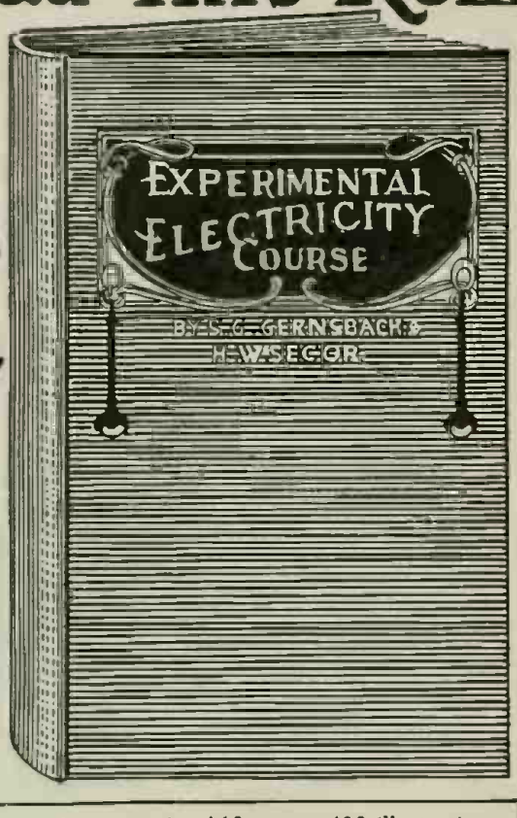
We have only a limited quantity to offer at this price which means that you must act quick if you wish to secure one at this low price.

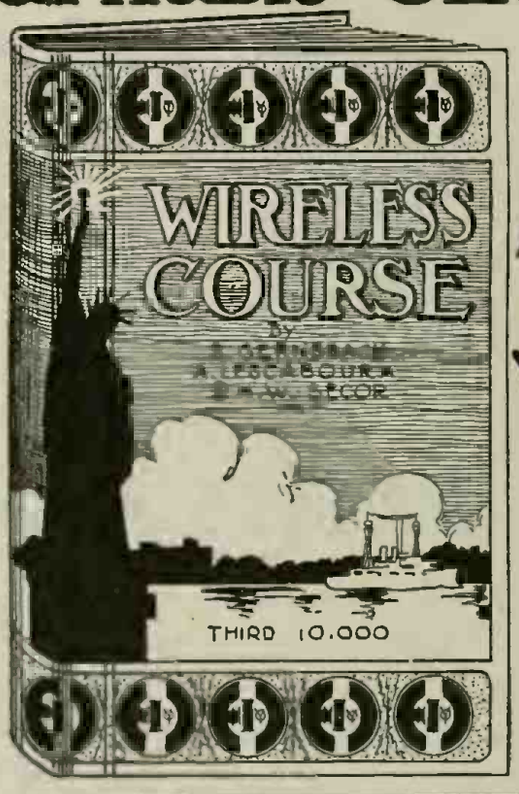
BODINE ELECTRIC COMPANY
2254 WEST OHIO STREET CHICAGO, ILLINOIS

www.americanradiohistory.com

Free to You!

Read this Remarkable Offer!





This masterpiece contains 160 pages, 400 illustrations. Size of book 5"x9". Printed on extra thin paper, so book can be slipped into pocket. Handsome flexible cloth cover. FREE with a year's subscription. Add 5c for postage.

The most comprehensive Wireless Course ever printed. Contains 160 pages, 350 illustrations. Size of book 6¾"x10". Very fine flexible cloth cover. FREE with a year's subscription. Add 5c for postage.

This is a very limited offer. It may be withdrawn at any time, due to the tremendous cost of paper, which IS JUST DOUBLE WHAT IT WAS ONE YEAR AGO. We have only a limited supply of these fine books on hand; after they are gone we cannot reprint the books until conditions become normal again. THIS MAY BE TWO YEARS OR MORE. Now is your chance.

The publishers of this journal have earned an enviable reputation of giving more than 100 cents' worth for each dollar spent with them. Profit by this liberal opportunity NOW; it may never be made again.

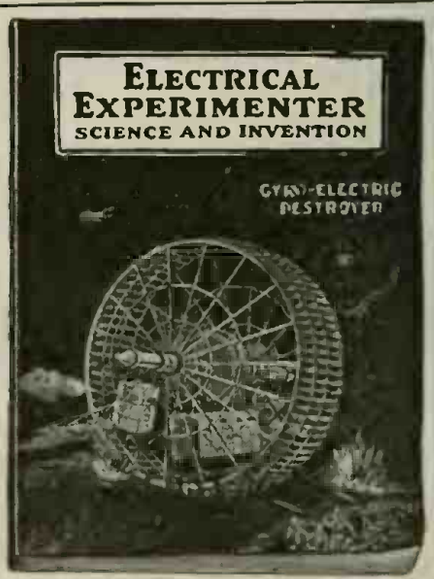
HERE'S THE OFFER

Subscribe to THE ELECTRICAL EXPERIMENTER for one year, at the regular subscription price of $2.00 per year (Canada, foreign and N. Y. C. $2.50) and we will send you FREE, POSTPAID, either one of the above books. If you subscribe for two years, BOTH BOOKS WILL BE GIVEN FREE, POSTPAID.

If you are a subscriber at present, take advantage of this wonderful opportunity anyway. If you do, we will extend your present subscription for one year.

This Offer Limited. Act Now.

EXPERIMENTER PUB. CO.
223 FULTON STREET
NEW YORK CITY



12 copies of THE ELECTRICAL EXPERIMENTER make a book 9" x 12" and 4" thick. This book will weight 7 lbs. It is the greatest Electrical and Wireless reference work in the world. And all for $2.00 a Year

FILL IN — TEAR OUT — AND MAIL

3-19

Gentlemen:
Please enter my subscription to THE ELECTRICAL EXPERIMENTER for the term of.....year..... for which I enclose herewith $.....
You will also send me at once FREE prepaid your....book....

.....
.....
Name.....
Address.....
.....
.....

www.americanradiohistory.com

MY INVENTIONS

(*Continued from page* 841)

did very well with that gun but my activities interfered with the window panes in our house and met with painful discouragement. If I remember rightly, I then took to carving swords from pieces of furniture which I could conveniently obtain. At that time I was under the sway of the Serbian national poetry and full of admiration for the feats of the heroes. I used to spend hours in mowing down my enemies in the form of corn-stalks which ruined the crops and netted me several spankings from my mother. Moreover these were not of the formal kind but the genuine article.

I had all this and more behind me before I was six years old and had past thru one year of elementary school in the village of Smiljan where I was born. At this juncture we moved to the little city of Gospic nearby. This change of residence was like a calamity to me. It almost broke my heart to part from our pigeons, chickens and sheep, and our magnificent flock of geese which used to rise to the clouds in the morning and return from the feeding grounds at sundown in battle formation, so perfect that it would have put a squadron of the best aviators of the present day to shame. In our new house I was but a prisoner, watching the strange people I saw thru the window blinds. My bashfulness was such that I would rather have faced a roaring lion than one of the city dudes who strolled about. But my hardest trial came on Sunday when I had to dress up and attend the service. There I met with an accident, the mere thought of which made my blood curdle like sour milk for years afterwards. It was my second adventure in a church. Not long before I was entombed for a night in an old chapel on an inaccessible mountain which was visited only once a year. It was an awful experience, but this one was worse. There was a wealthy lady in town, a good but pompous woman, who used to come to the church gorgeously painted up and attired with an enormous train and attendants. One Sunday I had just finished ringing the bell in the belfry and rushed downstairs when this grand dame was sweeping out and I jumped on her train. It tore off with a ripping noise which sounded like a salvo of musketry fired by raw recruits. My father was livid with rage. He gave me a gentle slap on the cheek, the only corporal punishment he ever administered to me but I almost feel it now. The embarrassment and confusion that followed are indescribable. I was practically ostracised until something else happened which redeemed me in the estimation of the community.

An enterprising young merchant had organized a fire department. A new fire engine was purchased, uniforms provided and the men drilled for service and parade. The engine was, in reality, a pump to be worked by sixteen men and was beautifully painted red and black. One afternoon the official trial was prepared for and the machine was transported to the river. The entire population turned out to witness the great spectacle. When all the speeches and ceremonies were concluded, the command was given to pump, but not a drop of water came from the nozzle. The professors and experts tried in vain to locate the trouble. The fizzle was complete when I arrived at the scene. My knowledge of the mechanism was nil and I knew next to nothing of air pressure, but instinctively I felt for the suction hose in the water and found that it had collapsed. When I waded in the river and opened it up the water rushed forth and not a few Sunday clothes were spoiled. Archimedes running naked thru the streets of Syracuse and shouting Eureka at the top of his voice did not make a greater impression than myself. I was carried on the shoulders and was the hero of the day.

Upon settling in the city I began a four-years' course in the so-called Normal School preparatory to my studies at the College or *Real-Gymnasium*. During this period my boyish efforts and exploits, as well as troubles, continued. Among other things I attained the unique distinction of champion crow catcher in the country. My method of procedure was extremely simple. I would go in the forest, hide in the bushes, and imitate the call of the bird. Usually I would get several answers and in a short while a crow would flutter down into the shrubbery near me. After that all I needed to do was to throw a piece of cardboard to detract its attention, jump up and grab it before it could extricate itself from the undergrowth. In this way I would capture as many as I desired. But on one occasion something occurred which made me respect them. I had caught a fine pair of birds and was returning home with a friend. When we left the forest, thousands of crows had gathered making a frightful racket. In a few minutes they rose in pursuit and soon enveloped us. The fun lasted until all of a sudden I received a blow on the back of my head which knocked me down. Then they attacked me viciously. I was compelled to release the two birds and was glad to join my friend who had taken refuge in a cave.

In the schoolroom there were a few mechanical models which interested me and turned my attention to water turbines. I constructed many of these and found great pleasure in operating them. How extraordinary was my life an incident may illustrate. My uncle had no use for this kind of pastime and more than once rebuked me. I was fascinated by a description of Niagara Falls I had perused, and pictured in my imagination a big wheel run by the Falls. I told my uncle that I would go to America and carry out this scheme. Thirty years later I saw my ideas carried out at Niagara and marveled at the unfathomable mystery of the mind.

I made all kinds of other contrivances and contraptions but among these the arbalists I produced were the best. My arrows, when shot, disappeared from sight and at close range traversed a plank of pine one inch thick. Thru the continuous tightening of the bows I developed skin on my stomach very much like that of a crocodile and I am often wondering whether it is due to this exercise that I am able even now to digest cobble-stones! Nor can I pass in silence my performances with the sling which would have enabled me to give a stunning exhibit at the Hippodrome. And now I will tell of one of my feats with this antique implement of war which will strain to the utmost the credulity of the reader. I was practicing while walking with my uncle along the river. The sun was setting, the trout were playful and from time to time one would shoot up into the air, its glistening body sharply defined against a projecting rock beyond. Of course any boy might have hit a fish under these propitious conditions but I undertook a much more difficult task and I foretold to my uncle, to the minutest detail, what I intended doing. I was to hurl a stone to meet the fish, press its body against the rock, and cut it in two. It was no sooner said than done. My uncle looked at me almost scared out of his wits and exclaimed *"Vade retro Satanas!"* and it was a few days before he spoke to me again. Other records, however great, will be eclipsed but I feel that I could peacefully rest on my laurels for a thousand years.

(In the April issue Mr. Tesla will describe in detail how he conceived one of his most important and far reaching inventions: "The Rotary Magnetic Field."—Editor.)



He's Winning!

Because He Followed His BENT.

Age 28—Salary $2500 a year—General Manager of the Company—his own boss—owns his home—married and happy and prosperous—there's the success of Wallace H. Rohrschneider, General Manager and Secretary and Treasurer of the Hustisford Light, Power and Manufacturing Company of Hustisford, Wisconsin.

"I followed my bent," says Mr. Rohrschneider. That's all. "I followed my bent." In these crisp words he sums up his success. Young—unknown—of humble birth—reared on the farm and deprived of scholastic advantages, he entered this school in 1907 and took up the study of Electricity. And today—at 28—in the work he felt he was fitted for—he's well on the road to success. Simply because he answered his instincts. Simply because he followed his bent.

Is Electricity YOUR "BENT"?

If it is—if you like to tinker with dry cells—if you like to experiment with "wireless"—if you're keen for the columns of "How To Make It" and each new edition of Electrical Experimenter is a fresh revelation to you—then tackle the job in earnest. Study electricity. Make a real start. And do it now right on the eve of the big coming era of reconstruction when thousands of trained electrical experts will be needed at home and abroad.

Earn While You Learn If You Wish—½ day of classes—½ day of paid employment—that is the basis of our "Earn-While-You-Learn" plan.

Hundreds of young men of ambition are taking advantage of the opportunities afforded by electricity to insure for themselves a sound, successful future. Why not decide now to join them? Why not take the first step today? Filling out and mailing this coupon will help you decide. Do it now and get the facts. No obligation whatever.

Spring Term Opens April 1st

— — — — —Tear Out Here— — — — —

SCHOOL OF ENGINEERING OF MILWAUKEE

"America's Most Democratic Electrical Institute"

79-373 Broadway, Milwaukee, Wis.

Without obligating me, please send me catalog and tell me how I can qualify in the subject I have checked below:
[ ] Electrical Engineering [ ] Electrotechnician

[ ] Electrician

Six Months' Trade Course

[ ] Electrical Trouble and Lineman
[ ] Electrical Meterman
[ ] Electrical Wireman
[ ] Motor and Generator Repairman (Course includes Armature and Transformer Winding)
[ ] Telephone Trouble and Repairman
[ ] Electrical Draftsman
[ ] Home Study Department (Special Preliminary Home Study Course for those who cannot at first come to Milwaukee)

NAME.....

ADDRESS.....

CITY.....STATE.....

AGE.....EDUCATION.....

www.americanradiohistory.com

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section seven cents a word for each insertion. No advertisement for less than 50c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. Ten per cent discount for 6 issues. 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the April issue must reach us not later than February 22.

The Circulation of the Experimenter is over 100,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Aeronautics.

Build your own aeroplane. Outfits cut to fit ready to assemble, on terms. G. Angeles, East Seattle, Wash.

Kites, send 25c for the "High Flier", Seefang, 1405 Broadway, New York.

Automobile Accessories.

More Power, Less Fuel, No Carbon. No mystery, plain facts, results guaranteed. Write for booklet S. O. "No-Leak-O Piston Ring Co., Baltimore, Md.

Fords Start Easy in Cold Weather with our new 1919 carburetors. 34 miles per gallon. Use cheapest gasoline or half kerosene. Increased power. Styles for any motor. Very slow on high. Attach it yourself. Big profits to agents. Money back guarantee. Thirty days' trial. Air-Friction Carburetor Co., 270 Madison, Dayton, Ohio.

Vulcanize on Anderson Steam Vulcanizer. See Advertisement, Page 836.

Wonderful Tire Bargains. At one-quarter the usual tire cost, we can furnish you with Double Tread Tires, also Black Rib Tread Cord Type Tires. Guaranteed 4000 miles. Send for price list. Save 50% on tire cost. United Sales Co., Aberdeen, So. Dak.

Repair parts for all make cars, also engines. Carburetors, magnetos, bucket seats for racing cars. We also carry a large stock of slightly used tires and tubes at very lowest prices. Write for list. Hayiland Supply Co., 2306 Seventh Ave., New York City.

Automobile Repairs.

Automobile Owners should subscribe for the Automobile Dealer & Repairer; 150-page illustrated monthly devoted exclusively to the care and repair of the car. The only magazine in the world especially devoted to the practical and mechanical side of motoring. The "Trouble Department" contains five pages of numbered questions each month from car owners and repairmen which are answered by experts on gasoline engine repairs. $1 per year or 15 cents per copy. Canadian subscription $1.50. Postals not answered. Charles D. Sherman, 48 Windsor Road, Hartford, Conn.

Motorcycles.

Motorcycles from $25 up—New and second-hand. Easy terms, large list to choose from, all makes. Send 4c stamps for Bulletin "A." Peerless Motorcycle Co., Watertown, Mass.

Motorcycles: Used parts for Indians, Thors and Excelsiors at 70 to 75 per cent off catalog list price. One rear pleasure car $60. Used motorcycles for $25 up to $225. Send for list. Peter Fox, Indian Dealer, Grand Junction, Colo.

Help Wanted.

Men Wanted to make Toy Soldiers, Army, Navy, and other toys. Homeworkers on small scale, manufacturers on large scale. Greatest chance for industrious people for independent business. Enormous demand and future in "American-made toys". This new American work stands out conspicuously. Factories have been established, people trained, machinery made with energy and success. Dealers don't want to handle any others except "American-made". We buy these goods all year, paying fixed prices. Experience or tools not necessary. Hundred and more made complete per hour. Casting form outfits $3 up. Booklet and information free. Toy Soldier Manufacturing Co., 32 Union Square, New York.

To Ascertain the Vocation for which you are best adapted send for Zancig's Revised Horoscope. Send date of your birth and 25c. Prof. Zancig, 109 West 87th St., New York.

Railway Mail Clerks Wanted—men 16 to 40—women 18 to 35. $1192-$1800 year. Alternate weeks off. Full pay. Examinations everywhere. Sample questions free. Franklin Institute, Dept. C 26, Rochester, N. Y.

Agents Wanted.

Greatest, biggest and best collection of modern money-making ideas printed. 2600 ideas, opportunities and secrets. Write "Hanson," Box 23, Mentor, Minn.

$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Ave. D, Decatur, Ill.

Insyde Tyres, inner armor for automobile tires, double mileage and prevent punctures and blow-outs. Quickly applied. Costs little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, O.

Postcards.

Everything in Postcards. Live-wire list free. Worth-while samples 25c. Mention subjects preferred. Mutual Supply Co., Bradford, Pa.

Five Prettiest Women Cards, hand colored, 25c. Durso, Dept. 41, 25 Mulberry, N. Y. City.

Charlotte, N. C.

Electrical Experimenter Pub. Co.,
233 Fulton St., New York.

Dear Sirs:

It certainly was SOME RESULTS.
I've almost worn out a good typewriter.
Just about exhausted myself writing.
Used all the paper in this part of America.
And about "Gone Busted" buying postage stamps.

Now, I'm a-goina quit, and will never do it again, or at least I won't promise to answer all the letters I received from an Ad that I put in the "E. E."

The letters are still coming in.—The apparatus advertised has long since been sold. Every piece of it. The letters are from all over the United States, AND ELSEWHERE. Received one today from Shanghai, China. Can you beat that. I'm enclosing the letter from China.

It's a great life, if you don't weaken.

I wish to THANK the "E. E."—Some circulation.

Very Respectfully,
G. R. SMATHERS,
403 N. Brevard St., Charlotte, N. C.

For the Hair.

I was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have good hair-growing results. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E 32nd St., B.A. 360. New York.

News Correspondents.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Scenery for Hire.

Collapsible Scenery for all Plays. Amelia Grain, Philadelphia, Pennsylvania.

Exchange Ads

Read—Want to buy, sell or exchange wireless goods? Do it thru our exchange bureau, and save money. Send stamp for full information. Exchange, Box 758, Newport, N. H.

Trade—75 Boys Books for Lionel Trains, standard guage. $8 Camera $4. Palier, 149 East 55th St., New York City, N. Y.

Have—1/6 K.W. Motor Generator with starter & transformer—$40. 1/8 H.P. D.C. motor—$9. Wanted Receiving Apparatus—R. Freure, 439a McDonough St., Brooklyn, N. Y.

SWAP—Electrical instruments for coins. Stamp gets price list. Benjamin Kinnick, Jr., Greenwood, Ind.

Wanted—Used printing press, small engine, and 32 volt generator. R. Hedstrom, Tularosa, N. M.

Exchange Ads—Cont'd

For Sale:—Wireless outfit, crystal detector, fixed condenser, variable condenser, telephones, spark coil, gap, condenser and helix. $14.00. Will exchange for ¼ h.p. A. C. motor; or what have you? Earl C. Brown, 514 Virginia Ave., Martinsburg, W. Va.

For Sale:—Books, Lessons in Practical Electricity, by Swoope, 75c; Military Signal Corps Manual, by White, 50c; Single Telephone headsets, 75c; $35.00 Complete Wireless Set, $17.50; Co-herer Sets, $2.00; Electrolytic Interrupter, $1.00; Telegraph Keys, 75c.; Gravity Cells, 60c. Other Wireless Apparatus. Address V. L. Hollister, Station A. Lincoln, Nebraska.

For Sale:—New Holton trumpet (cornet type) B-Flat low pitch. Cost $80, will sell for $55. Would take good violin in trade. A. T. Harrison, Albert Lea, Minn.

Sell—Cabinet coupler never used. Price $4.50. Chemistry set also. Granville Whittlesey, 130 E. 67th St., New York.

Sale or Trade:—Wireless goods. Transformer audion, rotary condenser, switches, etc. Silver cornet. Bicycle. Motor attachment. Rifle. Other goods. R. H. Parker, Box 510, Tilton, N. H.

For Sale or Exchange:—Caxton Printing Press; "Todd" Protectograph; Goodell-Pratt No. 306 Lathe; Lathe, 9" swing, 27" between centers; Large Erector Set; Large Electric Train Set. Would like Wood working machinery, small screw-cutting Lathe or what have you? C. E. Robinson, Portland, Conn.

Sacrifice: Regenerative audion set combined. $10. Write. "Wireless," 142 Oxford Ave., Buffalo, N. Y.

Wanted:—Radio 5A or Clapp-Eastham receiving transformer; variable condensers. Have for exchange set of drawing instruments. Premoette camera. R. L. Kunau, Sabula, Iowa.

Sale:—Omnigraph reasonable. Pastime Theatre, Union Hill, N. J.

Sale:—Regenerative Receiver, write for description. Geo. Sprouls, 5624 Palethorpe St., Phila., Phila., Pa.

Wanted:—One each of volumes Nos. 1, 2, 3, 4, and 5 of the Experimenter. (Bound or unbound), State price. C. O. Williams, 20 Midland Ave., Detroit, Mich.

Sale:—Men's hockey ice skates, screw clamps, new, never used, $1.50 cost $2.00. Also No. 24 enameled copper wire 90c lb., any quantity over 1lb. Write for list. Henry Lehmberg, 5116 N. 12th St., Philadelphia, Pa.

Sell:—Variables, headsets, spark gaps, detectors, audions, impedance coils, electrical goods, etc., etc. Send stamp for list. Wanted—Typewriter, printing press. S. Blong, Hawthorne, Calif.

For Sale:—Oakmans Wireless outfit sends and receives messages 8 miles. Complete $6.00. Used 5 weeks. Mrs. Barniff, 1346 Johnson St., Chicago.

For Sale: Tesla Coil $5., also Encyclopedia Britannica. Gillespie, Woodward Ave., Buffalo.

Sell—Hawkins' Guides, $8. Penaz, 1224 Geneva St., Racine, Wis.

Exchange—2 in. sending set-mahogany base—4 x 6 Excelsior press and type, cost $30—dynamo, Tesla coils, Detectors, Condensers—for Victrola, Columbia or Edison. Write Dale F. Scott, Denver, Ill.

Wanted—Motors, any condition. Small engines and machinery. Omnigraph Wireless and Electrical goods. State lowest price. Chas. Schmuck, 1384 W. 95th St., Cleveland, O.

For Sale—One Wicks Electrician's correspondence course, $35; cost $68. John Olsen, 552 New Brunswick Ave., Perth Amboy, N. J.

Swap—Electrical and Mechanical Books for Wireless or other Electrical goods. Jay Pounds, Coldwater, Kan.

Sell—Western Cabinet Telephone, $7.00. Sangamo D. C. 110 V. Wattmeter, $14.00. Fine condition. D. A. Benner, 1328 Central Ave., Alton, Ill.

Sale or Exchange—Two twelve inch spark coils. Arthur Raycraft, care Nev. First Nat'l Bank, Tonopah, Nevada.

www.americanradiohistory.com

Business Opportunities.

Branch Manager Wanted for old established Chicago concern. We furnish full stock of goods, advertising matter, and equip store completely, in good location, all at our expense and pay you $40.00 a week salary, in addition to liberal share of the profits your store earns. Work can be started in spare time. No investment or previous experience necessary to secure this position. If you are a hustler and want an opportunity to make $5,000 to $15,000 a year we want you and will pay you well from the start. Send me your application today. S. Levy, Mgr., Department 784, Como Bldg., Chicago, Ill.

Persons interested in a new 500% profit paying home business send two 3c stamps for particulars Philip Wall, North Road, Bedford, Mass.

How to color electric light bulbs, any color, for few cents per dozen. Six other trade secrets all $1.00. Postoffice Box 21, Fresno, Calif.

$30 a Week Evenings. I made it with a small mail order business—continued my regular job daytimes. Free booklet tells how, 2c postage Alex. W. Scott, Cohoes, N. Y.

Dollars Yearly in Your Back Yard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free, Metz, 313 East 89, New York.

Victory—Mechanical Toy Soldier window attraction. 30 inches high. Salutes, turns head, points with finger, etc., as set. Well made, nicely dressed officers, privates, Uncle Sam, etc. Electrically operated. Does some stunt every half minute or oftener as set, and will salute soldier and pay no attention to others if desired. Representative wanted in each city and town. Write for prices. The John M. Biggs Co., Box 324, Chattanooga, Tenn.

"Quick-Action Advertising—How it is Building Business for the Progressive Advertisers of America"; A little story of RESULTS, told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet, which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th Street, New York.

Build up an Income in Oil—Others are doing it—Why not you? Today is the opportunity. Join our easy monthly payment plan NOW—it may mean hundreds in profits. Write for information. National Oil Drilling Co., Dept. K, Houston, Texas.

Incorporate your business under the common law. No organization tax; no franchise tax; no federal corporation tax; certificates not taxable; stockholders exempt from company debts; do business anywhere; directors reside where you wish; lowest cost organization possible. Common Law Organization Co., 4 Randolph, Detroit, Mich.

Enter a New Business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks, at small expense; no further capital required; no goods to buy; job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston.

Make Die-Castings. Sketch, Sample, Booklet, and Proposition, 12c. R. Byrd, Box 227, Erie, Pa.

Have revolutionary invention of new type dynamo. To anyone who will invest a little money to take out foreign patents, I will give 1/4 interest in any patents taken out. You can handle your own money. Address Invention, Box 65, Electrical Experimenter, 233 Fulton Street, New York.

FOR SALE: $225. Studio outfit (8 x 10) $75. Small Steam Engine $15. Want Wireless Goods. Enclose Stamp. Lawrence Johnston, Fairfield, Ill.

PLANT Protector and irrigator, tested; fortune can be made; outright for sale. Cash, or 1/3 cash, balance cheap unimproved Texas land. Write—investigate. J. P. Arnold, Berclair, Texas.

The Dollar Adding Machine saves time. No mistakes. Also multiplies. Rapid. Seven columns. Money back if not satisfied. $1.00! The Crystal Agency, 35 Crystal St., Brooklyn, New York.

"Opportunity Ad-Lets" bring quick results. Over 100,000 circulation, net. Other firms are making money—so can you. For proof address Classified Department, Electrical Experimenter, 233 Fulton St., New York City.

Stammering

St-Stu-t-t-tering and Stammering cured at home. Instructive booklet free. Walter McDonnell, 105 Potomac Bank Building, Washington, D. C.

Printing.

100 Bond Noteheads, 4 lines and 100 envelopes, prepaid, $1.00 Southwestern, 1413-H Berendo, Los Angeles.

100 Each, Hammermill Bond, Notcheads and Envelopes, limit five lines, postpaid, $1.25. Eagle Press, Stamford, Conn.

Books.

What Every Draftsman Should Know. Very useful booklet. Price 12c postpaid. Wack Booklet Co., 1943 Patten St., Philadelphia, Pa.

20,000 Formulas, Recipes and Trade Secrets in double-column, 530-page book, only $1. Postpaid. Clifford Camp Co., 32 Prospect St., Claremont, N. H.

Free—$5,000 worth of valuable books as premiums. Write for more information and catalogue; it's free. I have many books on Natural healing, personal magnetism, Clairvoyance, seership, Hypnotism, Mesmerism, concentration, character reading, mind power, etc. Tell me your wants. A. W. Martens, JX8, Burlington, Iowa.

If You Are Interested in books of New Thought send for a copy of our catalog. Inland Book Company, 221 Inland Bldg., Ft. Wayne, Ind.

Send 10c for two issues of our interesting magazine containing 55 valuable Formulas, Tricks, Illusions, Household Hints. Globe Sta. "C", Box 7, Montreal, Canada.

Books for Real Live People. Lists free. J. E. Sheridan, 417 E. 151st., New York.

World-Romic System, Masterkey to All Languages. Six Textbooks, $1.44. French Chart, 37c; Spanish, 37c; Aviation Dictionary, $1.50. French-English Aviation Dictionary, 61c. Languages, 143 West 47th, New York.

How to Locate Oil, Minerals and Valuable Substances by Wireless; Scientific Book, $3 postpaid. Astral Child Publishing Co., Corpus Christi, Tex.

To Get Better Pictures: Read the Amateur Photographer's Weekly; illustrated; weekly prize competitions; print criticisms; many unique features; $1.50 per year; three months' trial subscription 25c. Abel Publishing Company, 401 Caxton Bldg., Cleveland, Ohio.

Old E. E. Back Numbers: We have some valuable old E. E. back numbers on hand as follows: 1915—Jan., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec., price each 35c. 1916—Jan., Feb., March, May, June, Sept., Dec., price each 35c. 1917—Jan., April, May, Aug., Nov., Dec., each 35c. 1918—Jan., 35c; Mar., May, June, July, Aug., Sept., Oct., Nov., Dec., each 20. 1919—Jan., Feb., 20. We can fill orders at once upon receipt of your remittance, and if you have not these numbers already, now is your chance to get them, as they probably will be snapped up very quickly. Experimenter Publishing Co., 233 Fulton St., New York City.

Cameras, Supplies—Photo Developing.

Clean, Neat, Perfect Kodak Finishing at the lowest prices. Work returned the same day received. Send film for sample print and copy of Catalog on Developing, Printing, Enlarging and Hand Coloring, also copy of Photo Craft Magazine which will help you make better pictures. Photo Craft Co., Box 69, Ann Arbor, Mich.

Any Six or Eight Exposure Film up to Post Card size developed and printed 10c, or enlargement 8 x 10, your favorite negative, 10c. Special Introductory offer to show high quality work. Associated Photo Co., Dept. 12, Cincinnati, Sta. A.

Beautiful, Natural Scenery photographs for the home, 8 x 10, 50c each; 3 for $1.00. C. R. Birch, 124 West 2nd St., Casper, Wyo.

Six beautiful postal enlargements made from your small films for fifty cents. The Photolo Company, 36 Garrison Road, Clarendon, Virginia.

Superfine—Enlargements made from your kodak pictures. Send negative and 35c for 8 x 12 sample. Carroll, 355 Magee, Rochester, N. Y.

Save Money by getting my price-list on developing and printing. Mailed free. R. Hedstrom, Box 184E, Tularosa, N. M.

Mail Us 15c with any size Film for development and 6 velvet prints. Or send 6 negatives any size and 15c for 6 prints, 8 x 10" mounted enlargements 35c. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke Va.

Wireless.

For Sale: Burned out amplifier bulbs, De-Forest double wing and grid, $2.50 each. Two step amplifier, $30. 1127 Ellicott St., Buffalo, N. Y.

Switch points, Binding posts, Switch levers and small parts, send 2c for catalogue describing these and other goods. A. W. Bowman & Co., 23 Church St. (Harvard Square), Cambridge, Mass.

Bargains:—¼" Wireless Coils complete, guaranteed, 90c, send postage. Also Wireless Coils without vibrators, 45c, send postage. A. Dubs, 1534 Pitkin Ave., Brooklyn, N. Y.

Blue Prints.

Electricians and Garagemen send 25c for blueprints for building and directions for using the E102 test and trouble finder. Locates shorts, opens and grounds in armatures, fields, winding, ignitions units and etc. 75c brings 12 blueprints of 3 phase A. C. motor windings. The Data Exchange, P. O. Box 1018, Dayton, Ohio.

Miscellaneous.

Songs—One dozen of New York's best song hits for one dollar. Also bargains in Ukaleles. Haviland Supply Co., 2300 Seventh Ave., New York City, N. Y.

Champion Hand Cleaner removes dirt, grease, grime. Cures chapped hands. 25c per can. (Silver only) postpaid. Gardner & Co., 222 East 34th St., New York City, N. Y.

Brush's Pad for Cleaning and Spotting any garment, etc. C. B. Twyford, 605 Hammel St., Akron, Ohio.

Indelible Ink makes Checks, all Documents Safe; Fountain Pens 100% efficient. Pint sample 25c coin; Quart supply $1. No powder. John Acker, 15 East 40th St., New York.

You Can Be a Winner. Gain Power and Individuality and become what you wish to be, through our system of Self-Development. Practical, positive benefits. Send 10c and birth-date for interesting Personality Sketch and first lesson in Efficiency. Thomson-Heywood Co., Dept. 350, Chronicle Bldg., San Francisco, Cal.

Wanted—All kinds of Specialties for mail order house.—The Jackson Smith Co., 95 Hester St., Norwalk, Ohio.

Cats crave catnip. Send 10c for a "catnip mouse" (a lifelike cloth mouse, stuffed with catnip). More fun than a "barrel of monkeys," and your "kitty" will like it. Address: Percy Ewing, Decatur, Ill.

Snow Plow. Removes snow from side-walks, etc. Easy to raise or lower. Thoroughly tested. Can also be used as toy. A. H. Tallyn, Benson, Ill.

Blacksmith, Listen! Prepare for big wages in Navy and Arsenal with Toy's Modern Methods doing hard jobs easy. Forging and making solid welds, hardening and tempering to a standard, with colored tempering charts. All for one dollar. Sample free. W. M. Toy, Sidney, Ohio.

Wanted—Small Gasoline and Steam Engines. Cash paid for 1 to 4 cylinder light weight Motors. ¼ to 10 H.P. Johnston, West End, Pittsburgh, Pa.

Catch Fish. Descriptive folder containing valuable information mailed for stamp. George Julian, Albany Building, Boston.

"Opportunity Adlets" bring quick results. Our 100,000 circulation, net. Other firms are making money—so can you. For proof address Classified Department, Electrical Experimenter, 233 Fulton St., New York City.

Stamps and Coins.

For 20 cents 100 various Foreign picked copies and 25 various British Colonies and 500 mixed U.S. and Foreign. Welch Postage Stamp Co., Hanford, Cal.

225 Different Stamps 25c. Fred Onken, 630—79th St., Brooklyn, N. Y.

305 All Different really fine Stamps from all over the world 30c. Magnificent Value. Dayton, East-Foxboro, Mass. We buy Stamps.

Free—61 different foreign stamps to applicants for our fine approvals, Send 3c postage. Airplane stamps wanted. E. W. Spafford, Martville, N. Y.

Stamps—65 different 5c to approval applicants. Michaels, 5600 Prairie, Chicago.

60 fine stamps FREE! Postage 3c. Frank Nickel, Jr., 847 Magee St., Philadelphia, Pa.

Stamps on approval. Send references. W. Berchtold, 6142 Vernon Ave., Chicago, Ill.

Stamps—12 different from warring nations, 10c; 10 different foreign coins, 15c; 10 Uruguay stamps, 10c. Lists free. Toledo Stamp Co., Toledo, O.

Big value approval packet! Ten cents. Multnomah Stamp Co., Portland, Ore.

Stamps: 50 Varieties, Transvaal, Brazil, Peru, Cuba, Mexico, etc., and Album, 10c. 60 different U.S., 25c, 1,000 hinges, 10c. List free. I buy stamps. C. Stegman, 5036 Cote Brilliante, St. Louis, Mo.

Free: Packet Valuable Stamps to Applicants 50% Approval—Benj. Forbes, 160 Devilliers—Pittsburgh, Pa.

50,000 Coins, medals, bills, Indian curios, firearms, daggers, spears, antiques Catalogue free. Collectors Exchange, 1536 Willington St., Philadelphia.

500 Finely Mixed United States or Foreign Stamps, 12c. Philatelic Star, Madison, N. Y.

California Gold, Quarter size, 27c; Half dollar size, 53c; Dollar size, $1.10; Large cent, 1820, and catalogue, 10c. Norman Shultz, Kings City, Mo.

Stamps—61 all different free. Postage, 3c. Mention paper Quaker Stamp Co., Toledo, Ohio.

We buy and Sell Old Money. $2 to $500 each paid for hundreds of coins dated before 1895. Keep all Old Money. Send 10 cents for new illustrated Coin Value Book, 4x7. You may have valuable Coins, get posted. Clarke Coin Company, Box 110, Le Roy, N. Y.

Novelties.

For Sale: Indian relics, all kinds for amateur and professional collectors; specimens getting scarce and valuable. If interested, address Harry B. Garber, Quaker City, Ohio.

Continued on page 846

www.americanradiohistory.com

Chemicals—Laboratory Equipment.

Experimenters—Complete outfit, chemicals and everything needed. Pictures on cloth. Transparent pictures, red and blue pictures, Magic Photos. Complete, $2.75. American Drug & Chemical Co., Photo. Dept. Gettysburg, Pa.

Experimenters!—Startling Chemical Outfit, contains chemicals and directions, only two dimes. X-ray novelty for 8c. Both 25c. Mystic Shop, 714 Vinto St., E. Waterloo, Iowa.

Chemicals and Laboratory apparatus for analytical and experimental work. Beaker free with $3 order. Feb. list 5c. Klaus, Eureka, Ill.

Formulos.

20,000 Formulas, $1 postpaid. List 4c. Oscar C. Hanson, Mentor, Minn.

Formulas for Every Purpose. H. Krause, 5740 So. Karlow, Chicago.

For Advertisers.

Unheard-of Trial Offer! Inch display or 30-word classified advertisement ten weeks, $1.00. Record Advertiser, Box 2E, Houston, Va.

"Quick-Action Advertising"—How it is Building Business for the Progressive Advertisers of America"; A little story of results told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th St., New York.

Health.

Enjoy Vigorous Health. My new book "Muscular Development" tells how. Send for it today—10c. Earle Liederman, Dept. A, 203 Broadway, New York.

Tobacco or Snuff Habit Cured or no pay; $1.00 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

Pyorrhea—H. E. Kelty, D. D. S., M. D., pyorrhea specialist for 15 years, has developed a successful home treatment for pyorrhea. Purifying, healing, preventative. Full month's treatment and booklet $1.00. Circular free. Dr. H. E. Kelty, 106 Gladwin Ave., Leonia, N. J.

Cigarette, pipe or chewing habit conquered. Nature's method. Guaranteed. Write for free brochure. Edw. J. Woods, TA-300, Station F, New York.

Motion Pictures.

Motion Picture Films $2.50 reel up. Queen Feature Service, Birmingham, Ala.

Motors, Engines and Dynamos.

Small Motors and Generators: 1000 New Motors and Generators from Bankruptcy Stock, ¼ H. P. A. C., $18.50 each; ½ H. P., $30.00. Battery Charging Sets—Robbins & Myers new outfits, all sizes, $30.00 each and up. Charging, Lighting and Moving Picture Arc Generators, $10.00 each and up. Motors for all phases of current. Immediate delivery. Less than ½ regular prices. Write for late bulletin. Johnston, West End, Pittsburgh, Penna.

Small Gasoline Engines, ¾ H. P. $20.00. Drives Dynamo, Washing Machines, Air Brush, etc. Honest Abe, 528 S. Taylor Ave., Oak Park, Ill.

Electric Motors. Let us send you an Electric motor for your Washing Machine, Drill Press, Lathe, Coffee Grinder, Air Compresser, Printing Press on a money back guarantee. Are for 110 V single phase 60 cycle have ¼ and ½ H. P. all new; cheapest place in country to buy a good motor. S. H. Rhodes, 129 Plum St., Johnstown, Pa.

Electrical Supplies & Appliances.

Any Formulas! 2 for 15c. Recharge your dry Batteries for 1 cent. Directions 15c. E. Nickerson, Warrenton, Mo.

While They Last—Danditoy Translormers, 2½ 37½ volts, $2.40. Send for description. Eagle Press, Stamford, Conn.

Repairing and rebuilding Galvanometers, Voltmeters, Ammeters on any electrical instruments. V. W. Bradbury, Winnsboro, La.

Mr. Business-Man—Your advertisement here will be read by over 100,000 live prospects. The "Opportunity Ad-Lets" of the Electrical Experimenter bring quick and positive results. For proof of what they have done for others address Classified Department, 233 Fulton Street, New York.

Instruction

Boys!—Learn Electricity by mail! Practical Instruction—25c a lesson. Send 25c for Lesson No. 1 and information. Warrenton School of Engineering, Warrenton, Mo.

Phonographs.

Build Your Own Phonographs and manufacture them for profit. Drawing instructions, Parts, Price List, Blue Prints, etc., complete, sent free upon request. Write today. Associated Phonograph Co., Dept. E-1, Cincinnati, Ohio.

Build Your Phonograph. "Perfection" high-quality spring and electric Motors, Tone Arms, Reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Indiana.

Choraleon Phonographs—Special agency proposition selling from your home. No soliciting or canvassing. Big profits. Write for home agent's special offer and convincing proof. We also supply complete material for building phonographs at home. Choraleon Phonograph Company, 2803 Monger Bldg., Elkhart, Ind.

Patent Attorneys.

Inventions Patented; Trade-Marks Registered; Labels, Prints and Publications Copyrighted; reasonable fees. Correspondence solicited; detailed information free; booklets. Jaynes & Jaynes, 702 Kellogg Washington, D. C.

John M. McLachlen, Atty. at Law. Patents, Trade Marks, Copyrights, 410 McLachlen Bldg., Washington, D. C.

Patents—Fees payable in monthly installments. Send sketch for free report. Books free. Frank Fuller, Washington, D. C.

Patent Your Own Inventions. Save attorney's fees; we prepare applications; furnish full instructions and give satisfaction. Free information. Carl Larsen Co., Park Row Building, New York City.

Millions spent annually for ideas! Hundreds now wanted! Patent yours and profit! Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. 212 Patent Dept., American Industries, Inc., Washington, D. C.

Fortunes from Patents are made only from a good invention STRONGLY PROTECTED. Send Sketch or model and $5 for thorough search and honest opinion of patentability. I give personal, conscientious and expert service. Lester Sargent, Patent Attorneys, 524 Tenth Street, Washington, D. C.

Your Idea Wanted. PATENT YOUR INVENTION. I'll help you market it. Send for 4 free books, list of patent buyers, hundreds of ideas wanted, etc. Advice free. Patents advertised free. RICHARD B. OWEN, Patent Lawyer, 130 Owen Bldg., Washington, D. C., or 2278-T Woolworth Bldg., New York.

Inventors! We have a proposition that will probably interest you. Inquiries invited. The Wakefield Engineering Co., 922-C F St., N. W., Washington, D. C.

James D. Lyles, Patents, Trade-marks and Copyrights. 734 Eighth St., N. W., Washington, D. C.

M. F. Miller, Ouray Building, Washington, D. C. Patent Attorney, Mechanical and Electrical expert. Best quality of work and results. Moderate charges. Advice free.

For Inventors.

Inventors: Before offering your patent for sale, or applying for one, write me. My experience may help you. Established 1900. Charles A. Scott, Department "E", Rochester, New York.

600 Mechanical Movements, also illustrations and explanations of 50 perpetual motions. My book, Inventors' Universal Educator, 4th edition, tells how to procure and sell a patent for your new invention. Government and other costs. Covers the matter from A to Z. 140 pages elegantly bound. Contains noted Court decisions on Patent cases. Mechanical Movements greatly assist inventors—suggest new ideas that might prove of great aid in perfecting inventions. Tells how to select an attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers. Price $1. Postage free. Fred G. Dieterich, 603 Ouray Building, Washington, D. C.

Inventors. Protect your Idea before exposing it. Advice Free. Inventor's Patent Service, Park Row Building, New York City.

Inventions Commercialized. Cash or royalty. Adam Fisher Mfg. Co., 205 St. Louis, Mo.

Inventors Market and secure your inventions through National Institute of Inventors, World Bldg., New York City. Membership co-operative organization.

Telegraphy.

Telegraphy, Wire and Wireless, and Railway Accounting taught thoroughly. Unprecedented demand for both sexes. Big Salaries. Oldest and Largest School—Est. 45 years. Catalog free. Dodges Institute, Seventh St., Valparaiso, Ind.

Real Estate Wanted

Sell your property quickly for cash, no matter where located, particulars free. Real Estate Salesman Co., Dept. 38, Lincoln, Nebr.

Tricks, Puzzles and Games.

Wonderful sealed envelope reading explained. Plain instruction, 20c. Magic Catalogue 5c. Rippey Magic Shop, Ocean View Ave., Los Angeles, Cal.

Chemical Comedy: Something new. Boys! stage a chemical comedy. Amaze, amuse and entertain your friends. New magic and trick chemical formulas united with a clever humorous plot, keep the audience a-roaring. Complete manuscript and formulas 50c. Formulas alone 25c (set of 24). Send stamps. I. Ellerin, 3803 Scovill Ave., Cleveland, Ohio.

Be a Fire Eater, give exhibitions and earn money. Directions 10c. Prof. Lindley, 84 Division St., Elizabeth, N. J.

Tricks, Puzzles, Jokes, Toys, Games, Novelties, Doll and Cane Racks, Plays, Wigs, Stage Supplies, Escapes and Illusions. Large 1917 catalog free. Oakes Magical Co., Dept. 549, Oshkosh, Wis.

1000 stage tricks with 500 illustrations. Catalogue 10c, small catalogue free. Hornmann Magic Co., Sta. 6, 170 Eighth Avenue, New York.

Black Art Hindoo Experiments, 1919 Edition, 25c. Invisible Ink. Free Trick. Catalogue each order. Linhorst Magic X Shop, St. Louis.

Patents for Sale.

For sale or royalty Patent 1270001 Combination Seat post and pump for Bicycles and Motorcycles. L. Reed, Woodcliff Lake, N. J.

Letter Specialists.

Business-building letters, advertisements, circulars, booklets, written at attractive rates. Results guaranteed. Criterion Service, Dept. 3, West New York, New Jersey.

Song Poems Wanted.

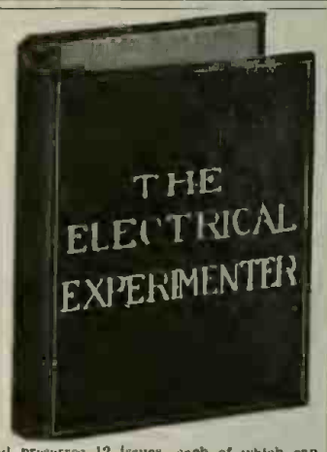
Write the Words for a Song. We write music and guarantee publisher's acceptance. Submit poems on war, love, or any subject. Chester Music Co., 538 S. Dearborn St., Suite 265, Chicago.

For Men

Mr. Shaver:—For a remarkably keen edge, use "velvashave" barbers compound on your strop. Calif. flourstone, lead and soft aluminum—no emery, 25c postpaid. Velvashave Agency, Box 60, Oakland, Calif.

Handy Binder

for the Electrical Experimenter



Holds and preserves 12 issues, each of which can be inserted or removed at will, without tools. Will keep your magazines perfectly for all time or just preserve them like new till you bind them permanently. Made of heavy material, extra strongly reinforced at the back and covered with handsome green cloth, suitably lettered in gold.

65c

Add postage for 2 lbs.

Experimenter Pub. Co., Inc. Book Department 233 Fulton St., N. Y.

With the consent of **NIKOLA TESLA**

We have prepared a genuine, handsome photograph, autographed in facsimile by the great inventor. This photograph, taken in December, 1918, was posed especially for the cover design of the February, 1919, issue of the "Electrical Experimenter". It shows Tesla as he is today, holding his famous wireless-lighted globe. No advertising whatsoever on this photo, except for the autograph. Size about 9 x 12". Ready for framing. A striking picture of the world's greatest inventor for your den, library, laboratory, workshop or radio station. Sent prepaid in strong cardboard tube. Price 50c.

Experimenter Publishing Co.
231 Fulton St. Book Department N. Y. City

www.americanradiohistory.com



WATCH CAMERA

The most wonderful and Ingenious Camera made

It is but little larger than a watch, which it closely resembles. You can carry the Expo about in your pocket and take pictures without any one being the wiser.

One Cent a Picture

The Expo loads in daylight with 25 Exposure Films, costing 15c, thus the picture taking part of a whole day's outing may be had for the nominal sum of 15c—One cent a picture. 10 Exposure Films for 25c, daily procurable. It is simplicity itself to operate. Takes pictures through the stem, where the Rapid Fire Lens is located. The photos (5/8 x 7/8) may be enlarged to any size.

Price $2.50

QUICK AS A FLASH Time and instantaneous shutters; the latter but 5 cents; nickel plated. Endorsed by amateurs and professionals the world over. Thoroughly practical—amazing and delighting as ordinary cameras—in daily use by the police, newspaper reporters, detectives, and the general public. Important facts have been secured with the Watch Camera by enterprising reporters. Produces clear, sharp negatives indoors or outdoors equal to any camera on the market, size or price notwithstanding.

Expo Watch Camera $2.50 Postage 10c Anywhere

FILMS, 10 Exposures 15c, 25 Exposures, 25c
Leather Pocket Carrying Case, 35c

JOHNSON SMITH & CO., Dept. E 4, 54 W. Lake St., CHICAGO

"The Baby" Double Action Revolver

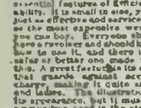
Hammerless

A Handsome and Most Effective Weapon. Measures but 6¼ Inches Long. Takes Regular .32 Caliber Cartridges $5.50

The new Baby Double Action Hammerless Revolver has been produced to meet the ever increasing demand for a revolver that would combine small size and light weight with the essential features of efficiency and practicability. It is small in size, but is just as effective and serviceable as the most expensive weapon you can buy. Everyone should have a revolver and should know how to use it, and there is no safer or better one made than this. A great feature is its safety action that guards against accidental discharge, making it quite safe for young men and ladies. The illustration gives an idea of its appearance, but we need say no more to demonstrate its merits. The ammunition used is the standard .32-caliber cartridge obtainable anywhere. The operation of the cartridges is extremely rapid and absolutely reliable, as all well aimed shots can be fired in as many seconds. The revolver is very well constructed, with finest nickel plated fluted barrel of rifle cut, and is weighs only 24 ounces. The price of the Baby Revolver is only $5.50, mail or cash, p.p. In any address.

JOHNSON SMITH & CO., Dept. E 4, 54 W. Lake St, CHICAGO

Sneezing Powder



Place a very small amount of this powder on the back of your hand, and then blow it into the air, and everyone in the room or within sight will begin to sneeze without knowing the reason why. It is most amazing to hear them sneeze, as they never know the source, but think they have caught it one from the other. Serves to tickle the throat and sneezing you yourself will be having the time of your life. For parties, social get-together, or any place where there is a gathering of people, it is the greatest fun out. Price 12c or 3 for 30c.

JOHNSON SMITH & CO.

STAGE MONEY



With a bunch of these bills, it is easy for each person of limited means to operate a successful game of roulette. Each of these bills at the proper time and peculiarly off a genuine bill or two from the outside of the pocketbook, the owner of which will be found to be all that can be desired. Prices, postpaid: 75 Bills 10c, 150 Bills 25c, 125 for 50c, 400 for $1.00 thousand.

GREATEST TOY SENSATION OF THE DAY!

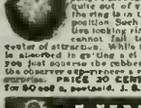
FIGHTING DREADNAUGHT

SENSATIONALLY REALISTIC!!!



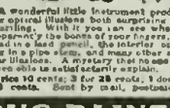
Here is a model of Uncle Sam's fighting monsters. Eight big guns, each of which flashes, at correct intervals, from twelve to twenty times. Extra ammunition always obtainable. Absolutely harmless. Can be operated indoors or out. Now, boys! Here's your chance to see a battleship in action, and the best of it is you can OWN the ship and command the firing yourself! By having two or more Battleships, you can stage EXCITING NAVAL BATTLES in your own home. Price of Warship and Ammunition, 180, three for 400, or a fleet of 52 ships for $1.80 postpaid. Extra Ammunition, 8 sorts per pkg.

SQUIRT RING



You may have a lot of fun with the Sparkling Comic Squirt Ring. It consists of a be-domino gated ring, attached to a rubber ball, as at present shown, but the latter is quite out of view when the ring is in the proper position. Such an attractive looking ring as this cannot fail to be an object of attraction. While the victim is absorbed in getting a fair view you just squeeze the rubber ball and the observer gets more a very great surprise. PRICE 20 CENTS. Three for 50 cent s, postpaid. J. S. & CO.

Wonderful X-Ray Tube



10¢

A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your fingers, the lead in a lead pencil, the interior spring in a pipe stem, and many other similar illusions. A mystery that no one has been able to satisfactorily explain.

Price 10 cents; 3 for 25 cents; 7 doses, 75 cents. Sent by mail, postpaid.

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night The very latest discovery in the scientific world. Simple, harmless, genuine, totally unobtainable except at an exorbitant price, and have at last succeeded in producing LUMINOUS PAINT, which, applied to the surface of any article, emits rays of white light, rendering it perfectly visible in the dark. THE DARKER THE NIGHT, THE MORE BRILLIANT IT SHINES. Quite simple to use. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the push buttons of electric lights, match boxes, and innumerable other articles, make your own Luminous Crucifixes, Luminous Rosaries, etc. Bottle containing sufficient to coat a dial 2½ inches in diameter, sent postpaid, by mail or express, only 90c and $1 postpaid. Johnson Smith & Co., Dept. E 4, 54 W. Lake St., Chicago.

MUSICAL KAZOO



With the Musical Kazoo you can, without the least practice whatever, play any tune right off, imitating any bird or animal, trombone, snare drum, Punch and Judy, etc. No holes to finger. It is simplicity itself. Produces excellent music. You do not blow into it, but sing, hum or speak into the instrument. Used with astonishing results at society entertainments, lodge, club or church entertainments, dances, serenades, picnics, parties, etc. Humorous. Just the thing for choruses and shows. Bands and marching clubs, etc. Excellent for vocal or instrumental accompaniments, either with or without other musical instruments. Price 15c p. pe.

MAGIC FLUTE



Wonderfully Sweet Toned and Musical

A marvelous musical instrument. No other instrument produces sweeter music, whether it be the brave notes of a quick step or the soft and plaintive strains of a church hymn—in fact, any class of music can be played upon the Magic Flute without practice, as it is almost a self-playing instrument. When played with a piano accompaniment, or any other musical instrument, the effect is charming. Full printed instructions for playing sent with each instrument.

Price 15c

New Vamping Card

No Teacher Needed Surprisingly Simple System



Persons having neglected their Musical Education need not despair, for with the aid of our new VAMPING CARD placing the card upright over the piano keyboard, you can at once Vamp away to thousands of Songs, Ballads, Waltzes, Rag Time, etc., etc., equal to a Professional Musician. No knowledge of music is required. After using it a few times, you will be able to dispense with the aid of the Vamping Card entirely. Only 15 cents, postpaid. Johnson Smith & Co., Dept. E 4, 54 W. Lake St, Chicago

All the Latest Surprising and Joke Novelties

Peck's Surprise Eggs, box	10c	Set of the Spot Trick, a series, nov.	10c
Miniature Water Pistol	10c	X Ray Novelty	10c
Cleopatra's Snake (very lifelike)	10c	Trick Pencil	10c
False Mustache (a good joke)	10c	Rubber Tacks (a good joke)	10c
Swell Auto Puzzle (Latest)	15c	Mesmerized Penny (defies the law of gravitation)	20c
Mysterious Ghost, shines at night	15c	Mysterious Tumbler and Vanishing Coin Trick	25c
Rubber Razor (very formidable)	20c	Magic Mirror (take one peep)	25c
Rubber Dagger (sensational)	20c	Magic Photo Lifter	25c
Window Smasher (great joke)	15c	Imitation Gold Watch	8 for 25c
Look behind you (see behind you)	15c	Great Hurelas Puzzle	10c
Great Mind Reading Mystery Cds.	10c	Wire Puzzle, 10c. 12 different, $1.20	
Thurston's Mysterious Trick Cds.	10c		
Fighting Roosters, pair	10c		

JOHNSON SMITH & CO., Dept. E 4, 54 W. Lake St, CHICAGO

The CONJURER'S CASKET

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment

ANYONE CAN DO THEM

50c

It is great fun mystifying your friends. Get this Conjurer's Cabinet, and you will be the center of attraction in great shape. It contains the apparatus for seven first-rate tricks, including The Disappearing Rose, which appears on the lapel of your coat, or anywhere from sight at will; the Magic Vase and Ball Trick to Wonder Ball is placed inside, and upon replacing the lid has disappeared and is found in some other place; The Magic Pin with which you seem to apparently cut your finger almost in two, the Wonderful Card Trick (a card is placed in an envelope, and when opened an entirely different card appears to be found); The Disappearing Coin Box (a coin is placed in the little wooden barrel, and when opened again, is found to have vanished entirely, or can be made to change into a coin of another denomination); The Famous Hammered Penny that defies the law of gravitation (suspends from the top of the head, nose, cheek, veil, clothing, etc.); The Glass Goblet and Vanishing Coin Trick (a coin is dropped into a glass of water, and when the water is poured out the coin has vanished). With the seven tricks described above we send full printed instructions for performing each trick, so that anyone can readily perform all the tricks to the great amusement of their friends or the public. Any boy of ordinary intelligence, with this Cabinet of Tricks in his possession, can give a clever entertainment. Nothing complicated or machinelike. Besides the tricks contained in the Cabinet, there are twenty-five other feats and illusions fully explained with full printed instructions, for which you can readily make or procure the necessary apparatus. Among them are The Mouse in a Pack of Cards; The Unseen Card; The Hat Trick; To Knock a Tumbler Through a Table; One Coin Found Inside Two; To Find the Number Thought of; Mysterious Wedding Ring etc. We also send the secret of performing three wonderful stage tricks, as follows: The Artificial Leg; The Leg Raising a Woman; Walking on the Ceiling of a Room, and the Disappearing Lady, together with an article describing the secret of the Vanishing Lady Cabinet. PRICE COMPLETE 50c.

ANARCHIST BOMBS



Consists of a little glass vial, containing a liquid form a chemical which will cause a most horrible odor. One dropped in a room full of people will cause more consternation than a limburger cheese. The smell will control disappear in a short time. 3 Boxes for 25c, shipped by express only with a Dollar's worth of other merchandise.

ITCHING POWDER



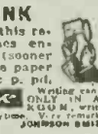
This is another good practical joke; the intense discomfiture of your victims to everyone but themselves is thoroughly enjoyable. All that is necessary to make the ball rolling is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more. 3 Boxes for 25c. Sent only by express. (Must order at least 50c Dollar's worth of other merchandise.)

INVISIBLE INK



The most confidential message can be written with this ink for the writing MAKES NO MARK. Can be read by no one but those you know the secret. Invaluable for many reasons. Keeps your postals and other private memorandums away from prying eyes. Great fun for playing practical jokes. Only 15c per bottle.

VANISHING INK



Writing written with this remarkable ink vanishes entirely in a few seconds (or less, if desired), leaving the paper QUITE BLANK. 15c p. pd.

LUMINOUS INK Writing can be READ ONLY IN A DARK ROOM. Write with pen or brush. 15c bottle. Quite invisible at daytime. Very remarkable. 15c bottle, 3 for 40c postpaid.

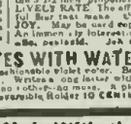
JOHNSON SMITH & CO.

GOOD LUCK RING



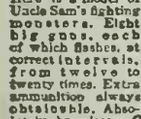
Don't fail to send for one of these VERY striking and unusual rings. It is made of gunmetal, finely finished and oxidized, and has a handsome design which is emblematic of Good Luck. Being a genuine curiosity it will attract the attention of everyone you meet. It is said by many to bring Good Luck to the wearer, hence its name Good Luck Ring, and while we will not positively guarantee that it is certainly a very unique ring that you will take a pride in wearing. They are made to sell at 50 cents, but as a special bargain we will supply them to our customers at this paper at HALF PRICE, viz., ONLY 25 CENTS, POSTPAID. JOHNSON SMITH & CO.

Newest Novelty Aerial Balloon



Flies gracefully in or outdoors. This is the VERY LATEST SENSATION IN BALLOONS. A bright colored balloon that measures six inches from tip to tip when blown up in the usual way, and, when released the air pressure sends the balloon SOARING TO AREA of 3 1-2 feet in a popular WINNING AROUND AT A LIVELY RATE. The effect is startling. It is a wonderful fine trade. The youngsters WILL GO WILD WITH JOY. May be used repeatedly indoors or outdoors. An immense ly interesting toy. Price 10c each. 3 for 25c, postpaid. Jos. K. Smith & Co., Chicago.

INKLESS PEN WRITES WITH WATER

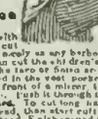


500 words every time you dip. Makes 1 to 2 copies. Writes as easy as with Nickel Plated Reversible, Holder 10 CENTS, 3 for 25c.

Write fashionable visiting card. Better and more reliable pen. Writes a long letter with one dip in plain water. No trouble. Simple as a lead pencil. Can be carried in the vest pocket ready for instant use and will last a lifetime. To use it, stand in front of a mirror, 1 pace away, and as the UTILITY TRIMMER lits the pop would a room. Push it through the hair downward, in the direction the hair lies, but never upward. To cut long hair, first straighten the hair, so it will lay smoothly, then start cutting at the top of the head and work downward cuts as high as you desire, evenly all around the head. Finish around the neck and ears with a square cut, like a barber. It is impossible to leave any "shingle" or "rat tail" on the head when using this device. The long, thin, single guard prevents the cutter blade from ever cutting the scalp. To cut very close, push the blade until the cutting edges are even with the gua d teeth. To thin out heavy hair, push the blade through the hair, reversing the blade in the holder, the cutting edge being to the back of the holder, exposing the safety blade, except the corner. To bevel, turn the blade in the holder, which will allow only the back, making the blade cut until the cutting edge is even with the back of the holder. Then hone in the usual manner. Finish on a strop as in an ordinary razor. Johnson Smith & Co., Dept. E 4, 54 W. Lake St., Chicago

Trim Your Own Hair With the Utility Safety Hair Cutter

Agents Wanted



Cuts the Hair Any Length, Short or Long—Saves Its Cost First Time Used.

Price Only 35c Extra Blades 50 Each

If you can COMB your hair you can TRIM your own hair with this marvelous invention. The UTILITY TRIMMER will cut your hair any length you desire, short or long, finish the job as neatly as any barber and in less than half the time before your own mirror. The lade s can cut the children's hair at home in a jiffy; can be used as an ordinary razor to shave the face or and the temples as a neck. Sharper than any razor; can be carried in the vest pocket ready for instant use and will last a lifetime. To use it, stand in front of a mirror, 1 pace away, and as the UTILITY TRIMMER lits the pop would a room. Push it through the hair downward, in the direction the hair lies, but never upward. To cut long hair, first straighten the hair, so it will lay smoothly, then start cutting at the top of the head and work downward cuts as high as you desire, evenly all around the head. Finish around the neck and ears with a square cut, like a barber. It is impossible to leave any "shingle" or "rat tail" on the head when using this device. The long, thin, single guard prevents the cutter blade from ever cutting the scalp. To cut very close, push the blade until the cutting edges are even with the gua d teeth. To thin out heavy hair, push the blade through the hair, reversing the blade in the holder, the cutting edge being to the back of the holder, exposing the safety blade, except the corner. To bevel, turn the blade in the holder, which will allow only the back, making the blade cut until the cutting edge is even with the back of the holder. Then hone in the usual manner. Finish on a strop as in an ordinary razor. Johnson Smith & Co., Dept. E 4, 54 W. Lake St., Chicago

THE "LITTLE GIANT" TYPEWRITER

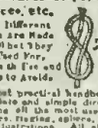
A First Class Writing Machine For $1.25



A perfect little typewriter for $1.25. There are thousands of persons who would like to use a typewriter but the fees and rentals are so net warrant the purchase at $100 to the purchaser and the operator is not perfect as confidently recommend our Little Giant. It is strongly built, yet simple in construction, so that any one can quickly learn to operate it, and write as rapidly after the first hour as with the best. Each of the alphabet most frequently used being so grouped as to enable one to write rapidly. Use a pencil to write the punctuation marks being touched. With this machine you can send your best girl typewritten love letters, address envelopes, make out bills, and do almost any kind of work that a typewriter will do. Size 10x6 inches. With each typewriter we send a bide of ink and full printed instructions for using for using the machine. Price complete $1.25 by mail postpaid.

NEW BOOK ON ROPE SPLICING

Useful Knots, Hitches, Splices, etc.



How Different Knots Are Made and What They are Used For; Knots to Tie and Knots to Avoid.

A most practical handbook giving full and complete and simple direction for making all the useful knots, hitches, splices, etc. Over 300 illustrations. Also how to splice rope, fasten hammocks, lashing, hitches, bowlines, etc. Every boy and girl should have one. It is fully illustrated. Of great value to mechanics, riggers, campers, boatmen, etc. Price 25c postpaid.

JOHNSON SMITH & CO.
Dept. E 4, 54 W. Lake St., Chicago

SERPENT'S EGGS



Each box contains 12 Eggs, which are no larger than a grain of oats. When lit with a match, however, each one gradually hatches itself into a Snake several feet long, which curls and twists about in a most lifelike manner. Price per box 10c, postpaid. Johnson Smith & Co.

MYSTIC SKELETON



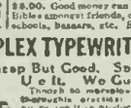
A jointed figure of a skeleton 14 inches in height, will dance to music and perform various gymnastic and acrobatic feats, the operator may be any distance from it. The figure may be examined by the spectators. When placed back to back operates it is simply placed on a chair or table, when it will perform in accordance with the music. At the command of the operator it will bow down, stand up, dance, etc. We send full directions with each skeleton, by the aid of which anyone can readily make it perform. 10c postpaid.

CIGARETTE ROLLER



Very neat and handy. Weighs less than a quarter of an ounce. It makes better cigarettes than you can buy and makes them easily and quickly. You can use just the tobacco you prefer and thus have either "mild" or "strong" smokes, and more of them besides saving about half of your money. Just try one and make your cigarettes just to your own liking. Price only 10c or 3 for 25c postpaid, with full instructions for use. JOHNSON SMITH & CO.

MIDGET ILLUSTRATED BIBLE

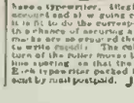


A Great Curiosity

The Smallest Bible in the World

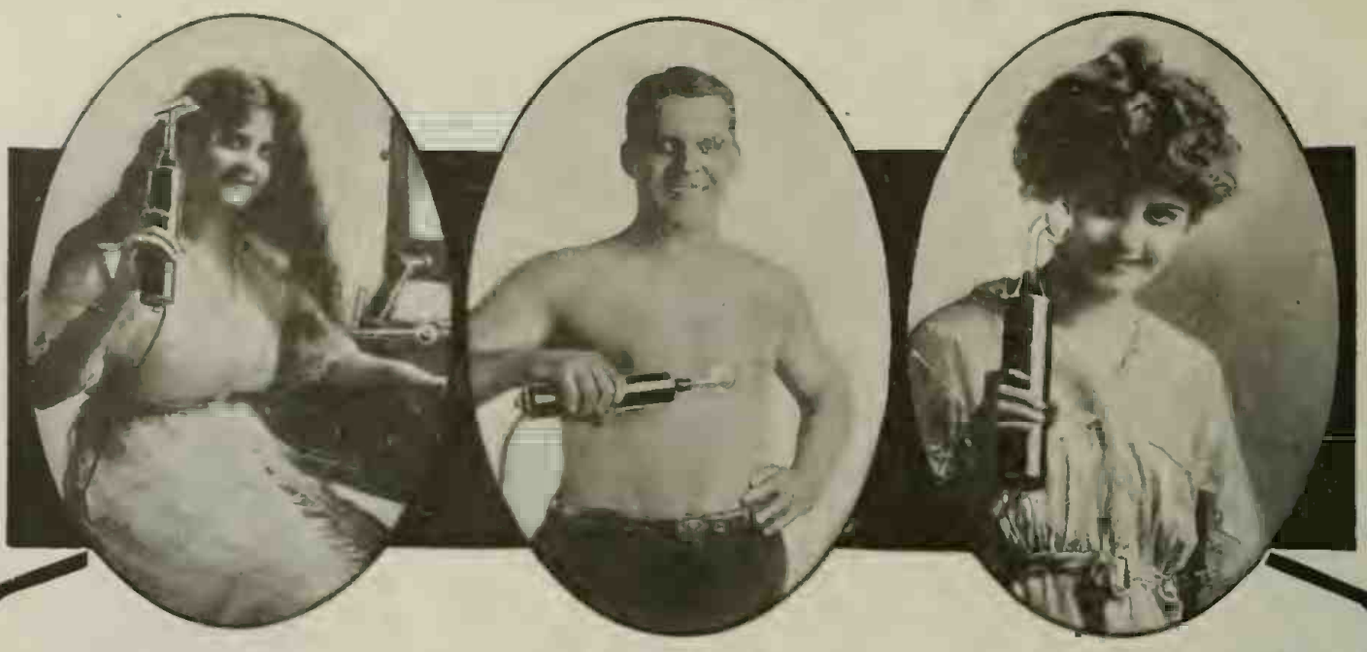
The Midget Bible is a perfect gem, and a wonder to all. It is about the size of a postage stamp and contains FIFTY-FIVE DRED AND FIFTY PAGES of the NEW TESTAMENT, perfectly illustrated. This little Bible is a wonder. It is said to bring good luck to the owner. Must be seen to be appreciated. Price, only 12 cents, these Bibles for 30 cents; one dozen Bibles for $1.00; or 100 for $8.00. Good money can be made selling these Midget Bibles among your friends, church acquaintances, Sunday schools, Bazaars, etc. Send for a few and try it.

SIMPLEX TYPEWRITER ONLY $2.50



Cheap But Good. So Simple a Child Can Use It. We Guarantee the Writing.

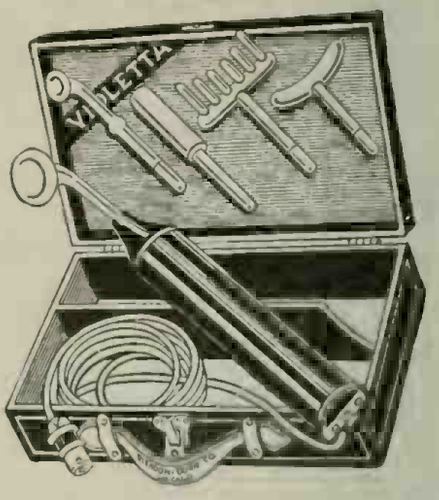
Though so marvelously cheap, the machine is a thoroughly practical typewriter. We guarantee it to be up to date in every respect and to do as perfect work as any $100 machine. It does not cost a cent more than the price, but we send you a specimen of the work and you will be convinced. With a reasonable care it will last a lifetime. It is so simple that a child just able to read can write with it. You can learn to write a page about in five minutes, and an hour's practice will make you an expert operator. Every business man has a typewriter, regardless of the amount of work he has to do. Makes your correspondence a pleasure instead of a task. Writes as fast as the average



Try This Wonderful New

VIOLET-RAY

Machine—10 Days Free!



NOW in your own home you can have wonderful Violet-Ray treatments exactly as are given by eminent physicians and beauty specialists throughout the country. Now you can rid yourself of headaches, catarrh, constipation, eczema, insomnia, lumbago, nervousness. Relieve your pain from neuritis, rheumatism, and other disturbances. Multiply your bodily health, vitalize your nerves, double or treble your energy by using Violet-Rays. Sleep better, increase your strength, and improve your appetite and digestion. Soothe your nerves, reduce or increase your flesh. Tone and strengthen the entire system. Beautify your complexion! All with Violet Rays!

Not a Vibrator

The wonderful Violetta is not a Vibrator. It is not a machine that contracts the muscles—it does not shock, it does not pound the muscles—it is absolutely painless. Violet-Rays administered by the Violetta are wonderful even for infants! Relieve pain and suffering in every part of the body. Simple tests prove that Violet-Rays pass completely through every part of the body, stimulating every cell and organ. It is electricity in its highest remedial form.



Treat Yourself at Home

Here is a partial list of ailments treated successfully, with the Violetta, Violet-Ray Machine.

Asthma	Earache	Obesity
Barbers' Itch	Eczema	Pains
Boils	Eye Disease	Paralysis
Blackheads	Falling Hair	Piles
Bunions	Hay Fever	Pimples
Callous	Headache	Pyorrhea
Catarrh	Goitre	Rheumatism
Chilblains	Insomnia	Skin Diseases
Colds	Lumbago	Sore Throat
Corns	Nervousness	Sprains
Constipation	Neuralgia	Tonsilitis
Dandruff	Neuritis	Whooping Cough
Deafness		

What Physicians and Users Say

Trixie Friganza, well known actress, says: "Cheerfully will I add my praise for Violetta. It's the best 'pain chaser' and 'soother' I've had the good fortune to find. It's WONDERFUL. It cured my brother of neuritis. As for myself I use it for facial treatments and general massage. I cannot say too much for it."

Dr. Bert H. Rice, of Vinton, Iowa, says: "I have good results with the Violetta High Frequency Instrument in all cases of neuralgia. Almost instant relief in Facial Neuralgia."

K. L. Allen, D. C., 205 Boone National Building, Boone, Iowa, says: "I have had very good results with the application of High Frequency Current in cases of Paralysis, Rheumatism and Neuritis, and think it a great help in drugless healing."

Dr. Daniels, Lisbon, North Dakota, says: "Have used the VIOLETTA in such cases as Goitre, Bronchitis, Pleurisy, Neuritis, Neuralgia, and Lumbago, and find it very beneficial. In fact, I would not be without it in my office."

Frank Borzone, Seattle, Wash., says: "I purchased the VIOLETTA for my wife who was suffering from an acute attack of Sciatica. From the very first treatment it induced peaceful rest and she is entirely well now."

BLEADON-DUN CO.,

Dept. 2B, 11-17 So. Desplaines St., Chicago, Ill.

Please send me your free book and 10 Days' Trial offer on Violetta Violet-Ray Machine.

Name .....

Address .....

.....

BOOK FREE!

Write today without fail. Mail coupon or just a post card. Let us send you our 32-page beautifully illustrated free book, describing the Violetta in detail. Read the amazing phenomena produced by Violet-Ray High frequency current. Why it produces stimulation and sedation. How to give spinal treatments with the Violetta, how to treat various ailments, including nervous troubles, rheumatism, obesity, hayfever, skin treatments, facial treatments. Note low price direct to you from our own laboratories. Note the amazingly superior construction of the Violetta in every detail. Mail coupon or postal right now before you turn this page. Violet-Rays will double your energy, will increase your life, will remove your pains and aches. Address

BLEADON-DUN CO., Dept. 2-B, 11-17 So. Desplaines St., Chicago, Ill.

www.americanradiohistory.com

Every Electrical Man Wants These Books and we ship them for your inspection FREE





Flexible Covers — Handy Pocket-Size Volumes

10 Volumes — 3500 Pages — 4700 Pictures

$1 Per Volume

$1 Per Month

Just what you need to know to succeed in ELECTRICITY

EVERY electrician, every engineer, every mechanic should know about these wonderfully helpful instructive books, which give in plain words a complete working knowledge of electrical engineering in all its phases.

You run into some new electrical problem almost every day. The information you need to help you in your every day work is in

HAWKINS ELECTRICAL GUIDES

These books place electricity at your finger ends. They cover every imaginable subject, principle, theory, problem, trouble, and way of doing things electrically. Every subject is indexed so that you can turn right to it. They are a study course and a reference guide in one, written in plain every day language—no wasted words—only what you need to know—chock full of up-to-the-minute electrical knowledge. The guides are a complete course in electrical engineering. They will help you in every detail of the day's electrical work. You can't ask an electrical question that Hawkins Guides can't answer.

What Electrical Men Say

Helped Him Make Good

"It is only right for me to recommend highly the Hawkins Guides, for they have been of the greatest assistance to me in placing me in my present position as Superintendent of Construction Department of one of Ohio's largest Electrical Companies. I would like to see every man have a set of Hawkins Guides."
Geo. Knecht, Columbus, Ohio.

In the Naval Electrical Dept.

"The Hawkins Guides are great help to me in the Naval Electrical Department, which they cover very thoroughly."
C. J. Cornell,
U. S. Receiving Ship, Brooklyn, N. Y.

Superintendent

"I am now superintendent of the Dunnville Hydro-Electric Systems, and Hawkins Guides were a great help to me in holding down a responsible position."
W. E. Swartz, Dunnville, Ontario.

Wireless Operators

"I have worked wireless for ten years—but I wish I had these books years ago, as they have saved me a great deal of trouble." H. Marshall,
Steamer M & B No. 2,
Walkerville, Ont.

Pocket-Size Flexible Covers

The books are small enough to slip into your coat pocket—handsomely bound in flexible black covers.

You can carry each volume with you until you have mastered its contents. 3,500 pages of actual information and 4,700 illustrations. Once you see these books and put them into actual use you will never again want to be without them. Try it at our expense.

SEND NO MONEY

It will cost you nothing to receive these books—to look them over—ask them all the questions you can think of—use them in your work—study them—pick up some information that will increase your earning ability. We will ship you the entire set of 10 volumes entirely FREE.

This is a sign of our confidence in the guides. Pure gold does not object to being tested. Keep them for seven days and if you do not decide that you can't get along without them, return them to us and owe us nothing.

When you decide to keep them you only have to pay $1.00 down and remit the balance of $9.00 on the easy payment of $1.00 a month till paid for.

Use this coupon to get the books. It will pay you many times over.

THEO. AUDEL & CO.
72 Fifth Ave. New York, N. Y.

SEND NO MONEY—USE THE COUPON

READ THIS PARTIAL LIST OF CONTENTS

No. 1 Contains 348 pages, 388 illustrations. Electrical signs and symbols—static and current electricity—primary cells—conductors and insulators—resistance and condu. ity—magnetism—induction coils—dynamo principles—classes of dynamos—armatures—windings—commutation—brushes, etc.

No. 2 Contains 348 pages, 394 illustrations. Motor principles—armature reaction—motor starting—calculations—brake horsepower—selection and installation of dynamo and motors—galvanometers—standard cells—current measurement—resistance measurement—voltmeters—wattmeters—watt hour meters—operation of dynamos—operation of motors, etc.

No. 3 Contains 300 pages, 423 illustrations. Distribution systems—wires and wire calculations—inside, outside and underground wiring—sign flashers—lightning protection—rectifiers—storage battery systems, etc.

No. 4 Contains 270 pages, 379 illustrations. Alternating current principles—alternating current diagrams—the power factor—alternator principles—alternator construction—windings, etc.

No. 5 Contains 320 pages, 614 illustrations. A. C. Motors—synchronous and induction motor principles—A. C. commutator motors—induction motors, transformers: losses, construction, connections, tests—converters—rectifiers, etc.

No. 6 Contains 298 pages, 472 illustrations. Alternating current systems—switching devices—circuit breakers—relays—lightning protector apparatus—regulating devices—synchronous condensers—indicating devices—meters—power factor indicators—wave form measurement—switch boards, etc.

No. 7 Contains 316 pages, 379 illustrations. Alternating current, wiring power stations—turbines: management, selection, location, erection, testing, running, care and repair—telephones, etc.

No. 8 Contains 332 pages, 436 illustrations. Telegraph—simultaneous telegraphy and telephony—wireless—electric bells—electric lighting—photometry, etc.

No. 9 Contains 332 pages, 427 illustrations. Electric railways—electric locomotives—car lighting—trolley car operation—miscellaneous applications—motion pictures—gas engine ignition—automobile self-starters and lighting systems, electric vehicles, etc.

No. 10 Contains 513 pages, 599 illustrations. Elevators—cranes—pumps—air compressors—electric heating—electric welding—soldering and brazing—industrial electrolysis—electro plating—electro-therapeutic—X-rays, etc.

Also a complete 126-page ready reference index of the complete library. This index has been planned to render easily accessible all the vast information contained in the 10 electrical guides. There are over 13,500 cross references. You find what you want to know instantly.

THEO. AUDEL & CO.
72 Fifth Avenue
New York, N. Y.

Please submit me for examination Hawkins Electrical Guides (in blue $1 each). Ship at once, prepaid, the 10 numbers. If satisfactory I agree to send you $1 within seven days and to further mail you $1 each month until paid

Signature .....

Occupation .....

Business Address .....

Residence .....

Reference .....

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

BE A CERTIFICATED ELECTRICIAN



I WILL TRAIN YOU AT HOME

A REAL POSITION LIKE THIS—FOR YOU

The country needs thousands of trained, Certificated Electricians to fill good positions—and at big pay. It's all a matter of knowing how, and I will teach you by up-to-date, modern instruction. You can learn at home, without interfering with your regular work, by my highly successful method of *Home Instruction* in *Practical Electricity*.

Prepare NOW and be ready in a few months to earn your $46 to $100 A WEEK

Send for this Book

My book, "HOW TO BECOME AN EXPERT ELECTRICIAN," has started thousands of young men on the way to splendid success. A new edition of this has just been printed. I want every young man interested in Electricity to have a copy, and will send you one, ABSOLUTELY FREE AND PREPAID. Write me today.

How I Train My Students

As Chief Engineer of the Chicago Engineering Works I know exactly the kind of training a man needs to enable him to get and hold good positions, and to earn big pay. I have trained hundreds of men who are holding splendid electrical jobs.

I give each of my students personal attention and a complete and thorough training. I give him a SPLENDID ELECTRICAL OUTFIT FREE, and much of the training is done by actual work. When my students graduate and receive their Certificate, they are ready for a real position. But *still more*, at any time you wish you can come to our splendidly equipped Electrical Shops for special training. No other school can give you this.

A Real Opportunity for YOU

Wishing is never going to make your dreams come true. You've got to *study*—to *learn*. A man is worth possibly $2 or $3 a day from his neck down—and no more; but there is *no limit* to what he can be worth from his neck up.

A *trained mind* is what gets the big pay. It is this training that you need, and I can train you in a few months. Are you ambitious to make a real success—then send me the coupon—today.

Electrical Outfit FREE

To every student who answers this ad I am giving a Splendid Electrical Outfit of standard size Electrical Tools, Instruments, Materials, etc., *absolutely free*. Furthermore, to every Electrical Student I give a truly *valuable* surprise that I cannot explain here.

Free Employment Service

I am continually receiving requests from employers to send them trained Electrical men. I assist my students to secure good positions. I keep in touch with them for years, helping and advising them in every possible way.

Write Now—Don't Delay

Delay never got you anything. Action is what counts. Get started—and get started now. Write me, or send me the coupon, right NOW.

L. L. COOKE
CHIEF ENGINEER
Chicago Engineering Works
Dept. 23
441 Cass St.
CHICAGO

YOU CAN DO IT

USE THIS "FREE OUTFIT" COUPON

CHIEF ENG. COOKE, Dept. 23, 441 Cass St., Chicago, Ill.

Sir: Send at once—fully prepaid and entirely free—complete particulars of your great offer for this month.

Name .....
Address .....
City ..... State .....

THE CAREY PRINTING CO., INC.
NEW YORK

www.americanradiohistory.com

TK
7800
E54
v.6
no.2

APRIL, 1919
20 CTS.

ELECTRICAL EXPERIMENTER

SCIENCE AND INVENTION

OVER 175 ILLUST.

REG. U.S. PAT. OFF.



A NEW INVENTION—
NOT X-RAYS
?

SEE PAGE 860

www.americanradiohistory.com

BE A CERTIFICATED ELECTRICIAN



A Real Position Like This—For You

The country needs thousands of trained, Certificated Electricians to fill good positions—and at big pay. It's all a matter of knowing how, and I will teach you by up-to-date, modern instruction. You can learn at home, without interfering with your regular work, by my highly successful method of *Home Instruction* in *Practical Electricity*.

Prepare NOW and be ready in a few months to earn your $46 to $100 A WEEK

Send for this Book

My book, "HOW TO BECOME AN EXPERT ELECTRICIAN," has started thousands of young men on the way to splendid success. A new edition of this has just been printed. I want every young man interested in Electricity to have a copy, and will send you one, ABSOLUTELY FREE and PREPAID. Write me today.

How I Train My Students

As Chief Engineer of the Chicago Engineering Works I know exactly the kind of training a man needs to enable him to get and hold good positions, and to earn big pay. I have trained hundreds of men who are holding splendid electrical jobs.

I give each of my students personal attention and a complete and thorough training. I give him a SPLENDID ELECTRICAL OUTFIT FREE, and much of the training is done by actual work. When my students graduate and receive their Certificate, they are ready for a real position. But *still more*, at any time you wish you can come to our splendidly equipped Electrical Shops for special training. No other school can give you this.

A Real Opportunity for YOU

Wishing is never going to make your dreams come true. You've got to *study*—to *learn*. A man is worth possibly $2 or $3 a day from his neck down—and no more; but there is *no limit* to what he can be worth from his neck up.

A *trained mind* is what gets the big pay. It is this training that you need, and I can train you in a few months. Are you ambitious to make a real success—then send me the coupon—today.

Electrical Outfit FREE

To every student who answers this ad I am giving a Splendid Electrical Outfit of standard size Electrical Tools, Instruments, Materials, etc., *absolutely free*. Furthermore, to every Electrical Student I give a truly *valuable* surprise that I cannot explain here.

Free Employment Service

I am continually receiving requests from employers to send them trained Electrical men. I assist my students to secure good positions. I keep in touch with them for years, helping and advising them in every possible way.

Write Now—Don't Delay

Delay never got you anything. Action is what counts. Get started—and get started now. Write me, or send me the coupon, right NOW.

L. L. COOKE, *Chief Engineer*
CHICAGO ENGINEERING WORKS
441 Cass Street — Dept 24 — Chicago, Ill.

USE THIS "FREE OUTFIT" COUPON

CHIEF ENG. COOKE,
Dept. 24, 441 Cass St., Chicago, Ill.

Sir: Send at once, fully prepaid and entirely free—complete particulars of your great offer for this month.

Name .....

Address .....

City .....

State .....

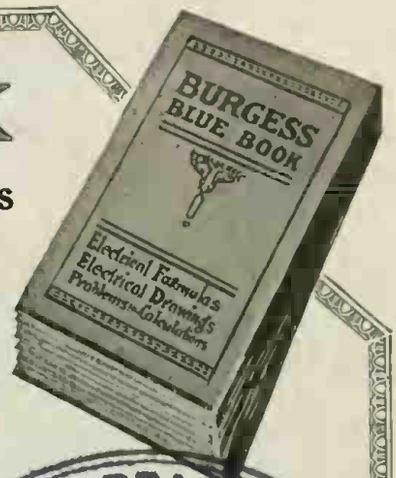
YOU CAN DO IT

www.americanradiohistory.com

The Burgess BLUE BOOK

for all Practical Men and Electrical Students

(See review of this book by Editor in December issue of your Electrical Experimenter page 568)



LIBRARY
SEP 2 8 1999
UNIVERSITY OF TORONTO

I have prepared a pocket-size note book especially for the practical man and those who are taking up the study of electricity. It contains drawings and diagrams of electrical machinery and connections, over two hundred formulas for calculations, and problems worked out showing how the formulas are used. This data is taken from my personal note book, which was made while on different kinds of work, and I am sure it will be found of value to anyone engaged in the electrical business.

The drawings of connections for electrical apparatus include Motor Starters and Starting Boxes, Overload and Underload Release Boxes, Reversible Types, Elevator Controllers, Tank Controllers, Starters for Printing Press Motors, Automatic Controllers, Variable Field Type, Controllers for Mine Locomotives, Street Car Controllers, Connections for Reversing Switches, Motor and Dynamo Rules and Rules for Speed Regulation. Also, Connections for Induction Motors and Starters, Delta and Star Connections and Connections for Auto Transformers, and Transformers for Lighting and Power Purposes. The drawings also show all kinds of lighting circuits, including special controls where Three and Four Way Switches are used.

The work on Calculations consists of Simple Electrical Mathematics, Electrical Units, Electrical Connections, Calculating Unknown Resistance, Calculation of Current in Branches of Parallel Circuits, How to Figure Weight of Wire, Wire Gauge Rules, Ohm's Law, Watt's Law, Information regarding Wire used for Electrical Purposes, Wire Calculations, Wiring Calculations, Illumination Calculations, Shunt Instruments and How to Calculate Resistance of Shunts, Power Calculations, Efficiency Calculations, Measuring Unknown Resistances, Dynamo and Dynamo Troubles, Motors and Motor Troubles, and Calculating Size of Pulleys.

Also Alternating Current Calculations in finding Impedance, Reactance, Inductance, Frequency, Alternations, Speed of Alternators and Motors, Number of Poles in Alternators or Motors, Conductance, Susceptance, Admittance, Angle of Lag and Power Factor, and formulas for use with Line Transformers.

WHAT PRACTICAL MEN SAY ABOUT THE "BURGESS BLUE BOOK"

Received your "Blue Book" and must say it is the best book I ever saw. I showed it to a friend of mine and he refused to give it back to me but he paid me a dollar and told me to get another. Rather than be without this book I am sending Money Order for three of them so I can show them to two more of my friends and have one left for myself. Wishing you would mail them at once, I am Yours very truly,

JOSEPH BRAITH, Electrician.
Madison, Wisconsin.

Your "Blue Book" received and it is just the book I have been looking for. Please mail me three more by return mail for which I am enclosing Money Order. Respectfully.

V. E. JOHNSON, Western Union Tel. Co.,
Marion, Ohio.

Have received the copy of the "Burgess Blue Book" and am very well pleased with the easily found formulas and data contained in it. I am enclosing Money Order for four additional copies. Very truly yours.

THURE C. ANDERSON.
Ridgeway, Penn.

I am enclosing three dollars for which please send me three copies of the "Burgess Blue Book". I showed the copy I got last week to some friends and three of them asked me to get them one. Very truly yours.

CHAS. H. DAVIS.
Los Angeles, Cal.

I received your "Blue Book" and after I looked over it I see that it is a very useful book. After I showed it to some fellows they wanted a copy also and I am enclosing Money Order for which please send me three at once. Yours very truly,

R. S. SWANSON.
St. Paul, Minn.

I received the three books I sent for and the next day I sold them. The fellows think they are well worth the price. Please send me three more for which I am enclosing Money Order. Yours very truly,

R. S. SWANSON.
St. Paul, Minn.

AN OPPORTUNITY FOR YOU TO MAKE SOME MONEY

To help get the "Burgess Blue Book" to the men who need it the most, we have established a resale discount to which those who have purchased a book from us are entitled. The "Burgess Blue Book" is not sold through the regular book dealers so we offer the regular book dealers' discount to men who will take orders and send them in to us. In this way the "Blue Book" is only sold by those who know its value and we feel that this arrangement is much more satisfactory to the purchaser, than if he bought it through the regular book-selling channels. The book practically sells on sight, as a man engaged in practical work realizes when he sees it, that it contains information which is extremely useful and which is difficult to obtain in any other way.

The Burgess BLUE BOOK Will Be Shipped, Postpaid, on Receipt of *$1.00*

Send dollar bill, money order or check. *I guarantee satisfaction or will return your money* if you decide not to keep the book after using it for five days

BURGESS ENGINEERING CO., YORKE BURGESS, *Consulting Engineer*
747 East 42nd Street Chicago, Illinois

www.americanradiohistory.com

Electrical Experimenter

233 FULTON STREET, NEW YORK

Publisht by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer;) 233 Fulton Street, New York

Vol. VI. Whole No. 72 APRIL, 1919 No. 12

GRAND OPERA IN YOUR HOME.....By H. Gernsback 855
NEW YORK TO CHICAGO VIA THE AIR IN 12 HOURS..... 856
GUIDING AIRSHIPS WITH THE "RADIO BARRAGE"..... 857
By Dr. Lee de Forest
HOW ELECTRICITY SERVES WORLD'S LARGEST HOTELS.. 858
By H. Winfield Secor
SEEING THRU YOU WITHOUT X-RAYS....By C. Battell Loomis 860
CATCHING DIAMOND THIEVES WITH THE X-RAY..... 862
GREAT BRITAIN'S NEW MONITOR-SUBMARINE WITH 12-INCH GUN..... 862
MY INVENTIONS. By Nikola Tesla. No. 3. "My Discovery of the Rotating Magnetic Field"..... 864
THE MOON'S ROTATION.....By Nikola Tesla 866
EXPERIMENTAL PHYSICS—SCIENCE IN THE WAR..... 867
By John J. Furia, A.B., M.A., (Columbia University)
POPULAR ASTRONOMY. THE PLANET EARTH—AS OTHERS SEE US.....By Isabel M. Lewis, of the U. S. Naval Observatory 868
RADIOPHONY TO AIRPLANES A GREAT SUCCESS..... 870
DO RADIO WAVES TRAVEL ABOVE THE EARTH OR THRU IT?.....By Dr. Lee de Forest 872
THE OPINION OF RADIO EXPERTS ON RADIO WAVE TRANSMISSION..... 873
THE HOW AND WHY OF RADIO APPARATUS—HOW TO MAKE A DIRECT-READING WAVE METER AND DECREMETER.....By H. Winfield Secor 874
GERMAN RADIO APPARATUS USED AT METZ..... 876
A TIMELY REINFORCEMENT—A COPPER-PLATED STOMACH 877
By Thomas Reed
THE ALKALINE STORAGE BATTERY.....By J. F. Springer 878
EXPERIMENTAL MECHANICS—THEORY OF TWIST DRILLS 879
By Samuel D. Cohen
PRACTICAL CHEMICAL EXPERIMENTS—BUTTER AND BUTTER SUBSTITUTES.....By Albert W. Wilsdon 880
HOW-TO-MAKE-IT DEPARTMENT—PRIZE CONTEST..... 881
WRINKLES, RECIPES AND FORMULAS..Edited by S. Gernsback 882
LATEST PATENTS DIGEST..... 883
WITH THE AMATEURS—PRIZE PHOTO CONTEST..... 884
SCIENCE IN SLANG—NO. 2—JAZZ STOKES ON WIRELESS DOPE.....By Emerson Easterling 885
"THE ORACLE"—QUESTION AND ANSWER BOX..... 886

EDITORIAL

Interplanetary Messages

A FEW weeks ago Marconi startled the world by stating that he had often received strong wireless signals which seemed to come from beyond the earth. In a recent interview publisht in the *New York Evening Post* Nikola Tesla, too, reminds us that he had made known to the world years ago the fact that extra-planetary signals were recorded in his Colorado Laboratory. That was in 1899, before the world dreamt of wireless.

Even today announcements such as the above are made light of by editorial writers and others of limited scientific perception. For the earth-bound layman still persists that intelligence can only exist on Earth. Such childish reasoning shows what sort of "intelligence" blossoms on this planet. It never occurs to these reviewers to question why Nature in her Wisdom should have singled out the little speck called Earth, on which to plant beings endowed with reason. Why should there be such an exception? Life in some form or other is certain of being found on myriads of worlds thruout the Universe. And if one world dies, all life does not die with it. Svante Arrhenius shows us how life-bearing spores are carried by the pressure of light thru interstellar space, notwithstanding the absolute zero which prevails there.

In our planetary system, conditions for life, such as we know it, probably only exists on two planets: Mars and Venus. Life on the latter being more or less doubtful, due to its heavy water-laden atmosphere, there remains Mars, a body much older in evolution than the earth. Conditions on Mars we know by direct observation as well as deduction are favorable for life, and we may be certain that it exists there. And if we once grant this, we must also grant that it must have existed for hundreds of thousands of years prior to that on Earth; consequently Martian civilization must be thousands of years ahead of ours.

From this we must deduce again that the Martians probably signaled to us ages ago, when prehistoric man still roamed the forests. But why go so far back? Suppose the Martians had sent us radio messages only thirty years ago. We could never have received them, for we then had no means of recording them. Detectors and audions were undreamt of.

In all this warped logic, we presuppose wireless signals. But why should a civilization so far ahead of ours use—to them—obsolete radio waves, which, like as not, can never hope to bridge 35 million miles! If the Martians are signaling to us, you may be certain that they use an entirely different means than Radio. To be sure, it may turn out to be one of the many wave forms of the ether, but we can only make a poor guess at it today. Meanwhile Martian signals probably fly about our heads day and night, as they may have for thousands of years, but we are still deaf and blind to them. The Martian Wave Detector still remains uninvented. At that the Martians probably have used many methods on us. It is not even impossible that they may have used reflected sun rays. Bell and Tainter in 1880 demonstrated a "wireless" telephone—the Photophone—by making use of a vibrating light ray falling upon a selenium cell. Speech was transmitted over many miles this way. With necessary refinements such a system might bridge interplanetarian space.

As to one planet understanding the other, that is of course child's play. Still, many humorous editorial writers have misgivings on that score. They are afraid that on Mars 2 + 2 might equal, perhaps, 5 or 3, so how could we get together, they ask.

A simple example might serve as an illustration. Suppose an American and a Frenchman, neither knowing the other's language, were connected by a long telegraph line. Both are ignorant of the code. But both have enough sense to tap the key. Suppose both have the desire to enter into communication, what will they do? Tap out dots from one to ten, of course. Thus . . . . . etc. It will not take them many months, if they keep at it, to work out a sort of "international" language by means of dots. And the higher their intelligence, the quicker will they understand each other.

That is the basis of interplanetarian communication.

H. GERNSBACK.

The ELECTRICAL EXPERIMENTER is publisht on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions. Canada and foreign countries, $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 20 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. A green wrapper indicates expiration. No copies sent after expiration.

All communications and contributions to this journal should be addrest to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

ELECTRICAL EXPERIMENTER. Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered U. S. Patent Office.

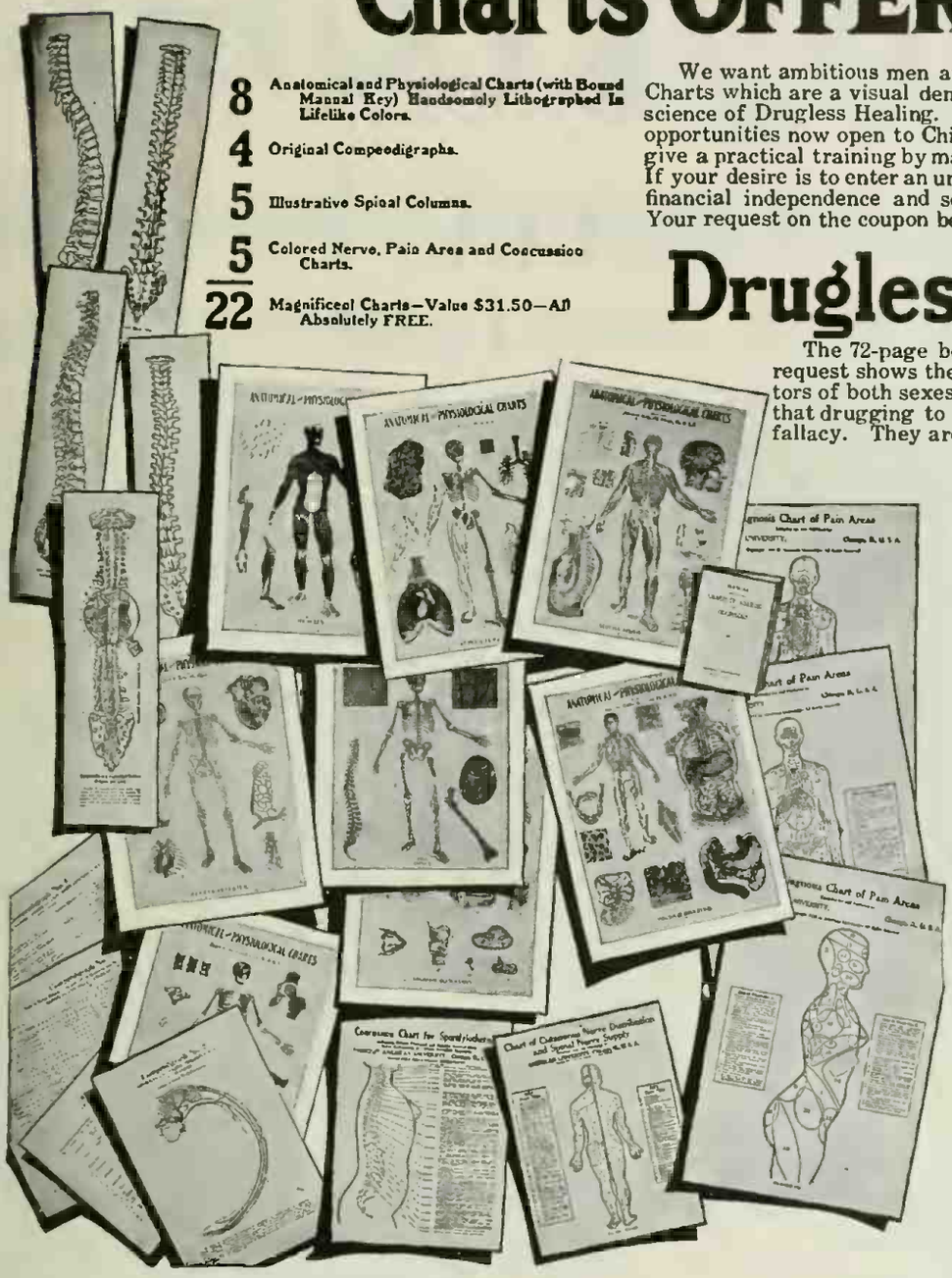
Copyright, 1919, by E. P. Co., Inc., New York. The Contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.

The ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris.

Member of the Audit Bureau of Circulation.

www.americanradiohistory.com

Remarkable FREE Charts OFFER



8 Anatomical and Physiological Charts (with Bound Manual Key) Handsomely Lithographed In Lifelike Colors.

4 Original Compeodigraphs.

5 Illustrative Spinal Columns.

5 Colored Nerve, Pain Area and Concussion Charts.

22 Magnificent Charts—Value $31.50—All Absolutely FREE.

We want ambitious men and women to have these remarkable Charts which are a visual demonstration of Chiropractic, the new science of Drugless Healing. This offer is now made to show the opportunities now open to Chiropractors. We also explain how we give a practical training by mail in this dignified, paying profession. If your desire is to enter an uncrowded field—if you want to achieve financial independence and social standing, at least investigate. Your request on the coupon below is all that is necessary.

Drugless Healing

The 72-page book and other literature we send on request shows the immense possibilities for Chiropractors of both sexes. The public is awakening to the fact that drugging to cure disease is in many instances, a fallacy. They are ready to welcome the practitioner who relieves and heals without nauseous dosing. The Charts show how the science of Chiropractic is applied. They reveal facts about the human body, instructive to the layman. You should obtain them without fail.

$3000 to $5000 a Year

Many Doctors of Chiropractic earn $5,000 a year and more; some upwards of $10,000. Dr. M. D. Moore of Ky., reports an income of $9,000 a year. Dr. L. H. Roche, New Jersey, $5.500; Dr. Hanna of Florida, over $5,000 yearly. What others are doing you should be able to do. A diploma gives you the same opportunity—is evidence that you are master of a profession of dignity, prestige and influence.

Our Lessons Teach You

how to make Spinal Adjustments for speedy relief of

Headache	Neuralgia
Indigestion	Neuritis
Lumbago	Catarrh
Epilepsy	Fevers
Pleurisy	Jaundice
Constipation	Dyspepsia
Rheumatism	Paralysis
Asthma	Etc., Etc.

Be a Chiropractor Learn At Home

By the American University system of instruction, you can become a Doctor of Chiropractic by studying in spare time at home or in class at the University. You do not require special talent or advanced education. A common school education and the ambition to succeed are all that is necessary. You will be trained under the direction of Chiropractic specialists who will teach you thoroughly the principles and practice of the profession. You will graduate with the degree of Doctor of Chiropractic.

Mail the Coupon

This coupon will bring full information about this new, interesting and profitable calling which any intelligent man or woman can readily master by our method—also information on how you can get these 22 instructive Charts. Send coupon for this free offer.

AMERICAN UNIVERSITY
Manierre Bldg., Dept 456 Chicago, Illinois

Free Charts

AMERICAN UNIVERSITY
Manierre Bldg., Dept. 456 Chicago

Gentlemen: Without cost or obligation, send me by mail, your new illustrated, 72-page book and your Free Charts Offer.

Name .....

Address .....

City .....

www.americanradiohistory.com

PRACTICAL

As experts Know it

SENT FREE FOR INSPECTION



Learn electricity as you would in actual PRACTICE—in accordance with the methods employed by the highest paid electrical experts in America. The New McGraw-Hill Library of Practical Electricity contains the actual working facts which you need in order to succeed in the electrical field. Terrell Croft, formerly with the Westinghouse Company, makes the conquest easy for you.

A New Standard in Electrical Literature

The New Library of Practical Electricity by Terrell Croft marks a new era in electrical literature.

The great field of electrical engineering, with its limitless possibilities of earning power, is brought to you in a form that makes success easy. The Library is a creation—an achievement that is without parallel in technical literature, because it sticks to actual practice throughout its 3,000 pages.

ONLY

$16

for a complete Electrical Education—

Payable $2 Per month

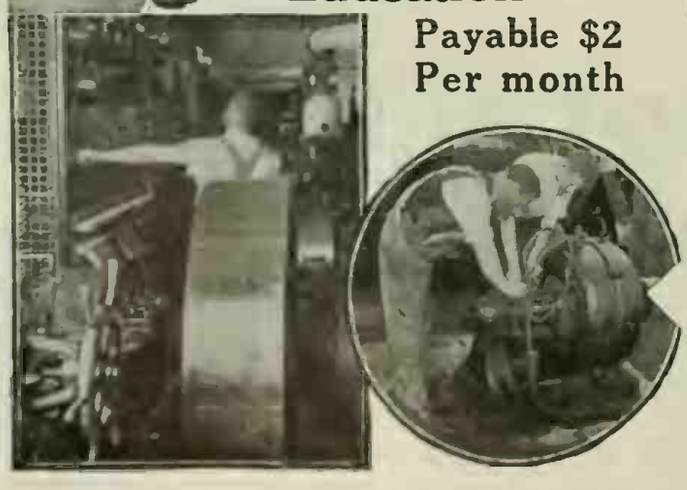
8 Volumes
Flexibly bound
Pocket size
3000 pages
2100 illustrations
Everything you must know about electricity at the finger's end

A letter that means something to YOU—

McGRAW-HILL BOOK COMPANY, Inc.
239 West 39th Street, New York, N.Y.

Gentlemen: In an attempt to express myself about CROFT'S NEW LIBRARY OF PRACTICAL ELECTRICITY, I have never seen, and do not believe there was ever printed in the English language, a more comprehensive set of books. It is a library that is just as valuable to the novice as to the expert, because it is all practice.

Respectfully,
GUY H. PEIFER,
Chief, Doplan Silk Corporation,
Hazelton, Pa.



Learn electricity as you would in actual practice—get Croft's Library NOW



www.americanradiohistory.com

ELECTRICITY

Records of actual Work

NOT ONE PENNY IN ADVANCE

You have always wanted a compact set of books containing the solution to all your electrical problems. You have wondered if it were possible for any author to place himself in your shoes, and explain the very problems that face you every day. You have picked up books that covered the other fellow's problems, but not yours. These books seemed to touch on everything except the matters that pertained to your own work.

These books were not complete. They were probably out of date. They were probably not practical.

You have said yourself and heard others say, "I want books that fit into my work. The man who writes those books must understand my work, and know what he is talking about. I like to go into theory and the higher spheres of electricity occasionally, but not while I am on the job. Then I want plain facts, plainly stated. I want books that have anticipated my problems and figured them out for me."

Your wants have been anticipated and met in the new Croft Library. It is a seven-year undertaking recently completed by a man whose experience covers the whole field of electrical practice.

Examination will show why Croft's Library is now the accepted standard. Why it is used by the highest authority as well as the lowest beginner. Examination will show how it is revolutionizing the methods of teaching the practical side of electricity.

Examination is absolutely free. Merely return the coupon below.

READ THIS—

McGraw-Hill Book Company, Inc.,
239 West 39th St., New York.

Gentlemen:

I am enclosing money order for $2.00, which I believe is my last payment on Library of Practical Electricity. I wish to say just a word about the books. I want to go on record with the statement that they are absolutely the best set of books ever published for the man on the job. To have these books and get familiar with them makes one want to meet and talk with Mr. Croft. As a rule books which claim to be self educational are very incomplete and well padded with tables, etc., which one may find at any time in catalogues, but I will say Mr. Croft has certainly gotten away from this. A man who cannot read these books understandingly is hopeless. There never was a correspondence course even with the aid of personal letters, that could give a man real knowledge as these books do. I am Chief Electrician at a State Institution here and have use for these books every day. I fear no job because I know that if I cannot solve the problem, I've a friend at home in Mr. Croft's books, who will come to my aid.

Yours truly,

E. E. CONYER,
Anna, Ill.



Meet Terrell Croft

Be guided in your study of electricity by an experienced Electrical Engineer of high professional standing. Terrell Croft, author of 7 of these volumes, climbed from the ranks to Electrical Engineer with the Westinghouse Company. He gained his knowledge with his sleeves rolled up and has met your problems in advance. He tells in plain, understandable language how to proceed by the best and most practical methods.

Now is the time to master Electricity—Now is the time to prepare for a high salary

Old books won't do. Amateurish books won't do. Books compiled by "desk authors" or men with no practical experience will not serve your purpose.

Practical books are easiest mastered. Practical books, written by practical men, teach you accurately and rapidly. There is nothing in the Croft Library which you cannot understand. Terrell Croft tells you the secrets of success in electricity in plain words, figures and illustrations. Nothing is left to the imagination. There is no guesswork. There is no theory or higher mathematics.

Send now for these eight volumes. No matter how many books on electricity you possess, you are unfair to yourself unless you take advantage of this free examination privilege. No matter whether you are beginner or expert, these books will show you the clear road to success. Inspection will prove this.

Not one cent in advance—Just the coupon

Examine this new Library for ten full days without expense. Find out for yourself why it is now taking the lead in electrical book sales in America. Use the books as you see fit for ten days. Look at the hundreds of illustrations that clear up all the mysteries in electrical practice. Stick a couple of the volumes in your pockets, and refer to them during the day. Figure out in an instant the problems that have heretofore taken hours.

Then send us $2 per month for eight months, or return the set entirely at our expense. You risk nothing by returning the attached coupon.

EXAMINATION COUPON

McGraw-Hill Book Co., Inc.
239 W. 39th St.,
NEW YORK

Gentlemen:
Please send me the Library of Practical Electricity (shipping charges prepaid) for 10 days' free examination. If satisfactory, I will send $2 in ten days and $2 per month until $16 has been paid. If not wanted I will write you for return shipping instructions.

Name.....

Home Address.....

City and State.....

Name of Employer.....

His Address.....

Your Position..... Ex. Apr. '19

ACT NOW

McGraw-Hill Book Co., Inc.
239 West 39th Street, New York, N. Y.
Publishers of Books for Engineers Since 1876

FREE

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com





Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Oldest and Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 5,000 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Let us explain this course to you in person. If you can't call, send now for 64-page book—it's FREE to you

New York Electrical School
29 West 17th Street, New York

New York Electrical School
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

..... (NAME)

..... (ADDRESS)

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

Electrical Experimenter

H. GERNSBACK, EDITOR
H. W. SECOR, ASSOCIATE EDITOR

Vol. VI. Whole No. 72 APRIL, 1919 Number 12

Grand Opera in Your Home

By H. GERNSBACK

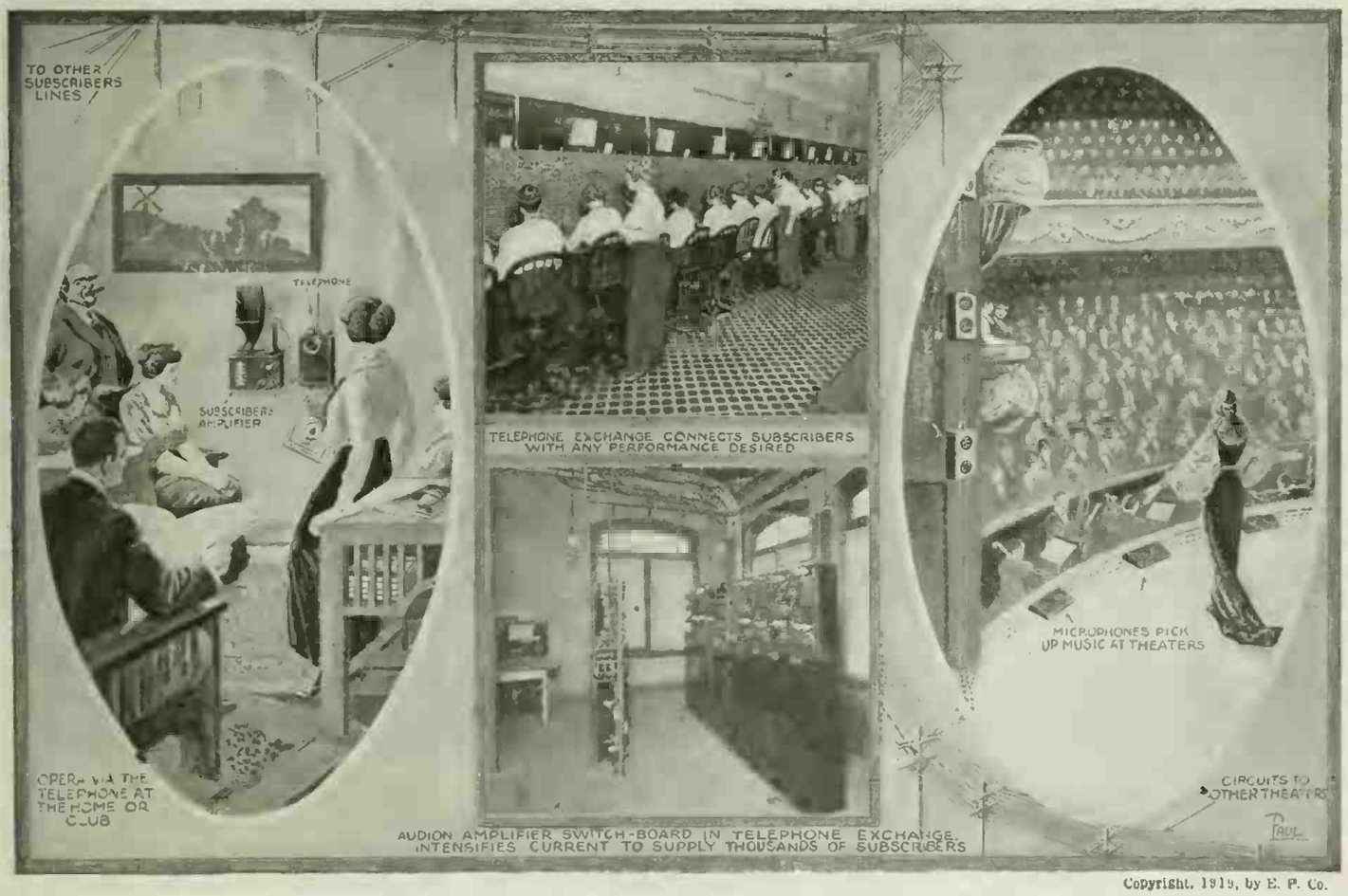
MANY thousands of people musically inclined are deprived of hearing our great operatic stars mainly on account of the high price of admission, also because of the limited seating capacity of even our largest opera houses. Take for instance a "star" performance at the Metropolitan Opera House, New York City. It is necessary to secure tickets weeks ahead if one wishes a good seat in the house, otherwise it is often impossible to make a reservation at all.

While seats may be bought at low prices "up in heaven", only our Italian friends of limited income prefer such seats and, therefore, the gallery is usually made up entirely of really music-loving Italians.

Suppose that all you had to do was to step to the telephone at 8.30 in the evening, no matter if you lived in New York or anywhere else in the country, and immediately had the whole room filled with Caruso's voice. Would this not appeal to you, providing of course that you were musically inclined? All this is now possible, and, we believe, will shortly come about. While of course the idea itself is nothing new—it having been tried thirty years ago to transmit music in this manner,—there was one great technical difficulty at that time which only during the past two years has been overcome.

While it is a comparatively simple thing to place sensitive microphones about the stage and on the other end of the line connect a loud speaking telephone in order to listen to the transmitted music, it is quite a different problem to connect say *twenty or forty thousand* subscribers' lines to these microphones and then reproduce the music at the end of *all* these thousands of circuits. The reason is that heretofore we had no satisfactory instrument whereby the

(*Continued on page* 924)



Copyright, 1919, by E. P. Co.

Due to the Invention of the Audion, It Is Now Feasible From a Technical Standpoint to Connect to One Stage As Many As Fifty Thousand Telephone Subscribers, All of Which Can Listen Simultaneously to Our Great Opera Stars. The Invention of the Loud Talking Telephone Also Has Made It Possible for the Entire Family to Hear the Music As Pictured Above.

www.americanradiohistory.com

New York to Chicago Via the Air in Twelve Hours

"AIRLINE TICKET for Chicago, Please." "Yes, sir; five hundred and twenty dollars. Please. The next 'liner' leaves in half an hour for Chicago and way stations," replied the ticket agent of the *Trans-Continental Airline Company* on a bright June morning in the year 1919. At least that is a fair sample of the conversation we may find quite common in a few months or so, if the plans of one of the largest aërial transportation organizations materialize in any such manner as their originators predict. Complete arrangements for the construction and operation of a line of passenger carrying dirigibles between New York and Chicago at an initial charge of sixty-five cents a mile for each passenger have been made by J. M. McElroy, chief engineer of the Sturtevant Aeroplane Company, of Boston, in collaboration with Noble Foss, one of the officials of the corporation and a son of former Governor Foss, of Massachusetts.

Announcement of the big undertaking was made recently by the Massachusetts Aircraft Association, which held its annual aeronautical exposition at Madison Square Garden and the Sixty-ninth Regiment Armory from March 1 to 15, inclusive, in co-operation with the War and Navy Departments.

It is proposed to form a company with four dirigibles and two main terminals, one at New York, the other at Chicago. The dirigibles are to be of the Zeppelin type, with rigid housing and multiple compartment structure. The U. S. War Department's wonderful new discovery, Helium gas, will be used, thus removing the danger of fire. The airship will be 425 feet in length and forty-five feet in diameter. Its engines will have a horsepower of 1,200. The bag will have a capacity of 650,000 cubic feet of gas, providing a gross lifting power of twenty tons at sea level. This would mean a practical net lift of ten tons.

It is estimated by Mr. McElroy that a speed of seventy miles an hour can be maintained and that the trip from New York to Chicago could be made in comfort in less than twelve hours.

"The cost per mile, roughly speaking," says Mr. McElroy, "would approach sixty-five cents per passenger, or $520 for the entire trip in either direction. There is no doubt but that after the line is run for some time, it will be possible to cut down the rate considerably."

Each dirigible will have accommodations for twenty-five passengers. The power plant will consist of two engines, side by side, driving thru gears a central stub shaft mounting a variable pitch air screw. Balance and altitude will be adjusted by expansion or compression of the gas.

The crew will consist of the captain, navigator, chief and two assistant engineers, wireless operators, steward, cook, waiter and maid.

In regard to the landing places, which with dirigibles is a great problem, Mr. McElroy says:

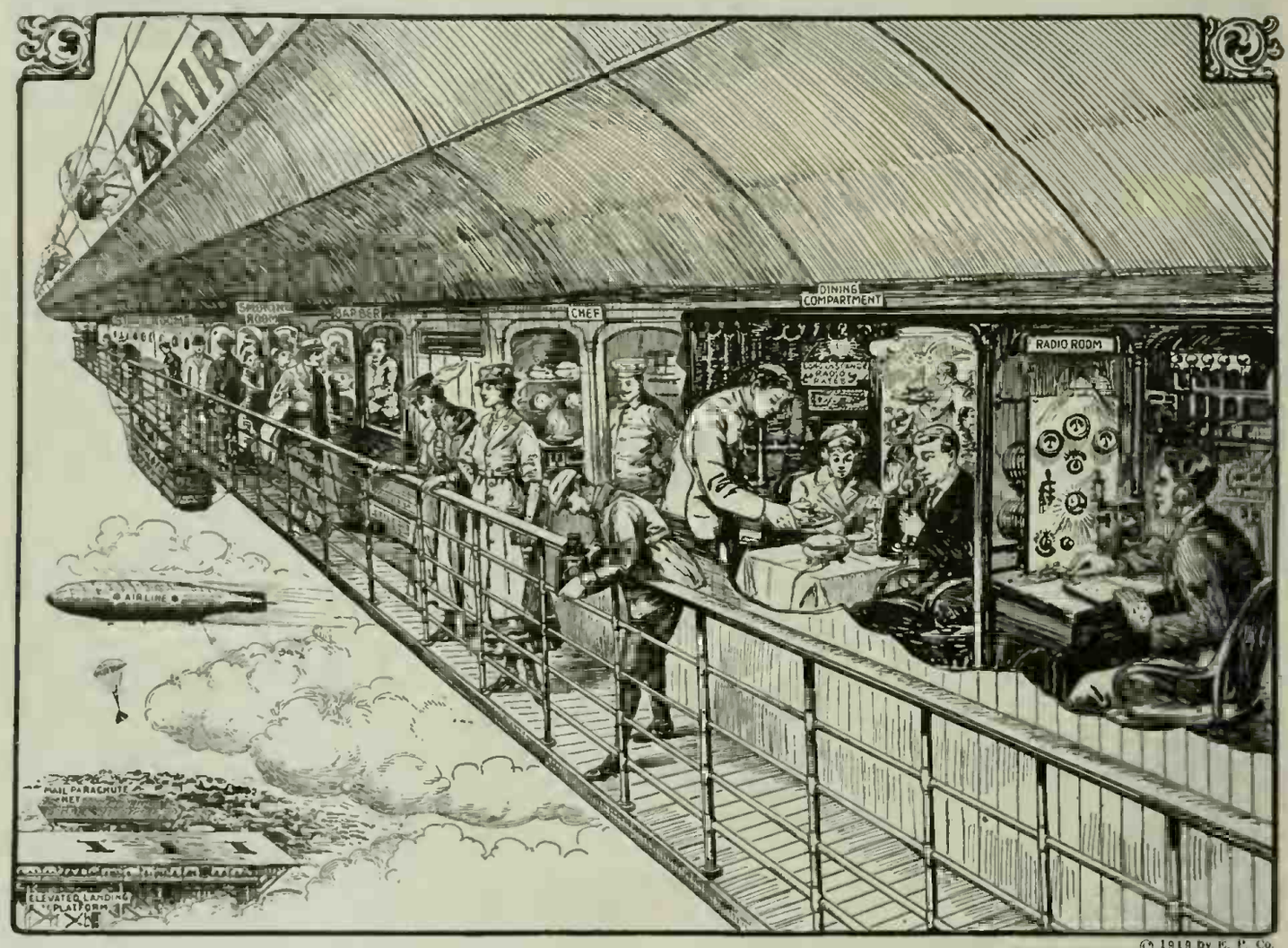
"It is reasonable to believe that hill walled landing zones could be located, or natural depressions in the earth could be enlarged to offer breakairs to permit the air liner to come down safely. The terminals at either end of the New York-Chicago route could be floating piers secured at one end, so as to swing with the wind to permit easy housing of the ship."

With regard to the possibility of trans-Atlantic flight, Mr. McElroy says:

"When we have put the New York-Chicago route into successful operation then it is time to throw a line across the pond and do a real job."

Apropos of transcontinental aërial transportation we find much food for thought in a speech recently made by Allan R. Hawley, president of the Aero Club of America, before the National Rivers and Harbors Congress, at Washington, D. C., on

(*Continued on page* 915)



© 1919 by E. P. Co.

Regular Air Line Passenger and Freight Transportation Between the Larger Cities, Particularly New York and Chicago, Promises to Become an Accomplisht Fact This Spring. A Company Has Already Been Formed to Develop and Promote This Project. All the Usual Conveniences Will Be Available to Passengers, Besides Wireless Communication, Mail Service, Sleeping Quarters and Aerial Promenade, Not to Mention the Most Wonderful Scenery ever Presented to Alpine Tourists, for These Giant Airships Will Fly Right over the Mountains.

www.americanradiohistory.com

Guiding Airships With the "Radio Barrage"

Invisible Walls of the Ether

By DR. LEE de FOREST

JUST at this time, when our army and navy officials, and many airplane builders, are taking steps for the commercial development of the airplane and dirigible, along industrial and governmental lines, is it not practicable, as well as advisable for radio inventors and engineers, as well as others concerned, to give thought to those essential safety devices which come within the scope of radio-communication and control?

I venture to say that if there was any one device used in the European war which contributed to the success of the Allies in their supremacy of the air, it was radio-communication, both telephone and telegraph. By means of it the fighters in the air were at all times able to talk and signal with their commanding officers at headquarters, and after a personal examination of the various kinds of apparatus used by the different countries, all of which pay high tribute to American genius, I feel I am fully justified in predicting an even greater use of radio control and communication for peace purposes.

One of the first questions to be taken up, it seems to me, when we have reached the point of regular passenger and freight traffic by air, is that of proper warning to pilots in case of fog, cloud or other interferences. Will it not be necessary, for example, to establish a regular "traffic squad of the air," for those cities in the principal lines of communication? The use of the human voice in sounding a warning, without wires, is already an accomplished fact; at Point Judith Light, where the *Radiophore*, at regular intervals, calls out to the ship operator: "Point Judith Light," and then in a weaker voice: "You are getting closer—Keep off."

By means of a number of wireless stations placed around any given city, why cannot we do likewise in the matter of our radio traffic squad of the air? So that when a pilot comes within range, he would receive a message such as the following:

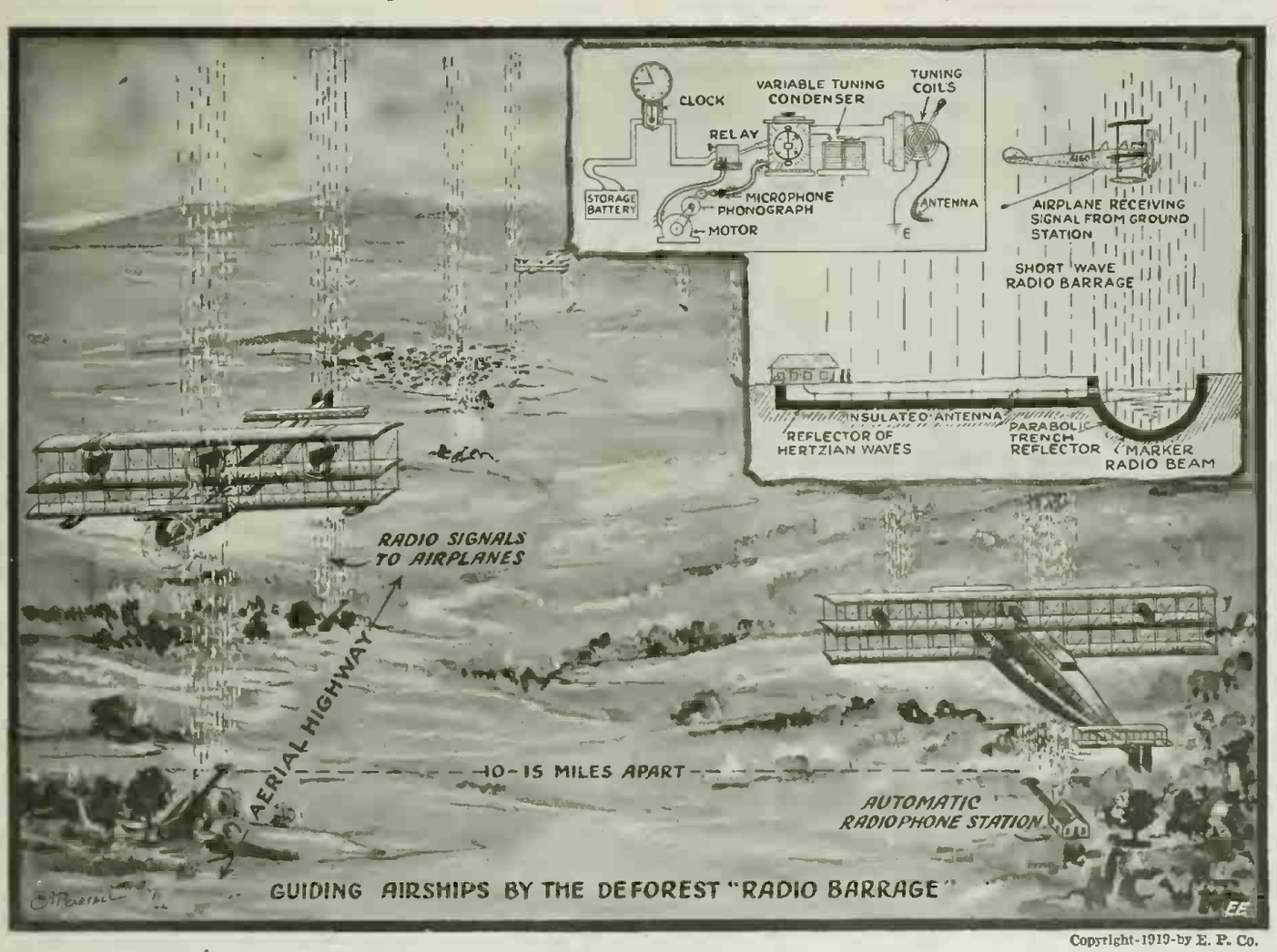
"Buffalo Office—Turn West by South, and Pick up Cleveland," or again such warnings as, for example, it will be necessary to inform the pilot of weather changes: "Weather Warning—Your are nearing a storm area—Cyclone Ahead," etc., etc.

There should be, no doubt, a continual "radio barrage," or zone of automatic warnings thru which airplanes must pass in approaching regions where air traffic is dense; namely, around landing stations, and especially so near steep mountain ranges and peaks, or cities like New York, with extraordinarily tall buildings with consequent air pockets.

By arrangement of antenna or reflectors not unlike those used behind large searchlights, a beam, or narrow zone of wireless waves, invisible to the eye of course, could be set up. This would necessitate the use of very short wave lengths, of only a few meters, far shorter than the wave lengths used today in radio-communication. This feature would also have the advantage that these short wave lengths would not interfere at all with existing radio-communication. All this short wave vertical radiation would be controlled by the automatically repeating phonograph, similar to the *Radiophore* arrangement at Point Judith Light.

The pilot of the airplane, his 'phone clamped to his head in the helmet, would hear these safety signals as he flies thru these invisible walls of etheric warning, in ample time to govern his course accordingly.

With the mastery of the air for governmental, and for commercial purposes, already at hand, certainly the question of radio control, and of traffic regulation, is of prime importance, worthy of the immediate interest, and of the best thought in the radio world.



Copyright-1919-by E. P. Co.

The Airships of Tomorrow Will be Guided by Wireless Telephone Signals, Possibly Arranged in "Barrages" or Walls, as Here Illustrated. This is the Only Feasible Way of Signaling Location and Weather Data to Aërial Craft in Stormy and Especially Foggy Weather. Prof. Walter I. Schlichter, of Columbia University, Has Also Recently Advocated the Use of Powerful Wireless Signaling Stations for Guiding Trans-Atlantic Seaplanes in Their Proposed Trips Across the Ocean.

www.americanradiohistory.com

How Electricity Serves World's Largest Hotels

Do you know that the two largest hotels in the world have just opened in New York City, each one with over 2,000 guest rooms and a bath in every room? One of these hotels has, among other startling new features, an electric automobile elevator, which carries the guests' motor cars up to the grand ball room floor, so that milady and her escort do not have to pass thru any chilling winds when arriving at the hotel. These hotels are veritable cities in themselves, and either of them has more telephones than the entire nation of Greece. One hotel has the largest electric laundry in the world, not to mention the gigantic dining rooms, ball rooms, kitchens, swimming pools, children's open-air playgrounds, and a whole regiment of employees.

By H. WINFIELD SECOR

THE two largest hotels in the world recently opened in New York City, one, the "Hotel Pennsylvania," opposite the Pennsylvania Railroad Terminal at 33rd Street and 7th Avenue, and the other, the "Hotel Commodore," located adjacent to the Grand Central Terminal, and built directly over both the Queensboro and Lexington Avenue subways. There are so many hundreds of innovations and conveniences which have been developed and applied to these—the last word in Hoteldom—that one can hardly judge of the undoubted value of all of these important and elaborate appointments without having actually visited such an establishment in person. Take, for example, the gigantic proportions of the Hotel Pennsylvania with its 2,200 rooms and bath. This hotel can accommodate 3,500 registered guests with rooms, not to mention several dozen additional small-town populations, which it can easily entertain in the grand ball room and its six well appointed restaurants, also numerous private banquet rooms and private dining rooms, not forgetting the roof garden, which is one of the most beautiful and perhaps the largest in the world, Besides a capacity of 3,500 guests with rooms, 3,000 additional guests may be entertained in the several restaurants including the roof garden, or the total capacity of 6,500 guests, which is a respectable little city all by itself.

If you haven't already visited one of these magnificent and beautifully appointed 20th century hotels, you will probably wish to know what conveniences are provided for the guest, and with that very object in mind, the writer paid a special visit to these establishments and enjoyed an afternoon off from the editorial rub-dub, amid the flowering palms and the aroma of one dollar Havana perfectos arising from the "loungees" reclining luxuriously on the thousand dollar leather settees, which grace the main lobby. This wonderful lobby is furnished in handsome imported marble and is lighted by reflected beams passing thru a richly designed leaded glass ceiling. Both the Hotel Pennsylvania as well as the Hotel Commodore have the same transit facilities, i.e., both have subway as well as railroad service, the one the Pennsylvania Railroad, and the other New York Central Lines. There are underground passageways in either case leading from the railroad terminals directly into the hotels, and special elevators for this service to carry the guests to the floor of the main lobby or vestibule. If one arrives by subway from up or downtown New York, he finds the same conveniences awaiting him, and is whisked from the subterranean passageway to the splendor of the main lobby by elevator, which is operated by young women nattily attired in spic and span uniforms. There is even a woman "elevator starter"—and speaking of elevators, the Hotel Pennsylvania boasts of a total of 27. In the following description of the hotel features, as the writer found them, the Hotel Pennsylvania is inferred, except where otherwise mentioned.

On arriving on the floor of the main lobby, which is certainly a magnificent piece of architecture, one finds that the principal and most important conveniences of the hotel are at once available. Among other appointments immediately accessible and available from the lobby are the main Dining Room, the Palm Room, used for afternoon teas, etc., the men's café, the men's bar, the grill room, and in the basement the most attractive barber shop imaginable, resplendent in handsome tile and marble with leather lounges, and adjacent to these the handsomest array of lady manicurists ever seen this side of Paris. While dining in the grill room, you may, if you wish, have a one-step or *two* with your guest on the highly polished dancing floor in the center of the room, while the Original Dixy Jazz Band turns loose the jazziest jazz you ever shook a foot to. Considering for the moment that some rainy afternoon you might happen to pop in at the "Pennsylvania" from the water-proof subway, and that you might find at arriving in the royally appointed lobby that your capital was limited to the large sum of 15c, due perhaps to the efficient activities of an unknown pickpocket on your ride up to the hotel, you can still enjoy yourself ostentatiously by repairing to the basement floor, where there is a "Quick Lunch Restaurant," which will accommodate several hundred guests, who may for one reason or another wish to enjoy a 15c or 25c meal. That is what you call real service, and both of these hotels are out for service with a capital "S," first, last and always. Later, when you are assigned to the guests' floors and see the layout of the rooms, you will find that these hotels undoubtedly count on a heavy, transient traffic, the suites in most cases consisting of from one to three rooms and a bath.

The lower part of the hotel is well shown in the accompanying illustration, and of course there are many rooms and conveniences not shown for obvious reasons, owing to their location on other parts of the mezzanine floors, et cetera, which cannot be brought out in the limited size of our illustration. The mezzanine floors, just above the main or street floors, contain the private offices, and also there are sleeping and living quarters on these floors for the employees. On the first mezzanine floor there are exhibition rooms for business purposes, and on the second and third mezzanines dining rooms for the employees. On the third mezzanine we find the "Grand Ball Room," which is most beautifully decorated in pleasing colors which do not jar or irritate the eye as do some of these large public rooms in similar establishments. The general decorative scheme thruout the hotel, it may be said, is one of good taste and extremely homelike. The service is carefully worked out to give this feeling at every turn.

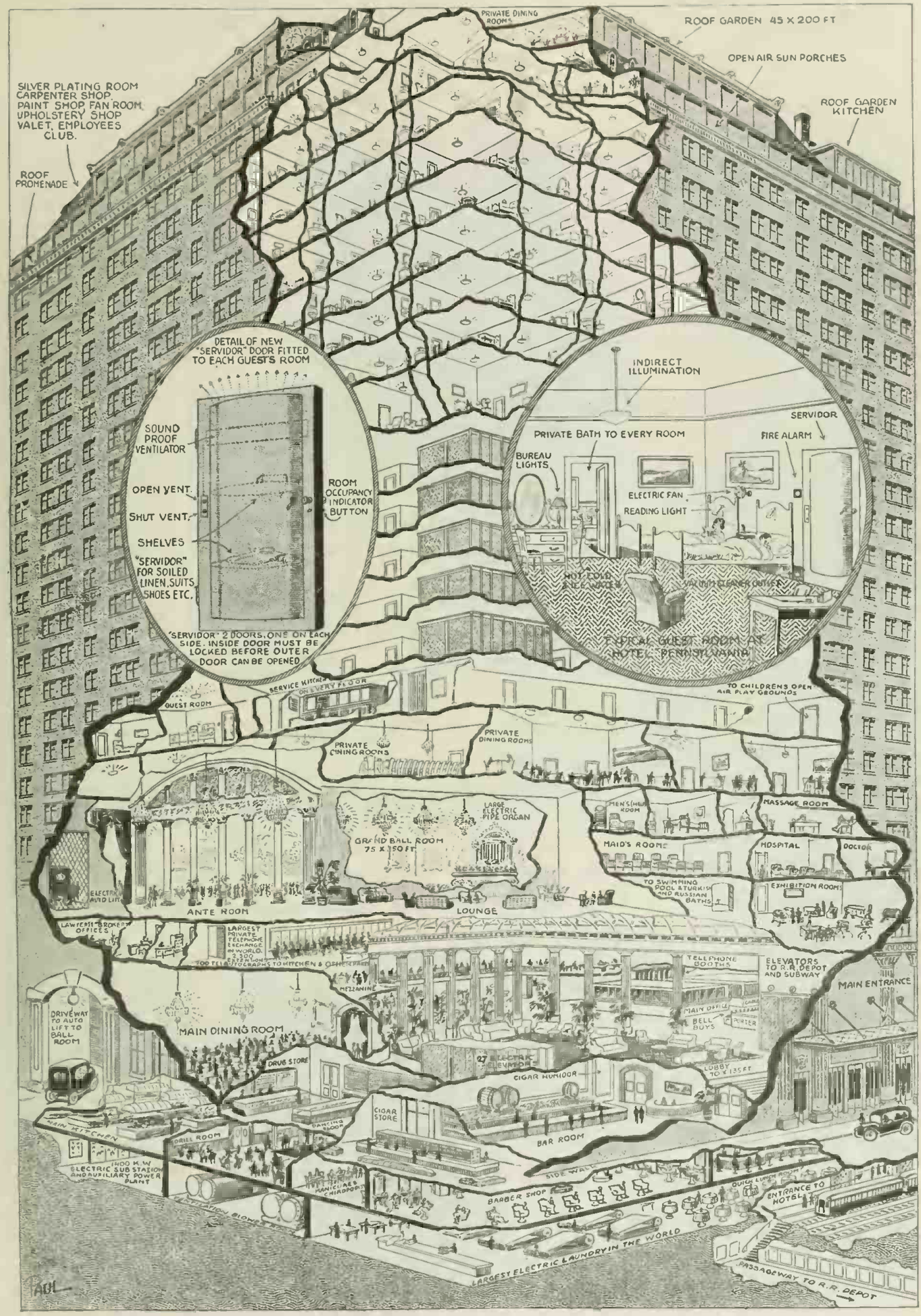
The largest private telephone exchange extant, with capacity for 3,340 extensions, 260 trunk lines and 23 operators is connected to the various rooms and other parts of the hotel, and this is located on the second mezzanine floor.

In the telephone exchange are also located a large battery of "Telautographs"—the electric machines that write—and both of these recently opened hotels have been very lavish in their telautograph equipment. The Hotel Pennsylvania has at present some 200 telautographs, and more will undoubtedly be added later as demands require them. The telautograph equipment at this hostelry has been very carefully worked out by skilled engineers, and it undoubtedly is one of the best that the writer has ever seen put into operation. More will be said with reference to the telautograph system anon, and for the present it will be of interest to the reader to note what happens when a guest is to be paged. In most hotels, at least in the smaller hotels, a guest is not paged except in the main lobby and dining room, but at the "Pennsylvania", when an outside party or a guest calls up the telephone exchange, and the operator writes down the name of the person who is wanted, the following operations ensue: the telephone operator,—(and they are all good looking, take it from your Uncle Dudley, for he had the good luck to actually visit this "holy of holies", past the door of which no man may enter, excepting that he has a pass signed by the powers that be in the telephone world),—proceeds to write the name on the *transmitting* platen of her telautograph, there being a telautograph for each of the 23 telephone operators, and simultaneously the written name appears in the main dining room, grill, bar, roof garden and the office, as well as at the bell captain's office in the main lobby, so that when the name is called out by one of the bellhops in your vicinity, you can rest assured that the same name is being called simultaneously in about ten other parts of the building. This of course, serves two purposes; it promotes speed in locating the guest, which is sometimes a very important factor, and also owing to the multiplicity of the system, it renders trebly certain the locating of the desired party, which would not be the case under ordinary conditions.

The total amount of electric power, not to mention the steam used for heating, is truly enormous in a building of this size, which covers a whole city block, and while talking to the chief engineer of the building, it was ascertained that the total light and power load for the hotel would require as much as 1400 K.W. or about 1900 horsepower. Electricity is used in a general way for many purposes and important operations conducive to the efficient operation of the hotel, which the average guest never sees or even dreams of. For instance, how do you suppose the ventilation of such a large hotel as this is taken care of? The chief engineer answers this question by taking you down to the sub-basement two stories underground, where you see one of the largest electric motor-driven blower rooms in the world, covering a quarter of a square city block. Here dozen of powerful electric motors rated at anywhere from 25 to 50 horse-power each, drive gigantic blowers or fans, each of which is connected up with certain air ducts leading to various parts of the building. Thru these ducts, air is pumped which promotes the proper circulation thru the hallways, and the rooms of the building. Neither of these monster hotels has a large power plant of its

(*Continued on page* 915)

www.americanradiohistory.com



FULL STORY OF THIS LATEST NEW YORK HOTEL—A VERITABLE CITY IN ITSELF—ON OPPOSITE PAGE.

www.americanradiohistory.com

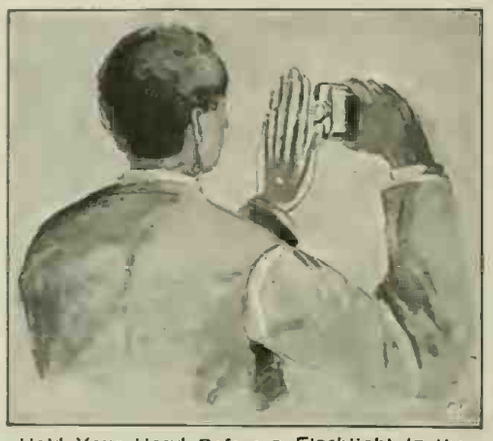
Seeing Thru You Without X-Rays

The New Shadow Photography

By BATTELL LOOMIS

WHAT of the infra-red ray in photography? Is its penetrative power the equivalent of the ultra-violet, or actuating principle of the X-ray? Has Dr. Paull S. Hunter, former State Secretary of Health for Colorado, and hailing from the city of Denver, stumbled on something he didn't know and doesn't know yet, in looking for something he had guest? That is a question it may take time and development to answer, but which the writer is content only to raise by way of introduction to a story which has its element of humor because tho it relates a serious discovery, worth thousands of dollars to society at large, the discovery will not realize its discoverer one penny. In which it is not unlike many other important scientific discoveries.

One night Dr. Hunter was waiting for a car. He held a flashlight in his hand, and covering the ray, was attracted by the marked red glow of his flesh. He noted the dim shadows of the bones in his fingers. "Hm," said he, "the red rays come thru. If the rays were more vivid, the shadow of the bones would be sharper. I can intensify them and I'll bet I can photograph that."



Hold Your Hand Before a Flashlight In the Dark—You Can See the Bone Outlines Dimly. This Is the Basis of the New X-Ray-ess Bone Photography Here Described.

The idea took hold. The doctor was a user of the X-ray, but he found it easier in ordinary practise to bring a patient to the ray than to take the weighty apparatus with its cells and coils to the patient. What a boon to the country doctor it would be if he could make a fracture diagnosis with an ordinary camera! The X-ray is of value only to the rich and the very poor who receive free treatment. The middle class must pay more than it can afford or go without.

So Dr. Hunter seized the first opportunity to lay his hand on a naked *panchromatic* photo plate and expose it to the electric light for a moment. He secured a picture of his bones with his first try. It was not very sharp, but it was a good beginning. He reasoned it out: "It wants only a concentrated *light from a point* to cast a clearer shadow. This ray must go thru a camera which protects the plate from random rays and I have a good bone picture," he argued.

Accordingly he employed his mechanical knack to construct a black box with an opening at one end large enough to receive his hand or foot. See illustration of the apparatus used by Dr. Hunter, herewith. He made it collapsible so it would fit in a physician's grip. He fitted an iris diafram in the top of his box and fastened a plate-holder on the bottom with a developing box beneath that, into which the plate might fall the instant of its exposure, for speedy developing. He then secured a Wratten F or extreme red ray filter and placed it above his lenseless shutter and diafram. He placed his hand over the plate, tied a black cloth at the open end about his elbow, turned on the electric light, removed the slide from the plate-holder, and squeezed his bulb for a half second exposure. The result was the excellent bone picture shown herewith.

This picture was *taken entirely with a filtered light*—the light that passes most easily of all visible light, thru blood. The discoverer has made nothing new except his camera, which is not essential to success He has merely combined a stock Eastman panchromatic photo plate brushed with eosin solution to intensify its sensitiveness, with an F ray filter and a fine point of light to do simply what Röntgen earned his fame for doing in a more roundabout and costly way. He has made a discovery which he prophesies every schoolboy will at once begin to play with, and every doctor to use in his business.

And he has given his discovery freely to the world. He does not intend to secure patents either on his combination of materials or on his novel folding camera, which may be made in any size and open at both ends to fit different portions of the limbs. Whether the rays will penetrate the trunk for abdominal and intercostal examinations he does not know from practise, altho from theory he contends they might be made to do so by improved technique, such as a more intense ray of light and a more sensitive plate.

Further Dr. Hunter has to say:

"My claim is apt with a box fitted out in this manner and a box of panchromatic plates a physician can tell whether a broken arm is set right before leaving the house, and that it will undoubtedly be used all over the country for that purpose.

"The machine can be improved by using a roll of film if the manufacturers would make it, and so do away with glass plates; the developing tank at the bottom would be adapted to films. The whole outfit is, moreover, made to fold up flat and occupy very little space.

"These pictures could also be made with a camera using a powerful arc lamp to throw the rays thru the human body, and if plates could be made sensitive enough, pictures of the heart's action could be made on celluloid rolls, giving moving pictures of the heart action and other organs of the body. So far I have only used it for extremity work and it has proved very satisfactory; in fact, the first pictures are as good if not better than the first ones made by the X-ray.

"I give the idea to the world with the hope that someone will further develop its usefulness and by improved design and more sensitive plates be able to make pictures as well with this $2.00 outfit as with a $1.000 X-ray machine."

IF you are old enough, you will probably remember the time when the X-ray was first announced. We all thought it one of the most marvelous inventions ever conceived by the human mind, and so it was indeed. But now Dr. Paull S. Hunter announces a strikingly simple way to perform the same experiment which Dr. Röntgen performed in a very difficult, roundabout way. Where Prof. Röntgen used a complicated electrical apparatus in order to take shadowgraphs of the human body, Dr. Hunter uses nothing but plain light rays. There is no doubt in our minds that if sufficiently powerful light rays are used in connection with a heat filter in order that the patient does not sustain burns, it should become possible in the near future for physicians to actually see every bone in the human body. Not only this, but we predict that by using certain color rays, it should be possible to bring out every organ in the human body as well, such as heart, liver, blood vessels, etc., which are now very difficult of observation by the X-ray.

Our front cover shows what is already possible today if you will drape the human body in such a way as to cut off all the direct glare, and then by exposing strong electric arc-lights from behind, it becomes possible to see the bones of the body clearly. Dr. Hunter, who is an American physician, deserves great credit for bringing about this extraordinary result, as simple as it is efficient. The accompanying article explains the system and methods fully.

EDITOR.

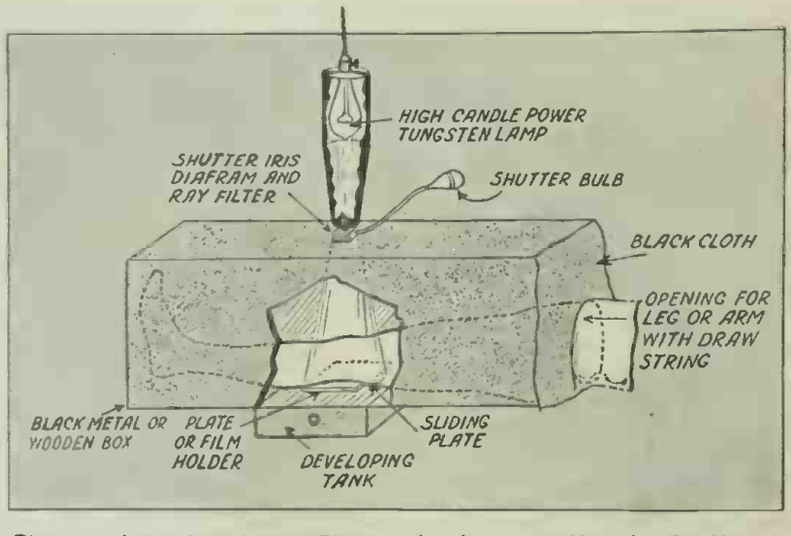


Diagram of the Actual Bone-Photography Apparatus Used by Dr. Hunter in Successfully Photographing the Bones of the Limbs.

www.americanradiohistory.com

The front cover picture, showing the bone structure of a woman, gives us a clear idea of how the full figure would appear, using of course, a sufficiently strong light source, such as an arc lamp. A frisket or template would be cut out to just fit the outer contour of the body, thus giving the maximum X-raying power available in any case. The fleshy portions of the body would appear red just as our artist has shown them, in contradistinction to the usual X-ray image observed in a fluoroscope, where the outline of the flesh is just discernible. It would seem that this new direct light system of bone photography would be much less harmful to the patient, as the X-rays exert a detrimental effect when applied in reasonably large dosages, and in some cases cause growths and burns which are incurable.



Actual Bone Picture of the Hand Taken by the Inventor of the New System of X-Ray-less Bone Photography—Dr. Paull S. Hunter, with a Strong Electric Light, a Red Ray Filter and a Photographic Plate.

WAR ACHIEVEMENTS OF U. S. SIGNAL CORPS.

When the American forces came to France "communication" was one of the first efforts to which American ingenuity and invention was directed and the Signal Corps, under which communications fall, met it as have the organizations of the American Expeditionary Force. Existing French telegraph and telephone systems were overburdened. There was little left for Uncle Sam and Brig. Gen. E. Russell, chief signal officer, and his staff of experts tackled the job.

What they have done in construction is shown in the following statistics: The Signal Corps has built approximately 1,750 miles of poles on which it has strung 4,175 miles of wire. In addition about 2,000 miles of American wire has been strung on existing systems for our use, and it has leased and operates more than 3,000 miles of French wire. Exchange lines to the extent of 12,750 miles have been built, and to operate these lines it has 244 stations, and 102 telegraph offices.

The long-distance telegraph and telephone system constructed by the Signal Corps is entirely maintained by its own personnel, and in addition some 3,000 miles of leased wires are maintained by it.

All this construction has been made by Signal Corps battalions with implements and material from the United States, with the single exception of poles, most of which were obtained in France.

THE JOHN FRITZ MEDAL FOR GENERAL GOETHALS.

The John Fritz Medal Board of Award, composed of representatives of the National Societies of Civil, Mining, Mechanical and Electrical Engineers, held their annual meeting for 1919 at the Engineers' Club, January 17, and awarded their gold medal to George W. Goethals, the builder of the Panama Canal.

The medal has previously been awarded to Lord Kelvin, George Westinghouse, Alexander Graham Bell, Thomas A. Edison, Charles T. Porter, Alfred Noble, Sir William Henry White, Robert W. Hunt, John Edson Sweet, James Douglas, Elihu Thomson, Henry M. Howe and J. Waldo Smith.

Col. John J. Carty, now in France, has been Chairman of the Board, but in his absence Ambrose Swasey, of Cleveland, presided.

George H. Pegram has been elected Chairman for 1919 and W. F. M. Goss, Treasurer, in place of Prof. F. R. Hutton, who died during the year.

NEW MARCONI INVENTION EXPLAINED.

A joint meeting of the Institute of Radio Engineers and the New York Electrical Society was held on Wednesday evening, March 5, at the Engineering Societies Building, at which Roy A. Weagant, chief engineer of the Marconi Wireless Telegraph Company of America, read a paper on "Reception thru Strays and Interference."

The recent announcement of Mr. Weagant's discoveries and inventions in connection with wireless telegraphy created wide sensation.

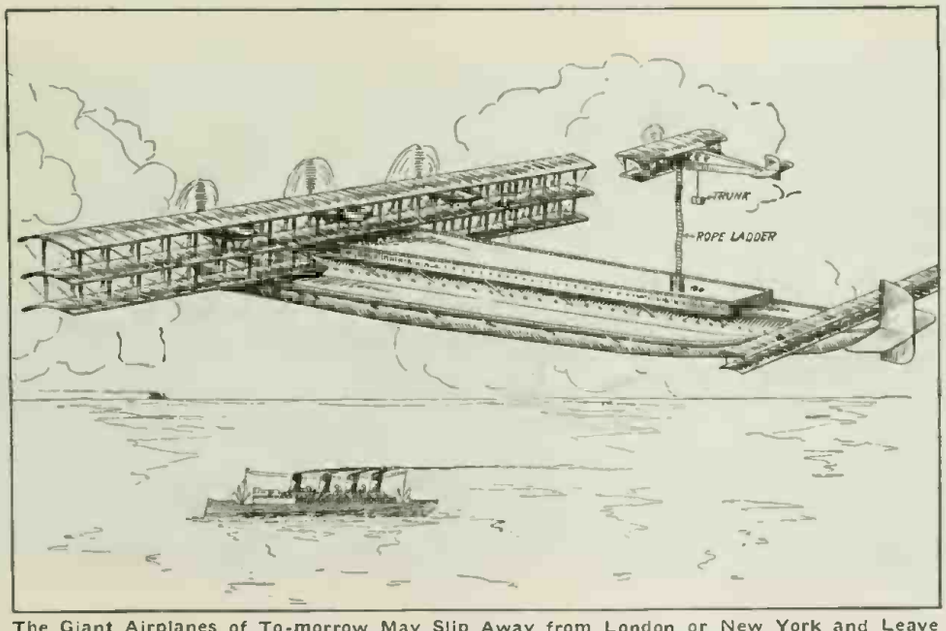
THE AERIAL PASSENGER LEFT BEHIND.

WE all know of the taxicab clattering down the street at breakneck speed with the belated passenger making a bee-line for the dock and just arriving in time to see the gang plank pulled in and missing the Liverpool steamer. But the American business man, nothing daunted, by such a trivial occurrence promptly charters a fast harbor boat and races the steamer down the bay, overtakes it and is hoisted up to the deck in time for lunch.

A few years from now humanity probably will not have changed much, and we will still have with us the late passenger, only this time he will not race down to the dock but up a 30-or 40-story elevator trying to catch the Trans-Atlantic Flier, but just in time to see the big bird "take the air."

Will the American business man of 1925 bewail his lot and return dejectedly to his home? Not if he can help it! He will signal a passing *taxiplane* which will come down on the huge platform which a few minutes ago harbored the great Trans-Atlantic flier. Twenty minutes later, the fast little *airliner* will have overtaken the big air monster and after depositing the belated passenger on the upper deck of the European bound flier,—not to forget the violent language of our businessman who thinks he has been overcharged by the modern bandit of the air,—he will go to his deck chair and begin perusing the latest edition of the ELECTRICAL EXPERIMENTER.

While the taxiplane might land directly on the big European-bound flyer, such a method might be more or less fraught with danger. Mr. H. Gernsback suggests that the transfer of the passenger might be accomplished much easier, as shown in our illustration. The taxiplane would fly about twenty feet above the deck of the big flyer, in the same direction of course, *and also at the same speed* as that of the large machine. The passenger could then descend from a rope ladder and drop to the deck with ease, as well as without danger.



The Giant Airplanes of To-morrow May Slip Away from London or New York and Leave You Behind. Then What Would You do? Easy—Board a "Taxiplane" and Chase the "Skyhound" Down the Bay.

YOU CAN WHITTLE THIS IRON.

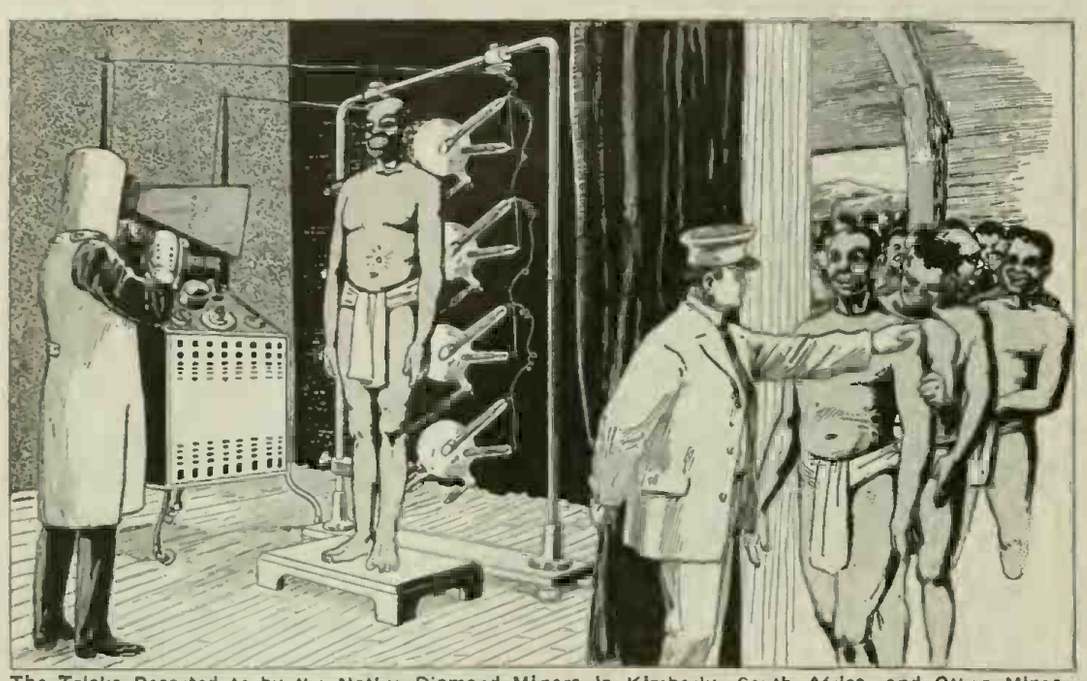
It is well known that rapid cooling of hot metals hardens them. That the opposite is true has recently been demonstrated in striking fashion by the General Electric Co. One of their scientists annealed American ingot iron surrounded by hydrogen gas for three hours at a temperature above 1,600° F. The product was very little harder than the softest copper, and could be whittled with a jack knife.

One of the largest electric plants in the world is being planned to supply power for nearly all the mines at Johannesburg, South Africa.

www.americanradiohistory.com

Locating Stolen Diamonds by X-Rays

Possibly you will remember having read from time to time of the remarkable tricks resorted to by the native diamond miners in the great Kimberly diamond region in South Africa and other parts of the world. So great has the temptation often become to steal diamonds, especially when an extra large one may have been suddenly unearthed, that these natives have been known to resort to the most unbelievable tactics in order to carry the diamonds out of the mine and to withstand inspection even when stript, as practically all of them are, before they leave the mine at the end of the day's labor.



The Tricks Resorted to by the Native Diamond Miners in Kimberly, South Africa, and Other Mines, Pass All Human Belief and Imagination at Times. Cases Have Been Known Where the Lucky Finder of a Particularly Fine Specimen Even Swallowed the Stone, Intending Presumably to Regain the Diamond Later. In Some Instances Diamonds Have Been Secreted in Self-Inflicted Wounds or Incisions in the Leg. But the X-Ray Spoiled All These Clever Ruses as Soon as It Was Adopted for Examining the Miners Every Day, Before They left the Mines. The Eye of the X-Ray Sees All.

One of the successful schemes which has been worked out by the superintendent of a large South African diamond mine is shown in the accompanying illustration, and it involves the use of a powerful X-ray machine having several X-ray bulbs excited simultaneously. As each miner passes before the X-ray bulbs, the examiner looks thru his fluoroscope and rapidly swings it up and down, so as to take in the entire body in a few seconds. This system of detecting the presence of a diamond, no matter whether it is buried in the flesh, resting in a throat cavity, or even in the stomach—an almost unbelievable practise resorted to in several instances on record—the X-ray examination quickly indicates the presence of the diamond.

Of course, the logical question that arises is—How can the X-ray detect the presence of a diamond inside of the body; especially when it may be temporarily lodged by the clever thief in proximity to large or fairly large bone structures, which would seem to preclude any possibility of detecting the precious stone? However, a perusal of a table showing the various transparencies of different materials under the X-ray will give the solution to the problem. It has been found that the diamond has a different transparency than any ordinary materials, including the bone and flesh of the body, which might happen to be in proximity to it at the time of such an X-ray examination. Also the diamond is a most peculiar substance, and it has certain fluorescent properties which render the facility of its detection all the more possible under an examination by X-ray, as it has a tendency to fluoresce or glow slightly when under the influence of X-rays, which phenomenon is readily detected on a sensitive fluorscope or X-ray screen.

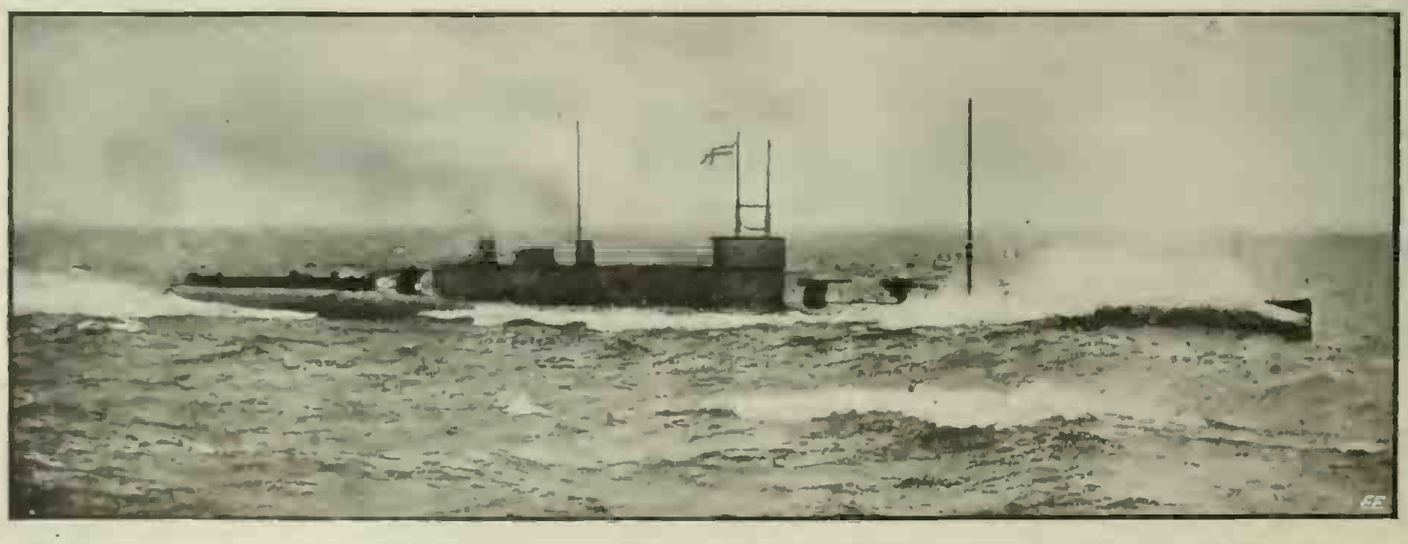
The X-ray machine here shown is connected to a battery of four powerful X-ray tubes of the latest Coolidge type, as otherwise if the tube had to be moved up and down behind the subject, considerable time would be lost in performing this operation, and where several hundred subjects have to be examined in a very short space of time, it can readily be imagined that such a device as here shown is imperative.

GIANT SUBMARINES HAVE 12-INCH GUNS AND STEAM PROPULSION.

We are now able to publish a photograph of one of the most jealously guarded secrets of the British Navy. While the Germans were boasting of the huge under-sea cruisers with which they proposed to gain the control of the seas, the British Admiralty were constructing submarines capable of matching the largest destroyers afloat and of fighting even cruisers in a surface contest.

The secret of these boats was their great size and speed and the fact that while on the surface they used steam as their propelling power, carrying two funnels like an ordinary surface warship. One photo shows a British "K" class, two funnel submarine "steaming" on the surface at sea. This is the largest class submarine produced by any nation and is 340 feet in length. It outclasses any U-boat built by Germany. Great Britain has a whole fleet of these sea terrors. Storage batteries and motors are used while running submerged.

The other photo shows a new British monitor submarine with a 12-inch gun, capable of giving battle to most any class of armed ship under favorable conditions. So far as known this is the first photograph to be received in this country showing Great Britain's combination of the U-boat and coast defense vessel. The 12-inch gun is the largest that was ever mounted on a submarine.



The Latest British Style in Submarines. It Is Capable of a Speed of 24 Knots on the Surface, When Propelled by Its Steam Power Plant. The Two Smoke Stacks Fold Down When the Submarine Submerges, and It Is Then Propelled by Storage Batteries Previously Charged While Running Awash. This Giant Craft Is 340 Feet in Length, and Is Armed with Three 4-Inch Guns, Two Forward and One Aft, as the Photo Shows. The Displacement of This Boat When Submerged Is 2,700 Tons and the Speed 10 Knots.

www.americanradiohistory.com

GERMAN RADIO FOR HOLLAND STATION.

Details of the giant wireless telegraph station to be erected in Holland by German interests for the purpose of facilitating communication between Holland and her East Indian possessions, according to a contract recently concluded between the Dutch Government and the Telefunken Company of Berlin, are found in a recent issue of Commerce Reports.

Paul L. Edwards, Commercial Attaché at The Hague, reports that the receiving station of the new plant, which is expected to cost about $2,000,000, will be at Boxmeer, in the Province of North Brabant, and the sending station will be located on a hill at Kootwijk, Province of Gelderland, near Apeldoorn, some thirty-five miles from the receiving station. The sending station will consist of six steel towers, each 200 meters (about 688 feet) in height. The *Radio-Nieuws* says that the Kootwijk sending station will have the same range as the German station at Nauen. The installation will be able easily to transmit to and receive from a station of like dimensions and capacity which is shortly to be built at Bandoeng, Java. The distance between the Kootwijk and the Bandoeng station is about 6,830 miles.

It is understood that an engineer representing the Telefunken Company is in Java with a view of supervising the construction of the station at Bandoeng. *De Nieuwe Courant* stated some time ago that all of the apparatus and raw material for the construction of the Bandoeng station were in Berlin ready for shipment at the first opportunity.

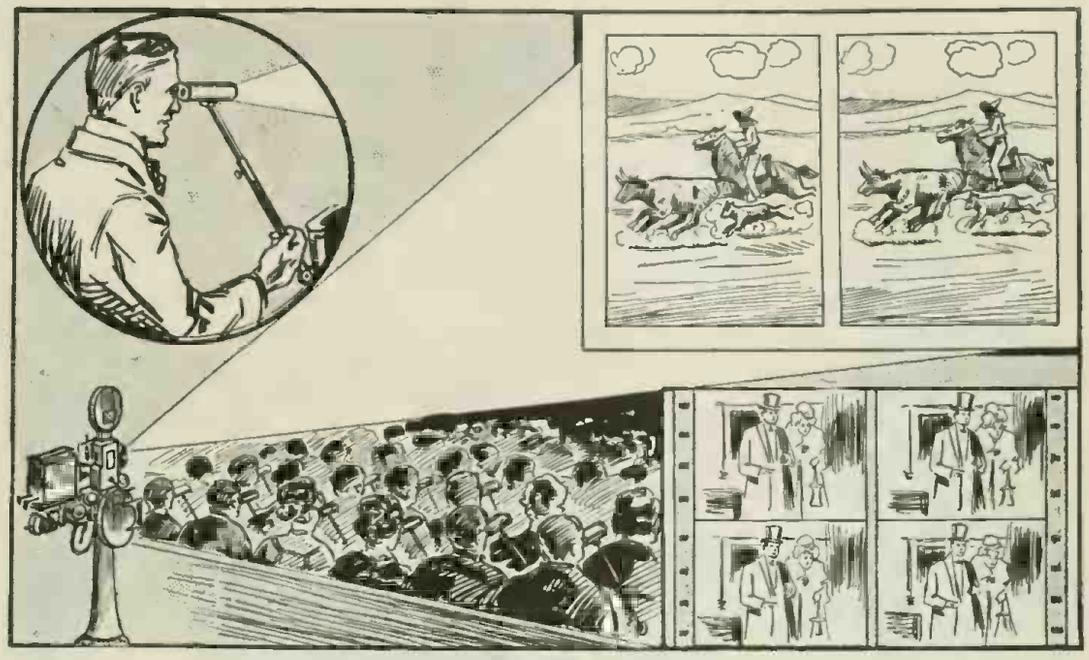
INSTRUMENT DISCOVERS COMING STORMS AT SEA.

A barocyclonometer, which locates the center of typhoons and other storms, and also indicates when they are due, and from what direction, has been invented by Father Jose Algue, director of the Manila Weather Bureau, and, according to Capt. A. W. Nelson, of the Pacific mail steamship *Ecuador*, is being used in safeguarding from storms numerous vessels plying in Chinese and Japanese waters.

Stereoscopic Movies

The accompanying illustration shows a possible later-day development of the present moving picture, which, altho it has been greatly perfected in the past few years, leaves considerable detail yet to be worked out. No matter how clear or flickerless a motion picture may be when viewed on the screen as projected by modern moving picture machines, it would still be one hundred per cent more perfect to our vision, if it could be thrown on the screen in duplicate or stereoscopic fashion in a similar manner to the parlor stereoscopes which we have all seen and used. Of course, if we ever do get to the stage of stereoscopic movies, then undoubtedly it will be necessary for the theater proprietor to provide or make readily accessible, by means of slot machines arranged on the back of the theater chairs, etc., a special small size stereoscope similar in appearance to a pair of opera glasses, thru which the duplicate moving images on the screen could be properly viewed and focust. These would of course be fitted with proper lenses for the purpose.

It might seem off-hand that this latter refinement would be unnecessary, but it is really one of the great marvels of science that causes us to see the images stand out, as it were, from the picture, when we look thru a stereoscope at the photographs or other views mounted in duplicate. The stereoscope operates on a very simple and yet peculiar physiological arrangement, based on the inter-action of the optical powers of the two eyes when they are focust on two properly made and similar images.



Of All the "Movie" Inventions That Have Past OurWay, We Have Yet to See Exploited, at Least Commercially, the "Stereoscopic Movie." If You Have Ever Used a Parlor Stereoscope Then You Will Appreciate What a Wonderful Improvement This Idea Would Make in the "Movie" Show, for Then the Figures Would Actually Stand Out in Relief. A Special "Stereoscope" Would Be Placed on Every Seat. Try This Experiment—Hold a Small White Card Vertically Between the Two Similar Views Here Shown, Move the Page Up and Down Until the Images Appear in Relief.

The names of the manufacturers of new devices and appliances in which readers are interested will be furnished free of charge by addressing our TECHNICAL INFORMATION BUREAU.



Here's the New British "Monitor-Submarine." It Sports a Dangerous Looking 12-Inch, 50-Ton Gun, Which Can be Traversed 6 Degrees. It Was Built for Bombarding the Forts at the Dardanelles Straits. This is the Famous "M-1," a 1,700-Ton Subsea Craft That Would Make Any Light Cruiser or Similar Warship, Not to Mention a Dozen or So Armed Merchantmen, Scratch as They Never Scratched Before. She Carries, Besides the 12-Inch Gun, Two Torpedo Tubes and an Anti-aircraft Gun, and Several Other Surprises Which Heinie Never Even Dreamed About.

www.americanradiohistory.com

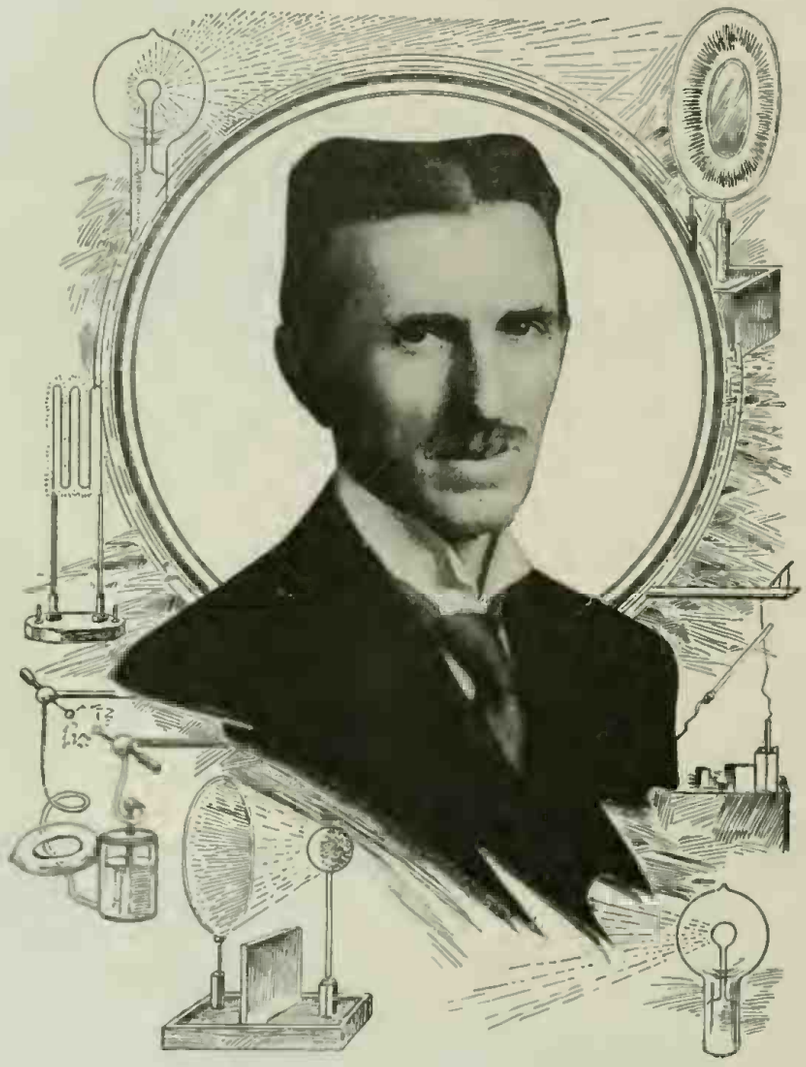
My Inventions

By Nikola Tesla

III. MY LATER ENDEAVORS

The Discovery of the Rotating Magnetic Field

AT the age of ten I entered the Real Gymnasium which was a new and fairly well equipt institution. In the department of physics were various models of classical scientific apparatus, electrical and mechanical. The demonstrations and experiments performed from time to time by the instructors fascinated me and were undoubtedly a powerful incentive to invention. I was also passionately fond of mathematical studies and often won the professor's praise for rapid calculation. This was due to my acquired facility of visualizing the figures and performing the operations, not in the usual intuitive manner, but as in actual life. Up to a certain degree of complexity it was absolutely the same to me whether I wrote the symbols on the board or conjured them before my mental vision. But free-hand drawing, to which many hours of the course were devoted, was an annoyance I could not endure. This was rather remarkable as most of the members of the family excelled in it. Perhaps my aversion was simply due to the predilection I found in undisturbed thought. Had it not been for a few exceptionally stupid boys, who could not do anything at all, my record would have been the worst. It was a serious handicap as under the then existing educational regime, drawing being obligatory, this deficiency threatened to spoil my whole career and my father had considerable trouble in railroading me from one class to another.



Nikola Tesla at 60. A Very Recent Portrait of the Great Inventor. An Excellent Likeness.

In the second year at that institution I became obsest with the idea of producing continuous motion thru steady air pressure. The pump incident, of which I have told, had set afire my youthful imagination and imprest me with the boundless possibilities of a vacuum. I grew frantic in my desire to harness this inexhaustible energy but for a long time I was groping in the dark. Finally, however, my endeavors crystallized in an invention which was to enable me to achieve what no other mortal ever attempted. Imagine a cylinder freely rotatable on two bearings and partly surrounded by a rectangular trough which fits it perfectly. The open side of the trough is closed by a partition so that the cylindrical segment within the enclosure divides the latter into two compartments entirely separated from each other by air-tight sliding joints. One of these compartments being sealed and once for all exhausted, the other remaining open, a perpetual rotation of the cylinder would result, at least, I thought so. A wooden model was constructed and fitted with infinite care and when I applied the pump on one side and actually observed that there was a tendency to turning, I was delirious with joy. Mechanical flight was the one thing I wanted to accomplish altho still under the disconraging recollection of a bad fall I sustained by jumping with an umbrella from the top of a building. Every day I used to transport myself thru the air to distant regions but could not understand just how I managed to do it. Now I had something concrete—a flying machine with nothing more than a rotating shaft, flapping wings, and—a vacuum of unlimited power! From that time on I made my daily aërial excursions in a vehicle of comfort and luxury as might have befitted King Solomon. It took years before I understood that the atmospheric pressure acted at right angles to the surface of the cylinder and that the slight rotary effort I observed was due to a leak. Tho this knowledge came gradually it gave me a painful shock.

I had hardly completed my course at the Real Gymnasium when I was prostrated with a dangerous illness or rather, a score of them, and my condition became so desperate that I was given up by physicians. During this period I was permitted to read constantly, obtaining books from the Public Library which had been neglected and entrusted to me for classification of the works and preparation of the catalogues. One day I was handed a few volumes of new literature unlike anything I had ever read before and so captivating as to make me utterly forget my hopeless state. They were the earlier works of Mark Twain and to them might have been due the miraculous recovery which followed. Twenty-five years later, when I met Mr. Clements and we formed a friendship between us, I told

Copyright, 1919, by E. P. Co. All rights reserved

Mr. Tesla's articles started in our February issue

www.americanradiohistory.com

him of the experience and was amazed to see that great man of laughter burst into tears.

My studies were continued at the higher Real Gymnasium in Carlstadt, Croatia, where one of my aunts resided. She was a distinguished lady, the wife of a Colonel who was an old war-horse having participated in many battles. I never can forget the three years I past at their home. No fortress in time of war was under a more rigid discipline. I was fed like a canary bird. All the meals were of the highest quality and deliciously prepared but short in quantity by a thousand percent. The slices of ham cut by my aunt were like tissue paper. When the Colonel would put something substantial on my plate she would snatch it away and say excitedly to him: "Be careful, Niko is very delicate." I had a voracious appetite and suffered like Tantalus. But I lived in an atmosphere of refinement and artistic taste quite unusual for those times and conditions. The land was low and marshy and malaria fever never left me while there despite of the enormous amounts of quinin I consumed. Occasionally the river would rise and drive an army of rats into the buildings, devouring everything even to the bundles of the fierce paprika. These pests were to me a welcome diversion. I thinned their ranks by all sorts of means, which won me the unenviable distinction of rat-catcher in the community. At last, however, my course was completed, the misery ended, and I obtained the certificate of maturity which brought me to the cross-roads.

THIS installment, no doubt the most interesting of the three published so far, reveals many extraordinary occurrences and experiences in the world's greatest inventor's life—experiences such as do not fall to the lot of ordinary mortals. And Tesla, the many sided, aside of inventing, knows the rare art of painting word-pictures. He does so here in a masterly fashion. He tells us how he finally conceived the induction motor—perhaps his greatest discovery—the invention which changed the face of the globe, the invention which made possible the street car, the subway, the electric train, power transmission, the harnessing of water falls and countless others. But let Tesla tell you himself how it all came about. It is a classic worth reading.

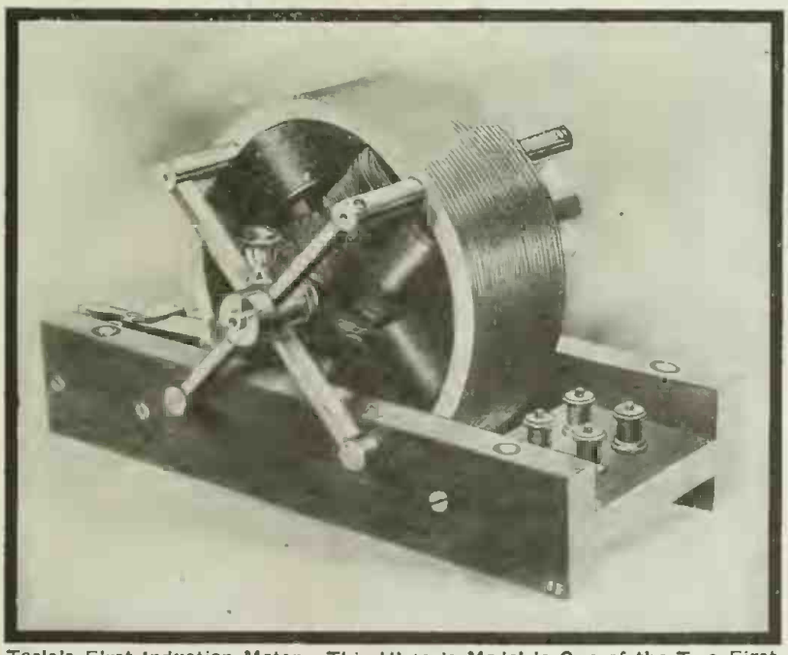
EDITOR.

During all those years my parents never wavered in their resolve to make me embrace the clergy, the mere thought of which filled me with dread. I had become intensely interested in electricity under the stimulating influence of my Professor of Physics, who was an ingenious man and often demonstrated the principles by apparatus of his own invention. Among these I recall a device in the shape of a freely rotatable bulb, with tinfoil coatings, which was made to spin rapidly when connected to a static machine. It is impossible for me to convey an adequate idea of the intensity of feeling I experienced in witnessing his exhibitions of these mysterious phenomena. Every impression produced a thousand echoes in my mind. I wanted to know more of this wonderful force; I longed for experiment and investigation and resigned myself to the inevitable with aching heart.

Just as I was making ready for the long journey home I received word that my father wished me to go on a shooting expedition. It was a strange request as he had been always strenuously opposed to this kind of sport. But a few days later I learned that the cholera was raging in that district and, taking advantage of an opportunity, I returned to Gospic in disregard of my parents' wishes. It is incredible how absolutely ignorant people were as to the causes of this scourge which visited the country in intervals of from fifteen to twenty years. They thought that the deadly agents were transmitted thru the air and filled it with pungent odors and smoke. In the meantime they drank the infected water and died in heaps. I contracted the awful disease on the very day of my arrival and altho surviving the crisis, I was confined to bed for nine months with scarcely any ability to move. My energy was completely exhausted and for the second time I found myself at death's door. In one of the sinking spells which was thought to be the last, my father rushed into the room. I still see his pallid face as he tried to cheer me in tones belying his assurance. "Perhaps," I said, "I may get well if you will let me study engineering." "You will go to the best technical institution in the world." he solemnly replied, and I knew that he meant it. A heavy weight was lifted from my mind but the relief would have come too late had it not been for a marvelous cure brought about thru a bitter decoction of a peculiar bean. I came to life like another Lazarus to the utter amazement of everybody. My father insisted that I spend a year in healthful physical outdoor exercises to which I reluctantly consented. For most of this term I roamed in the mountains, loaded with a hunter's outfit and a bundle of books, and this contact with nature made me stronger in body as well as in mind. I thought and planned, and conceived many ideas almost as a rule delusive. The vision was clear enough but the knowledge of principles was very limited. In one of my inventions I proposed to convey letters and packages across the seas, thru a submarine tube, in spherical containers of sufficient strength to resist the hydraulic pressure. The pumping plant, intended to force the water thru the tube, was accurately figured and designed and all other particulars carefully worked out. Only one trifling detail, of no consequence, was lightly dismist. I assumed an arbitrary velocity of the water and, what is more, took pleasure in making it high, thus arriving at a stupendous performance supported by faultless calculations. Subsequent reflections, however, on the resistance of pipes to fluid flow determined me to make this invention public property.

Another one of my projects was to construct a ring around the equator which would, of course, float freely and could be arrested in its spinning motion by reactionary forces, thus enabling

(*Continued on page 905*)



Tesla's First Induction Motor. This Historic Model Is One of the Two First Presented Before the American Institute of Electrical Engineers.

WHAT IS THE INDUCTION MOTOR?

The induction motor operates on alternating current. It has no commutator like a direct current motor, nor slip rings like an alternating current motor. Contrary to the two types just cited the "field" current is not steady, but the current itself rotates constantly pulling around with it—by induction—the only moving part of the motor—the rotor—or armature. Having no armature nor slip rings, the induction motor never sparks. It consequently knows no "brush" trouble. It needs no attention because of its ruggedness. Only the bearings wear out. Its efficiency too is higher. On account of all this the induction motor is used in a prepondering proportion in street cars, electric trains, factories, etc.

www.americanradiohistory.com

The Moon's Rotation

By NIKOLA TESLA

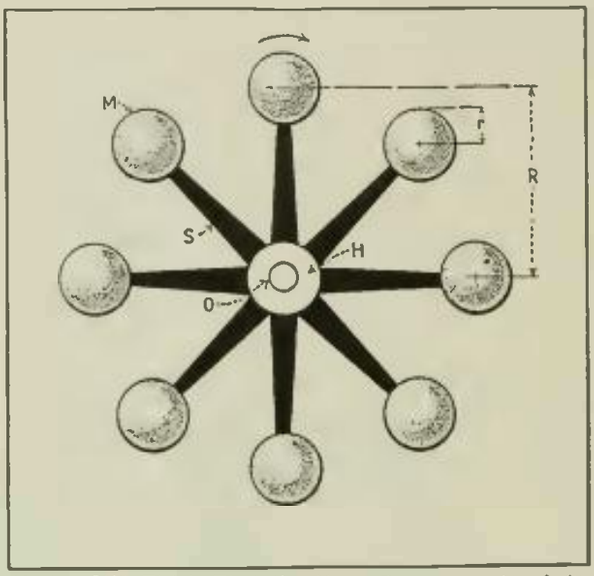
SINCE the appearance of my article entitled the "Famous Scientific Illusions" in your February issue, I have received a number of letters criticizing the views I exprest regarding the moon's "axial rotation." These have been partly answered by my statement to the *New York Tribune* of February 23, which allow me to quote:

In your issue of February 2, Mr. Charles E. Manierre, commenting upon my article in the *Electrical Experimenter* for February which appeared in the *Tribune* of January 26, suggests that I give a definition of axial rotation.

I intended to be explicit on this point as may be judged from the following quotation: "The unfailing test of the spinning of a mass is, however, the existence of *energy of motion*. The moon is not posest of such *vis viva*." By this I meant that "axial rotation" is not simply "rotation upon an axis nonchalantly defined in dictionaries, but is a circular motion in the true physical sense—that is, one in which half the product of the mass with the square of velocity is a definite and positive quantity. The moon is a nearly spherical body, of a radius of about 1,087.5 miles, from which I calculate its volume to be approximately 5,300,216,300 cubic miles. Since its mean density is 3.27, one cubic foot of material composing it weighs close on 205 lbs. Accordingly, the total weight of the satellite is about 79,969,000,000,000,000,000, and its mass 2,483,500,000,000,000,000 terrestrial short tons. Assuming that the moon does physically rotate upon its axis, it performs one revolution in 27 days, 7 hours, 43 minutes and 11 seconds, or 2,360,591 seconds. If, in conformity with mathematical principles, we imagine the entire mass concentrated at a distance from the center equal to two-fifths of the radius, then the calculated rotational velocity is 3.04 feet per second, at which the globe would contain 11,474,000,000,000,000,000 short foot tons of energy sufficient to run 1,000,000,000 horsepower for a period of 1,323 years. Now, I say, that there is not enough of that energy in the moon to run a delicate watch.

In astronomical treatises usually the argument is advanced that "if the lunar globe did not turn upon its axis it would expose all parts to terrestrial view. As only a little over one-half is visible it *must* rotate." But this inference is erroneous, for it only admits of one alternative. There are an infinite number of axis besides its own in each of which the moon might turn and still exhibit the same peculiarity.

I have stated in my article that the moon rotates about an axis passing thru the center of the earth, which is not strictly true, but it does not vitiate the conclusions I have drawn. It is well known, of course, that the two bodies revolve around a common center of gravity, which is at a distance of a little over 2,899 miles from the earth's center.



If You Still Think That the Moon Rotates on Its Axis, Look at This Diagram and Follow Closely the Successive Positions Taken by One of the Balls M While It Is Rotated by a Spoke of the Wheel. Substitute Gravity for the Spoke and the Analogy Solves the Moon Rotation Riddle.

Another mistake in books on astronomy is made in considering this motion equivalent to that of a weight whirled on a string or in a sling. In the first place there is an essential difference between these two devices tho involving the same mechanical principle. If a metal ball, attached to a string, is whirled around and the latter breaks, an axial rotation of the missile results which is definitely related in magnitude and direction to the motion preceding. By way of illustration—if the ball is whirled on the string clockwise ten times per second, then when it flies off, it will rotate on its axis ten times per second, likewise in the direction of a clock. Quite different are the conditions when the ball is thrown from a sling. In this case a *much more rapid* rotation is imparted to it in the *opposite sense*. There is no true analogy to these in the motion of the moon. *If the gravitational string, as it were, would snap, the satellite would go off in a tangent without the slightest swerving or rotation, for there is no moment about the axis and, consequently, no tendency whatever to spinning motion.*

Mr. Manierre is mistaken in his surmise as to what would happen if the earth were suddenly eliminated. Let us suppose that this would occur at the instant when the moon is in *opposition*. Then it would continue on its eliptical path around the sun, presenting to it steadily the face which was always exposed to the earth. If, on the other hand, the latter would disappear at the moment of *conjunction*, the moon would gradually swing around thru 180° and, after a number of oscillations, revolve, again with the same face to the sun. In either case there would be no periodic changes but eternal day and night, respectively, on the sides turned towards, and away from, the luminary.

Some of the arguments advanced by the correspondents are ingenious and not a few comical. None, however, are valid.

One of the writers imagines the earth in the center of a circular orbital plate, having fixedly attached to its periperal portion a disk-shaped moon, in frictional or geared engagement with another disk of the same diameter and freely rotatable on a pivot projecting from an arm entirely independent of the planetary system. The arm being held continuously parallel to itself, the pivoted disk, of course, is made to turn on its axis as the orbital plate is rotated. This is a well-known drive, and the rotation of the pivoted disk is as palpable a fact as that of the orbital plate. But, the moon in this model only revolves about the center of the system *without the slightest angular displacement* on its own axis. The same is true of a cart-wheel to which this writer refers. So long as it advances on the earth's surface it turns on the axle in the true physical sense; when one of its spokes is always kept in a perpendicular position the wheel still *revolves* about the earth's center, *but axial rotation has ceased*. Those who think that it then still exists are laboring under an illusion.

An obvious fallacy is involved in the following abstract reasoning. The orbital plate is assumed to gradually shrink, so that finally the centers of the earth and the satellite coincide when the latter revolves simultaneously about its own and the earth's axis. We may reduce the earth to a mathematical point and the distance between the two planets to the radius of the moon without affecting the system in principle, but a further diminution of the distance is mani- (Cont. on p. 892)

WE believe the accompanying illustration and its explanation will dispel all doubts as to whether the moon rotates on its axis or not. Each of the balls, as M, depicts a different position of, and rotates exactly like, the moon keeping always the same face turned towards the center O, representing the earth.

But as you study this diagram, can you conceive that any of the balls turn on their axis? Plainly this is rendered physically impossible by the spokes. But if you are still unconvinced, Mr. Tesla's experimental proof will surely satisfy you. A body rotating on its axis must contain rotational energy. Now it is a fact, as Mr. Tesla shows, that no such energy is imparted to the ball as, for instance, to a projectile discharged from a gun. It is therefore evident that the moon, in which the gravitational attraction is substituted for a spoke, cannot rotate on its axis or, in other words, contain rotational energy. If the earth's attraction would suddenly cease and cause it to fly off in a tangent, the moon would have no other energy except that of translatory movement, and it would not spin like the ball.—Editor.

www.americanradiohistory.com

Experimental Physics

By JOHN J. FURIA, A. B., M. A., (Columbia University)

LESSON TWENTY (Conclusion)

PHYSICS AND THE WORLD WAR.

As a fitting conclusion to this series of articles, let us consider to what extent Physics helped to beat the Huns. The bulk of the wonderful work done by all branches of science has as yet not been disclosed to the general public; but the following material disclosed by Professor Ames, of Johns Hopkins University, in his address at the University of Virginia, by Dr. Hale in his address before the New York Engineering Societies, by Professor Millikan, of the University of Chicago, in his address at the Philadelphia meeting of the American Institute of Electrical Engineers, and by Major-General Squier in his address at the New York meeting of the A. I. E. E., is more than sufficient to make it evident to us that Science in general and Physics in particular, deserves a lion's share of the glory accruing from the victory of the Allies.



Wireless Telegraphy — It Often Proved the Only Reliable Communication in Battle.

The American public at the beginning of the war held its scientific men in insignificant regard, and was very much surprised to learn of the high degree of mobilization of Germany's scientific men for war work. The "fool professor" was destined to come before the public eye. On our entering the war our wizard inventors with their efficient press agents won the war for us over night by their epoch-making inventions. Days went by, but our epoch-making inventions did not appear, and gradually the usual murder and divorce cases appeared in the papers again, displacing the names and ideas of our wondrous newspaper wizards. An Inventions Board received some 1,600 inventions from our inventors and found about half a dozen of them were worth considering. Magnets of tremendous size were proposed, which when placed in the bottom of the sea would attract all shells, etc., and thus stop the war. Others proposed magnets of various forms, which on trailing along beneath an airplane would drag up any submerged invisible submarine. Another proposed generating a wind so strong that it would push away any approaching airplane, balloon, etc. Thus airplaine raids were eliminated, submarine attacks were ended, and the war was over. These fool inventions were coming in so fast that the Board in self-defence determined not to consider any inventions sent in by these wonder-workers unless a "working model" accompanied the papers. It was evident that the road to a successful termination of the war lay in bringing together men possessing scientific knowledge, and equipt with scientific methods. In ordinary peace times the college professor is at a disadvantage —he is usually ignorant of, or not interested in commercial development, and does not come in contact with the technical trades. However, his researches in pure science are eventually commercialized and become of vast technical importance. In bringing together eminent scientists, presenting them with problems, showing them the conditions, having them perform their researches under the best of conditions and immediately making use of the fruit of their toil—this proved the way to victory. In Washington, London, Paris and Rome, some of the foremost of the Allied scientists were gathered. Among the Physicists we have Millikan, Ames, Mendenhall, Gale, Wood, Duff, Hubbard and others, all in uniform and commissioned as officers in the U. S. Army or Navy. Major-General G. O. Squier, the Chief Signal Officer of our army, is a Physicist of considerable reputation, having received his degree of Ph.D. in Physics at Johns Hopkins University. The rest of our Physicists served in civilian capacities.



Machine Guns — Another Weapon of Science, Worked Havoc to Both Sides Night and Day.



Giant Bombing Planes Were Threatening to Wipe Out Berlin When the Armistice Was Signed.

IN THE "MAY" EXPERIMENTER

The Editors have in preparation some exceptionally interesting articles for the May number of the ELECTRICAL EXPERIMENTER, *among which are the following:*

The Latest in Aërial Railways.

"My Inventions"—No. 4, by Dr. Nikola Tesla.

Electricity and Dynamite — How they help the farmer irrigate land, divert streams, loosen hard soil, and clear land of stumps and stones.

Recording Our Thoughts Electrically, by H. Gernsback.

New York to New Jersey Via Wagon and Auto Tunnel—A Gigantic Engineering Problem.

The Latest Electrical News from France, by Jacques Boyer, Paris Correspondent of the "E. E."

Springtime Fashions in Electric Fans—Several dozen new wrinkles with these useful devices that will interest the whole family.

X-Raying Our Teeth—How disease and mental ailments have been actually traced to ordinarily invisible infections of the teeth. Written by the Medical Director of a Prominent State Hospital.

How to Build a Professional Medical Induction Coil Outfit, by H. Winfield Secor.

Some Interesting Facts Concerning the Electron, by L. R. Jewett.

How to Build an Efficient Open-core Step-up Transformer, by William Holladay.

Choke Coils—How to compute their dimensions with data on actual coils, by Prof. F. E. Austin, Instructor of Electrical Engineering, Dartmouth College.

"Science in Slang" — Installment No. 3, by Emerson Easterling.

Let us now see how our war needs affected scientific research. It is a well-known property of charcoal that it has a high absorbing power for many gases. When the Huns brought forth their little surprise of "poisonous gas," the gas mask was immediately evolved. Research developed that a special treatment of charcoal, made in certain sizes from special kinds of wood had an increased absorbing power. The Physicist knew that charcoal had this absorbing power, and when the problem of increasing this power to make the combating of gas warfare more efficient was proposed, the problem was solved. Airplane engines have been manufactured for many years, but never before has the necessity arisen for high speed quantity production. The problem arose and was solved, the Liberty engine was designed, developing 400 horse-power and weighing only 800 pounds; about 2,000 per month were manufactured. The resistance offered by the wings of different sections, the stability of the airplane, the character of the covering surfaces, etc., have all been investigated in detail. The instruments of navigation and of signaling are perhaps every bit as important as the airplane itself. Instruments for indicating speed, direction, height, distance travelled, etc., have all required extended and careful research by the Physicist. In all airplane work, whether in observations or in making attacks, it is necessary for the men in the machines and the men on the ground to be in constant communication. The wireless telephone is the obvious solution. Wireless telephony has no doubt made more progress in one month of war than in one year of peace. The modifications and improvements made in wireless telephony apparatus in America's physical laboratories by her scientists (most of which have as yet not been disclosed to the public) are positively epoch-making. Our improvements have made it possible

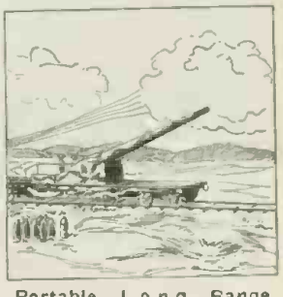
(*Con. on page* 926)



The Submarine—A Terror of the Seas, with a Range of 4,000 Miles.



Tanks by the Thousand Frequently Turned the Tide of Battle for the Allies.



Portable Long Range Guns Routed the Enemy and Leveled His Cities as Well as Fortifications.

www.americanradiohistory.com

Popular Astronomy

The Planet Earth as Others See Us

By ISABEL M. LEWIS
OF THE U. S. NAVAL OBSERVATORY



Copyright, 1919, by E. P. Co.

The Earth As It Appears to an Observer Stationed At the Moon, One of the Most Wonderful and Awe-Inspiring Objects of the Heavens. On the Moon, the Earth Appears Sixteen Times Larger Than the Moon Appears to Us On the Earth. The Sun Shown At the Right Illuminates Only Part of the Earth, Which Therefore Appears in Crescent Form. It Is, However, Not In Total Darkness for Some of the Light Is Reflected By the Moon Onto the Earth and Back to the Moon, Hence the Darkened Portion Is Not Entirely Dark, But the Continents Can Be Faintly Seen. There Being No Atmosphere On the Moon, the Sky Appears Dead Black In Day Time. The Sun Will Be Seen With Its Corona and Streamers Somewhat as Shown in This Illustration.

WERE it possible for us to view the heavens from the planet Mars we might see in the hours just following sunset or preceding dawn a most beautiful star of first magnitude rivaling and at times surpassing the great star Sirius in brilliancy, closely attended by a small companion star considerably less brilliant. The smaller body is evidently a satellite of the brighter one, as its position relative to the larger body changes in such a way as to show it is revolving around it. It appears now to the east, now to the west of the chief star. At their widest separations the two form a very distinct double star, unique in the heavens of the Martians. As the little star travels from one side to the other of the bright star it usually goes above or below it tho occasionally it passes directly in front of or behind the brighter body and at such times only one star is then visible to our Martian observers.

This lustrous double star, the morning or evening star of the Martians, is our planet Earth and its satellite the moon.

Were we observing our planet from Mars it would be quite beyond our powers of imagination to conceive that this tiny point of light, glowing by the reflected light of the sun, has been for ages upon ages the abode of species and forms of life of well nigh infinite variety that have existed under widely different conditions of temperature and pressure not only on the surface of the planet but in the depths of the seas that cover three-fourths of its surface.

We can imagine conservative scientists of Mars frowning at the flights of fancy of the Martians in regard to the nature of the inhabitants of this other world in space. Yet in their wildest speculations the Martians could hardly exaggerate the wonders of our planet Earth or the strength of the conflicting forces for good and evil to be found upon it.

Let us consider for a moment how our planet Earth and its satellite would appear were we able to examine it telescopically from Mars. Most of the difficulties that beset us here on earth in our attempts to observe Venus telescopically would be experienced in attempting to view the planet Earth from Mars. A reference to Fig. 1, which shows the relative positions of the three planets, will make this clear. The earth's orbit lies between Mars' orbit and the sun, just as the orbit of Venus lies between us and the sun. As we will see later, Venus has a decided advantage over Mars for observations of the planet Earth. On Venus and on our own planet, Mars can be seen in opposition to the sun that is on the Meridian at midnight, with its disk fully illuminated like the full moon. To Mars, on the contrary, all the inner planets, Mercury, Venus and Earth, appear as half or crescent moons telescopically when they are in the best position for observation and they never appear with fully illuminated disks.

When the earth is nearest to Mars, in position E_0, see Fig. 1, it is invisible to the Martians, just as Venus is invisible to us in the corresponding position, owing to the fact that it is then *in line with the sun* and lost in the glare of its light. This position is known as the planet's inferior conjunction with the sun. Just before and after the earth is in this position it would show a very thin crescent if viewed telescopically from Mars.

In the position E_2 the earth is once more in line with the sun and Mars in what is

www.americanradiohistory.com

known as superior conjunction, and is again invisible. Just before and after it is in this position its disk is like a gibbons moon almost entirely illuminated, but it is unfavorably situated for observations from Mars because it is so near the sun and on the far side of its orbit from Mars. In position E_4 and E_3 the earth is at its greatest distance from the sun, spoken of as its greatest eastern and western elongations, as seen from Mars. It is then a half-moon in the telescope, is at its highest elevation above the horizon and is evening or morning star to the Martians, according as it is east or west of the sun. We might expect that it would now be in its most favorable position for observation, but this is not so.

Looking at Fig. 1 we see that as the earth passes from the position E_3 toward inferior conjunction with the sun at E_0, its distance from Mars *decreases* and therefore the apparent size of its disk *increases*. The *form* of the illuminated portion now changes from half moon to crescent but the *total area* of the illuminated portion increases up to a certain point. When the area of the illuminated portion of the planet has its greatest value the brightness of the planet is at a maximum. The exact time when this will occur can be worked out mathematically. The best observations of the earth seen from Mars would be obtained when the planet is in this position and the corresponding one lying between inferior conjunction and western elongation. (See positions E' and E" in Fig. 1.) We can therefore imagine the Martians observing our planet at its best in the morning or evening twilight. The brilliancy of the earth in Martian skies at this time usually surpasses that of all other planets. Mercury and Venus, tho also evening and morning stars to the Martians, appear considerably less brilliant than they do to us. The earth appears to the Martians much as Venus does to the earth, tho less brilliant, owing to the fact that Venus comes nearer to the earth than the earth does to Mars. The only planet that may rival the earth at the time of its maximum brightness is the giant planet Jupiter, which appears at times brighter to the Martians than does our own planet.

In their telescopic observations of the earth the Martians would experience the same difficulty that we experience in our observations of Venus. When the planet is in its most favorable positions for observation the greater part of its disk is darkened, owing to the fact that the phase is the same as that of the crescent moon.

The Martians, however, would not be handicapped by a dense cloud-ladened atmosphere such as surrounds Venus and makes it so difficult for us to observe. As the earth's diameter is twice that of Mars, our surface markings would appear considerably more extensive to the Martians than the markings on Mars appear to us, tho drifting clouds and snow storms on our planet would frequently hide temporarily some of the markings on our planetary disk.

We can imagine the Martians puzzling over our seas and continents and largest islands and lakes, our polar snow caps and tropical vegetation showing in green and grey-green splatches, our reddish-tinted deserts, our mountains and our great level plains just as we puzzle over the canal-system and the desert and marshy tracts on the planet Mars.

The fact that our planet rotates on its axis in twenty-four hours and has marked seasonable changes could be as readily determined from the distance of Mars as the seasonal changes and rotation of Mars on its axis have been determined by us. We can imagine the interest that our large satellite would arouse and the speculations that would be made concerning its indistinct surface markings. In one respect the Martians would have an advantage over us in their observations of the moon. They would be able to examine one side of the moon that we have never seen. The side of the moon that is never turned toward the earth would be visible frequently to the Martians.



Fig. 4. The Earth As Seen from Mars. At the Time of Its Greatest Brilliancy the Earth Appears As a Crescent to the Martians. To Better Understand This See Figs. 2 and 5. To the Martians the Planet Earth Can Never Be Viewed As a Full Disc—Only In Crescent Form. When Entirely Illuminated By the Sun, It Is Lost In Its Rays and Is Therefore Invisible to the Martians



The Planet Earth and Its Satellite the Moon As It Appears Among the Stars When In Opposition to the Sun, Viewed from the Planet Venus

Let us now consider how our planet would appear if we were stationed on the planet Venus, assuming that it is possible at times to see the beauties of the starry heavens thru occasional rifts in dense clouds that apparently shut the surface of this interesting planet almost completely away from the universe beyond.

Seen telescopically at the time of its opposition to the sun, the planet Earth and its satellite the moon would be for the inhabitants of Venus the most beautiful and interesting object in the heavens. No planet appears to any other planet as magnificent as the Earth-Moon system does to Venus at the time of nearest approach. The brilliancy of the earth seen from Venus at this time is twice that of Venus as it appears to us at its best. As the earth's disk is then fully illuminated the inhabitants of Venus would have a great advantage over the inhabitants of Mars in their study of the surface markings of our planet. Objects on the earth's surface fifty miles in diameter could be made out easily by the inhabitants of Venus with the assistance of such telescopes as we employ for the observations of the planets. When Mars is most favorably situated for observation from the earth the diameter of its disk is between fifteen and twenty-five seconds of arc, according to its distance from the earth at the time of opposition. When the earth is most favorably situated for observations from Venus the diameter of its disk is sixty-three seconds of arc and that of the moon is seventeen seconds of arc. So even the disk of our moon appears at certain times as large seen from Venus as the disk of Mars seen from the earth. The markings on the earth itself seen from Venus stand out more distinctly at opposition than the markings on Mars do to us at the most favorable opposition of Mars as we are nearer to Venus than to Mars.

It is when we take our station on our own little satellite, however, that we behold our planet earth as the ancients wished to consider it—the most wonderful and awe-inspiring object in the heavens. To the inhabitants of the moon, were there such, the earth's disk would appear four times greater in diameter and *sixteen times greater in area than the moon's disk appears to us.* Since the moon, in its revolutions around the planet Earth, always keeps the same face turned toward it, *the position of the earth,* for any one point of observation on the moon, *remains immovable in the heavens,* and it goes thru the various phases of its illumination by the sun in the reverse order to that followed by the moon. When the moon appears to us to pass from new to full the earth appears to the moon to pass from full to new and vice versa.

The rotation of the earth on its axis is plainly visible from the moon even to the naked eye. A distinctive marking will appear at the western edge of the earth's disk, say the Black Sea or Central America. It will be carried gradually eastward by the rotation of the planet and will finally disappear twelve hours later at the eastern edge.

Oceans and continents and polar caps appear in their general outlines and contrasting shades, visible easily to the naked

(*Continued on page* 911)

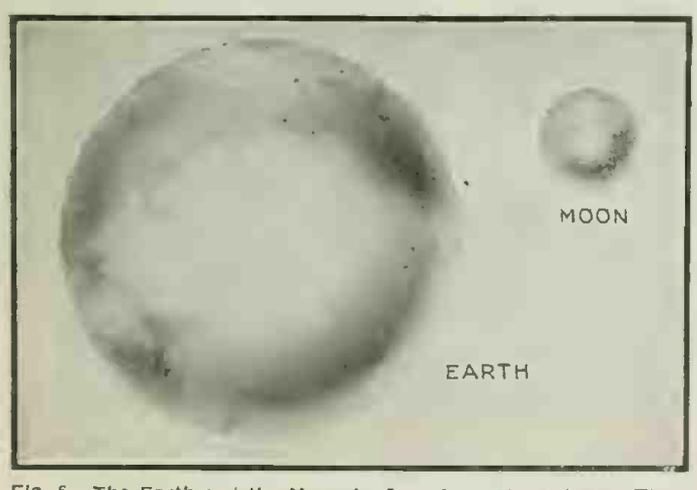


Fig. 6. The Earth and the Moon As Seen from Planet Venus Thru the Telescope At the Time of Its Opposition to the Sun

www.americanradiohistory.com

Radiophony to Airplanes a Great Success

A CONSIDERABLE time before the United States entered the world war the Bell Telephone system supplied the American Navy with a wireless telephone outfit designed for communication between an airplane and a station on land or on a ship. From that time on until this country entered the world-conflict, the Western Electric Company, as a part of its general study, conducted the work of perfecting light, compact wireless telephone sets, which would be available on small vessels and on airplanes. The first successful wireless test between an airplane and the ground after our entry into the war was made with one of the sets designed and completely built by this enterprising engineering organization prior to our entry into the war. The test was made on Langley Field.



U. S. Army Airplane Pilot and Observer Equipt with Wireless Telephone Sets for Transmitting as well as Receiving Speech. These Sets Are Provided with a Change-over Switch Which Permits the Instruments to Be Utilized as a Regular Telephone Between the Two Birdmen.

On May 22, 1917, Gen. George O. Squier, Chief Signal Officer of the United States Army, sent for Dr. F. B. Jewett, chief engineer of the Western Electric Company, to confer with him with reference to the matter of equipping airplanes with wireless telephone apparatus. At this conference, which was held in Washington, besides Gen. Squier and Dr. Jewett, there were present E. D. Craft, one of Dr. Jewett's principal assistants; Capt., now Col. C. C. Culver, of the Signal Corps, and Col. Rees, of the British Army Air Service. The possibility of providing airplanes with wireless telephone service was discust, and the reports of the development work being done by the Western Electric Company made by Dr. Jewett were so promising that he was ordered in writing by Gen. Squier to proceed with the development of the system, and to actually equip 'planes with it.

The Bell system engineers had progrest so far at that time that they were able on July 1, 1917, five weeks after the first conference, in a test at Langley Field, to actually demonstrate the working of the wireless telephone between an airplane and the ground. This test also showed that it was practical to operate the system between two or more airplanes in the air.

"All this sounds very simple, but it would take volumes to describe the innumerable experiments and heart-breaking failures before the first real successes. So far as the radio part of the equipment was concerned we had an answer in a short time. We had developed some very successful forms of vacuum tubes and it was a simple matter to assemble them with the necessary coils, condensers and other apparatus that comprise the transmitting and receiving elements. Working this apparatus under ordinary conditions on the ground, and in a swift-moving and tremendously noisy airplane, were two entirely different propositions. The noise of the engine and rushing air was such that it was impossible to hear one's own voice, to say nothing of the weak signals of the telephone receiver," stated Edward B. Craft, Assistant Chief Engineer of the Western Electric Co.

One of the first problems was to design a head set which would exclude these noises, and at the same time permit of the reception of the telephone talk. A form of aviator's helmet was devised with telephone receivers inserted to fit the ears of the pilot or observer. See accompanying illustration of the helmet with 'phones complete. Cushions and pads were provided for adjusting the receivers to the ears and the helmet fitted close to the face so as to prevent as far as possible, the sound being heard either thru the ear passage or thru the bony structure of the head, which acts as a sort of a sounding board. A helmet, such as that illustrated, was finally developed and was found to solve this portion of the problem. The earpiece finally adopted was made of sponge rubber (made so by blowing air thru it while molten), reënforced by tinfoil, and the receivers themselves embedded therein. These were mounted in a thick leather helmet, to be clamped over the flier's head and ears. It effectually muffles bone transmission also, besides permitting the use of oxygen or gas masks.

Everyone knows how sensitive the ordinary telephone transmitter is to extraneous noises, and it does not require a wide stretch of the imagination to picture how this would act alongside the exhaust of a 200 horsepower gasoline engine. A brilliant line of experimentation finally resulted in a form of a telephone transmitter or microphone, which possest the remarkable quality of being insensitive to engine and



Photo by Central News Photo Service

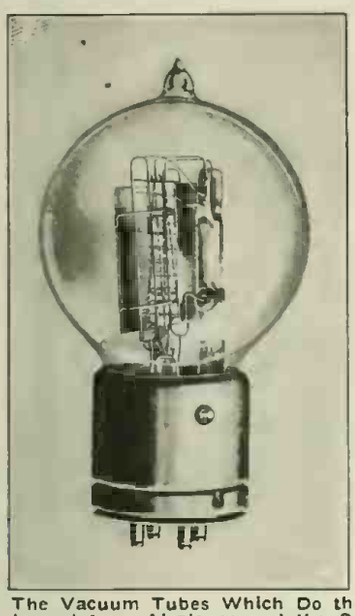
Testing the Radiophone Between New York and Washington. A Photograph of U. S. Naval Operators Communicating with the U. S. Navy Department at Washington, D. C., from the Bankers Club in New York, Thru the Radio Telephone. Many of the Country's Leading Bankers Were Present to Witness the Demonstration. Afterward Tests Were Made from this Station to Airplanes and Dirigibles Flying over New York City, Various Orders Having Been Successfully Sent to the 'Planes.

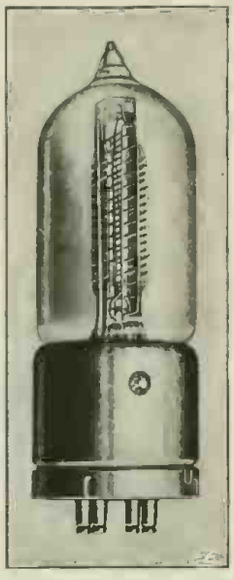
www.americanradiohistory.com

wind noises, and at the same time very responsive to the tones of the voice. With these two elements in hand, the problem was apparently solved. The fact remains, however, that three solid months of the hardest kind of work was necessary to iron out all the kinks and get the thing in shape so that it might be considered a practicable device for the everyday use of other than experts, as Mr. Craft points out. The microphone perfected for this work has no mouthpiece, but instead a flat cap having three tiny openings about 1/16 inch in diameter. The voice waves pass thru these onto the diafram easily, but the engine noises swirl round it in other directions and do not enter in sufficient volume to be heard at all.

A typical performance of the radiophone between 'planes and ground will prove of interest. Here is the way it worked at one of the first official army tests at the flying field at Dayton, Ohio, December, 1917, as related by Mr. Craft.

"The 'planes left the ground and after what seemed to be an interminable length of time, we got the first sounds in the receiver, which indicated that they were ready





The Vacuum Tubes Which Do the Work in Radiophoning to and from Airplanes and the Ground. At the Left—the Transmitting Tube; at Right—the Receiving Tube. America Was Turning Out These Bulbs by Thousands Every Day When the Armistice Was Signed, so Rapid Had the Standardization and Production Progress.

to perform. The spectators were only mildly interested, and some seemed to be a bit bored. Suddenly out of the horn of the loud speaker came the words, "Hello, ground station. This is 'plane No. 1 speaking. Do you get me all right?" The bored expression immediately faded, and looks of amazement came over their faces. Soon we got the same signal from No. 2, and the show was on. Under command from the ground the 'planes were maneuvered all over that part of the country. They were sent on scouting expeditions and reported what they saw as they traveled thru the air. Continuous conversation was carried on, even when the 'planes were out of sight, and finally upon command they came flying back out of space and landed as directed."

Electric current must be supplied to operate the wireless set on the 'plane, as we well know, this current being used to heat the filaments of the vacuum tubes and to operate the transmitter. But the 'planes were already loaded down with all the gear they could carry, and the use of heavy storage batteries was out of the question. The airplane engineers would allow nothing to be connected to their engines, so there was nothing left but to supply a separate radio dynamo, and drive it by a wind propeller, taking its power from the rushing air. Airplanes are in the habit of flying at various speeds, and the specifications stated this to be from forty to one hundred and sixty miles per hour, the latter figure representing the speed when the machine was diving. The little dynamo, therefore, had to deliver a constant voltage with a speed varying from 4,000 to 14,000 R.P.M.

In our next issue will appear an important article by Nikola Tesla entitled

"TRUE WIRELESS"

In this article Dr. Tesla will make known his views of the propagation of the wireless waves.

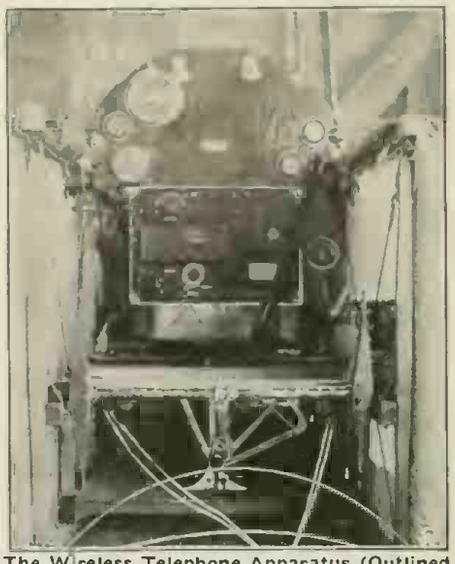
The microphone and receivers used for radiophoning from 'plane to 'plane or 'plane to earth are arranged by means of a switch so that the pilot and observer can converse over the telephone circuit between the pilot and his mechanician with ease, and by throwing a switch can connect themselves with the radio apparatus and talk with the men in another 'plane three or four miles away, or to the ground.

The primary object was to make it possible for the commander of an air squadron to control the movement of his men in the air, the same as a squad leader of infantry does on the ground. For this purpose extra long range is not required, and the distance over which they can talk is purposely limited to two or three miles, so that the enemy cannot overhear, except when actually engaged in combat, and then nobody cares.

The Navy also makes use of these sets in their seaplanes, and here the range is somewhat greater, up to twenty miles in some cases. The Navy has also made use of a modified form of this set in their 110-foot submarine chasers. The chasers hunt submarines in packs, and by means of the radio telephone, their commanders keep in constant touch with each other, thereby greatly increasing the effectiveness of their operation.

Finally, with the formal demonstration completed, pressure was immediately applied to produce the necessary quantity of sets with their multitude of auxiliary and subsidiary parts. From January 1, 1918, to the early summer of that year the Western Electric Company established factories and trained thousands of operatives so that when the armistice was signed the necessary transmitting and receiving tubes for radio telephone sets were being produced at a rate in excess of a million and a half good tubes per year. Improvement in vacuum pumps has resulted in a wonderfully high degree of exhaustion being attained—about one-billionth of an atmosphere.

Altogether thousands of radio telephone sets of different types have been manufactured and delivered to the Army and Navy since the early part of 1918. In spite of the fact that prior to July, 1917, no commercial types of this apparatus were in existence, and some of the fundamental problems had not yet been solved, the resources of this great telephone engineering organization were sufficient to establish



The Wireless Telephone Apparatus (Outlined in White Square) Installed in Cock-pit of Airplane. It Takes up But Little Room and Has Such a Small Weight as to Be Insignificant, Compared to the Lifting Power of the Plane.

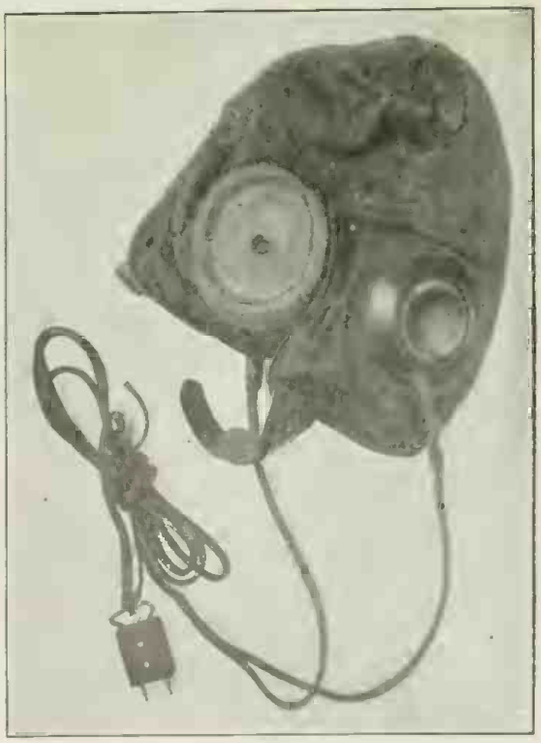
on a commercial basis, within this short space of time, practically speaking, *an entirely new art!—Photos Courtesy W. E. Co.*

HOW AIRPLANES FIND THEMSELVES BY RADIO.

In his recent lecture before the American Institute of Electrical Engineers at New York Major-Gen. G. O. Squier, in connection with his description of the war's developments in radio apparatus, spoke as follows concerning the problem of aërial navigation:

"One of the principal problems of airplane navigation has been the evolution of a suitable compass, particularly for night bombing work. Magnetic and gyroscopic compasses have limitations at present which make impossible reliable air navigation by dead reckoning.

(*Continued on page* 926)



Aviator's Radiophone Helmet Fitted with Special Sound-proof Pads and Having the Two Receivers Mounted Tightly Therein. The Receivers Are Moulded In Sponge Rubber. The Helmet Is Made of Leather.

www.americanradiohistory.com

Do Radio Waves Travel Above the Earth or Thru It?

By DR. LEE de FOREST

(Written exclusively for the Electrical Experimenter)

THE article on "Radio Around the World" is very interesting. From my own rather extended experience and based also on the calculations and results obtained by most of the serious workers in this field, I think there can be no doubt but that the *etheric wave* component is by far the more important one. Understand, however, that these are not ordinary space waves, *but are grounded waves gliding over the surface of the earth*, thus following the contour of the earth. See Fig. 1. The depth of the wave in the ground or sea water has been shown by actual measurements, as well as by theoretical calculations, to be ordinarily and until recently only a few feet; sufficient, however, to explain the interesting results obtained with an horizontal antenna lying close to the surface of the earth, or even in trenches a few inches below the surface and extending, of course, in the general direction of wave propagation.

Unquestionably the molten interior of the earth would conduct low frequency oscillations with comparatively little loss, but it is obviously impossible to make connection to this molten interior, ordinarily. If one cared to experiment with two volcanoes at a comparatively short distance apart, making each crater the terminus of a line connecting with the terminals of an A. C. generator, and at some distant spot of the earth's surface between two neighboring volcanoes another parallel wire, in which a tuning and detecting device was located, very interesting results might be obtained. See Fig. 2.

However, if such a combination could be found there would probably exist not the slightest excuse for sending telegrams between stations thus situated. Unfortunately, or fortunately, we cannot locate our volcanoes as we would subway tubes.

If, as you suggest, a powerful wireless station could be operated at a sufficient distance from the earth's surface, and completely isolated therefrom, remarkable distances of transmission thru the ether might be achieved. However the energy obtainable at the moon from a given output of energy transmitted near the earth's surface can be calculated, by inverse square law. It will be found that a tremendously powerful station would be required to transmit signals to any such distance. You doubtless are aware of the remarkable distances obtainable from airplanes to the earth, using comparatively small transmitters. Just recently an army airplane carried on radio communication successfully over a distance of 150 miles. The distances are usually much greater than where a similar transmitter is located on the earth's surface, using a similar length of antenna.

The phenomena involved in such transmission, where the airplane is, say, two miles above the earth's surface, are doubtless complex. Here the ground wave is originally a *free space spherical wave*, but when the surface of this wave reaches the earth it doubtless cuts into the earth for a small depth and becomes then a true *grounded wave*, just as if it originated from an earthed antenna. See Fig. 3. There is great need for interesting data on the phenomena of transmission from airplanes and whoever will collect and publish such data will be conferring a great service to the Radio Art.

Concerning your question as to whether the wireless waves travel or glide along the surface of the earth in the manner which I have described above, each wave having a grounded foot or base penerating a short distance into the earth, I might mention a very interesting phenomenon which we have encountered in installing wireless stations in mountainous or mining country in the western part of the United States. Figs. 4 and 5 illustrate this phenomenon. Fig. 4 shows a case which often happened in the early commercial days of radio-telegraphy, where a mine owner or other party wished to install a station in a valley or cañon, which happened to have sharply rising cliffs on either side. Apparently the composite etheric and ground waves became so stretched out or attenuated in their effort to leap across this valley, that the station was only able to intercept either very weak signals or no signals at all. Therefore it was found advisable in-

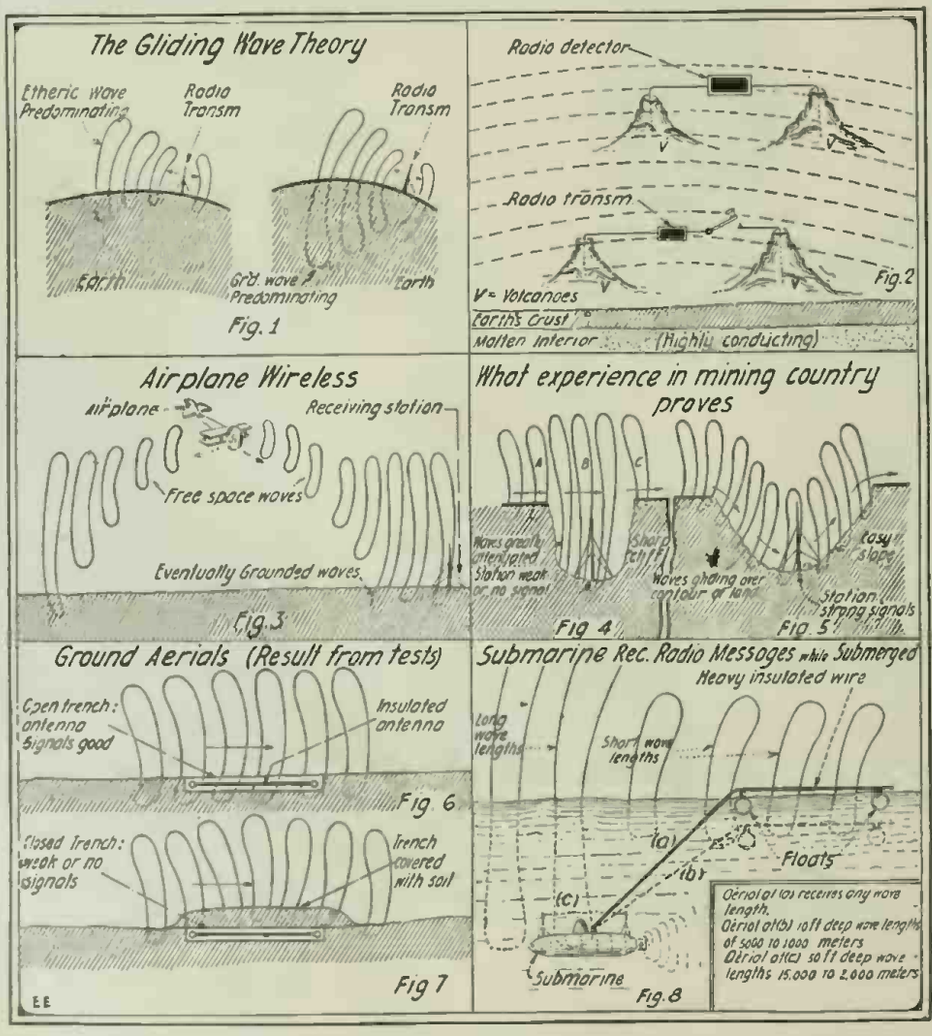
(Cont. on page 919)

THE editors sent a copy of the article published in the December issue of the ELECTRICAL EXPERIMENTER entitled "Radio Around the World," and also the editorial in that issue by Mr. H. Gernsback, covering several interesting and more or less doubtful theories concerning the propagation of these electric waves over a distance of 12,000 miles, i.e. between Carnarvon, Wales, England and Sydney, Australia, to Dr. Lee de Forest, the prominent American radio engineer and scientist. The editors asked Dr. de Forest the following questions:

First: What is your opinion concerning the etheric wave transmission above the surface of the earth, i.e., free space wave propagation? Do you believe that the etheric wave wireless transmission is better beyond the computed fifty mile atmospheric envelope surrounding the earth, and how far into interstellar space do you believe these signals might be carried? Imagine for the moment that an airship fitted with sensitive wireless receiving instruments could have traveled away from the earth for any desired distance? Do you think these waves would be felt on the moon, approximately 238,000 miles distant, considering of course that suitable receiving instruments were available at that point?

Second: What is your opinion concerning the ground wave transmission, i.e., do you believe, with the geologists and others, that the earth presumably being a molten mass in the interior, might be a better conductor than the soil and rock crust surrounding it, and that this gaseous interior of the earth might therefore prove a better conductor than the soil and rock strata, and thus that the ground radio wave may have traveled directly thru the earth or a distance of nearly eight thousand miles—corresponding to the diametrical axis—or do you believe it much more likely that these ground waves followed around the curvature of the earth in the manner explained by Prof. J. Zenneck and other investigators, each ground wave gliding over the surface of the earth?

Third: Is it your opinion at the present day that the pure etheric space wave, gliding over the earth in accordance with the generally accepted theories concerning radio transmission, is the predominating wave, both as to electrical energy involved and amplitude, compared to the ground wave; or is the ground wave superior in its energy component and amplitude? These conditions are shown in one of the following diagrams, Fig. 1, and we would request your opinion on the relative extent above and below the surface of the earth, of the space wave and the ground wave respectively.



Various Phases of Gliding Wave Wireless Transmission Used In Discussion Here Given. In General, the Etheric Space Wave Glides along the Surface of the Earth, Accompanied by Its Grounded or Foot Wave.

www.americanradiohistory.com

Aërial or Ground Radio—Which?

The Opinions of Two Leading Wireless Experts

Do Radio Waves Travel Above the Earth or Thru It?—by Dr. L. W. Austin, Radio Expert, U. S. Naval Radio Laboratory.

REPLYING to your queries of recent date, I am very glad that you have asked these questions and will answer them to the best of my ability.

Q-1. I see no reason to doubt the validity of the old theory of wireless transmission which supposes a wave in ether (and under certain circumstances in the upper layers of the earth, provided they are sufficiently bad conductors), the lower ends of the electric lines being grounded on the conducting surface. The space wave under most circumstances certainly carries the *greater* part of the energy, except where the wave front is bent very far forward. This theory, it seems to me, is sufficiently proven by quantitative observations on received radio current which at moderate distances always agree within a few per cent with the theory that the antenna produces a field corresponding to a Hertz oscillator of twice its length.

Q-2. I believe that the currents in the earth are only incidental to the presence of the ether waves.

Q-3. In the case of transmission between airplanes and the earth, the phenomenon is similar. In sending from a 'plane, the wave must start as a *pure ether wave* which spreads downward and *grounds itself*, and then spreads out longitudinally (with a more or less bent wave front) very much like the wave from a grounded antenna.

Q-4. In antennas close to the ground or buried in the ground which, by the way, behave exactly alike except for a slight difference in static-signal ratio, the reception is accomplished by picking up the earth currents produced by the wave. These, of course, become relatively more powerful at greater distances from the sending station, owing to the usual bending forward of the wave front. The sending from earth or buried antennas is probably accomplished as follows:

In the first place, *ground currents* are formed which produce an electric field in the ether above the earth's surface. This field in spreading out and upward gradually rights itself and travels off very much like the field from an antenna, except that it is *directive.*

Q-5. I do not believe that it is probable that any wireless radiation passes thru the Heaviside layer. (Ed. Note: This would seem to eliminate the "Mars" radio story which has been going the rounds of the daily press.)

Q-6. Experiments indicate that *long waves* can be detected at *greater depths* than short ones, as would be expected from the ordinary skin effect phenomenon of alternating currents.

I am very sorry I have to disagree with Mr. Tesla in this matter, for I consider him the father of wireless telegraphy. His lectures in the early '90s contain full descriptions of a wireless system superior to anything which we actually had in practise before 1910, except for the lack of a proper detector.

Here Are the Questions the Editors Submitted

Q. 1. Do you believe that wireless transmission is effected by complex ether waves having a grounded foot, these waves gliding over the surface of the earth from the antenna, and if so:

(a) Do you think that the etheric space wave above the ground is the predominating one in energy component and amplitude?—or

(b) Do you believe that the ground wave component is the predominating one in energy component and amplitude?

Q. 2. Do you believe that underground wireless transmission is effected by means of ground impulses or currents radiating thru the earth from the base of the antenna, and that the etheric space wave radiation from the antenna is merely an incidental and separate phenomenon, which dissipates itself at a comparatively short distance of a few hundred miles or so?

Q. 3. Do you not believe in this general direction of thought on the matter, that it is the etheric space wave radiation from the antenna that accounts entirely for airplane radio transmission; either 'plane to 'plane, 'plane to earth, or earth to 'plane communication?

Q. 4. How do you account for the results obtained with the Rogers underground and undersea radio transmission and reception? Do you believe that this is accomplished by the grounded components or "feet" of the gliding etheric space waves in conformity with the usual theory accepted theretofore by the Hertzian wave school, or do you think that it is due to ground impulses or high frequency oscillating currents propagated thru the conducting shell of the earth?

Q. 5.—Do you think that, all things considered, and in the light of present day radio developments, such as the Rogers underground and undersea system, that radio transmission would take place with higher efficiency in free interplanetary space, or do you believe that our wireless signals produced at stations on the earth are retained within the atmospheric envelope of the earth due to reflection from the "Heaviside" ionization layer?

Q. 6. It has been hinted at by several naval radio experts and others that it has recently been found that the penetration of the ground wave component in radio transmission increases with increase in wave length, and this phenomenon they are inclined to believe accounts for the results obtained with the underground system. Do you believe this to be a fact?

How I Believe Radio Wave Transmission Is Accomplished

By F. H. KROGER

Chief Engineer, International Radio Telegraph Co., Formerly Chief Engineer, National Electric Signaling Co.

IN response to the request of the Editors of the ELECTRICAL EXPERIMENTER, I give below my replies to the questions here submitted:

Q-1. Practically all the energy delivered by the radio transmitter is radiated in the form of waves *gliding on the earth's surface.* Any energy which may be found to exist in the earth's surface is supplied by the waves sent out from the antenna. The *poorer the conductivity* of this surface, the more energy is taken from the wave, and consequently the less there is available at the receiving station.

Q-2. There must exist in the earth's surface, currents at the feet of the waves referred to in question number one. Means for detecting these currents will give a method of receiving messages. These currents, however, represent only a small per cent of the energy of the traveling wave. It is quite generally agreed that the wave above the surface cannot exist without the current in the surface and vice versa.

Q-3. Yes.

Q-4. Currents due to the gliding wave.

Q-5. The "Heaviside" ionization layer must be a boundary to the waves. One of the explanations of the marvelous work done in the North during the winter is the fact that the ionized layer of the Aurora, coming close to the earth, provides a boundary to the waves which prevents the usual attenuation.

Q-6. The ground losses are higher with longer wave-lengths for poorly conducting earth, in the vicinity of the antenna, which indicates that a greater volume of the earth is affected by the currents. This greater penetration would also hold for the gliding wave. Ground tests made some years ago indicated that the ability to receive signals *did not depend* upon the quality of the ground nor the wave-length: therefore Mr. Rogers' system probably does not depend upon a penetration due particularly to long wave-lengths, but upon a penetration which is sufficient for his purposes, given by any wave-length.

EXAMINATIONS FOR AMATEUR FIRST GRADE RADIO OPERATOR'S LICENSE AT NEW YORK.

Examinations for amateur first grade radio operator's license are being given at Room 603, Custom House, Bowling Green, New York City, every day after 9 a. m., announces Charles D. Guthrie, Radio Inspector of that district.

Attention is called to the fact that applicants for amateur first grade radio operator's license must qualify in the transmission and reception of Continental Morse code at the rate of *ten words per minute* instead of five as heretofore.

Papers covering these examinations will be rated by the examining officer as soon after the examination as possible *but no licenses will be issued until amateur stations are permitted to operate.*

PLEASE NOTE: By taking this examination authority is NOT granted to open your station. It will be necessary after the stations are authorized to open, to furnish on form 762, Applicant's Description of Apparatus, the particulars required and await the issuance of station license as well as the operator's license before operating the station and form 762 cannot be filled in and filed until the station has been made ready for operation as it is important that the exact dimensions of the antenna and the amount of power to be used be stated in this application.

You are hereby cautioned that it is unlawful to operate an unlicensed station, and all amateur licenses (operator's and station) issued prior to the war are now void.

When authority is granted to issue amateur licenses, new station numbers and call letters will be given.

CHAS. D. GUTHRIE,
Radio Inspector.

www.americanradiohistory.com

The How and Why of Radio Apparatus

By H. WINFIELD SECOR

No. 11. How to Make and Use a Direct-Reading Wave Meter and Decremeter.

From time to time we will describe one particular instrument used in either the radio transmitting or receiving set, explaining just how it works, and why. We have received so many requests from new readers asking for such explanations that we have decided to publish this matter in seriol form. In the course of several issues all of the principal transmitting and receiving apparatus will have been covered. The subject for the eleventh paper is HOW TO MAKE AND USE A DIRECT-READING WAVE METER AND DECREMETER.

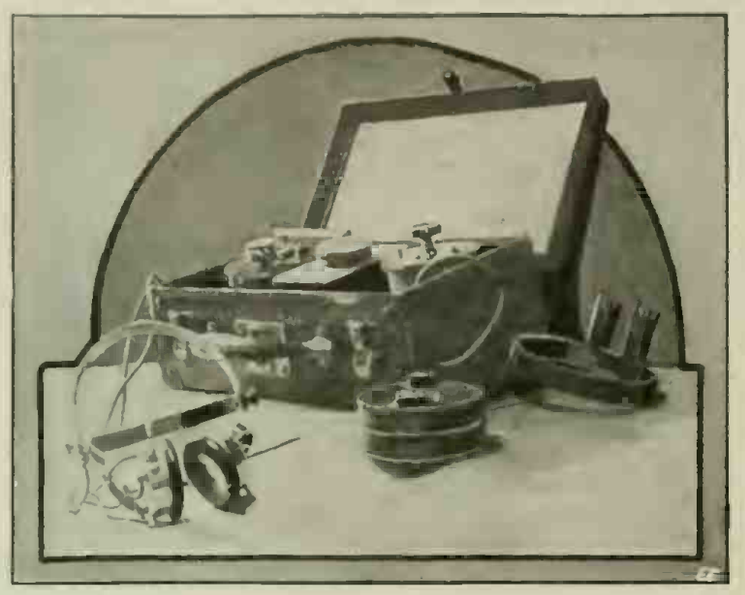
THE present time seems an opportune one for the radio student and the radio amateur to prepare for the forthcoming opening of experimental radio opportunities, and we believe that no better use can be made of the spare time than to construct and study the use of the *wave meter and decremeter*. The accompanying text and illustrations show how to build a home-made wave meter which will give very satisfactory service. The dimensions given for the various parts of the instruments are taken from an experimental one which was carefully calibrated for the writer.

We will first take up the construction of the wave meter and will afterward consider the calibration curves to be used with it, and also the determination of decrement.

Perhaps the first part of the instrument that will come to hand as the student sets about the building of it, is the *inductance*, or rather the inductances. These coils are also referred to as the *exploring coils* or exploring inductances. They are used to pick up sufficient energy from a radio transmitter or receiving set, so as to cause oscillations to be set up in the wave meter circuit, which will be of sufficient strength to give a positive indication of resonance or non-resonance of the circuit, and thus to determine the exact period at which the current being measured is oscillating.

The illustration, Fig. 1, gives the details of construction for the three inductances used with this wavemeter. The wooden forms on which the coils are wound are best turned on the lathe from some fine grained hard wood such as mahogany or maple. The physical dimensions of the forms are given in the drawing and the length A, of each of the three coils varies with the number of turns on each, the table in the figure providing these values for the different coils. The winding in each case consists of one layer of No. 20 B. & S. gage enameled magnet wire. These inductances have been accurately calibrated by comparison with a standard wave meter at the Radio Standardization Laboratory of the College of the City of New York, thru the courtesy of Dr. Alfred N. Goldsmith, Director, and the specifications for building these coils must be rigidly adhered to. Where the accuracy of the instrument within a few per cent below or above the calibrated values is not imperative, No. 20 gage magnet wire, covered with a single winding of silk may be used; but due to the peculiar qualities of enameled magnet wire and the number of turns per inch of winding, etc., it will be seen that the specifications here given should be carefully followed to obtain the inductance values in centimeters here given. The three coils, numbers 1, 2 and 3, have inductances of 36,000, 126,000 and 259,000 centimeters respectively.

The manner of attaching the inductance coils to the wave meter cabinet is shown at Fig. 1, and consists of two lugs made of 1/16 inch brass and having slots at the lower ends of each. This enables the operator to slip the coils on and off the binding posts quickly. The inner and outer leads from the winding of the inductance should be carried thru diagonally drilled holes in the wooden form, as is indicated by the dotted lines, and they should be soldered to the two brass lugs, which are screwed to the form by means of small flat-head brass wood screws. The wooden form may be varnished or shellacked before winding, but the winding itself should not receive any coating of shellac or varnish, as this changes the distributed capacity of the coil. Do not use any iron in building these inductances.



Photograph of Author's Wave Meter Fitted with Calibrated Condenser and Inductance Coils of the Dimensions Given in the Present Article.

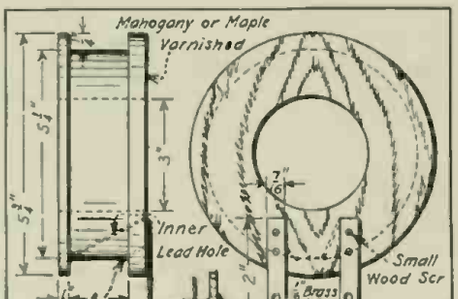


Fig. 1
Inductance Coil Data

Dimensions of 3 Inductance Coils				
Coil No. 1	12 Turns No. 20 B&S Enam. Mag. Wire	A: ¾"	Ind. cms. 36,000 cms.
" " 2	24 "	"	"	4¼"	" " 126,000 "
" " 3	36 "	"	"	4¼"	" " 259,000 "

Details of Inductance Coils, Three of Which Are Used to Give the Wave Meter a Desirable Range.

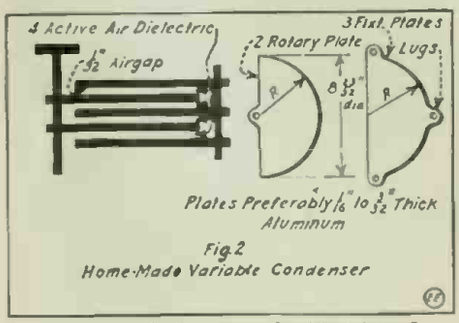


Fig. 2
Home-Made Variable Condenser

Dimensions of Home-made Variable Condenser of the Required Capacity for Wave Meter Here Described.

The next item claiming our attention is the variable condenser, and we might say a great deal concerning this part of the apparatus, and then again we might just as well say very little. Experience dictates that this comes out about as follows: in the first place many radio experimenters would rather obtain on the open market a small rotary type variable condenser having the proper capacity for use in this particular wave meter, and this should be .00086 microfarad. Of course any condenser having this capacity within a small fraction one way or the other may be used, but if the student wishes to have a good accurate wave meter, and intends to eventually have it calibrated or checked against a standard wave meter, then he will do well to select a good sturdy and reliable make of rotary condenser. Some of the points to be watched in the design of such a condenser are that it should not have the rotary and fixt plates too closely spaced, or else it will frequently give trouble by short-circuiting; the rotary plates should be accurately locked on the rotary shaft either by having their hubs molded on the shaft or else they should be mounted on a square shaft so as not to turn, or again they can be keyed on the shaft. For the purpose of a wave meter there should also be practically no up and down movement or play in the vertical shaft supporting the rotary plates. For all practical purposes, the capacity of a rotary variable condenser (see Fig. 2), is determined by the usual capacity formula using a K value of 1, which is that for air.

Many radio amateurs and experimenters

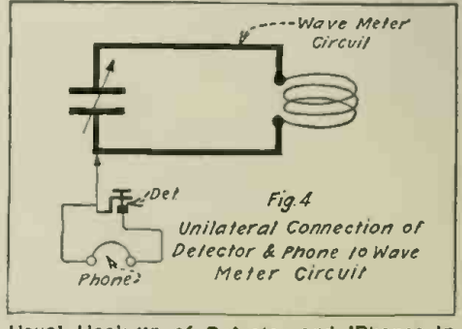


Fig. 4
Unilateral Connection of Detector & Phone to Wave Meter Circuit

Usual Hook-up of Detector and 'Phones In Unilateral Fashion. Where There Is Sufficient Energy to Actuate Detector Properly.

www.americanradiohistory.com

will undoubtedly wish to construct their own variable condenser having this required capacity, and the physical dimensions of such a variable condenser are given in Fig. 2. As will be seen, this particular design comprises three stationary and two rotary aluminum or brass plates. These plates should preferably have a thickness of 1/16 to 3/32 inch so as to be perfectly flat and retain their shape, and thus maintain the accuracy of the condenser when once assembled. The four active air dielectric spaces between the plates should be exactly 1/32 inch. The diameter of the rotary plate, as Fig. 2 indicates, should be 8-23/32 inches, and by cutting the lugs on the stationary plates as well as on the rotary plate in the manner indicated, will permit of the accurate interleaving of the rotary and fixt plates so as to give the proper capacity.

Thus we see that the two principal parts of any wave meter are—an accurately cali-

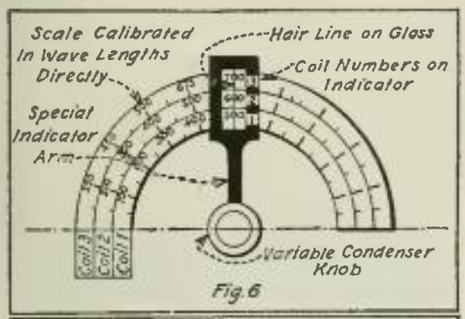


Fig. 6

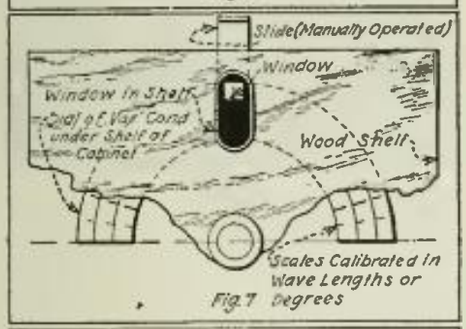


Fig. 7



Fig. 8

Three Schemes for Improving the Wave Meter Dial and Indicator so as to Make It "Direct Reading." Fig. 8 Shows an Automatic Dial Arrangement Which Causes the Correct Reading to Appear, no Matter Which of the Three Coils Is in Use.

brated precision variable condenser and an accurately calibrated inductance. In practically all cases this inductance and capacity of known values are connected together in parallel or shunt as shown at Fig. 3-A. Referring to Figs. 3-A and 3-B, the lead wires joining the inductance or exploring coil to the variable condenser are composed of two pieces of No. 16 flexible lamp cord, each 6 inches long. A 3-inch length of copper strip joins the two pairs of binding posts. Fig. 3 shows one set of binding posts being used for the inductance coil and the other set intended for the connection of a hot wire milliampere meter or thermo-couple and galvanometer. Ordinarily this latter pair of binding posts are fitted with a piece of copper strip about 1/16 inch thick forming a *jumper*.

It is well in all cases to fit a safety spark gap across the terminals of the variable condenser as shown at Fig. 3-B, as when the wave meter is used in close proximity

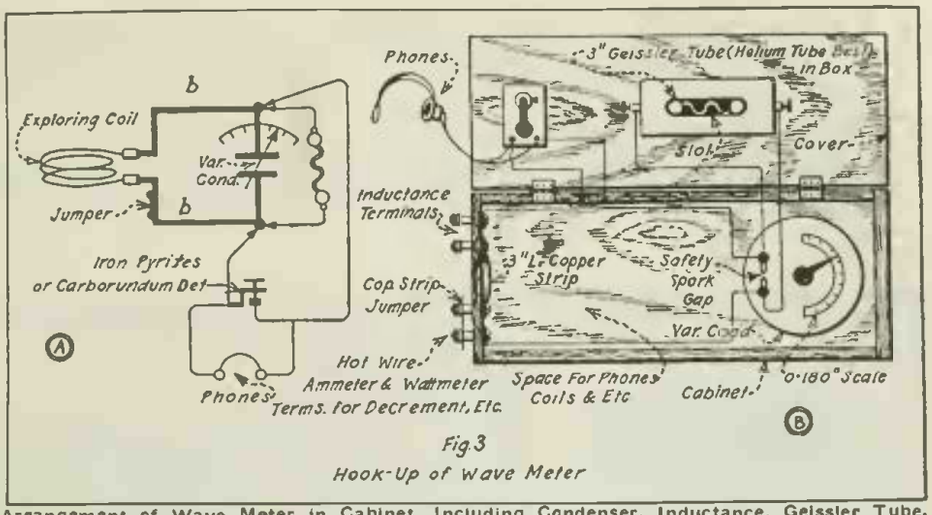


Fig. 3
Hook-Up of Wave Meter

Arrangement of Wave Meter in Cabinet, Including Condenser, Inductance, Geissler Tube, 'Phone (1,000 or 75 ohm), Etc. The Diagram Shows Geissler Tube and Detector and 'Phone Indicator Circuit, Either of Which Can Be Used.

to radio transmitting sets, there is very often a sufficiently heavy current induced in the wave meter circuit to cause a puncture of the insulation of the inductance coil or a short-circuiting of the variable condenser, especially if the latter happens to have closely spaced plates.

For indicating the maximum resonance when measuring the wave length of a transmitting set, where the induced current in the wave meter is of course quite strong in any case, a very good indicator, as proven by practise and experience, is an ordinary 3-inch Geissler tube, or better yet a small *helium* gas tube. It is best when using either a Geissler or helium tube as an indicator of maximum resonance, to place the tube in a small box mounted on the lid of the wave meter, the box being blackened inside and provided with a slot in the front so that the degree of glow in the tube may be easily seen. It is also common practise to connect a hot wire milliampere meter in series with the inductance and condenser of the wave meter by removing the jumper on the series binding post terminals and connecting the meter to this; in this case the maximum resonance, and therefore the wave length at which the circuit under test is oscillating, is indicated by turning the condenser handle until the needle of the hot wire meter reaches a maximum reading. Some operators prefer to use the well-known detector and telephone receiver method of determining the maximum resonance point in the wave meter circuit as the diagrams at Fig. 3 show. The detector and wireless 'phones are connected (in series or in multiple) across the variable condenser for the purpose. This arrangement is extremely sensitive, and is the one invariably used in measuring the wave length of received signals. The Geissler tube or other apparatus is, of course disconnected from the wave meter circuit, if the detector and 'phone method is to be used. With respect to the detector used on the wave meter, it may be said that either carborundum or iron pyrites proves best, as either may be subjected to a very strong current without harm.

Figures 4 and 5 show two more circuits used with the wave meter. Fig. 4 shows a detector and telephone receiver circuit, connected to the main oscillating circuit of the wave meter by a unilateral or one-wire connection. This method is highly recommended in many text books treating on the wave meter and its uses, and at the present time it is used on many of the best commercial wave meters. This connection of the detecting circuit possesses the advantage that it cannot have any detuning or offsetting effect on the oscillating circuit as is the case where it is placed in shunt to the capacity and inductance composing this circuit, and it is very efficient for the purpose in hand, as with this connection the detector and 'phone receive just a sufficient amount of energy to operate

(*Continued on page 921*)

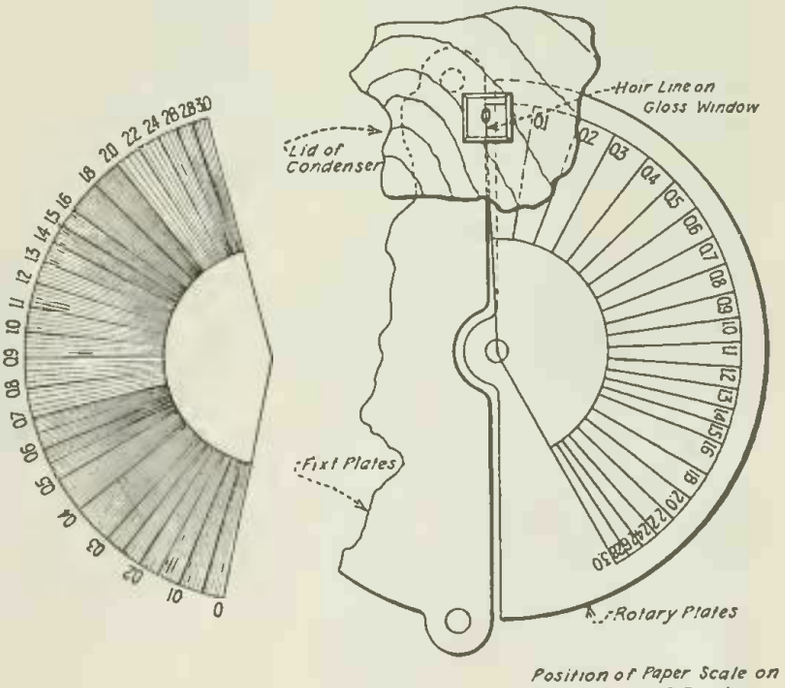


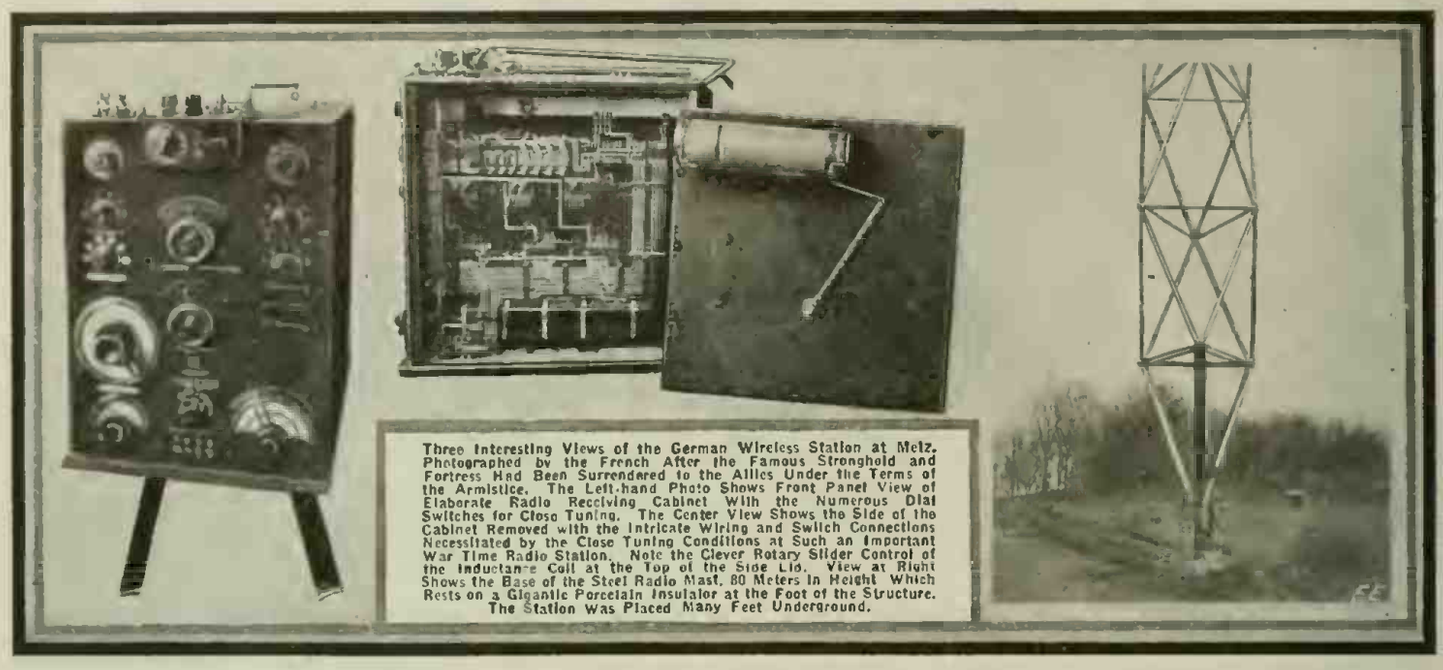
Fig. 10

To Make a "Direct Reading Decremeter" of Your Wave Meter, Cut Out the Paper Scale at the Left and Mount It on the Variable Condenser Shaft or on the Top Rotary Plate in the Manner Here Shown. The Decrement Is Read thru the Window When Resonance Is Indicated.

www.americanradiohistory.com

German Radio Apparatus Used at Metz

THE accompanying illustrations show the interesting radio apparatus and antenna mast used at the famous German military base at Metz. These photographs were taken by the French Army when they entered Metz after the signing of the armistice. The photograph of the aërial mast is interesting as it shows a very novel construction whereby a strongly braced tower structure is formed of steel tubes or pipes, provided with flattened ends thru which bolts are past. The base of this radio mast, measuring 80 meters in height, is tapered to a point at the bottom, as the photograph shows, and rests on a large porcelain insulator. Suitable guys and pins were used in arranging this insulating base support, so that the foot of the mast could not slip or break away if for any reason the insulator should break. The mast was well-guyed with steel cables running in different directions, and the antenna was supported in umbrella fashion from the top of the mast. As the photograph discloses, a high steel fence enclosed the grounds connected with the station to preserve secrecy, and also to prevent any one coming in contact with the highly charged aërial conductors.



Three Interesting Views of the German Wireless Station at Metz, Photographed by the French After the Famous Stronghold and Fortress Had Been Surrendered to the Allies Under the Terms of the Armistice. The Left-hand Photo Shows Front Panel View of Elaborate Radio Receiving Cabinet With the Numerous Dial Switches for Close Tuning. The Center View Shows the Side of the Cabinet Removed with the Intricate Wiring and Switch Connections Necessitated by the Close Tuning Conditions at Such an Important War Time Radio Station. Note the Clever Rotary Slider Control of the Inductance Coil at the Top of the Side Lid. View at Right Shows the Base of the Steel Radio Mast, 80 Meters in Height Which Rests on a Gigantic Porcelain Insulator at the Foot of the Structure. The Station Was Placed Many Feet Underground.

The remaining two photographs show respectively front and side views of the receiving apparatus used at Metz. One of the first interesting things we note in connection with the design of the apparatus, and plainly visible in the side view is the rotary control of the inductance slider. This is accomplisht by a lever secured to a rotary knob, the free end of which is joined by means of a link member to the slider of the inductance in the manner shown, so that as the handle is turned in rotary fashion, the slider will move back and forth along the coil. The detectors, of which there are several in duplicate, are observed at the top of the instrument, while an elaborate multiplicity of control handles with graduated inductance pointers, are provided for changing the wave length of the primary and secondary receiving circuits, as well as the coupling between the coils of these circuits, and also the capacity values used.

The telephone receivers, several sets of which may be used when desired, are connected with the receiving set cabinet by means of flexible cords and jacks, eight of which are placed in a group at the lower center of the front panel.

Among other things, we find it interesting to note the very neat arrangement of the interior wiring of the cabinet, the various connections being run symmetrically in straight lines, evenly spaced and held rigidly in place by means of insulating cleats. In the side view of the apparatus, which shows the interior, one may perceive the neatly wound inductance coil at the bottom of the cabinet, and as will be seen, it is square in form with a number of inductances placed along the form on which it is wound. This set is designed so as to be suitable for receiving either spark or arc signals. No vacuum bulb detectors or oscillators are shown, but we know that they were used in many of the German sets, the bulb employed being that devised by Lieben and Riez.



Wireless Terms Illustrated—"Beat Receiver" —Courtesy The Oscillator.

MORE BUNQUE.

By J. A. Weaver.

I often wonder how Noah made the arc light.

And it sure does get my goat why insulators wear petticoats.

And of what possible use is a vacuum cleaner, being as a vacuum is always clean?

And whether undamped waves oscillate or vibrate?

And whether it would be murder to kilowatt?

And whether you can measure water with a wavemeter?

And how a bus-line can run from place to place without moving?

And whether it would be nice to be a miner in the mines of Asia-Minor?

And if a condenser is over charged by a conductor would it cause a disturbance on the trolley line?

And where does the dago when nite approaches?

And how to tell when onion plants armature?

And what is the price of a drink at the bus bar?

And why some boobs persist in saying a.c. current and d.c. current instead of a.c. and d.c.?

And whether there are any seeds in a transformer core.

CHAIN OF RADIO STATIONS.

The establishment of a chain of radio stations, approximately 30 miles apart along the Atlantic Coast, was announced at the headquarters of the 1st Naval District recently. The statement intimated that by this arrangement incoming vessels, when 150 or 200 miles off coast, could determine their position easily by communicating with shore stations, regardless of weather conditions. Along the 250 miles of coast included within the 1st District eight stations are already in operation.

COAST GUARD STATIONS TO HAVE WIRELESS.

In the near future radio stations will be installed at the coast guard stations at the Isles of Shoals, at Station No. 2 at Cross Island, Buck's Harbor, Me., and Station No. 8 at Damiscove Island, Boothbay Harbor, Me. A number of radio operators will be sent to these stations.

www.americanradiohistory.com



A Timely Reinforcement

A Copper Plated Stomach

By THOMAS REED

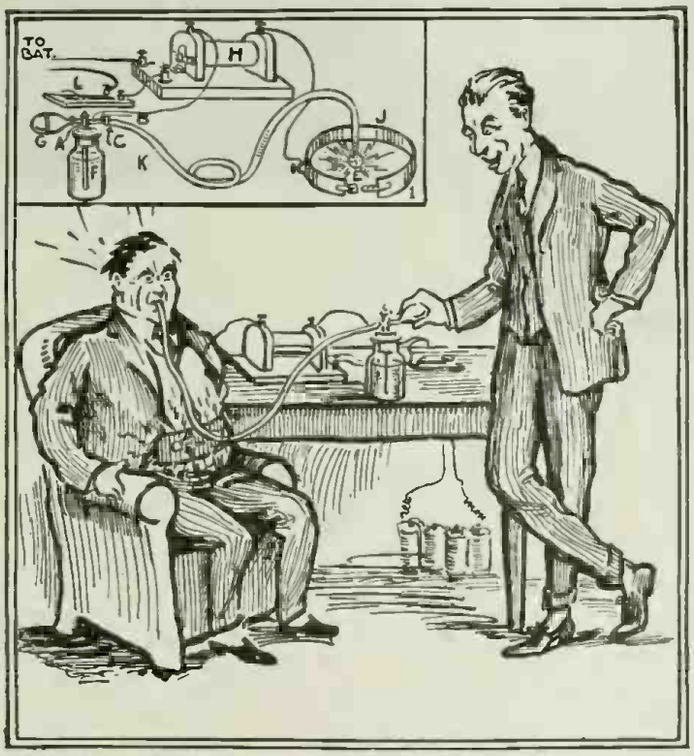
THERE'S a lot in being forehanded. Mother was that way. Every Saturday we used to have salt fish for dinner, so she wouldn't be bothered with getting up anything to eat on baking-day. That sounds like a paradox, but it wasn't, it was a shame, for the "baking" was very appetizing and savory, while the fish was—well, not so savory.

Now, when you wanted salt fish on Saturday, you had to begin way back in the week somewhere. Tuesday was a good day because there wasn't much of anything to do (on top of the regular chores) except the ironing, and you had a chance to think. Follow me carefully—you know how long it is from Tuesday before Saturday comes around? Well, mother used to plan ahead all the time, foreseeing she was going to be heated and tired, and all fust up with cooking formulas, and would need an accommodating viand for dinner that she could slap down most anywhere without hurting it, and tell us children to go to it and forget the whole business. On Tuesday she commenced *deodorizing* the fish.

You see, while the fish abode with the grocer, it was always picking up scents like coffee and spices and matches and kerosene, from the clerk's habit of wiping his hands on it in passing, and the hostler would chuck a horse-blanket on it often enough to give it a quaint stable tang. But what you'd call the basic flavor was imparted by "Tabby"—the store cat. The pile of codfish was the place where the cat slept and took her bath (the kind of dry-cleansing a cat calls a bath); also her refuge from stray dogs—or ambush, according to whether she could lick the dog or not. The result was you couldn't say the cat smelt fishy, or the fish catty, but they smelt about alike! It was a blend, like this fancy-named toilet-water you have to have pronounced for you, *eau de* something or other.

If you just wanted the fish for a smelling fish, you didn't have to do anything to it, it was all right as it was. But when you wanted to use it for an eating fish, you had to go to work and separate the fish part from the odor part, or as much of it as you could. It wasn't difficult or laborious at all, but it took time, and that's why you had to be forehanded. You put this fish into a good stout pan—a pan that wasn't particular whom it associated with—and covered it with common ordinary water. The water didn't stay that way very long. In a few hours it was most *un*common water, yelling to heaven and casting into the air bunches of assorted perfumes, like Spring-time tripping o'er the lea and scattering flowers—I mean the operation was the same, not the raw material.

When one dose of water had suffered about enough you poured it off and renewed it, and so on. If you tended right to your business thru Tuesday and Wednesday and Thursday and Friday and Saturday morning, then by Saturday noon there was your fish—transformed into a regular eating fish—at least those who had to eat it could. That's how you had to plan meals in those days—no frittering away your time at *tea-dongsongs* till the last minute, and tossing on a preserved pig's foot for supper.



To Copper Plate Human Stomachs So as To Digest the Present Post-War Foods, Thomas Reed Here Shows Us How To Set About Rigging Up the Necessary Apparatus. When You Once Receive This Treatment You Will Be Able to Swallow Nails, Old Milk Cans, Sections of Steam Boilers, Bricks, et Cetera, and Then the Undertaker Will Nail You Up.

Examples like this gave me the same habit of being forehanded. I'm always looking ahead and spying out some situation that's liable to be dangerous or disagreeable, and providing against it. It's a lucky thing I am, as it happens, and you'll say so, too, when I tell you.

Perhaps you remember we had a "war", or something like that, recently. Well, just when we were thinking it was going to last forever, we began to hear noises from the Other Side that sounded like "By gorry we've got 'em licked!" "They're quitting!" "The war is over!" "Honk-honk!" "Wow!" and other expressions of quiet satisfaction. From that moment nothing was thought of but comebacks to hand to Germany in return for her favors of the past 40 years, with the accent on the last 4—which was righto, and success to the job; but in the rush of business, a very important point was overlooked by everybody but ME. I'll tell you what I mean.

You know how thick and fast the celebrations came, along there in November? They made a record for thickness and fastness that won't be beaten till "Bill" gets back from Hell. There was the "Fake Peace Celebration" on Thursday, and the "Real One" on Monday, and the "Regular One" on Tuesday. I don't know how it was with you, but by Wednesday I had food for thought—and it was the only kind of food I was able to sit up and take any notice of.

The thought, being fed, was mainly to the effect, how nice it would have been if I'd had one of those *copper-lined stomachs* that are always being talked about and never realized. I don't know as I ever appreciated before how reliable copper is. Viewing the ruin of my faithful Gastric Cavity thru handling the few easy objects I'd sent down to it, I envied the old copper boiler at home—how it used to digest 3 or 4 bushels of the family wash, or boil up a barrel of soft soap, or a tub or two of whitewash-stunts really exacting, you know—and get away with it year after year.

Ah me, as the fellow says. With a tummy built on the lines of that boiler, one could celebrate Peace till the cows came home with their 16-cent milk, and then tackle a New Year's Eve and a couple of "wakes" on the side, instead of rueing the day—whatever that is—as I was doing.

But the real horror of the situation was this; here were a million or two of soldiers and sailors due to come home and go thru this celebration-thing multiplied to the hundredth-power. The big cities were going to stuff 'em, then the smaller branch cities, and the railroad towns, and the home towns—the strain all the time increasin as the burg grew smaller—till finally they'd fetch up at "Home" itself, the one with the Big "H", with Mother roasting chickens and frying flapjacks and baking pies in a wild effort to make up a year's deficiencies in army rations all at one meal. All that, and only an ordinary membranous stomach to stand it! Was there any time to lose? No. The copper stomach, so long postponed, had to be invented *tout de suite* if it was going to be ready for the occasion.

Well, here it is, all ready and waiting,

(*Continued on page* 927)

www.americanradiohistory.com

The Alkaline Storage Battery

By J. F. SPRINGER

STORAGE batteries are of two principal kinds—(1) the lead-acid battery, and (2) the alkaline battery. Our attention is now directed upon the latter. There is but one alkaline cell of prominence on the market—the Edison battery. Each cell is a complete self-contained unit and may be used alone or in conjunction with other cells. A typical cell will have a voltage of about 1.2 average discharge potential; the maximum discharge potential is about 1.45 volts at the start. The charge and discharge voltage characteristics are given in the accompanying graph, Fig. 1. While charging the cell voltage may rise as high as 1.85 volts. The amperage will vary with the size of the cell. By connecting a battery of cells *in series*, it is possible to run the voltage up to any desired point; see Fig. 2-A. A usual voltage for rather short circuits—under 300 feet—is 30-32 volts. Accordingly, about 30 cells are required. The battery used as a unit will have a voltage equal to the sum of the voltages of the individual cells. The amperage will remain the same as with the single cell. It is necessary, therefore, to choose a size of cell that will give the amperage required for the service or else use more than one battery, connecting the batteries—not the cells—*in parallel*, see Fig. 2-B. For a 110-volt system, a large number of cells will be needed. In making such calculations, it will be best to rate the alkaline cell at just about 1 volt. Thus, for 110-volt service use 110 cells, connected in series.

In purchasing a battery, it will be necessary to decide on the voltage to be used. There are probably more household and similar devices on the market that are designed for the 110-volt system than for any other. At the same time, there is a considerable range of such devices which are adapted to, and available for use on 30-32 volt circuits.

The alkaline cell has a tight-fitting cover. As in all batteries there will be generated a certain amount of gas; this escapes thru a special valve. The cell is well suited to rough usage, partly because of the tight cover and partly because the container is of sheet steel and not of glass or hard rubber. The liquid is of an alkaline character. It loses but little of its water as time goes on. In order to determine whether the strength is normal, a hydrometer may be used. The electrolyte consists of potassium hydrate (21 per cent solution) to which has been added a small amount of lithium hydrate. The specific gravity of the alkaline cell does not change during charge or discharge. The normal specific gravity will be 1.210, but this may drop at times to as low as 1.160 without affecting the cell. A brand new alkaline battery will not develop its full capacity at once. After a number of chargings it will settle down to a standard performance. This settlement into a standard condition is understood to be due to the improvement in the conditions of the negative plate consequent upon regular charging and recharging. This process of self-forming continues over a period of from one to three months.

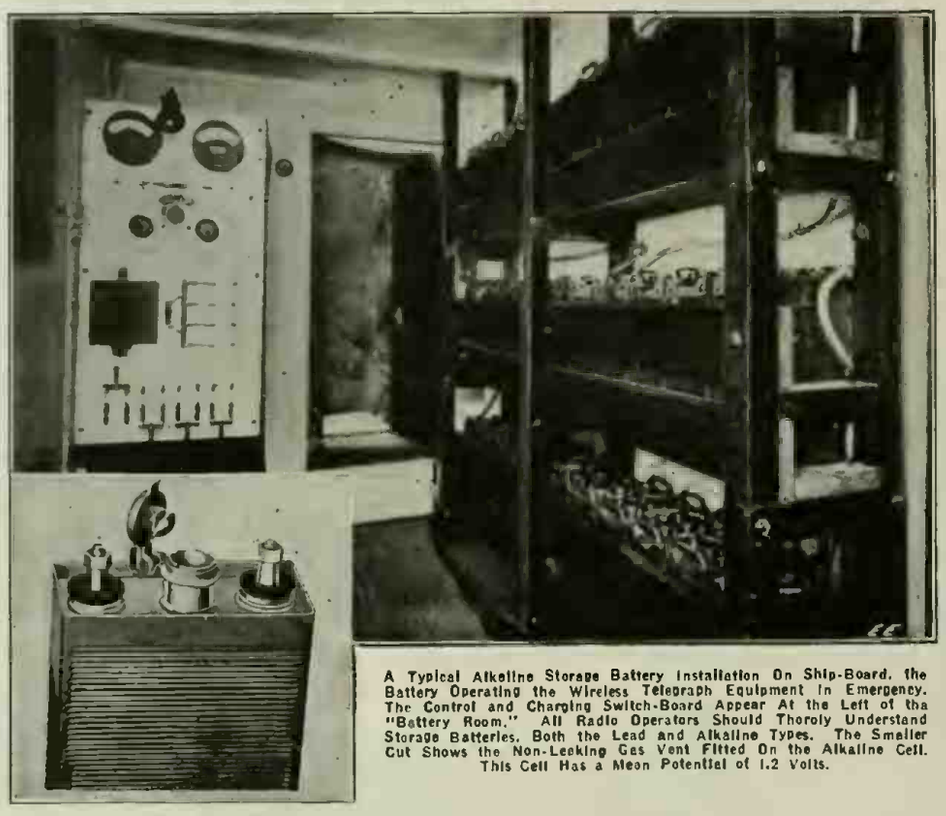
The care of an alkaline battery will ordinarily be simple. The density of the liquid may be watched and corrected, if necessary. This will usually mean the addition of a little water to bring the hydrometer reading down to 1.210. Regularity of handling will probably give better results in an alkaline battery than any other one thing. This is especially true in connection with the charging.

A battery may be charged slowly or rapidly or at a medium rate. That is, it may be done *normally* in 7 hours, or rapidly in 1 or 2 hours, or at a moderate rate in 4 or 5 hours. Slow, regular charging at the normal rate is to be preferred, if conditions make slowness conveniently possible. Whether the battery is charged slowly or rapidly, evenness of charging is always to be adopted.

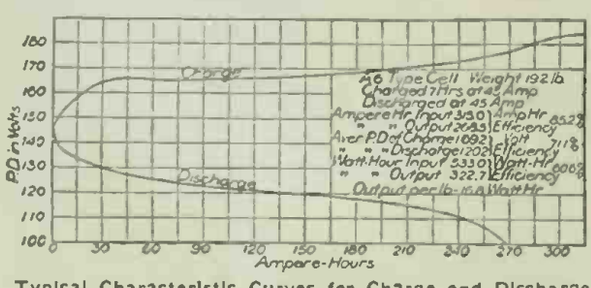
Direct current only is usable in charging. If alternating current is the only source of energy available it will be necessary to convert it into direct current and to use the latter with the battery. There are several methods which may be employed. First, there is the motor-generator. The alternating current is used to operate a motor. The motor drives the generator and produces the direct current for charging. A mercury arc rectifier is another device for converting the alternating current into direct. This device is often more economical and convenient if only a small current is to be handled.

Of course, direct current may be generated at once. The equipment necessary will be (1) an engine or some equivalent means of operating the generator; (2) a generator, and (3) a switchboard. It would probably be cheaper to use the current direct from the generator to operate the lights, etc., and to dispense with the storage battery, if the current were required in a steady, even stream. But current is not ordinarily required thus in a home or on board a boat.

(*Continued on page* 931)



A Typical Alkaline Storage Battery Installation On Ship-Board, the Battery Operating the Wireless Telegraph Equipment In Emergency. The Control and Charging Switch-Board Appear At the Left of the "Battery Room." All Radio Operators Should Thoroly Understand Storage Batteries. Both the Lead and Alkaline Types. The Smaller Cut Shows the Non-Leaking Gas Vent Fitted On the Alkaline Cell. This Cell Has a Mean Potential of 1.2 Volts.



Typical Characteristic Curves for Charge and Discharge of Edison Type Alkaline Storage Battery. The Average Discharge Potential Is Seen to Be 1.2 Volts. Fig. 1.

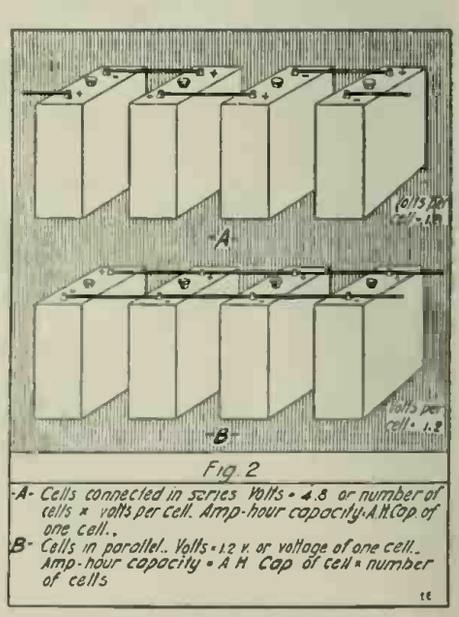


Fig. 2

-A- Cells connected in series Volts = 1.2 or number of cells × volts per cell. Amp-hour capacity A.H. Cap of one cell.

-B- Cells in parallel. Volts = 1.2 v. or voltage of one cell. Amp-hour capacity = A.H. Cap of cell × number of cells

Diagram Showing Voltage and Amperage With Series and Parallel Connections of Battery Cells.

www.americanradiohistory.com

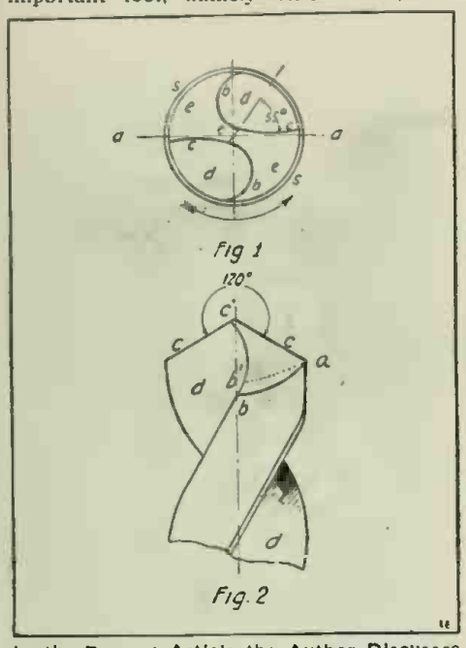
Experimental Mechanics

BY SAMUEL D. COHEN

LESSON XI

THE THEORY OF TWIST DRILLS.

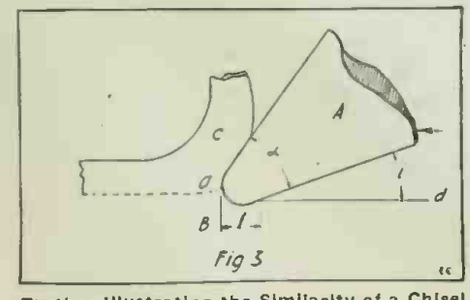
THE student who has been following the past lessons in "Experimental Mechanics" may now find himself confronted by a more or less difficult task in properly utilizing a very important tool, namely—*twist drills*, and



In the Present Article the Author Discusses the Theory of Twist Drills, the Shape of the Grooves, the Pitch of the Cutting Edges, Et Cetera. The Lips C-C May Be Considered as the Cutting Edges of Two Chisels, Which Turn about the Axis of the Drill.

the writer gives below a brief resumé of the subject of twist drills and their grinding. Because it is very essential to follow understandinly the subject of twist drills, a short mathematical treatise of simple nature will be given in order to more readily facilitate the understanding of the subject.

The twist drills stand in use so far above flat drills that they are now an indispensable tool in every workshop for metal working. They may be manufactured by milling or forging two spiral grooves out of a cylindrical bar, or by twisting a bar of the desired cross-section, so that the lines originally running parallel to the axis become spiral lines. The first method of manufacturing is today still the most common one. When we take a spiral drill and turn it with the top towards us, we shall see it as shown in Fig. 1. *dd* are the spiral grooves, *cc* both cutting edges, so the drill will have to turn in the direction of the arrow. *ee* is the solid part of drill; the top of the drill nearest to us is the edge c^1, which unites the two edges *cc*, making an angle of about 55 degrees with each of them. The cylindrical surface of the drill at *ss*, only exists for the part *aa*, for, to prevent unnecessary friction against the walls of the hole, the rest of the surface is brought to a somewhat smaller diameter. Sometimes the surface *s*, is gradually backed off, beginning at the edge without a distinctly perceptible step, as in Fig. 1. The profile of the grooves *dd*, is chosen so that the intersection with the top plane *b*, gives as far as possible a right angle line *C*. The shape of the line *b* is of lesser importance provided that the groove *d* is wide enough to allow the chips to pass easily. The dimension of the weakest point of the drill where the edge c^1 is found, is fixt by the demand of strength in the drill. The edge c^1, which cuts very badly, should he as short as possible. Ordinarily, it is taken 1-10th of the diameter at the point of the drill and gradually increases to the upper end, for reasons of strength.



Further Illustrating the Similarity of a Chisel Cutting Into a Piece of Metal to the Two Cutting Edges of a Twist Drill.

When looking at the drill sideways we now see it as shown in Fig. 2; *cc* are the sectants which form together an angle of about 120 degrees, c^1 the connection, *dd* the grooves, the pitch of which amounts to 5 to 8 times the diameter of the drill. We consider *cc* as being the cutting edges of two chisels, which, turning around the axis must cut chips from the metal. The form and the position of these chisels in regard to the metal will have to answer the same requirements as every other cutting chisel, which are these: In Fig. 3 *A* represents a cross-section of the chisel, *B* the piece of work from which the chip *C* is cut by moving *A* in the direction of the arrow.

To prevent the chisel breaking its cutting edge—the angle α—obtained by grinding, and therefore called the *grinding angle*, must be sufficiently strong. For cutting mild steel and iron α is made upon an average of about 55 degrees; with very good steel the angle can be some degrees smaller; with a poorer grade steel it must be some degrees larger. The loosening of the chip from the metal is not done at the lowest point of the chisel, but at *a*, being the point most advanced. The metal is pushed down at a length *l*, Fig. 3, and thereafter returns to its level *a-d*. The smaller the angle *i*, which may be enlarged or diminished by the position of the chisel, the longer *l* will be, and the greater will be the resistance of the metal being pushed down. Experience tells us how large the angle *i* must be; it varies between 4 degrees to 8 degrees for lathe and planer tools. We shall see how great it must be made for twist drills. In no case may it be smaller than 4 degrees, or the chisel will refuse to cut.

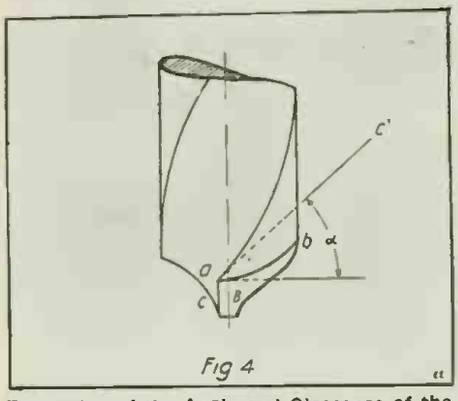
Don't Miss the Next Lesson—"Grinding Twist Drills."

It will discuss the various factors involved in properly grinding twist drills, both by hand and machine or jig. A real practical article which every amateur machinist will want to read.

Referring to Fig. 4, the point *a*, of the cutting edge *c*, situated on the cylindrical surface of the chisel, we find the grinding angle *a*, appointed by the tangent to the spiral and by the tangent to the line *ab*, sectant of the cylindrical surface of the drill, and the ground top *B*. So the size of this angle is determined with regard to the strength of the edge and practically amounts to about 55 degrees. Then follows the angle *i* in Fig. 3; where to find it. While turning around on its axis the drill advances into the metal. So each point describes a spiral line with the pitch equal to the feed of the drill for one revolution. These spiral lines, however, are of unequal diameter. Point *a*, in Fig. 4, on the circumference of the drill is given in Fig. 5, as if moving on the spiral line a^1a. The diameter of the drill being $D = 1$ in. and the feed 1-50th in.; the inclination of the spiral line is found by:

$$\text{Tan } \beta = \frac{\text{feed}}{\text{circumference}} = \frac{1}{50 \times \pi} = 0.00637$$

$$\beta = 0° 22'$$



Discussion of the Angle and Clearance of the Cutting Edge of a Twist Drill.

Point *a*, in Fig. 4, at a distance of 1-20th in. from the drill axis, describes the spiral line c^1c with the same pitch *h*, Fig. 5, as a^1a; the angle of inclination γ however, is quite a different one; for the case of 1-20th in. it is:

$$\text{Tan } \gamma = \frac{1}{50 \times \pi \times 1/10} = 0.0637$$

$$\gamma = 3° 39'$$

In Fig. 5 the value *h* of the feed has been given immoderately large for the sake of clearness, and the angle γ has consequently been drawn much larger than it is in reality.

The spiral lines, a^1a and c^1c, are the lines in regard to which the angle *i*, in Fig. 3, has to be measured. They agree with the line *a-d*, in that figure. From this it follows that for point *a* of the drill the setting angle *i* is measured in regard to the line, inclining already 0° 22', and therefore must be so much greater than usually. For point *c* this difference becomes 3° 39'. The setting angle becomes a changeable value, increasing towards the center of the drill. In giving it everywhere the same value for simplicity's sake, that is to say the largest cutting cross-section desired in the center, the edge would become too weak at the circumference.

With the above facts in mind the writer will give a complete practical discourse on how to handle twist drills, grinding, *et cetera*, in the next installment.

(To be continued)

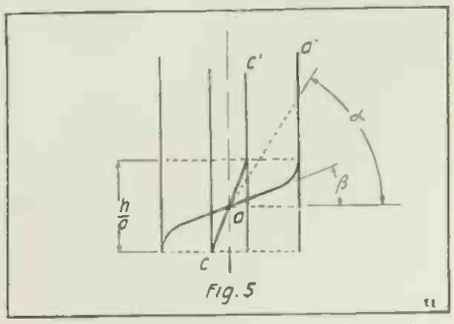


Diagram Used in Explaining the Value of the Angles of Grinding of Twist Drills.

www.americanradiohistory.com

Practical Chemical Experiments

Butter and Butter Substitutes

By ALBERT W. WILSDON

BUTTER is obtained by skimming the milk and putting it thru the process of churning, the globules coalesce and the solid fat separates more or less thoroly from the other constituents of the milk. As found on the market, butter is rarely found to contain more than 80 to 85 per cent fat; the rest

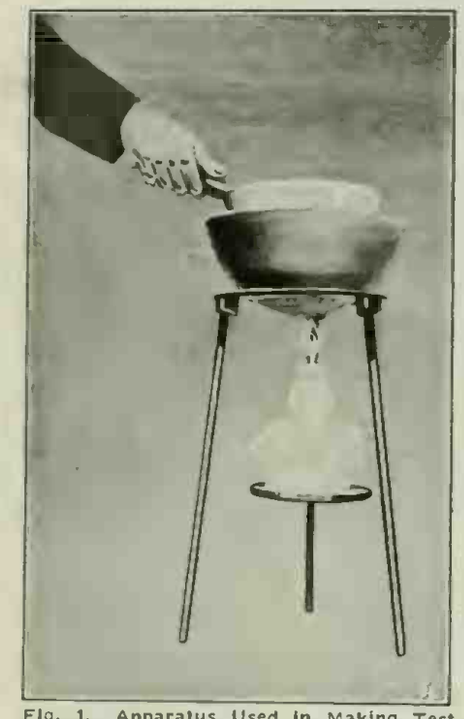


Fig. 1. Apparatus Used in Making Test for Butter and Oleomargarin or Renovated Butter.

being principally water, with some proteids and lactose from buttermilk still remaining in it, and more or less salt or saltpeter, to flavor and preserve it. It quite frequently is colored with some harmless vegetable compound.

Oleomargarin is usually prepared from the fat contained in the intestinal folds of beef cattle. It is carefully stript from the fresh carcass, washed, chilled and hashed exceedingly fine. It is then *rendered* in water-jacketed kettles at a temperature of about 50 deg. C. The scum which separates out at the top is drawn off and the scraps settle at the bottom. The liquid fat is then run into vats and there permitted to stand for a day or two at about 27 deg. C., at which temperature butter is just liquid. The semi-liquid mass is then wrapt up in cloths and prest to remove the thin yellow liquid oil (oleo oil) from the solid fat (oleo-stearin). To turn this liquid oil (oleo oil) into a very good substitute for butter it is churned with some milk so that it can absorb some of the butter taste, then some coloring matter is added (vegetable compound), and the mass is finally run into ice-water, thus chilling it rapidly. It can then be salted and packed like ordinary butter. Two marked advantages which this material has over butter are: (1) It is much cheaper, and (2) owing to the absence of buttermilk and butter fats it has much better keeping qualities. Its flavor ranks well with second-class butter.

"*Renovated*" or "*Process*" butter is in general prepared as follows: Old, rancid, and unsalable butter is melted in a large vat surrounded by a hot water jacket at a temperature of about 45 deg. C. The curd and brine are then drawn off at the bottom, the scum being taken off at the top. Air is blown thru the mass, to remove the disagreeable odor, and after mixing with some milk, the mass is churned and then run into ice cold water to make it granular in structure. It is then ripened, worked to free it from buttermilk and salted. It is required by law in some states that this product be marked "Renovated Butter."

SIMPLE TEST FOR BUTTER

Experiment No. 1. See Fig. 1.

Heat about 3 grams of the sample in a large iron spoon over a low Bunsen flame, stirring constantly. Genuine butter *will boil quietly*, with the production of considerable froth or foam, which may, on removal

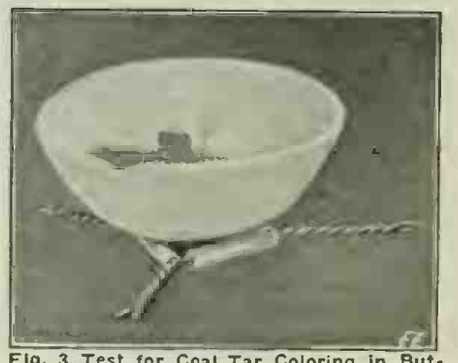


Fig. 3. Test for Coal Tar Coloring in Butter Which Can Be Made by Anyone in a Few Minutes' Time.

from the flame, boil up over the side of the spoon. *Renovated butter* or *oleomargarin* will sputter and act like hot fat containing water, but will not foam. Examine also the curdy particles when the sample is removed from the flame; in the case of genuine butter these particles are *small* and *finely divided*, but in the case of oleomargarin the curd *will gather in large masses.*

MILK TEST FOR BUTTER

Experiment No. 2. See Fig. 2.

To make a "milk test" for butter, place



Fig. 2. Set-up of Simple Apparatus Utilized in Making the "Milk Test" for Butter.

about 60 cc. of sweet milk in a wide-mouthed bottle, which is set in a vessel of boiling water. When the milk is thoroly heated, a spoonful of the butter is added and the mixture stirred until the fat has melted. The bottle is then placed in a dish of ice-water, and the stirring continued until the fat solidifies. If the sample is butter, either fresh or renovated, it will be solidified in a granular condition and distributed thru the milk in *small particles*. If, on the other hand, the sample consists of oleomargarin, it solidifies practically in *one piece*, so that it may be lifted by the stirrer from the milk.

By the two tests just described, the first of which distinguishes fresh butter from process butter or renovated butter and oleomargarin; and the second of which distinguishes oleomargarin from either fresh butter or renovated butter, the nature of the sample examined may be determined.

Every house-wife should know how to test butter and oleomargarin and the important differences between them. That is one object of the present paper. The author trusts it proves of value.

BEGINNING with this issue, "EXPERIMENTAL CHEMISTRY", as will be noted, has been changed to "PRACTICAL CHEMICAL EXPERIMENTS." For several years past, Mr. Albert W. Wilsdon, who will continue the new department, has become familiar to our readers thru his chemistry articles. There has, however, been an urgent demand from our readers for articles on everyday chemistry, practical experiments, etc. We are, therefore, beginning with this issue a series of practical chemistry, free from technicalities. We think the change will be welcomed by our friends.

In the same department we are also inaugurating a Question and Answer Department, and every reader is invited to ask any question on chemical phases which may occur to him. Such questions will be answered every month hereafter in these columns. When sending questions, they should be addrest to "Editor, Chemistry Department."—Editor.

(*Continued on page* 894)

www.americanradiohistory.com



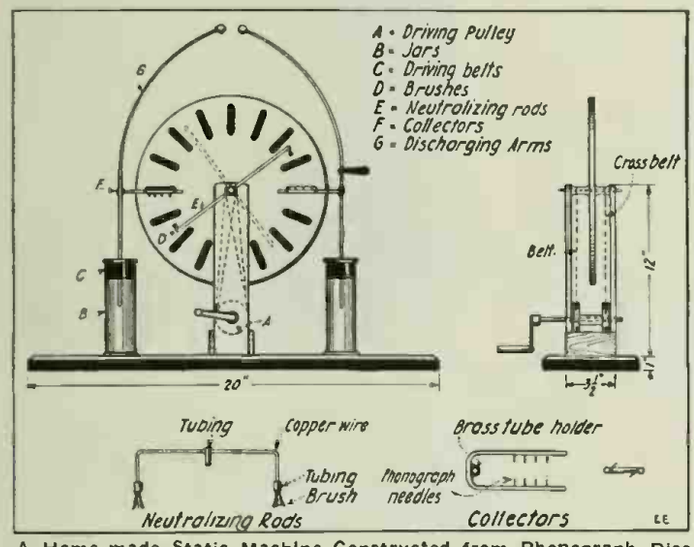
This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 is awarded; for the second best idea a $2.00 prize, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

FIRST PRIZE, $3.00

A SIMPLE WHIMSHURST INFLUENCE MACHINE.

By Melville Fisk.

THE static machine described herein is made of simple materials, is easy to construct and the work does not require the use of special tools. A similar machine built by the writer produces a violent and steady spark discharge about an inch or more in length, without the use of Leyden jars.



A Home-made Static Machine Constructed from Phonograph Disc Records.

The plates are two twelve-inch phonograph records of the disk type. Select two which have one side blank. The tinfoil sectors are cemented to the smooth side. It is not necessary to varnish the plates. The bosses that keep the plates parallel on the shaft are small cotton spools, that have a hole in them the size of the one in the record. Fit the spools up with brass tube bearing and fasten to the plates with glue. A thin cloth or paper washer inserted between the boss and plate will help the glue to hold. Rubber tire cement will hold better if at hand. The shaft on which the plates revolve extends out ¾ of an inch on either side of the wooden standards; it is held stationary by a cotter pin inserted in a hole bored down thru the top of the standard. Glue a cardboard washer 1½ inches in diameter to the inside of one of the plates. The base and standard are made of wood in the manner illustrated.

Make the double driving pulley from a large spool such as wire is sold on. Fasten it to the shaft by drilling thru the shank and shaft and inserting a cotter pin or screw. Be sure and make the grooves in the pulleys deep enough to hold the belts securely. Rubber bands tied together make very good driving belts. Tie them with strong linen thread and leave a half inch of slack between each band. As the plates are to revolve in opposite directions, cross one belt.

The neutralizing rods are made from ⅛ inch copper wire bent to shape. They are pivoted on the protruding ends of the shaft by a short piece of tubing soldered to the center. Press the tubing slightly together at the open end to make it grip firmly. The brushes are made from very fine copper strands secured from wire such as is used in receiver cords (gilt tinsel). Cut about twelve strands two inches long; tie a knot in the center, and fold over so that all ends are together. The brushes are then slipt into the small tubes soldered onto the ends of the rods and are fastened by squeezing the end of the tube together.

Make the collectors as per sketch, using heavy copper wire. The points are long phonograph needles, fastened to the arms by drilling and then soldering. The needles should be slanted slightly in the direction in which the plate rotates. The supports are brass tubing, soldered on.

The discharging arms are of brass rod of a size that will fit in the collector supporting tubes. Make a small dent in each tube so that the rods do not slip all of the way thru. Fit balls to the ends of the rods by boring, then pegging and soldering.

The jars are used as supports only. Varnish them inside and out and fit with stoppers, bored to hold the collector tubes. A simple stopper is made by cutting a large wire spool in half and then winding paper around the shank to make a fit with the jar. Before using soak the stopper in melted paraffin. Further insulation can be obtained by placing pieces of a broken record under the jars. Glue the jars to the base.

In operation the neutralizing rods should be at right angles to each other, the best angle, however, can easily be found by trial. The brushes should touch the plates lightly—no pressure is necessary. The collector points should be about ¼ inch away from plates. Be sure that they are all the same distance away or else some will not contribute to the collecting. The distance between the plates should be about ⅛ to ¼ inch.

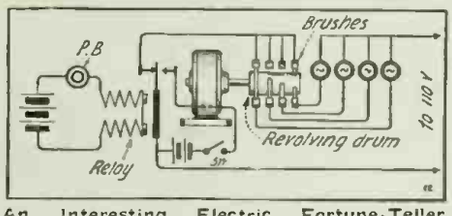
SECOND PRIZE $2.00

BLINKING LIGHTS TELL YOUR FORTUNE.

A glance at the illustration will show that while the magnet side of the relay is open, the small battery motor is running, revolving the drum. A gear may be used if a slower speed is necessary. When the push button is prest, the armature of the relay is attracted, breaking the motor circuit and making connection on the other side of the relay which goes to the one set of brushes on one side of the drum. The armature is itself connected to one side of the battery for the motor, and to one side of the current supply for the lamps. On the other side of the drum are the brushes connecting to the different rings on the drum. These brushes also connect with the various lamps which are again connected to the other side of the current supply for the lamps. As the button is prest, the motor stops and the circuit thru one of the lamps is made, the particular lamp depending upon the position of the drum when the motor stopt. In front of each lamp is a pane of glass on the back of which is pasted the fortune telling matter. The front of the glass may be painted with a thin white paint.

Contributed by

WILLIAM F. HAASE, JR.

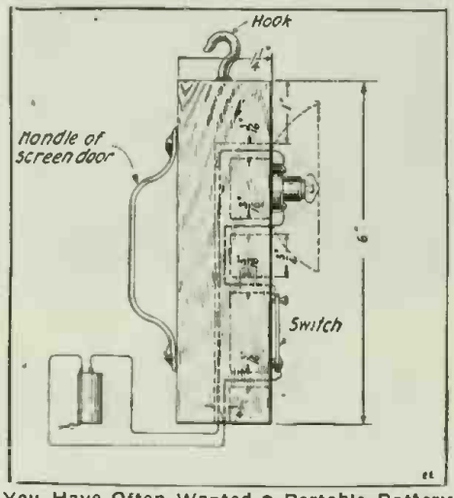


An Interesting Electric Fortune-Teller, Which Will Provide Hours of Amusement.

THIRD PRIZE, $1.00

PORTABLE BATTERY HAND LAMP FOR THE HOME.

The articles for the construction of this lamp can be purchased at a small sum, if you haven't them at home. Flexible lamp wire is the best for the wiring of this light.



You Have Often Wanted a Portable Battery Hand Lamp—Here's How to Make One at Practically No Cost.

About ten feet of wire is needed, when a large dry cell is used which cannot be carried around. For a pocket (flashlight) battery only a few feet is necessary. By means of the hook the lamp can be hung anywhere or in any corner on a nail, etc. A 1½ volt tungsten lamp is right for a single dry cell. A reflector adds greatly to the efficiency of the light.

Contributed by RAYMOND WAGNER.

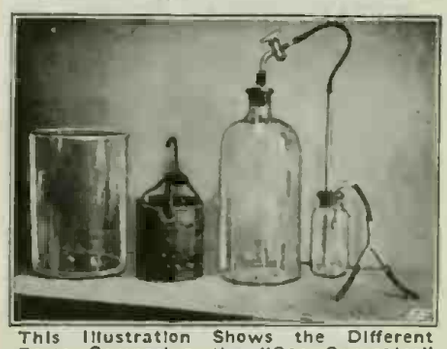
www.americanradiohistory.com



A Simply Constructed Gas Generator

By IVAN CRAWFORD

AMONG the automatic gas generators on the market there are few within reach of the average experimenter. To meet this condition, Prof. C. D. Dilts has recently developed a generator which may be easily and cheaply constructed. In experimenting with qualitative analysis a constant supply of hydrogen sulfide is essential. This generator, being self-regulating, will furnish a constant flow of hydrogen sulfide, carbon dioxid, or hydrogen. The principle of operation is the same as that of the well-known Kipp generator, namely that when the gas formed is not allowed to escape the solid material is automatically raised out of the liquid, but when the pressure is relieved the solid substance is lowered into the liquid, and the generator begins to function. As will be seen in the drawing, the four parts are: first, a glass jar or container; second, a bottle of slightly smaller diameter, with the bottom removed, and fitted with a stopcock in the top; third, a lead basket for holding the solid material; and fourth, a small wash bottle.

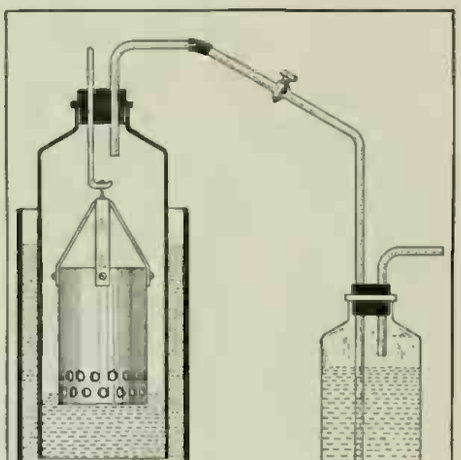


This Illustration Shows the Different Parts Composing the "Gas Generator" Here Described.

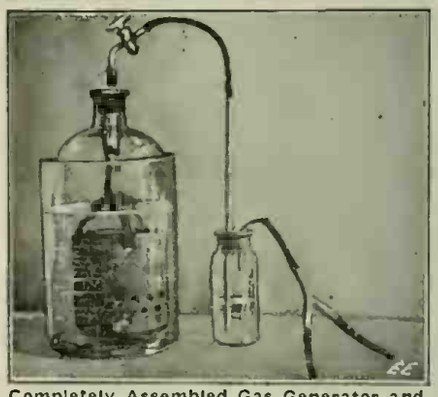
The glass jar may be easily made by cutting off the top of a large bottle. There are many methods which may be employed in removing the bell of the bottle, but by far the best and surest is the one described below.

Several long strips of newspaper, about an inch wide, should be soaked in water and wound about the bottle in two bands at the place where it is desired to break the bottle. About a quarter of an inch should be left between the two bands. The bottle should then be slowly revolved with the hands, allowing a blow-pipe flame to play upon the exposed part between the bands. When this portion is heated sufficiently the application of a drop of water will cause the glass to be evenly broken. The edges should then be smoothed on a soft grindstone. The bottom of the smaller bottle is removed in the same manner.

The sheet lead for the basket may be procured at any plumbing shop. It may be easily bent to the required shape, leaving small holes in the bottom to allow the acid to enter. The basket is suspended by means of a closed piece of glass tubing, bent to form a hook, which runs thru the two-hole stopper. The delivery tube from the bottle may be fitted either with a glass stop-cock or with rubber tubing and metal pinch-cock. Altho not absolutely necessary, a wash bottle is a desirable addition to the generator, as it not only steadies the flow but cleans and purifies the gas.



Sectional View of Gas Generator.



Completely Assembled Gas Generator and Wash Bottle.

The apparatus should now be assembled as is illustrated in the drawing and photograph. The solid material, such as iron sulfid (when H_2S is desired) is placed in the lead basket and the dilute acid in the glass jar. When the smaller bottle is placed in the jar the acid, reacting with the iron sulfid, engenders a flow of H_2S which forces the acid out of the basket if the stop-cock is closed. When the stop-cock is opened, the gas escapes and allows the acid to touch the iron sulfid, again causing the formation of H_2S. Thus gas is always easily procurable without waste of material.

TESTED CHEMICAL LABORATORY STUNTS.

1. *Spoons That Will Melt in Hot Water.*—Fuse together in a crucible 8 parts of bismuth, 5 of lead, and 3 of tin. These metals will combine and form an alloy, of which spoons can be easily made which possess the remarkable property of melting in hot water, coffee or tea.

2. *A Self-dancing Egg.*—Take a thin glass tube about 3 inches long and fill it with mercury then seal both ends with good hard wax. Next have an egg boiled and then break a small piece of the shell from the smaller end and thrust the tube with the mercury in, lay it on a table and it will not cease tumbling until the egg is cool. The same can be done by taking a small bladder putting a little mercury inside and blowing it up, then warm the bladder, it will skip about as long as the heat remains.

3. *To Give a Piece of Charcoal a Coat of Silver.*—Lay a crystal of silver nitrat upon a piece of burning charcoal; the metallic salt will catch fire and will emit sparks of various colors. The silver is reduced, and, in the end, produces upon the charcoal a very brilliant and beautiful appearance.

4. *In Water But Not Wet.*—Powder the surface of a large or small vessel of water with some lycopodium, which may be obtained at any drug store; you may then challenge any one to drop a coin into the water, and that you will get it without wetting your hand. The lycopodium adheres to the hand and prevents its contact with the water.

5. *Artificial petrifactions* (turning into stone).—In a retort place a small quantity of pounded fluor-spar and sand, and pour upon it some sulfuric acid; fluosilicic acid gas will be disengaged, holding silex in solution. The subjects you wish to petrify must be moistened with water and placed in a vessel connected with the neck of the retort, the silex will be precipitated upon them like a frost and will have a beautiful appearance. It will wear for years. Note—Do not breathe in this gas.

6. *An Experiment With Sugar.*—Take about 5 or 6 pieces of lump sugar and place them in a cup; next pour about 3 tea spoons full of boiling water upon them, and then add some sulfuric acid. It is truly a wonderful spectacle, and more instructive than reading, to see the sugar turn black, then boil, and now, rising out of the cup in a black color. It is now charcoal.

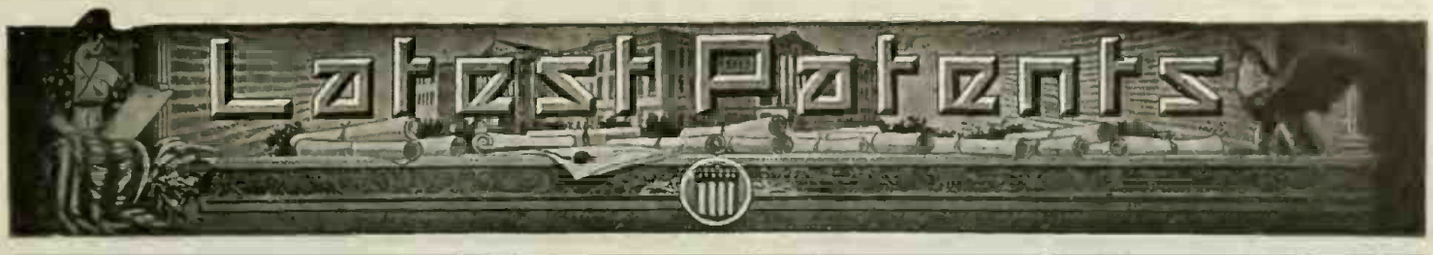
7. *To Melt Steel.*—Heat a piece of steel to redness in a fire, then hold it with a pair of pincers. In the other hand take a stick of brimstone or roll sulfur and touch the piece of steel with it. Immediately after their contact the steel will melt and drop like melted butter.

8. *Explosion Without Heat.*—Take a crystal or two of nitrat of copper and bruise them; then moisten them with water and roll them up in a piece of tin-foil, and in a minute the foil will begin to smoke and soon after will take fire and explode. Unless the crystals of copper are moistened, no heat will be produced.

9. *To Melt Lead in Paper.*—Wrap up a very smooth piece of lead in a piece of paper, then hold it over the flame of a taper; the lead will be melted without burning the paper providing there are no wrinkles in the paper and that it is in contact with the lead everywhere.

Contributed by EUGENE McGOWAN.

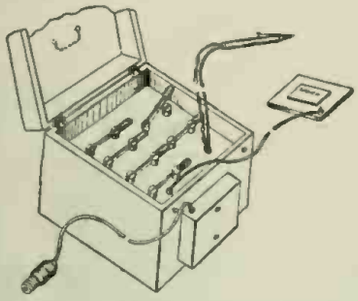
www.americanradiohistory.com



Electric Engraving Apparatus

(1,289,000; issued to Andrew M. Robinson)

An electric engraving apparatus employing a source of electric current forming an arc to produce the engraving. It consists of an ap-

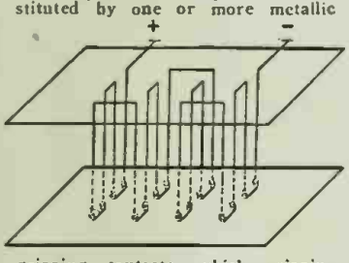


paratus employed with graduating tools, etc., for marking metal parts of machines, etc. A further object in the invention provides an auxiliary electric current or circuit connected to the pencil, and means in the pencil for controlling the make and break of the auxiliary circuit, to open and close the main circuit so as to prevent arcing when it is raised from the work. This apparatus eliminates this objectionable feature. The case contains a transformer, also a number of switches, by which the character of the current may be varied at will.

Current Modulator

(1,288,117; issued to Francesco Morano)

The chief object of this invention is a metallic microphone for high currents, which microphone is constituted by one or more metallic



gripping contacts, which gripping contact is formed of two contact elements, so arranged that one of them grips the other. The vibrating element is firmly mounted by the diafram, while the other element is supported by such means that the pressure of the contact which is formed by both elements accurately affects it. In consequence, the electrical resistance of the contact itself may be capable of varying in rigid conformity with the vibrations of the diafram according to the amplitude of said vibrations.

Apparatus for Locating Sunken Bodies

(1,287,907; issued to Patrick B. Delany)

Sunken ships and bodies, by the use of this invention, may be found very readily. It is an electrically operated device, used with some form of communicating device, such as a telephone receiver, and acts upon the principle of the circuit

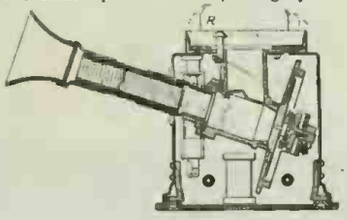


being closed, and having normally a certain definite resistance, i.e., the inventor does not use coils conductively or otherwise for the detection. The bare electrode is lowered by means of an insulated wire thru the water, and depends upon actual contact with some metallic body for its location. The circuit is formed thru a pair of sensitive head receivers, the bare electrode, the water and the electrode, and normally is of high resistance.

Recording Telephone

(1,290,621; issued to John F. Malthaner)

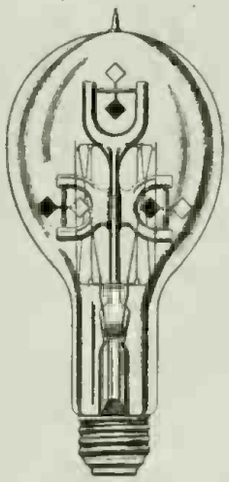
A new form of recording telephone, more or less on the style of the dictating telephone. A device in convenient size and weight for use on office desks, etc. It is so constructed that it may be used for receiving direct dictation over the phonograph, and also may be used to receive telephone messages from the ordinary telephone receiver, and in this manner to record the same on a phonograph record. Particular attention is attached to a new form of reed diafram constructed of the same width from end to end; approximately at its center is mounted a square soft iron disc held in place by clips, which on its underside has a holder for supporting the saffire point of the phonograph.



Advertising Lamp and Radiometer

(1,290,749; issued to Edward J. Hunt)

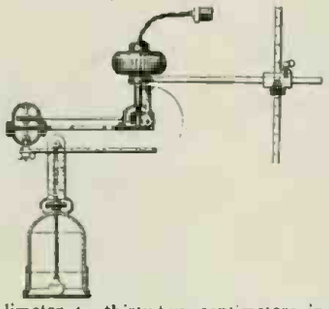
The device consists of a motor operating on the principle of the radiometer, in which the moving motor elements are caused to rotate upon their axes by the action of light. The device is primarily intended to be inserted with the enclosure of any ordinary incandescent lamp bulb and combined with the filament support in a manner permitting the use of the usual lamp filament, so that the light issuing therefrom shall cause the rotation of the several motor vanes. The motor element consists of a series of vanes, preferably four or more, which are silvered upon one side and blackened upon the other side with carbon or lamp black.



Radium-Applicator

(1,288,048; issued to George Kunkle)

A radium applicator adapted for the use of radium and other radioactive salts. The applicator is properly calibrated in advance and so arranged that the physician using it can accurately measure and administer by any of the approved methods the correct dosage at any moment by a simple adjustment of its parts. This instrument automatically and evenly irradiates surfaces of widely variable areas, as, for instance, areas of from one mil-

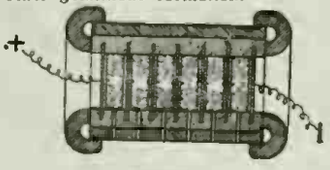


limeter to thirty-two centimeters in diameter.

Secondary Or Storage Battery

(1,285,660; issued to Bruce Ford)

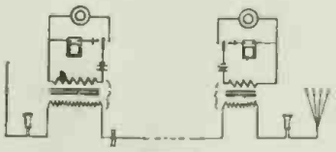
A new type and form of storage battery, its principal object being to minimize leakage between cells and still have a multiple voltage battery of sufficient strength to withstand the stresses and wear acting on such a battery. The structure may be described as a number of plates having a central portion, one face provided with a negative formation and the other face having a positive formation, with a rim projecting beyond both formations so as to fit and be prest into soft rubber tubing, which will make it nonleakable. The spaces between are filled with an electrolyte, which may be any plain liquid, or else held soaked in blotting paper or some other gelatinous formation.



Method of Telephonic Transmission Without Return-Wire

(1,287,180; issued to C. Bardeloni)

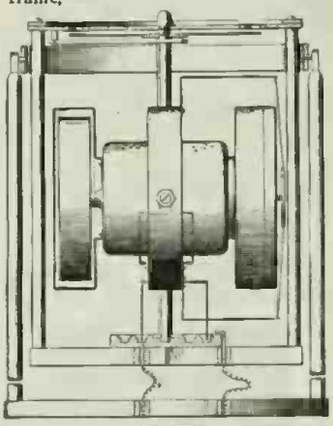
A new method of transmitting speech without a return wire. It is sometimes necessary to use a single wire for telephonic transmission without earthing its end. A condition like this might exist in connection with an observation balloon where the stringing of the separate telephone cable would not be feasible. Under these conditions the circuit does not close by conductivity, but remains as an open circuit, the return being formed by one or more metal conductor squares, electrostatically and electromagnetically connected between each other. This invention has the object of effecting telephonic transmission by the variations of the electrostatic and electromagnetic conditions, without any metallic conductors, or the earth, connecting the extremities of the system.



Compass-Gyroscope

(1,289,813; issued to Emil Klahn)

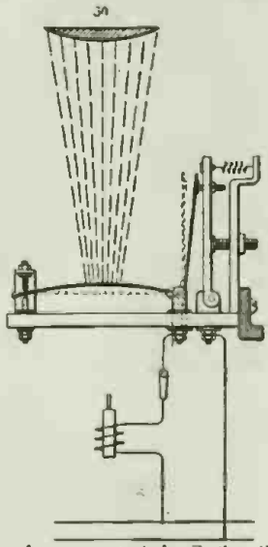
The invention consists primarily in mounting the gyroscope so that at all times it is unaffected by gravity, and in utilizing this potential function of the gyroscope to regulate the position of the controlled member, when a disturbing force is acting on the gyroscope. Its application is mainly a non-magnetic compass, when such disturbing or directive force results from the rotation of the earth, and for movements and changes in the course of a vessel carrying the compass, and apparent rotation of the compass card or controlled member taking place and serving as a measure of the change in course. The gyroscope is a means to partly suppress freedom of rotation about its vertical axis and a frame within which said gyroscope is pivotally mounted. A resilient means is connected with the frame adapted to work on the gyroscope, when the control member or compass card is in connection with said frame.



Thermostat

(1,287,188; issued to Henrich Beck)

A new design of thermostat, which to a certain extent eliminates many of the troublesome factors of the old style instrument. This type of thermostat is one which employs but one movable contact, the other being fixt, altho adjustable, and the two thermostat elements generally control the single movable contact, in response to a variation in temperature. But only one is subject to the action of radiant heat, and acts directly upon the carrier, and thereby acts directly upon the movable contact. The heat ray



may be concentrated on the thermostatic element by means of a condensing lens. When the element is at a normal room temperature it is straight, but when the radiant heat strikes the thermostatic element, then it curves slightly upward, moves a crank upon the carrier, which presses the fixt contact, thereby closing the circuit.

www.americanradiohistory.com

With the Amateurs

Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light-toned ones. We pay $3.00 prize each month for the best photo. Address the Editor, "With the Amateurs" Dept.

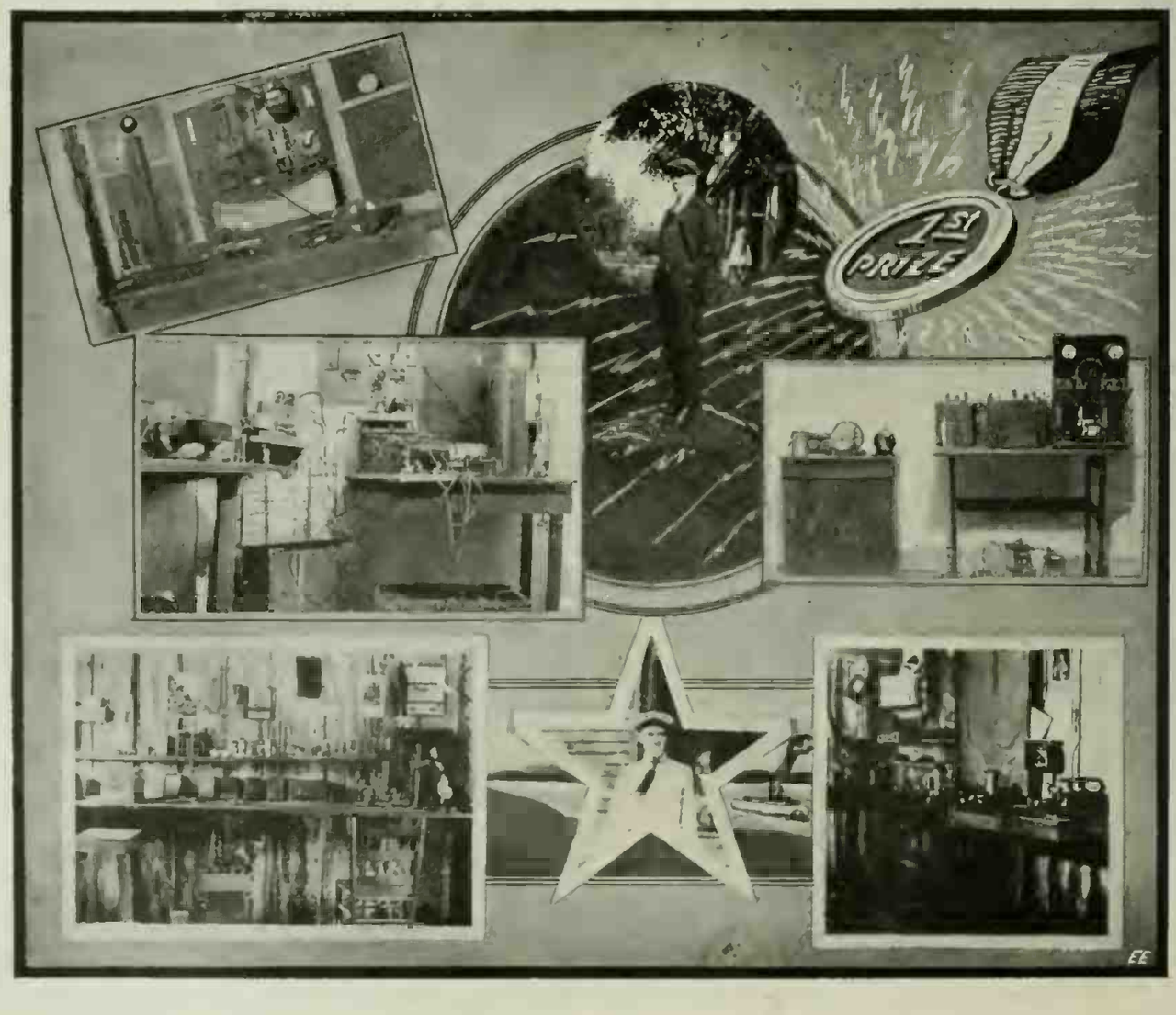
"Amateur Electrical Laboratory" Contest

THIS MONTH'S $3.00 PRIZE WINNER—RAYMOND L. CASSELL

HEREWITH I present three pictures of my Electrical Laboratory. In this "Lab" you can find anything from a binding post to a six hundred thousand volt Tesla coil. I have constructed two high potential transformers and one welding transformer with an output of three volts and five hundred amperes. Practically everything in this "Lab" was built by me. There are several motors, both A. C. and D. C., dynamos, about a dozen spark coils, transformers, storage batteries, small steam engine, rectifiers, Tesla coil (Oudin type), switches of all kinds, telegraph instruments, condensers, volt and ammeters, et cetera. I can get a twelve to fourteen inch spark from the Oudin coil. If the spark is not drawn off, it will brush discharge to a length of ten inches, crackling and waving like a thing alive. I perform some very interesting experiments with the coil. I also have a small storage battery set with a separate switch-board for charge and discharge. I have a search-light (arc), which will throw a beam about two miles. I operate this on a 110 volt circuit with a transformer built for the purpose. I am now building a 330 watt D. C. dynamo. I experiment with about everything going and a lot more.—Raymond L. Cassell, Roanoke, Va.

HONORABLE MENTION (1 year's subscription to the "ELECTRICAL EXPERIMENTER")—J. H. ENGLAND

HEREWITH are photographs of my Laboratory. In one of the photographs may be seen my "Wireless Table," which contains all the different instruments used for both sending and receiving. The transmitting set consists of a ¼ K. W. step-up transformer, condensers, spark gap, key, ammeter, et cetera. There is also a 1 inch spark coil for sending short distances. For receiving I have used successfully (before the war) a tuning coil for short distances and a loose coupler for long distances, in connection with a silicon detector, 2,000 ohm Brandes' phones, loading coil, variable and fixt condensers. To the left may be seen my switch-board, which is home-made. It contains a number of different switches, a buzzer, a lamp resistance, and a pilot lamp. To the left of the switch-board there are several shelves on which are different electrical books, such as "Hawkin's Electrical Guides," Houston's "Electricity in Everyday Life," and many others. There are various other instruments on this table, such as telegraph key and sounder, electric fan, Solderall torch, and an interrupter. Another photograph shows the chemical and and photographic table. This table consists of a complete developing and printing set. To the left will be seen the printing box, which is home-made. The frame is an Auto Mask Printing Frame and is secured to the box by means of small hooks, so as to permit it to be removed easily. Inside there is a red and a white light. To the right there are a large number of chemicals, such as nitric acid, bromin, sodium, et cetera. This part of my "Lab." comes in handy when I need a picture of some electrical experiment. This laboratory is the result of but one year and a half of earnest work and study.—J. H. England, 509 George, Greenwood, Miss.



www.americanradiohistory.com

Science in Slang

Jazz Stokes on Wireless Dope

By EMERSON EASTERLING

"I SAW a while back in a paper that Tesla and Marconi were expressing their ideas on interplanetary wireless communication. It don't look very reasonable to me that it could be done in the way that they proposed it, but I don't say that the feat is impossible," remarked Jazz Stokes the other night.

"How does a wireless wire?" asked Bender.



Heiney Hertz — Who While Monkeying Around Spark Coils and a Micrometer Spark Gap, Fell over the Hertzian Wave.

"It don't wire, that is why they call it wireless," returned Jazz.

"Well," I put in, "of course, Punk and I know all there is to know about wireless; but for Bender's sake I wish you would tell us a little about wireless."

"You are probably familiar with the African tum-tums and the Indian signal fires," he began. "They were the original form of wireless.

"A scientist by the name of Hertz. Herr Heinrich Hertz, got to monkeying around with spark coils and developing the micrometer spark gap or resonator. This apparatus worked on the principle that electro-magnetic waves radiate from a point of discharge. The twinkling spark between the gap was due to induced current, being virtually a secondary coil of one turn. Well, this set Heiney to deducing, and he deduced the present Hertzian theory of wireless wave radiation.

"While Hein*rich*, never having caught up with the second syllable of his first name, died a poor man. Nick Tesla hadn't been napping either. The whole wireless dope to this bird was an unsealed book as early as 1893, when Marconi still slid down the banister in his knickers. Thus we see Nikola two-stepping it nonchalantly to the Pat. Office, where he grabs the first REAL wireless patent along in 1900. The old boy had it all down in black on white, aerial, ground, spark gap, *et al*—the real, honest to goodness dope. This earned him the title of "Papa of the Wireless." But in those days there were no detectors and few experimenters to boot. So the then wiseacres sniffed at Nick's Patents, tapt their foreheads significantly and made known that this wireless stuff was all loco, bunque, and then some. The same ginks today however sing a different tune and admit that in 1900 THEY were fast asleep and deader than an Egyptian mummy, with heads as solid.

"Then along comes Kid Marconi and devils around with oscillators, sending waves thru buildings and other masses until he gets to work and builds a real wireless telegraphing station. By sticking his aerials up so as to clear the buildings and other masses he finds that he can send and receive for miles instead of blocks. In 1901, on the twelfth day of December, he shoots a 'can-you-get-it' across the Atlantic—and they got it. Soon all the first class vessels were equipt with radio men and added antennae to their rigging, so that they could let the world know that all was off with them by their C. Q. D. and S. O. S. yelps, instead of leaving floating spars upon the briny deep for some brig to sight later.

"Marconi went on improving his apparatus and handled the financial end so that besides being a first rate experimenter and Italian gentleman of standing, he don't have to eat macaroni with a pencil.

"The world wallows along, and the patent offices pile up the documents in the wireless department, when an ardent bird, Dr. Lee de Forest, waltzes on the stage of industry to the tune of "N' EVERYTHING' and shows us *something*. You might mistake it for an incandescent bulb, but it is as much like a light globe as a Victrola is like a centre table. We call it the Audion Amplifier, and with it in your receiving set you are able to make a squeal a scream. The wireless nuts first found that it was a scream when the ionizing sunlight failed to close the Hula-hula island and 'Frisco communication in the wee sma' hours of the morning, after the hour that the other detectors went bad on 'em.

"For Bender's sake I will give you 'Kicks'* the line up on a simple wireless station. First the transmitting apparatus obtains its juice from batteries or other sources. Is that plain? Yes, well next there is a spark coil that steps the voltage up to a dangerous stage and a spark gap that lets the high tension current break down across the air space. This discharge sets up an oscillating current of high frequency. To increase the efficiency there are condensers inserted in the circuit—these store



Doc "Nick" Tesla—Papa of the Wireless, Who Grabbed the First REAL Wireless Patent in 1900

up and discharge the juice like a nigger squirting prune juice thru his teeth, only very much faster."

Taking a pen and pad from his pocket, Jazz proceeded. "It is like this—see the K is the key; C, coil; c^1, condenser; A, aerial; G, ground; and B is for the source of juice. Then the receiving station is like this—A, aerial; D, detector; R, receiver. There is added more stuff to sensitize the layout, but they would only look like a telephone central station wiring diagram here on paper, and besides, there are more different kinds than there are ways for a young boy to go wrong.

"In Guglielmo Marconi's original contraption the Signor used a *coherer*, where we use a detector or audion now. The coherer works by being welded by the incoming waves, the electrical resistance being less when the filings in the coherer are welded. The current is so regulated that when the wave waltzes in and unites the nickel and silver filings, the sounder that is connected in the circuit bangs down with a faint tap. The coherer is tapt by a de-coherer, jarring the nickel and silver filings loose for the next dot or dash—*ad infinitum*.

"The detector rectifies the oscillating current, making it fit to vibrate the diafram on the receiver that the 'Radio-bug' has glued to his ear.

"The audion is an incandescent bulb with a parallel grid and plate, working on the theory that current will flow

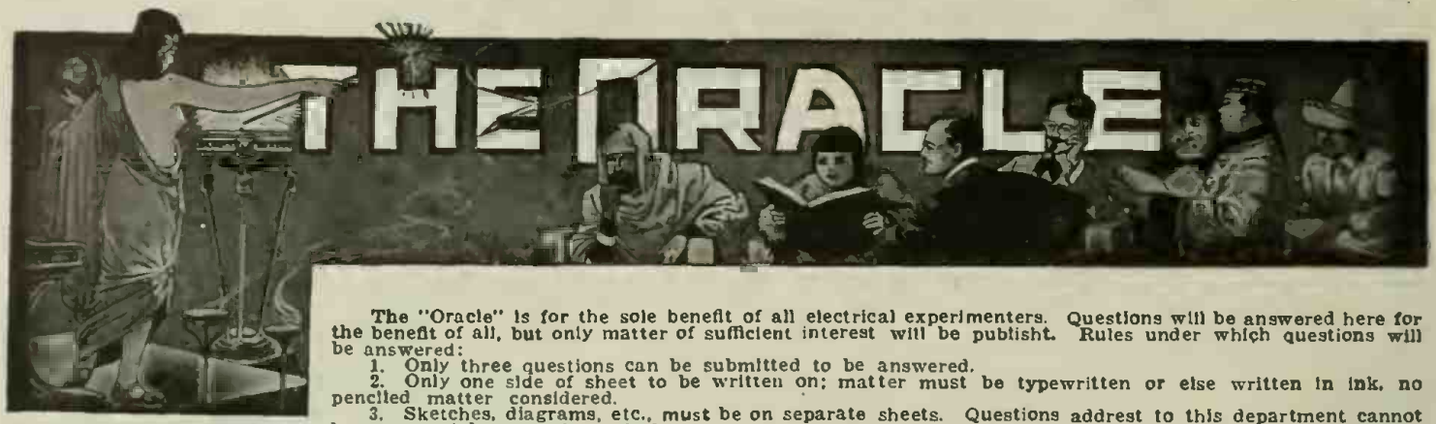


Kid Marconi Who Deviled Around Oscillators and Who Shot "Can-You-Get-It" Across the Atlantic.

*That word is Kick and not Hick. Kick is a San Francisco slang word—it means almost anything, originating from a kick in booze and now applying to almost anything, good, bad, and indifferent.

(*Continued on page* 911)

www.americanradiohistory.com



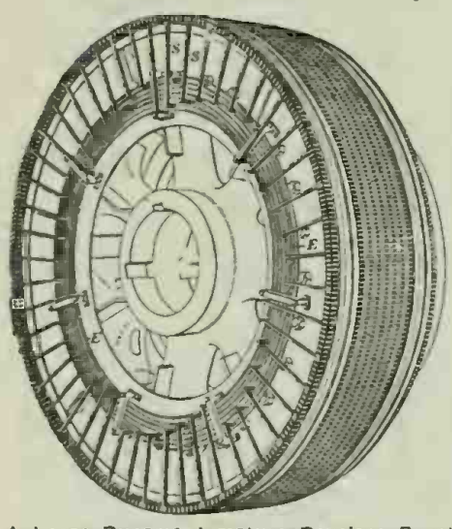
The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be publisht. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no pencilled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addrest to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

500 K. W. DYNAMO DEVELOPS BURNT SPOTS ON COMMUTATOR.

(990) Geo. W. B., Chicago, Ill, inquires of the "Oracle":

Q. 1. What causes commutator bars to burn, blacken and roughen up in the following manner? There are about 4 bars under a set of brushes and every set of 4 bars spaced equally between centers of field poles will blacken. Description of machine: D. C. 500 K. W. rope drive, 8 poles, compound wound. 220 volts. Even airgap all around, commutator undercut, commutator true, field coils equal strength, no reversed coils, no overload, machine runs alone most of the time; sometimes in parallel with a 150 K. W. Brushes have a perfect gloss, practically no sparking. Four hundred segments to the commutator, all tight. Sanding commutator stops the trouble for 2 to 6 months. What causes it?



A Large Dynamo Armature Develops Burnt Spots on the Commutator at Equally Spaced Points, Corresponding to the Pole Pitch. One of the Remedies Suggested Is That the Armature Be Equipt with Balancing or Current Equalizing Rings, as Here Illustrated, which Shows Them Applied to a Parallel-Wound D. C. Dynamo Armature. These Rings Help to Equalize Any Heavy Cross Currents In the Armature which Might Produce Such Troubles.

A. 1. We were particularly interested in the phenomenon you describe where the 500 K. W. D. C. dynamo, which altho apparently in perfect shape and maintenance, develops burnt spots all around the commutator at points corresponding to the spacing of the brush studs.

The Editor of the Oracle, while serving as engineer in a large power house some years ago, had similar trouble, and it practically defied solution by any of the experts who attempted to remedy it. Also in this case, it is clearly recollected that the machine, of about the size you mention, was in very fine running condition, and everything semed to be in favor of its perfect operation. But still these spots developed just as you state. After some thought on the matter it would seem from later experiences, that some of the following troubles might be the cause of these burnt spots appearing on the commutator:

ODD PHOTOS WANTED AT $1.00 EACH!!!

Now is the time to make your Kodak pay for itself in a real practical way. We are after interesting photographs of out-of-the-ordinary electrical, radio and scientific subjects and are willing to pay $1.00 *cash for every one we can use. Please bear in mind that for half-tone reproduction in a magazine, a photograph should be particularly sharp and clear. Of course, if a subject happens to interest us particularly well, we can have the photo retouched. For the general run of subjects, however, it does not pay to go to such expense. Therefore, please take pains to properly focus and expose your pictures. It often happens that a really mediocre subject well photographed wins approval over an excellent subject poorly photographed. And don't send us plate or film "negatives"; send unmounted or mounted "prints", preferably a light and dark one.*

As to what to photograph: Well, that's hard for us to say. We leave that up to you, and every reader now has the opportunity to become a reporter of the latest things in the realm of Electricity, Radio and Science. But, please remember—it's the "odd, novel or practical stunts" that we are interested in. Every photo submitted should be accompanied by a brief description of 100 *to* 150 *words. Give the "facts"—don't worry about the style. We'll attend to that. Enclose stamps if photos are to be returned and place a piece of cardboard in the envelope with them to prevent mutilation. Look around your town and see what you can find that's interesting.*

Address photos to—Editor "Odd Photos", ELECTRICAL EXPERIMENTER, *233 Fulton Street, New York City.*

1. From experience with several smaller machines, especially motors on elevator service, it would seem that field discharge currents, which are often of very high instantaneous e.m.f. value, would be liable to cause this burning. The remedy, or rather safeguard, against such trouble from this source would be to provide a field break switch fitted with an extra contact, so that when the switch is open half-way it makes connection, so that the field can discharge thru a resistance. This resistance in some cases has been formed of a lamp bank, and if you try this, you will be surprised to see how brightly the lamps flash up whenever the field switch is open, i.e., when the dynamo is being shut down and after the main D. C. bus-bar switch has been opened. The field magnet, of course, possesses very high self induction, and when the field switch is opened, a very high self-induced current occurs in the field windings, tending to prolong the magnetization, and causing therefore, a very heavy current of high e.m.f. to occur when the switch is suddenly opened. Practically all dynamos above 50 K.W. capacity are and should be provided with proper protective field discharge resistance and field break switches of the type described.

2. It seems that insufficient brush tension would also cause this trouble, not perhaps while the machine is rotating at its normal speed and load, but due to a tendency which the brushes in such a case might have to jump when the machine was started.

3. Another possible but hardly probable source of this burning might be traced to *hard* commutator bars. High mica would also cause the trouble, but as you state, in your particular case the mica has been undercut.

4. Trouble is often experienced in power-station work where two or more dynamos are run in parallel, and especially if there is any weakness in the design of the equalizing circuit between the two or more machines, which may cause heavy cross currents to pass between the two machines. As you will readily conceive, such a current which might be caused by a parti l unbalancing of the load between the two machines, might cause a momentary and in fact a fairly high e.m.f. transitory current to pass thru the brush and commutator system of one of the machines, and such a current would tend to have the effect of producing the burnt commutator.

5. Another trouble which would seem to point very strongly as a frequent source of this trouble, and one also that is very often overlooked entirely, is the *unequal distribution of the armature current* in such a large machine as this. The Editor recollects a case at one of the southern universities a few years ago, where no end of trouble was experienced in the operation of a large D. C. generator unit, due to this very reason, i.e., the unequal distribution of the current thru the armature windings. This defect in design, for that, of course, is what it is, causes a number of current paths to be set up periodically around the armature, and comparatively heavy currents will start flowing around these paths, their area being that enclosed between the axial lines of the two field poles in most instances. In the case in question, this was finally solved by the proper designing and installation of

(*Continued on page* 888)

www.americanradiohistory.com

The Opportunities In Draftsmanship

By CHAS. W. MOREY
President Chicago Technical College



During the twenty-five years in which I have had exceptional opportunities to observe the progress of technical work of every character, I have never known of such opportunities as exist today for competent draftsmen.

Very naturally the war had a great effect in producing the present conditions. Men were called from the drafting room to the trenches, leaving great gaps in our industrial organization which have not yet been filled.

And now when the war is over, we find many men not returning to their old jobs. We see business pushing harder than ever for markets. We hear of great building operations to be undertaken. We see a vast area of Europe devastated beyond description, to be rebuilt and very largely I believe with American material and with the help of American technical experts.

When it is considered that the draftsman must be employed on every detail that goes into the manufacture of structural work of every kind, machinery, ships, railroads, buildings, etc., the vast field for men in this profession can be somewhat appreciated.

The problem before thousands of ambitious young men is not whether to become draftsmen or not, but how and where to learn most quickly and thoroughly.

Formerly it was necessary to attend a resident school, which often meant giving up a position and spending time as well as money. It also often meant, if a man wanted to graduate, taking studies not really bearing upon technical training. Some got their training in drafting rooms of factories, architects' offices, or other places where they started out as boys and slowly worked their way up.

It has remained, however, for correspondence instruction to give every man a chance to become an expert in any branch of draftsmanship without leaving any job he may have and as quickly as his industry will let him pass from one lesson to another.

The Chicago Technical College by its method of training has prepared and is now preparing men everywhere to study in spare time at home and then to step into high-paying positions.

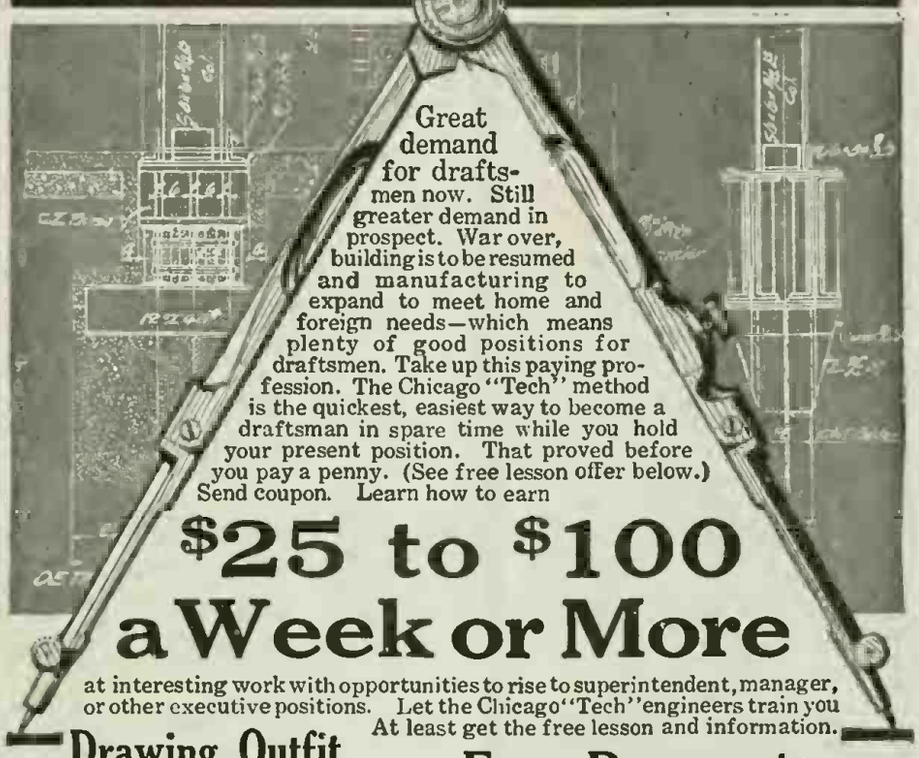
By this method no time is wasted on unnecessary branches. The student gets exactly the training he will use in practical work and in every case he has the direct personal instruction of specialists in the branch he has selected.

Before he decides about enrolling, any man can easily find out just how well qualified he may be to follow Draftsmanship. A test lesson is sent free to show the plan of instruction and to give the prospective student a chance to "size himself up."

We are ready to help ambitious men to get into this great profession with the least expense of time and money. We here know what the opportunities are. The calls we have to furnish good draftsmen to every kind of an organization prove every day that the job is always ready for the man who can fill it. If young men throughout the country could only realize what a future there is in Draftsmanship, many a one now wondering what his future is to be would come to a quick decision.

I hope that every reader of the Electrical Experimenter who is now doubtful about the calling he is to follow will write for information on one of our Drafting courses. If in doubt about which branch to take up, a letter sent to me personally will bring suggestions based on my own experience and that of our staff.

Make a Bigger Income
Learn Draftsmanship



Great demand for draftsmen now. Still greater demand in prospect. War over, building is to be resumed and manufacturing to expand to meet home and foreign needs—which means plenty of good positions for draftsmen. Take up this paying profession. The Chicago "Tech" method is the quickest, easiest way to become a draftsman in spare time while you hold your present position. That proved before you pay a penny. (See free lesson offer below.) Send coupon. Learn how to earn

$25 to $100 a Week or More

at interesting work with opportunities to rise to superintendent, manager, or other executive positions. Let the Chicago "Tech" engineers train you At least get the free lesson and information.

Drawing Outfit



(No Extra Charge)

Every student of the Chicago "Tech" Home Study Course in Draftsmanship receives this drawing outfit—set of instruments in case, drawing board, T square, triangles, scale, curve, drawing paper, pencils, etc., or a cash credit in case he already has an outfit. You use them while learning—then take them right into your practical work.

NOTE: Enrolled with Chicago "Tech" you have the personal direction of practical engineers, builders and architects who teach you the methods they use in their own work. No useless theories, no time wasted. You are prepared to stand beside old, experienced men. Big advantage to learn from a staff like this—every man a specialist.

Come To the College or TRAIN at HOME

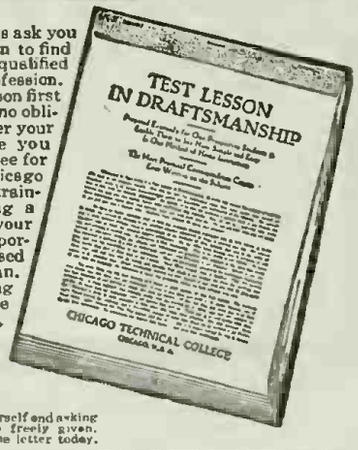
Wherever you are you can have this Chicago "Tech" training. Complete instruction by mail. Exercises, lessons, personal direction of our experts right in your own home if you cannot come to the college for a resident course. Send the coupon and get the facts.

Easy Payments

The fees for Chicago "Tech" courses are very moderate—and you can pay on easy terms. And also—you can obtain in a few months what it would take several years to acquire by ordinary methods. You can get an early start. You are soon ready to take a paying position and to quickly get back the cost of your course.

FREE TEST LESSON

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything. And see for yourself just what Chicago "Tech" offers you in training which will bring a ready market for your services and open opportunities which are closed to the untrained man. The coupon will bring all the facts about the course, the small fee, and the easy terms.



Mark with X the branch you are interested in—or if in doubt about which course to take, write a letter stating facts about yourself and asking our advice which will be freely given. Mail either the coupon or the letter today.

Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Splendid opportunities open now.

Learn All This in Spare Time

All about the Principles of the Automobile.
All about Gasoline Engines.
All about Power Plants and Transmissions.
All about Carburetors and Fuel Supply Systems.
All about Lubrication and Cooling.
All about Batteries.
All about Magneto Ignition.
All about Starting and Lighting Systems.

Know How To Fix Troubles

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men.

Write Send the coupon and get catalog and all information now.

CHICAGO TECHNICAL COLLEGE,
445 Chicago "Tech" Building, Chicago

Without obligation upon me, send your Catalog on subject indicated below. Also FREE Lesson if inquiry is on Drafting or Plan Reading. Mark X opposite work in which you are especially interested.

- ☐ Architectural Drafting
- ☐ Machine Drafting
- ☐ Electrical Drafting
- ☐ Structural Drafting
- ☐ Sheet Metal Drafting
- ☐ Builders' Course
- ☐ Plan-Reading—Buildings
- ☐ Plan-Reading—Shop Men
- ☐ Estimating
- ☐ Surveying
- ☐ Map Drafting
- ☐ Autos and Gas Engines

Name.....

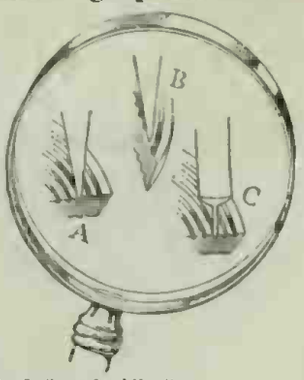
Address.....

City..... State.....

College or Home Study? State which.....

www.americanradiohistory.com

Preserve Your Phonograph Records!



A—Ordinary Steel Needle, new.
B—As the ordinary needle wears down, owing to its taper form, it can no longer fit the record groove perfectly and has a tendency to wear the record.
C—Sonora Needle having *parallel sides* ALWAYS fits record groove exactly and lengthens the record life.

Sonora

Semi-Permanent Silvered NEEDLES
Replace steel needles!
They play 50 to 100 times without wearing out

Use Sonora Needles for mellower tone, greater economy, convenience and for longer record life.

Loud—Medium—Soft

30c per card of 5

Sample Needle FREE! Write for it.

Sonora Phonograph Sales Company, Inc.
GEORGE E. BRIGHTSON, President
Executive Offices:
279 Broadway, Dept G, New York

Use Sonora Needles on *all* makes of steel needle records

CAUTION! Beware of similarly constructed needles of inferior quality

Humanize Your Talking Machine

with the Ellis "Music Master" Reproducer. It is adapted for all makes of machines using disc records and entirely overcomes those harsh, rasping, scratching, metallic sounds, disagreeable nasal tones and other annoying "faults". Brings out all the hidden harmonies, musical shading and tone coloring and makes your old phonograph sound like an entirely different instrument. Guaranteed for five years, but improves with age and will last a lifetime. Write for circular "E".

J. H. ELLIS, P.O. Box 88
Milwaukee, Wisconsin

CLEARTONE PHONOGRAPHS
$4.00 to $200.00 Retail



Needles $4.50 per thousand in lots of 500,000
Motors $1.35 to $14.75 each. Tone Arms and Reproducers $1.30 to $5.75 per set. Main Springs 20c to 90c each. Records, Needles, Sapphire Points and Parts at reasonable prices.
Write for our 84 page catalogue, the only one of its kind in America, illustrating 33 different styles of Talking Machines and over 500 different Phonographic Parts.
LUCKY 13 PHONOGRAPH COMPANY
Export Dept. 461 E. 12th St., N. Y., U.S.A.

LANGUAGES QUICKLY LEARNED ON ALL PHONOGRAPHS



"Like learning a tune—and as easy." Our Disc Records repeat the correct accent and pronunciation until you know it. Family and friends enjoy language study by the
LANGUAGE-PHONE METHOD
And Rosenthal's Practical Linguistry
War has created unlimited opportunities for those who know languages. Prepare now to better your position or increase your business. Used and recommended by educators in leading colleges. Write for booklet and Free Trial Offer.
SPANISH, FRENCH, ITALIAN, ETC.
THE LANGUAGE PHONE METHOD
931 Putnam Building 2 W. 45th St., N. Y.

THE ORACLE.

(*Continued from page 886*)

current equalizing rings placed on the back of the armature, as shown in the accompanying illustration.

Many different windings have been proposed and used successfully, but the majority of direct-current armatures are wound with either the single-parallel ring winding, the single-parallel drum winding, or the single-series drum winding. The single-parallel drum winding is probably more used than any other, and, on large multipolar machines, any unbalanced condition in the magnetic circuits is likely to cause the current to divide unequally among the several paths thru the armature. For example, if the air gap on one side of the armature becomes *slightly shorter* than that on the opposite side, which may easily occur due to wear of the bearings, the flux in the short air gap will become unduly dense, thus causing the generation of higher e.m.f. in the armature conductors on that side than in those on the other side, and the path that develops the highest e.m.f. takes the greatest share of the current. In some cases this unbalanced condition may not be bad enough to cause trouble other than some slight sparking, but in extreme cases, the e.m.f. of one path or of the paths on one side of the armature may become so excessive as to reverse the current in some of the other paths, making part of the armature act as a generator and part of it as a motor at the same time. This condition is usually accompanied by severe vibration of the whole machine, due to excessive mechanical strains, with more or less violent sparking or flashing at the brushes, and the machine is said to be "bucking." On account of the effects of armature reactions, bucking is somewhat more liable to occur in motors than in generators. The bad effects due to unbalancing can be eliminated by providing the armature with equalizer rings as shown. By means of equally spaced leads these rings connect points of equal potential in the winding and allow an equalization of current between the various paths in the armature.

Sometimes erratic line disturbances, motor flare-backs, defective motor control apparatus, will cause the effect you describe.

We would recommend that you look up some of the better class books on D. C. machinery operation and design, particularly those by Hobart and Parshall, which you can procure at your local library.

BALLAST COIL FOR ALTERNATING CURRENT ARC-LAMP.

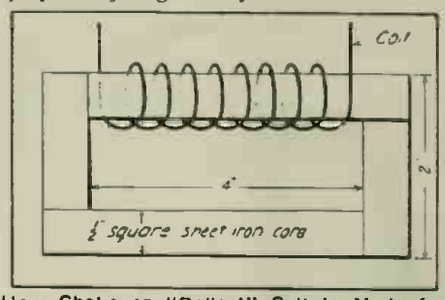
(991) Henry Tustin, Ocean Grove, N. J., writes:

Q. 1. I am having trouble in operating an experimental arc-lamp on 110 volts. What can you suggest?

A. 1. Regarding the operation of arc lamp at 110 volts house lighting current, you do not state what kind of current you have, whether alternating or direct. For one thing, this factor would determine whether your experiment would be a success or not, for the reason that if you are trying to operate the arc on alternating current, then you will find invariably that it will not operate well using a simple resistance coil or rheostat in series with it.

For alternating current operation the proper *ballast* is always composed of an adjustable impedance or choke coil made up of an iron wire or laminated sheet iron core on which several layers of magnet wire are wound. Where an ordinary 1,200 C. P. arc, such as used in ordinary store lighting, etc., is employed and taking about 5 amperes on a 110-volt circuit, the impedance coil may be composed of an iron core about 4" x 2", as shown in the diagram, and on one leg of which is wound about six layers of No. 14 D. C. C. magnet wire, taking off taps from the third, fourth, fifth and six layers.

We very strongly surmise from the symptoms you give in your letter concern-



How Choke or "Ballast" Coil Is Made for Use in an A. C. Arc Lamp Circuit. This Takes the Place of the Resistance Coil in a D. C. Arc Lamp.

ing the failure of the arc to operate, that this is the trouble, as on A. C. circuits *resistance* will give a very poor break spark, and for this purpose there is required an inductance of the order described above.

HOMOPOLAR DYNAMO.

(992) O. S. M., U. S. N. R. F., writes:

Q. 1. Giving a sketch of a commutatorless D. C. dynamo which he has invented and believes to be entirely new.

A. 1. We have looked over your drawings and description of what you term a direct current commutator-less dynamo, and while you appear to have something new in the peculiar design of the pole-shoes of the field magnet and the arrangement of the armature inductors, the whole principle of this type of dynamo has been known for the last forty years or more.

In other words what you have shown is simply the well-known "homopolar" dynamo, also called the "unipolar" dynamo. Faraday's first disk type dynamo belonged to this class. All machines of this type have the disadvantage of producing a very low electromotive force or voltage and are not usually practical, altho a few machines of this type have been used, where a very heavy current at a potential of a few volts was desired. You will find all the information you may desire in this direction by referring to the following works:

"Elementary Lessons in Electricity and Magnetism," by Silvanus Thompson, page 498. Also you would do well to refer to Professor Thompson's complete treatise, "Dynamo Electric Machinery," and a most thoro work covering the complete design and calculation of the electrical as well as the magnetic circuits of the "homopolar" dynamo is given in Prof. Alfred E. Wiener's excellent book, entitled "Continuous Current Dynamo Electric Machinery Design." These books are available thru our "Book Department."

The outline of the action of the machine you show is in accordance with the opinion of this machine given by Prof. Silvanus Thompson, in which he says in part:

"There is a class of dynamo-electric machine, differing entirely from any of the commutating types, in which a coil or other movable conductor slides around one pole of the magnet and cuts the magnetic lines in a continuous manner without any reversals in the direction of the induced currents. Such machines, sometimes called 'homopolar' or 'unipolar', have a very low electromotive force or voltage. Faraday's disk machine belonged to this class."

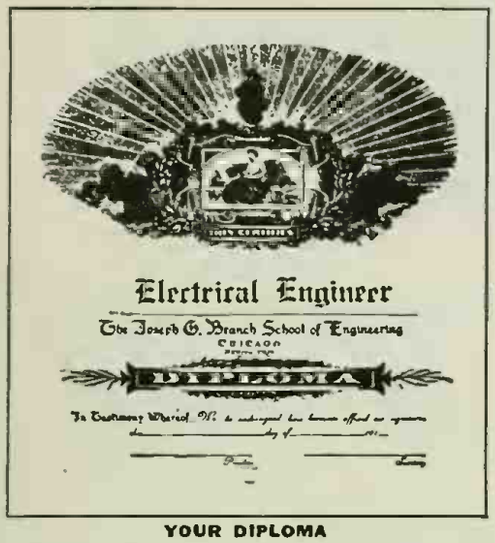
The stream that has been supplying the ancient city of Damascus with water for forty centuries has been harnessed to provide electricity to light the city and operate a railway.

According to an Italian scientist's figures, a square mile of the earth's surface in six hours of sunshine receives heat equivalent to the combustion of more than 2,600 tons of coal.

www.americanradiohistory.com

You can be a Graduate

ELECTRICAL ENGINEER



YOUR DIPLOMA

Our method of teaching saves you time and money in becoming a graduate, practical, Electrical Engineer—at Big Pay.

There is a large and constantly increasing demand for Graduate Electrical Engineers. Our Diploma is accepted as evidence of a competent, trained electrician. Hundreds of our Graduates are now big, successful Electrical Engineers. They will tell you what we have done for them. We can do the same for you—in your *spare time at home*. Read how these results are accomplished:

Your object in taking a correspondence course is to *Increase your Earning Power*. To learn exactly what you need and not waste your time and efforts on superfluous matter, is the shortest means to that end. The *Joseph G. Branch School of Engineering* specializes in equipping you with the *practical* and *usable* knowledge that enables you to qualify as an Electrical Engineer in the shortest time, yet our course is practical and complete. *This we definitely guarantee.*

You Get Intensive, Selected, Personal Instruction

Our courses are simple, practical and easily understood. Everything is made clear. You do not become involved in difficult technical matter of no practical value, and which is so discouraging to the student, but you go straight into the principles of the subject and the application of these principles. Every one of our students gets *personal* instruction, so that his progress is steady and sure. *You can't fail* with this course if you will simply follow our very clear directions. One of our students says: "Your course is strong for the Engineer. It gives him the vital working knowledge of the subject which makes him a competent Electrical Engineer in a very short time and at a very moderate cost." Many Electricians earn

$2,500 to $7,500 a Year

The course in Electrical Engineering covers the installation and operation of all kinds of modern electrical machinery and appliances, including power plant work, viz.: Practical Electricity, Alternating Currents, the Electric Motor, Practical Mathematics and Electrical Wiring. Under Practical Electricity both direct and alternating currents, high potential and high frequency currents are covered.

You get *everything* that will make you a proficient, *practical* Electrical Engineer—without the loss of time spent on endless theory and difficult technical work of other methods. This has been made possible by the thirty years of practical experience of Mr. J. G. Branch, B.S., M.E., in the engineering field. This is now presented to you in compact, usable and easily learnable form. There is no course which will put you on a big salary basis in so short a time.

SEND FOR COMPLETE CATALOG, TESTIMONIALS AND LIST OF POSITIONS SECURED

Complete, Practical Correspondence Courses in

Electrical Engineering
Stationary Engineering
Mechanical Refrigeration
Drafting
Drawing and Designing
Power Engineering
Power Plant Accounting
Practical Chemistry
Practical Mathematics
Ingenieria Electrica (Spanish course)
Marine Engineering

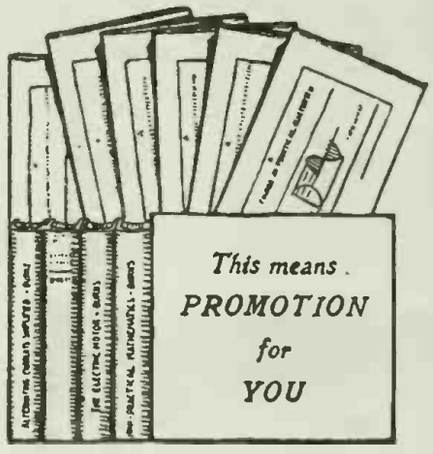
We trained over 1,000 men for Government Marine Service

THESE BOOKS FREE!

With the Electrical Engineering course you get, FREE, these splendid text books—all *Standard Works*. These books alone are worth more than the price of the course. Each book by a recognized authority:

Practical Electricity
Alternating Currents
Electric Wiring
The Electric Motor Simplified
Practical Mathematics

You need this Electrical Library. Here is your chance to get it *free*.



Due to Mr. Branch's long experience in and close contact with the engineering field the courses embrace such questions as are usually asked by the various Boards of Examining Engineers throughout the country. Our graduates will testify to the ease with which they were able to pass these examinations, and the cooperation received from us in helping them get positions.

A Diploma from the Branch School of Engineering is a sure step to a better position and a larger salary. You can soon have *your* Diploma—without interfering with your present work.

SPECIAL OFFER

The price of the course is extremely low and just now we are making a Special Limited Offer to those who reply to this advertisement. This remarkable offer reduces the cost of the complete course to a very low figure. You will be astonished to find how little this tremendously valuable training will cost you. Mail coupon at once for full particulars and Special Terms. Jos. G. Branch School of Engineering, Dept. 14, 542 Dearborn Street, Chicago.

USE THIS COUPON

Jos. G. Branch School of Engineering
Dept. 14, 542 Dearborn St., Chicago

Without obligation you may send me information about your Special Offer on your course checked below:

Electrical Engineering
Stationary Engineering
Mechanical Refrigeration
Drafting
Drawing and Designing
Power Engineering
Power Plant Accounting
Practical Chemistry
Practical Mathematics
Ingenieria Electrica (Spanish course)
Marine Engineering

Name .....
Address .....
City ..... State .....
Present Position .....

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

SAVE! Speak QUICK

'WAY UNDER MANUFACTURER'S PRICE!

Genuine, visible writing Underwoods—rebuilt in our factory, with Back Spacer, Tabulator, Lateral Guide, Stencil Attachment, 2-color Ribbon, Waterproof Cover and Special Touch Typewriting Guide Book sent on *10 Days' Free Trial*. Write.

Over 100,000 Underwoods Sold to U. S. Govt.

That makes rebuilt Underwoods scarce. So—*speak quick* for yours. Guaranteed for 5 years. You can rent, buy on easy terms, secure cash discount or easily earn one through agency plan; no canvassing. Ask for Offer No. 154

TYPEWRITER EMPORIUM
34-36 Lake St.
CHICAGO, ILL.

RENT OR BUY

How to Get a Good Job

You have the requirements necessary to hold a good job—but do you know how to get one? This book, entitled "Getting a Good Job," will tell you how. Based on the practices followed by big, successful employers, it tells what to do and say—how to make applications by letter—how to get personal interviews—what kind of job to choose—references, how to use them—answering advertisements—in all—135 things you should know. It costs a dollar and may be worth thousands to you.

Cloth Bound

MONEY BACK

Send a dollar bill, stamps or money order with your name and address. We will send the book at once. Use it five days and return it if you don't think it worth the dollar. Your money back if you don't keep it.

5 Days Trial

American Technical Society
Dept. C-104, Chicago

Send To-day for the
"Electrical Worker's Friend"

An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting A.C. motors. Special at $3.50

Or write for full particulars of this valuable book.

J. SMITH & SON
1524 LOWRIE ST., N.S., PITTSBURGH, PA.

GET ON THE VAUDEVILLE STAGE

I tell you how. Fascinating profession for either sex. Big salaries. Experience unnecessary. Splendid engagements always waiting. Opportunity for travel. Theatrical agents and authorities endorse my methods. Thirty years' experience as manager and performer. Illustrated book "All About Vaudeville" sent FREE.
Frederick La Delle, Sta. 49, Jackson, Mich.

POPULARITY FOLLOWS THE UKULELE

If you play quaint, dreamy Hawaiian music or latest songs on the Ukulele you will be wanted everywhere. We teach by mail 20 simple lessons; give you free a genuine Hawaiian Ukulele, music, everything—no extras. Ask us to send the story of Hawaiian music. You will love it. No obligation—absolutely free.

The Hawaiian Institute of Music
1400 Broadway, Suite 1104, New York

Pour Red, White and Blue from a Glass of Water

You can mystify your friends with puzzling chemical tricks; write secret letters with invisible ink; make your own magic writing paper, and your own blue ink or ink powder. Write with water and have it turn blue. You can pour seemingly plain water into three glasses and have it turn red in one, white in another and blue in the third. Send twenty-five Cents in stamps and get your outfit by mail, postpaid. If you send right away, we will enter your name to receive a copy of "The Chemcraft Chemist," it's an interesting magazine for boys.

"Chemcraft" Junior Outfit 25c.

Regular "CHEMCRAFT" Outfits at $1.50, $3.00 and $5.00.

THE PORTER CHEMICAL CO.,
Arcade Building Hagerstown, Md. Postp'd

ZIP-ZIP Patented Sept. 3rd, 1918

The Greatest 50 Ct. Article on the Market. Shipped right from the factory the same day we receive your order. The Prongs made of beautiful metal; never break or wear out; scientifically made and best workmanship. The rubbers are elastic and lasting, with plenty of pep and force. Zip-Zip, complete, only 50c prepaid. Be sure the name Zip-Zip and our address appear on the article you buy. Order from us or any Sporting Goods Store in your city. Send Stamps, Coin or Money Order.

AUTOMATIC RUBBER CO.
COLUMBIA, S. C.

BOOK REVIEW

A VEST-POCKET DICTIONARY OF TECHNICAL TERMS USED IN WIRELESS. Flexible cloth covers, 168 pages, indexed alphabetically, size, 3¼ x 2½ inches, price $0.75. Publisht by the Wireless Press, Ltd., London, England.

A very useful compendium of the principal wireless terms which should prove useful to all radio operators and students of the art. The various technical terms are arranged alphabetically, and the subject matter given seems to cover most of the more important terms used in radio engineering and operating. Some of the definitions are rather terse, and it seems that they could have been easily amplified without increasing the size of the book very much. For instance, we find the term "billi-condenser," and the definition of the term succinctly says—"consists of a metallic tube made to slide over an insulating tube having a metallic lining." This definition does not mean very much to any radio man, and really it is nothing but a trade definition, while as a matter of fact most of the regular text-books on wireless telegraphy describe this condenser as one having a definite electrostatic capacity of one billi-farad. This little work forms a handy, low-priced compilation of wireless terms which may prove of considerable use to radio students and others interested generally in this line of work.

HAND-BOOK OF CHEMISTRY AND PHYSICS—A READY REFERENCE POCKET-BOOK OF CHEMICAL AND PHYSICAL DATA, by Charles D. Hodgman, B.S., and Melville F. Coolbaugh, M.A. Flexible leather covers, 478 pages, size 7 x 4⅜ inches, price $2.00. Publisht by The Chemical Rubber Company, Cleveland, Ohio.

This work is something out of the ordinary and places in the hands of chemistry students and chemists in general a most excellent collection of tables and formulas worked out, which would require many hours of search thru books on chemistry and physics in order to determine these quantities. There is a large number of tables giving the complete equations for various organic compounds; physical constants of the elements; physical data of organic compounds; qualitative analysis procedure; flame and bead testing; various solutions of salts and other reagents; solubility charts, including a table giving the solubility of organic salts in water; a large number of tables giving gravimetric factors and their logarithms; tables of nitric and surfuric acids, as well as ammonium hydroxid and potassium hydroxid, giving the proportion by weight and the corresponding specific gravities for these various chemicals in solution; tables of sound and heat velocity and conduction; the various properties of saturated steam; co-efficients of thermal expansion; voltage and composition of voltaic cells; sparking potential or dielectric strength, wave length of principal lines of various elements, for spectroscopic and other work; tables giving index of refraction for gases in solution as well as metals and glass, radio-active tables, etc., etc.

This is a practical hand-book which every student of chemistry and physics should not be without. It contains an excellent glossary of technical terms with many chemical equations worked out and completed, also a large number of various physical formulas in mechanics, etc. There is given a considerable number of very useful and practical laboratory recipes, such as those for silvering glass, making of pole test paper, making cross-hairs for telescopes, etc.; various forms of photographic developing solutions for both plates and printing papers, etc. A very complete bibliography is appended at the close of the book, giving a valuable titled list of several hundred works on chemistry and physics. The volume is well indexed.

MILITARY AND NAVAL RECOGNITION BOOK, by Lieut. J. W. Bunkley, U. S. Navy. Cloth bound, 224 pages, 51 full page plates. 18 being in color, size 5 x 7 inches, price $1.00. Publisht by D. Van Nostrand Company, New York City.

This work proved of great value during the war and is one of the best ever publisht on the subject of military and naval organizations thruout the world, giving as it does not only the different insignia of rank in the various organizations of the principal countries of the world, but the customs of the service as well, such as etiquette of enlisted men and officers, etc. This book has been endorsed by the Secretary of the Navy. The treatment starts with the organization of the army bureaus and corps, the composition of the army and its various departments, how the staff is composed, and the divisions into the various arms of the service, such as cavalry, field artillery, coast artillery, infantry and engineers. Then we learn about the various coast artillery districts thruout the United States, the various ranks held in the army, and the duties of the officers holding these ranks, army etiquette and customs including salutes and courtesies in conversation, when and when not to address a lieutenant by his title; how to address a colonel, et cetera.

The succeeding chapters take up the composition of the navy and the organization of the naval force ashore, including an explanation at last, on page 41, of the duties of the Bureau of Steam Engineering, and how it comes about that the "Bureau of Steam Engineering" has to do with the installation of Radio Equipment on ships of the navy and on shore—a nice little poser that has been asked many times thru our "Oracle Department," and of the editors personally every time we meet a "Radio-bug."

Then follow interesting chapters on naval etiquette and customs, including what to do when the officer of the deck passes you, when to stand up, and when to sit down when a naval officer enters a cabin, and when an army officer enters a tent or barracks; what to say and how to say it, why a "gob" or his high superior officer must walk down Broadway in the pouring rain without an umbrella, and also you will find it prescribed in the rules and regulations on naval etiquette, that it is unbecoming an officer in uniform to carry a package of any kind. But at the close of the hum-drum of red tape, which tells you how you shall place your feet, and when you shall take off your hat, also when you can use your handkerchief, and which proves mighty interesting reading to us poor land-lubbers, we come to the most interesting announcement that—"it is customary for a committee of officers, to make the round of calls on New Year's Day on all ships in the same port," and further—"when in Washington, it is customary to call on the Secretary of the Navy and other high officials on New Year's Day, and you shall appear in your full dress uniform," rain or shine, and leave your umbrella at home.

Other chapters treat of the U. S. Marine Corps, the coast guard and the light house service. We then come to the sections dealing with the strength and organization of foreign armies and navies with the insignia of rank printed in colors.

The volume is one of the best works of this kind ever publisht, and Lieut. Bunkley should be complimented on the excellent and very interesting style in which he has compiled the work.

ELEMENTARY NAVAL ORDNANCE AND GUNNERY, by Lieut. H. C. Ramsey. Limp leather cover, size, 4¼ x 7¼ inches, illustrated and numerous drawing plates. Publisht by Little, Brown & Company, Boston, Mass., 1918, Price $3.00 net.

One of the most valuable works publisht during the war as a ready aid to the new students in the Naval Gunnery Schools and also as a guide to instructors and those trying for commissions. It has been prepared in a simple, easy and direct manner so that all classes of readers may readily acquire a correct and thoro knowledge of the fundamentals and general principles of the art of modern naval gunnery.

Most of the material has been gathered from lectures delivered at the Ensign School at Harvard University, and a number of interesting questions asked by students have been incorporated in the work with full answers.

A few titles of some of the more important chapters follow:—Naval Guns, Manufacture of Naval Guns. Gun Mounts, Breech and Firing Mechanisms, Electrical Firing Mechanisms, Turrets, Gunpowder, Projectiles, Magazines, Inspections and Tests, Spotting, Sighting, Fire Control, The Battery in Action, Care of Turrets, Automatic Machine Rifles, Battle Drills, The Gunnery Officer of a Ship, Infantry.

The chapter on Infantry has been included in order that those new to the service may understand some of the newer positions as practised in this branch of the service.

There is no doubt but that this book will fill a very distinct want amongst those who are studying this subject, besides serving to give the layman a real glimpse into what a tremendous part Gunnery plays in every battle engagement whether on land or sea. Lieut. Ramsey is to be complimented upon the excellent style in which he has covered the work in hand. The illustrations are particularly fine and show at a glance just how the breech mechanisms of the great naval cannon work as well as the small arms, including automatic rifles, machine guns, etc. Every kind of projectile is fully explained with sectional drawings, how the powder is placed and computed, calculating the range from a moving war-vessel with the compensations made for wind, speed of target, temperature of powder charge, etc., etc. A most interesting, authentic and valuable work.

www.americanradiohistory.com



Free Proof that I Can Raise Your Pay

No matter how much you are earning now, I can show you how to increase it. I have even taken failures and shown them how to make $100—$200, and in once case as high as $2,000 weekly. I am willing to prove this entirely at my risk and expense.

LET'S have a little chat about getting ahead —you and I. My name is Pelton. Lots of people call me "The Man Who Makes Men Rich." I don't deny it. I've done it for thousands of people—lifted them up from poverty to riches.

I'm no genius—far from it. I'm just a plain, everyday, unassuming sort of man. I know what poverty is. I've looked black despair in the eye—had failure stalk me around and hoodoo everything I did. I've known the bitterest kind of want.

But to-day all is different. I have money and all of the things that money will buy. I am rich also in the things that money won't buy—health, happiness and friendship. Few people have more of the blessings of the world than I.

IT was a simple thing that jumped me up from poverty to riches. As I've said, I'm no genius. But I had the good fortune to know a genius. One day this man told me a "secret." It had to do with getting ahead and growing rich. He had used it himself with remarkable results. He said that every wealthy man knew this "secret,"—that is why he was rich.

I used the "secret." It surely had a good test. At that time I was flat broke. Worse than that, for I was several thousand dollars in the hole. I had about given up hope when I put the "secret" to work.

At first I couldn't believe my sudden change in fortune. Money actually flowed in on me. I was thrilled with a new sense of power. Things I couldn't do before became as easy for me to do as opening a door. My business boomed and continued to leap ahead at a rate that startled me. Prosperity became my partner. Since that day I've never known what it is to want for money, friendship, happiness, health or any of the good things of life.

That "secret" surely made me rich in every sense of the word.

MY sudden rise to riches naturally surprised others. One by one people came to me and asked me how I did it. I told them. And it worked for them as well as it did for me.

Some of the things this "secret" has done for people are astounding. I would hardly believe them if I hadn't seen them with my own eyes. Adding ten, twenty, thirty or forty dollars a week to a man's income is a mere nothing. That's merely playing at it. In one case I took a rank failure and in a few weeks had him earning as high as $2,000.00 a week. Listen to this:

A young man in the East had an article for which there was a nation-wide demand. For twelve years he "puttered round" with it, barely eking out a living. Today this young man is worth $200,000. He is building a $25,000 home—and paying cash for it. He has three automobiles. His children go to private schools. He goes hunting, fishing, traveling whenever the mood strikes him. His income is over a thousand dollars a week.

In a little town in New York lives a man who two years ago was pitied by all who knew him. From the time he was 14 he had worked and slaved—and at sixty he was looked upon as a failure. Without work—in debt to his charitable friends, with an invalid son to support, the outlook was pitchy black.

Then he learned the "secret." In two weeks he was in business for himself. In three months his plant was working night and day to fill orders. During 1916 the profits were $20,000. During 1917 the profits ran close to $40,000. And this genial 64-year-young man is enjoying the pleasures and comforts he little dreamed would ever be his.

I COULD tell you thousands of similar instances. But there's no need to do this, as I'm willing to tell you the "secret" itself. Then you can put it to work and see what it will do for you.

A Few Examples

Personal Experiences

Among over 550,000 users of "Power of Will" are such men as Judge Ben B. Lindsey; Supreme Court Justice Parker; Wu Ting Fang, Ex. U. S. Chinese Ambassador; Assistant Postmaster General Britt; Lieut. Gov. McKelvie of Nebraska; General Manager Christeson of Wells-Fargo Express Co.; E. St. Elmo Lewis, former Vice-Pres. Art Metal Construction Co.; Gov. Ferris of Michigan, and many others of equal prominence.

$300 Profit from One Day's Reading

"The result from one day's study netted me $300 cash. I think it a great book and would not be without it for ten times the cost."—A. W. Wilke, Faulkton, So. Dakota.

Worth $15,000 and More

"The book has been worth more than $15,000 to me."—Oscar B. Sheppard, 1117 E. Locust St., Decatur, Ill.

Would Be Worth $100,000

"If I had only had it when I was 20 years old, I would be worth $100,000 today. It is worth a hundred times the price."—S. W. Taylor, The Santa Fe Ry., Milano, Tex.

Salary Jumped from $150 to $800

"Since I read Power of Will my salary has jumped from $150 to $800 a month."—J. F. Gibson, San Diego, Cal.

From $100 to $3,000 a Month

"One of our boys who read Power of Will before he came over here jumped from $100 a month to $3,000 the first month, and won a $250 prize for the best salesmanship in the State."—Private Leslie A. Still, A. E. F. France.

I don't claim I can make you rich over night. Maybe I can—maybe I can't. Sometimes I have failures—everyone has. But I do claim that I can help 90 out of every 100 people if they will let me.

The point of it all, my friend, is that you are using only about one-tenth of that wonderful brain of yours. That's why you haven't won greater success. Throw the unused nine-tenths of your brain into action and you'll be amazed at the almost instantaneous results.

The Will is the motive power of the brain. Without a highly trained, inflexible will, a man has about as much chance of attaining success in life as a railway engine has of crossing the continent without steam. The biggest ideas have no value without will-power to "put them over." Yet the will, altho heretofore entirely neglected, can be trained into wonderful power like the brain or memory and by the very same method—intelligent exercise and use.

If you held your arm in a sling for two years, it would become powerless to lift a feather from lack of use. The same is true of the Will—it becomes useless from lack of practice. Because we don't use our Wills—because we continually bow to circumstance—we become unable to assert ourselves. What our wills need is practice.

Develop your will-power and money will flow in on you. Rich opportunities will open up for you. Driving energy you never dreamed you had will manifest itself. You will thrill with a new power—a power that nothing can resist. You'll have an influence over people that you never thought possible. Success—in whatever form you want it—will come as easy as failure came before. And those are only a few of the things the "secret" will do for you. The "secret" is fully explained in the wonderful book "Power of Will."

How You Can Prove This at My Expense

I KNOW you'll think that I've claimed a lot. Perhaps you think there must be a catch somewhere. But here is my offer. You can easily make thousands—you can't lose a penny.

Send no money—no, not a cent. Merely clip the coupon and mail it to me. By return mail you'll receive not a pamphlet, but the whole "secret" told in this wonderful book, "POWER OF WILL."

Keep it five days. Look it over in your home. Apply some of its simple teachings. If it doesn't show you how you can increase your income many times over—just as it has for thousands of others—mail the book back. You will be out nothing.

But if you do feel that "POWER OF WILL" will do for you what it has done for over a quarter of a million others—if you feel as they do that it's the next greatest book to the Bible—send me only three dollars and you and I'll be square.

If you pass this offer by, I'll be out only the small profit on a three-dollar sale. But you—you may easily be out the difference between what you're making now and an income several times as great. So you see you've a lot—a whole lot—more to lose than I.

Mail the coupon or write a letter now—you may never read this offer again.

PELTON PUBLISHING COMPANY
30-H WILCOX BLOCK MERIDEN, CONN.

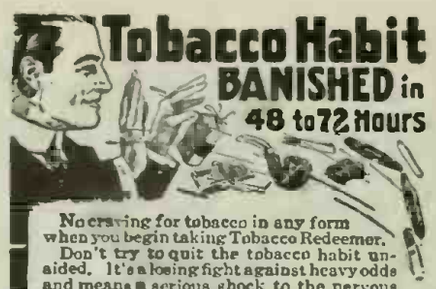
Pelton Publishing Company
30-H Wilcox Block, Meriden, Conn.

You may send me "Power of Will" at your risk. I agree to remit $3.00 or remail the book to you in five days.

Name .....

Address .....

www.americanradiohistory.com



Tobacco Habit BANISHED in 48 to 72 Hours

No craving for tobacco in any form when you begin taking Tobacco Redeemer.

Don't try to quit the tobacco habit unaided. It's a losing fight against heavy odds and means a serious shock to the nervous system. Let the tobacco habit quit YOU. It will quit you, if you will just take Tobacco Redeemer, according to directions for two or three days. It is a most marvelously quick and thoroughly reliable remedy for the tobacco habit.

Not a Substitute

Tobacco Redeemer contains no habit-forming drugs of any kind. It is in no sense a substitute for tobacco. After finishing the treatment you have absolutely no desire to use tobacco again or to continue the use of the remedy. It makes not a particle of difference how long you have been using tobacco, how much you use or in what form you use it—whether you smoke cigars, cigarettes, pipe, chew plug or fine cut or use snuff, Tobacco Redeemer will positively banish every trace of desire in from 48 to 72 hours. This we absolutely guarantee in every case or money refunded.

Write today for our free booklet showing the deadly effect of tobacco upon the human system and positive proof that Tobacco Redeemer will quickly free you of the habit.

Newell Pharmacal Company,
Dept. 521 St. Louis, Mo.

BOYS! *Write For New AUTO-WHEEL BOOKLET, and*

FREE FELT PENNANT

Send us the names of three coaster wagon dealers, mentioning which handle the AUTO-WHEEL, and we'll send you a beautiful Felt Pennant FREE and tell you all about the wonderful Auto-Wheel Coaster and the patented Auto-Wheel Convertible Roadster.

Wouldn't YOU Like to Organize a Coaster Club?

It's great fun. Every member receives a cap and the Captain a special cap. When you write, be sure to ask for full information and the new Auto-Wheel Booklet. It's brimful of information you should have.

The Buffalo Sled Co.
Dept. 163 N. Tonawanda, N. Y.

In Canada: Preston, Ont.

Get an



Auto-Wheel

BOYS BUILD THIS CAR

This nifty little car driven by gasoline motor, can be built by any boy. Parts are furnished by us and are very cheap. Send 2c cents for building plans and price list of parts showing how to build this lads' car.



SYPHER MFG. CO.
156 Warren Street
TOLEDO, OHIO.



BUSH CAR—FREE

This Five Passenger 37 H. P. car, 116 in. whl. base. All bearings Timken. Delco Ign.—Dyneto Stg. and Ltg. Write at once for my great Free Offer and 48-page catalog. Agents wanted to drive and demonstrate. Territory open. Prompt shipments. Big money. Cars guaranteed or money back. 1919 cars ready. Address J. H. Bush, President. Dept. 215

BUSH MOTOR CO., Bush Temple, Chicago, Illinois

The Moon's Rotation

(Continued from page 866)

festly absurd and of no bearing on the question under consideration.

In all the communications I have received, tho different in the manner of presentation, the successive changes of position in space are mistaken for axial rotation. So, for instance, a positive refutation of my arguments is found in the observation that the moon exposes all sides to other planets! It revolves, to be sure, but none of the evidences is a proof that it turns on its axis. Even the well-known experiment with the Foucault pendulum, altho exhibiting similar phenomena as on our globe, would merely demonstrate a motion of the satellite about *some* axis. The view I have advanced is NOT BASED ON A THEORY but on facts *demonstrable by experiment*. It is not a matter of *definition* as some would have it. A MASS REVOLVING ON ITS AXIS MUST BE POSEST OF MOMENTUM. If it has none, there is no axial rotation, all appearances to the contrary notwithstanding.

A few simple reflections based on well establisht mechanical principles will make this clear. Consider first the case of two equal weights w and w_1, in Fig. 1, whirled about the center O on a string s as shown. Assuming the latter to break at a both weights will fly off on tangents to their circles of gyration, and, being animated with different velocities, they will rotate around their common center of gravity o. If the weights are whirled n times per second then the speed of the outer and the inner one will be, respectively, $V = 2(R + r)n$ and $V_1 = 2\pi(R - r)n$, and the difference $V - V_1 = 4\pi rn$, will be the length of the circular path of the outer weight. Inasmuch, however, as there will be equalization of the speeds until the mean value is attained, we shall have $\frac{V - V_1}{2} = 2\pi rn = 2\pi rN$, N being the number of revolutions per second of the weights around their center of gravity. Evidently then, the weights continue to rotate at the original rate and in the same direction. I know this to be a fact from actual experiments. It also follows that a ball, as that shown in the figure, will behave in a similar manner for the two half-spherical masses can be concentrated at their centers of gravity and m and m_1, respectively, which will be at a distance from o equal to $\frac{1}{8}r$.

This being understood, imagine a number of balls M carried by as many spokes S radiating from a hub H, as illustrated in Fig. 2, and let this system be rotated n times per second around center O on frictionless bearings. A certain amount of work will be required to bring the structure to this speed, and it will be found that it equals exactly half the product of the masses with the square of the tangential velocity. Now if it be true that the moon rotates in reality on its axis *this must also hold good for EACH of the balls as it performs the same kind of movement.* Therefore, in imparting to the system a given velocity, energy must have been used up in the axial rotation of the balls. Let M be the mass of one of these and R the radius of gyration, then the rotational energy will be $E = \frac{1}{2}M(2\pi Rn)^2$. Since for one complete turn of the wheel every ball makes one revolution on its axis, according to the prevailing theory, the energy of axial rotation of each ball will be $e = \frac{1}{2}M(2\pi r_1 n)^2$, r_1 being the radius of gyration about the axis and equal to 0.6325 r. We can use as large balls as we like, and so make e a considerable percentage of E and yet, it is positively established by experiment that each of the rotating balls contain only the energy E, no power whatever being consumed in the supposed axial rotation, which is, consequently, wholly illusionary. Something even more interesting may, however, be stated. As I have shown before, a ball flying off will rotate at the rate of the wheel and in the same direction. But this whirling motion, unlike that of a projectile, neither adds to, nor detracts from, the energy of the translatory movement which is exactly equal to the work consumed in giving to the mass the observed velocity.

From the foregoing it will be seen that in order to make one physical revolution on its axis the moon should have twice its present angular velocity, and then it would contain a quantity of stored energy as given in my above letter to the *New York Tribune*, on the assumption that the radius of gyration is 2/5 that of figure. This, of course, is uncertain, as the distribution of density in the interior is unknown. But from the character of motion of the satellite it may be concluded with certitude *that it is devoid of momentum about its axis.* If it be bisected by a plane tangential to the orbit, the masses of the two halves are inversely as the distances of their centers of gravity from the earth's center and, therefore, if the latter were to disappear suddenly, no axial rotation, as in the case of a weight thrown off, would ensue.

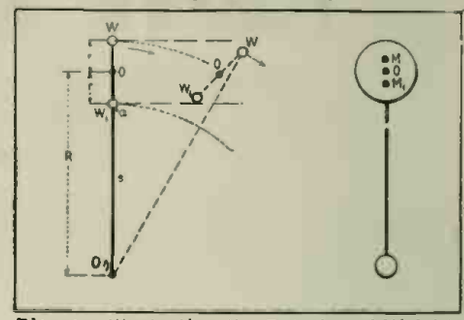


Diagram Illustrating the Rotation of Weights Thrown Off By Centrifugal Force.

WHAT IS MAN?

A man weighing 150 pounds will contain approximately 3,500 cubic feet of gas,—oxygen, hydrogen and nitrogen in his constitution, which at eighty cents per thousand cubic feet would be worth $2.80 for illuminating purposes. He also contains all the necessary fats to make a 15-pound candle, and thus, together with his 3,500 cubic feet of gases, he possesses considerable *illuminating* possibilities. His system contains 22 pounds and ten ounces of carbon, or enough to make 780 dozen, or 9,360 lead pencils. There are about fifty grains of iron in his blood and the rest of the body would supply enough of this metal to make one spike large enough to hold his weight. A healthy man contains 54 ounces of phosphorus. This deadly poison would make 800,000 matches, or enough poison to kill five hundred persons. This, with two ounces of lime, make the stiff bones and brains. No difference how *sour* a man looks, he contains about 60 lumps of sugar of the ordinary cubical dimensions, and to make the seasoning complete, there are 20 *spoonfuls of salt.* If a man were distilled into water, he would make about 38 quarts, or more than half his entire weight. He also contains a great deal of starch, chlorid of potash, magnesium, sulfur, and hydrochloric acid in his wonderful human system.

Break the shells of 1,000 eggs into a huge pan or basin, and you have the contents to make a man from his toe-nails to the most delicate tissues of his brain. And this is the scientific answer to the question, "What is Man?"

www.americanradiohistory.com

"I have watched the progress of the International Correspondence Schools almost from the very beginning. To me their rapid growth is easily understood, because I realize the practical value that is back of them and know something too of the success attained by many ambitious men throughout the country who have taken their courses.

"May your splendid institution continue to so grow and flourish that the world will come to appreciate the actual worth of the I. C. S. trained man."

—THOMAS A. EDISON.



"I am familiar with the textbooks and method of instruction used by the International Correspondence Schools in their Courses in Electrical Engineering, and I also know of a number of young men who have taken these Courses with great benefit. I believe that any young man who is interested in electricity but who cannot find an opportunity to go through an engineering college, if he will apply himself to one of these courses will find it a practical and economical way to acquire a knowledge of the profession second only to that acquired by devoting all the time for years to this study, in a regular college course."

—DR. CHARLES P. STEINMETZ.

What Would Their Advice Be Worth to You?

Suppose you have a knack for things electrical—that you realize what a wonderful opportunity for earnings and advancement the field of Electricity offers. What, then, would it be worth to *you* to have Edison and Steinmetz, the two foremost figures in the electrical world, tell you of a thorough, practical plan by which you can acquire, right at home, the training you need for success?

Well, *here* is their advice, based on years of familiarity with the instruction given by the International Correspondence Schools and on personal knowledge of I. C. S. trained men in their employ:

"I know of the success attained by men who have taken your Courses," says Edison. "It is a practical and economical way to acquire a knowledge of the profession," says Dr. Steinmetz. Read their full statements above.

For 27 years the I. C. S. have been training men at home in their spare time for success in Electricity and 280 other subjects. It is training over 100,000 men and women right now. It is ready and anxious to prepare you for advancement in Electrical Engineering or any special branch of it—or in any other line that appeals to you.

Pick the position you want in the work you like best, then put it up to us to prove how we can help you. Here is all we ask—without cost, without obligation, mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6184, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

☐ ELECTRICAL ENGINEER	☐ CHEMICAL ENGINEER
☐ Electrician	☐ SALESMANSHIP
☐ Electric Wiring	☐ ADVERTISING MAN
☐ Electric Lighting	☐ Show Card Writer
☐ Electric Car Running	☐ Outdoor Sign Painter
☐ Heavy Electric Traction	☐ RAILROADER
☐ Electrical Draftsman	☐ ILLUSTRATOR
☐ Electric Machine Designer	☐ DESIGNER
☐ Telegraph Expert	☐ BOOKKEEPER
☐ Practical Telephony	☐ Stenographer and Typist
☐ MECHANICAL ENGINEER	☐ Cert. Public Accountant
☐ Mechanical Draftsman	☐ Traffic Management
☐ Toolmaker	☐ Commercial Law
☐ Machine Shop Practice	☐ GOOD ENGLISH
☐ Gas Engineer	☐ Common School Subjects
☐ CIVIL ENGINEER	☐ CIVIL SERVICE
☐ Surveying and Mapping	☐ Railway Mail Clerk
☐ MINE FOREMAN OR ENGINEER	☐ STATIONARY ENGINEER
☐ ARCHITECT	☐ Textile Overseer or Supt.
☐ Architectural Draftsman	☐ AGRICULTURE
☐ PLUMBING AND HEATING	☐ Navigator ☐ Spanish
☐ Sheet Metal Worker	☐ Poultry Raising ☐ French
☐ Ship Draftsman	☐ AUTOMOBILES ☐ Italian

Name _____

Present Occupation _____

Street and No. _____

City _____ State _____

Canadians may send this coupon to International Correspondence Schools, Montreal, Canada

www.americanradiohistory.com

Commercial Telegraph Apparatus Bargains

Standard twenty ohm Telegraph Sounders at $2.00 each

Standard Telegraph Keys at 1.25 each

110 Volt A.C. Dynamos

Three Bar..... 1.75 each

Four Bar..... 2.25 each

Five Bar..... 2.75 each

For other bargains see page 935

Skinderviken Telephone Equipment Co.

Abbreviated Address

STECO-2118-2136 N. Clark St. CHICAGO

FACTORY-TO-RIDER SAVES YOU MONEY



Ranger Electric Lighted Motorbike

Buy direct and save $10 to $20 on a bicycle. RANGER BICYCLES now come in 44 styles, colors and sizes. Greatly improved; prices reduced. Other reliable models also. WE DELIVER FREE to you on *approval* and *30 days trial* and riding test.

Our big FREE catalog shows everything new in bicycles and sundries. Write for it.

TIRES, lamps, wheels, parts and supplies at *half usual prices.*

Do not buy a bicycle, tires, or sundries until you get our *wonderful new offers*, low prices and liberal terms. A postal brings everything.

MEAD CYCLE COMPANY Dept. D-107. Chicago

Build Your Own PHONOGRAPH, SAVE OVER HALF

It's Easy With Our Help

A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fine profit building phonographs for your friends.

Write Today for Our Free Blue Print Offer. Agents wanted for our ready built Chorateons.



Chorateon Phonograph Co.
704 Monger Bldg., Elkhart, Ind.

House Lighting Plants

$225 to $2100



Write for Catalog, giving name of your electrical dealer. Agents Wanted.

Dynamos, Motors

All sizes. Battery Chargers and Motor Generator Sets, $25 to $120. Hydro-Electric Generators.

SPECIAL — Holtzer-Cabot 110-V. A.C. Hand Generators, while they last, only $5. Order from this ad.

WATSON ELECTRIC CO., Dept. 14, Gas Bldg., Chicago.



BIG BUNCH OF FUN 10c

1 New Airship Game with Airships, 1 Chess and Checker Board and men, 1 Chinese Dim-se-lu-la, 1 Set Dominoes, 12 Other Games, 12 Lessons in Magic, 12 Money Making Secrets, Wireless Code, 18 Pictures Pretty Girls, 3 Puzzles, & New Ford Joke Book. All for 10c with large Catalogue.

Dept. 72

American Toy Co., Lowell, Mass., U. S. A.



Printing Cheap

Cards, circulars, labels, book, paper. Press $6. Larger $20 Job press $65 up Save money. Print for others, big profit. All easy, rules sent. Write factory for press catalog, TYPE, cards, paper. THE PRESS CO. D-47 Meriden, Conn.

HOW BOY SCOUTS CAN GAIN "WIRELESS MERIT" BADGE.

The committee on badges, awards and scout requirements of national headquarters has just established a "wireless merit" badge which no doubt will become quite popular as soon as there is an opportunity for scouts to perfect themselves in the details. The requirements are as follows:

Be able to receive and send correctly not less than 10 words a minute.

Know the correct form for sending a message.

Be able to tell in own words the principal laws regarding radio communication.

Know at least 10 of the radiogram abbreviations (Q signals).

Be able to name two types of detectors and explain how they work.

Name five minerals used in detectors in the order of their sensitiveness.

Draw a diagram of a simple transmitting set, showing how the following instruments are connected: Source of power (dynamo or storage battery), transformer, condenser, spark gap, helix, key, and explain their function.

Draw a simple diagram showing how to connect the following instrments: Tuning coil or loose coupler, condensers, fixt or variable, detector, 'phones and ground. Tell the use of the above apparatus.

Draw a diagram of three different types of aerials and tell their advantages or faults.

Know how to properly ground a radio set and know what precautions to take during a thunderstorm.

Demonstrate how to rescue a person in contact with a live wire, and have a knowledge of the method of resuscitation of a person insensible from shock.

Write a brief essay on the development of wireless telegraphy.

ELECTRIC DRIVE FOR U. S. WARSHIPS.

America's capital fighting ships of the future will be superior to those of other nations because of their electrically driven machinery, Secretary Daniels told the House Naval Committee recently, in disclosing remarkable results attained by the new dreadnought New Mexico, equipt with the electric drive which is to be a feature of all the big ships authorized since 1916.

The New Mexico's turbo-electric machinery was designed to develop 26,500 horse-power at full speed and to give the ship a speed of twenty-one knots.

"It actually developed more than 31,000 horse-power," Mr. Daniels said, "and maintained for four hours a speed of twenty-one and one-quarter knots, and this when running at a displacement 1,000 tons greater than its design called for.

The secretary said fuel economy at cruising speed had been one of the things sought in substituting electric drive for the ordinary turbine equipment.

Practical Chemical Experiments

(*Continued from page* 880)

TO TEST FOR COAL TAR COLORING.

Experiment No. 3. See Fig. 3.

To test for coal tar colors in butter, a small sample is mixed on a porcelain plate with Fuller's earth, and if coal tars are present, there will be a red mass, while if absent the color will be only light yellow or brown.

Experiment No. 4.

Put a little butter in a test-tube, and a little oleomargarin into another. To each add one inch or so of alcoholic potash solution, and warm each in the steam of the water bath. Distinguish the one from the other by smell. Add a little sulfuric acid (dilute) to each and smell again. Notice that "olco" test tube will only smell of alcohol, but that the other will smell, besides, of butyric ether.

Radium Substitute.

We are all quite familiar with the uses of Radium in medicine and as an ingredient in luminous paint, both of which have been brought to the general public's attention within the past few years.

Luminous paint in particular offers a field whereby a substitute for Radium may be judiciously utilized. This paint played an important rôle in the war which has just terminated, having been used more particularly on the dials of instruments used on airplanes, so that they could be read at night. It has also been used for electric push buttons, door numbers, etc. The paint is permanently luminous in the dark and contains from 0.1 to 0.25 milligrams radium element to one gram of zinc sulfid. A luminous watch face usually contains from ten to twenty cents worth of radium on it.

An excellent substitute for radium for certain purposes is Meso-thorium. This is a radio-active element found in Monazite sand and other thorium minerals. When first extracted it is not satisfactory for luminous paint, and consequently must be "ripened" for several months, or even a year before it can be used. During this time the *alpha* radiation, which is required for luminous paint, becomes sufficiently strong. On the other hand the *beta* and *gamma* radiation of Meso-thorium grows rapidly and it can be used for medicinal purposes within a few days after preparation.

Radium, we are told, has a long life, half of it decaying in approximately 1800 years. Meso-thorium on the other hand possesses a short life, 5 or 6 years being its useful life for luminous purposes. For luminous paint to be used on objects which themselves have a short life, it is an excellent substitute for radium and will conserve the element radium for medicinal purposes only.

Static Electricity and Gasoline.

Static electricity, superinduced by the passage of gasoline thru chamois skin during the filtration process, was declared to be full of great danger. When this idea became prevalent, a well known automobile concern undertook a series of rigid experiments to learn what prospects there were of real danger. Their investigations resulted in their finding that the static electricity scare from the use of chamois skin was without foundation. They claim to have secured authentic data from which it was proved that a static electric charge cannot be developed with the temperature above freezing (32 deg. F.), while at zero (0 deg. F.) the conditions for producing the spark are most favorable.

Two Trade Secrets.

There are two trade secrets at least that the world at large may never know, but which it is well worth the while of inventors to study. One is the Chinese method of making the bright and brilliant color known as Vermilion, or Chinese red; and the other is a Turkish secret—the inlaying of the hardest steel with gold or silver. Among the Chinese and Turks these two secrets are guarded well. Apprentices, before they are taken for either trade, are compelled to swear an ironclad oath to reveal nothing of what passes in the workshop. They must also belong to families of high standing, must pay a large sum of money as a guaran-

(*Continued on page* 911)

www.americanradiohistory.com

Learn Electricity



In the Great Shops of COYNE IN 3½ MONTHS

Thousands of Electrical experts are needed to help rebuild the world. Come to Chicago to the great shops of Coyne and let us train you quickly by our sure, practical way, backed by twenty years of success. Hundreds of our graduates have become experts in less than four months. *You* can do the same. *Now* is your big opportunity. Come—no previous education necessary.

Earn $125 to $300 a Month

In the Electrical business. Come here where you will be trained in these great $100,000 shops. Experts show you everything and you learn right on the actual apparatus. You work on everything from the simple bell to the mighty motors, generators, electric locomotives. dynamos, switchboards, power plants, everything to make you a master electrician. We have thousands of successful graduates. Just as soon as you have finished we assist you to a good position. We now have more positions than we can fill. Think of it.

Become an Expert in 3½ Months

No need of taking from 1 to 4 years to become an expert, we have proved this in thousands of cases. The Coyne method of practical training eliminates all books, useless theory and other non-essentials and trains you in just what you need to know to become an expert.

Earn Your Way

Don't tell yourself you haven't got the money to come to Coyne. If you have ambition and the nerve of a real man, that's all you need. Dozens of our students every year work in their spare time and earn their living expenses. Dozens of others work in the day time, earn all their expense and attend our evening school. Our employment department will help you without charge.

Day or Evening Courses

Don't worry about the money. Anyone with ambition can learn here. Our tuition is low with small easy payments if desired. All tools and equipment is furnished free. Our students live in comfortable homes in the best section in Chicago—on the lake—just a few minutes' walk from our school.

Electricity, Drafting Motion Picture Operating Plumbing

We teach all these trades and professions quickly and in such a thorough, practical way that when finished you are ready to step right into a position of responsibility and big pay.

Send Today for Big Free Book

Write today, *now*, for the book. It tells what Coyne graduates have done. What you can do. Fill in the coupon, check the trade you are most interested in or send a postal card, do it *now*.

Learn Drafting

The country is crying for skilled draftsmen in all lines. Thousands of positions open with princely salaries. We have been able to place every graduate in a good position. One firm asked for all our men. Now is the time to get into this big field. Experts train you under practical working conditions, no books and theory go here. Check drafting on the coupon below and mail it *at once* for full particulars.

BENNETT W. COOKE, *Director*

COYNE TRADE AND ENGINEERING SCHOOLS

Dept. 24 39-51 E. Illinois Street, Chicago, Ill.

MAIL COUPON FOR FREE BOOK NOW!

COYNE TRADE AND ENGINEERING SCHOOLS
Bennett W. Cooke, Director
Dept. 24, 39-51 E. Illinois St.
Chicago, Ill.

Please send at once your big Free Book—I am interested in

[ ] Electricity [ ] Drafting [ ] Plumbing
[ ] Motion Picture Operating
(*Check trade interested in*)

Name.....

Address.....

www.americanradiohistory.com



DO Your Own PLUMBING AND HEATING at low cost

Send for our big instructive 256 page well-bound Handy-Man Book Catalog. Every Home Owner, Contractor, Electrician, Farmer, Factory Manager, etc., needs it. Shows over 10,000 Fixtures and Supplies in plumbing and heating at wholesale. Shows how to save skilled labor, hard work and unnecessary material by



OUR NEW
Cut-to-fit-Method

This wonderful book helps you select and install the proper Plumbing, Water Supply System, Hot Air, Water or Steam Plant. Besides being our Wholesale Catalog it has many practical plans, diagrams, sketches, elevations, etc., showing how to do the work this newer, cut-to-fit way. Any handy man with a few tools can easily do his own installing with the aid of this



Big Handy-Man Book

We have spared no effort and have gone to a great expense to compile this valuable book. With economy still a National necessity, it would be unpatriotic to send this expensive book broadcast to non-interested parties. Therefore, we request a temporary deposit for each copy of 25c which we refund on first order, or we send our Bargain Bulletin Free. Address Today

HARDIN-LAVIN COMPANY
40 Years At
4510-20 Cottage Grove Ave., Chicago
$500,000 plants behind our guarantee

I Earned $2200 IN FOUR MONTHS



THIS is Richard A. Oldham. He earned $2200.00 in four months with a Haywood Tire Repairing outfit. For 20 years he was telegraph operator on the Illinois Central Railway. He is now 58 years old. He answered my advertisement—quit his job—bought a plant and opened a business. He just wrote me "I have made more in eight months than 2½ years as operator." There are now 500 stations where tire repairing is neglected.

I Must Have 500 Men
To Fill These Positions

I have a Big interesting Book to send you. It tells all about tires—gives inside figures and profit. Send for it! What Oldham and others are doing You can do. $2500.00 to $4,000.00 per year is conservative. Like Mr. Oldham—One machine will start you. Then open a shop. You can see business all around you. Put out a Haywood Sign and business will come to you. Now get started. Send for the Big Book and start making money.



M. HAYWOOD, Pres.
Haywood Tire & Equipment Co.
1209 Capitol Ave. Indianapolis, Ind.

CONSULT US When in need of definite and reliable data concerning trade formulae or industrial processes. When you desire to either duplicate or improve upon a product or process now in use, we can help you, as we are ever on the alert and closely following the development of the industrial art in all its branches. The formulae listed below will serve briefly to show the field we cover: 1—Preparing Solidified Alcohol. 2—Producing Liquid Toilet Soap. 3—Process for Electro-galvanizing Iron. 4—Ink for Typewriter Ribbons (all standard colors). 5—Process for Sensitizing paper which gives excellent prints from line drawings and plan tracings; it supplies copies in white lines on a brown ground. 6—Alloy for Soldering Aluminum. The standard price for each formula issued by this bureau is Thirty-five cents. Letters of inquiry welcomed. Informative literature sent upon request. Industrial Methods Bureau, 320 Fifth Avenue, New York, N. Y.

INTRODUCING
Mr. R. W. DeMott

For eight months past Mr. R. W. DeMott has been advertising manager of your magazine.

You have noticed the rapid growth of "E. E." during that time. One big reason for this astounding growth and betterment of your magazine is due directly to Mr. DeMott and his "ads."

If you have the welfare of your magazine at heart, read Mr. DeMott's message. It means money to you.

The Publishers.

Advertising Talks

You, as a reader of the ELECTRICAL EXPERIMENTER, are vitally interested in every department of the magazine. There are some very strong reasons why you should be doubly interested in the advertising.

The publishers are constantly striving and planning to improve the quality of the magazine offered you each month. But it is your magazine and it is up to you as to how big it shall grow. There are a great many things that you ought to know about advertising, and how this powerful force affects you personally.

Progressive and responsible firms all over the country announce what they have to offer you through the advertising pages of the ELECTRICAL EXPERIMENTER. Not only will you help your magazine by showing an interest in its advertisers, but you will benefit yourself to an even greater degree. I will take up these points one by one each month, and hope that every reader will follow this column and offer any suggestions or ask any questions that may come to his mind regarding advertising and its relation to a big magazine.

If you have any suggestions to make regarding the advertisements that appear, if there is any information you would like regarding advertising in general, write me personally and your questions will be taken up in due course through this column.

For the next few months I will tell you about "E. E." advertising and its relation to you. Each month I will give you one reason more why the advertisements should be of vital interest to everyone of us.

You have watched the EXPERIMENTER grow from a little sixteen-page magazine to its present size. You have watched the class of articles improve, its staff of authorities who contribute each month get bigger and better, finally resulting in the wonderful announcement made in our January issue that the publishers had secured for you the services of the world's greatest inventor, Nikola Tesla, to give you exclusive feature articles in every issue for the next two years at least.

One of the principal factors in this rapid growth has been its advertising.

Next month I will show you how, by reading and answering the advertisements, you will help to still further build up and increase the size of the EXPERIMENTER.

R. W. DeMott

Advertising Manager.

AN OZONE WATER PURIFIER FOR THE HOME.

For use in homes, offices, drug stores, restaurants, hospitals and institutions, a Milwaukee concern has designed a convenient size of Ozone Water Purifier constructed as shown in the accompanying illustration. It is pointed out that in the ozonizing process employed, ozone is produced by means of an electric current and mixed thoroly with the water as drawn from the faucet, so that all water used comes into actual contact with ozone. The extra oxygen atoms of the ozone combine with organic matter of the germs in the water and burn them up. The carbon dioxid formed by this chemical action passes out into the air leaving a trace of the same effect produced in carbonated beverages, which adds to the palatability of the ozonized water. It is claimed that all tastes and odors are removed by this process while mineral elements essential to health remain, for they do not oxidize.

There are a great many cities whose water supplies are chlorinated and it is claimed that the use of this ozone water purifier will eliminate the odor and taste of chlorin from the water the same as it



New Design of Ozone Water Purifier for the Home, Office and Factory. The Ozonizer Connects With Any Lamp Receptacle. The Purifier Has a Capacity of Over 2,000 Gallons Per Day.

eliminates other objectionable odors and tastes.

As an amelioration of filtered water, or as a substitute for filtered or distilled water, it is claimed the process of ozonization stands by itself; it has no equal in efficiency; the removal of disease germs is absolute; the water resulting from such process is as perfect as one can wish, being bright and sparkling. Each of the water purifiers has a purifying capacity of over 2,000 gallons a day, and, therefore, any user is entirely independent of the condition of the water at the municipal plant in his city.

THE MAKING OF A MATCH.

Thorpe gives the following proportions for match head and for striking surface:

Head composition: Potassium chlorat, 5 parts; potassium bichromat, 2 parts; glass powder, 3 parts; gum, 2 parts. Rubbing surface: Antimony trisulfid, 5 parts; red phosphorus, 3 parts; manganese dioxid, 1½ parts; glue, 4 parts.

Tungsten is now used as an electric battery element.

Electrical goods of American manufacture are extensively sold in Porto Rico.

www.americanradiohistory.com

WHAT IS A "KILOWATT" AND "KILOWATT-HOUR".

By Frank Szabo.

THERE seems to be quite a wrong conception of the terms *kilowatt* and *kilowatt-hour*. Quite frequently one hears expressions such as "10 kilowatts per hour", but such an expression does not mean anything.

What is a kilowatt? Kilowatt is a term for power or rate of work. According to Kent and other authorities, one kilowatt is equivalent to the evaporation of 3.52 lbs. of water *per hour* from and at 212 deg. F., or 3,415 heat-units *per hour*. In this definition, *per hour* is a necessary part of it, without which the definition is incomplete.

If it takes approximately 3 lbs. of burning coal to evaporate 3.52 lbs. of water from and at 212 deg. F., then one kilowatt represents the consumption of *3 lbs. of coal per hour*, and not simply the consumption of 3 lbs. of coal. If we extend the evaporation of 3.52 lbs. of water from and at 212 deg. F. by a consumption of 3 lbs. of coal uniformly over a period of two hours, we do not have the equivalent of one kilowatt, but one-half, or ½ kilowatt, because during one hour only one-half of 3.52 lbs. = 1.76 lbs. of water have been evaporated with a consumption of one-half of 3 lbs. = 1.5 lbs. coal. Also, if we did the above performance in 30 minutes, or one-half hour, we would not have the equivalent of one kilowatt, but two kilowatts, because at the same rate we would, during one hour, evaporate 2 x 3.52 lbs. = 7.04 lbs. of water with a consumption of 2 x 3 = 6 lbs. of coal. Hence, *one kilowatt represents the consumption of 3 lbs. of coal per hour.*

Of course the quantity of 3 lbs. of coal in the above explanation is not fixt; it may take slightly more or less than 3 lbs. per hour for one kilowatt, depending on the heat value of the coal and the efficiency of the steam and current generating units, but 3 lbs. is a fair average figure.

What is a kilowatt-hour? According to Kent, it is the evaporation of 3.52 lbs. of water from and at 212 deg. F., or 3,415 heat units. In this definition, *per hour* is left out because no matter how fast or how slow the water evaporates, the actual work done in evaporating 3.52 lbs. of water from and at 212 deg. F. is equivalent to *one kilowatt-hour*. In other words, one kilowatt-hour is the equivalent of the rate of one kilowatt for a period of one hour. The rate of ½ kilowatt for a period of 2 hours is also equivalent to one kilowatt-hour. Hence:

$$\text{Kilowatts} = \frac{\text{Kilowatt-hours}}{\text{No. of hours}}$$

and kilowatt-hours = kilowatts x No. of hours.

Referring to the operation of electric cars, we cannot correctly say they require *four kilowatts per car mile;* we must say *four kilowatt-hours per car mile*, because the speed of the train has to be considered. Suppose we introduce a watt-meter and a watt-hour-meter into the circuit. The watt meter will indicate the *rate* of power consumed in kilowatts, whereas the watt-hour-meter sums up all the kilowatt-hours consumed during the run. At uniform speed of the car the watt-meter pointer will remain approximately steady in one position, but the watt-hour-meter will continue increasing the reading at a constant rate. If the watt-hour-meter at the end of ten miles' run at constant speed shows a reading of 40 kilowatt-hours, and it took one hour to make the run of ten miles, then the watt-meter showed a constant reading of 40 kilowatts. But if the run of 10 miles is made in say one-half hour, the reading of the watt-hour-meter will be approximately the same—40 kilowatt-hours (neglecting the difference in efficiency of the unit at different loads)—but the watt-meter

(*Continued on page 700*)



ELECTRICITY

Taught By A Practical Man *and in Your Home!*

I am teaching electricity and electrical drafting to many men, young and old, and trust you will become sufficiently interested after reading this advertisement, that you will send for my catalog which tells what I am endeavoring to do and also places before you the simple way in which the instruction work is handled. The catalog is written in a very plain manner, much in the same style as my lessons are written, and tells you exactly what you get and what the course can do for you. My catalog, as well as my advertisements, is written in a very careful, conservative manner so there is no possibility of you expecting something you will not get.

The Purpose of the Course of Study

I have been designing courses in electrical instruction and teaching electricity, off and on during the past 17 years, and during that time I have had an unusual opportunity to make a special study of the teaching business, from the standpoint of a practical man. This course of my own is designed with a view of reaching those who do not have a lot of time and money to devote to study work, and to give them as thorough a knowledge as possible of electricity, in the shortest possible time. The instruction is given like you were working on various jobs and I was the boss telling you what to do and how to do it, and giving the explanation necessary for the understanding of the theory covered by the subject under discussion. There are many conditions which seldom occur in the every day run of electrical experience, and these conditions I lay particular stress on. This part of the instruction makes the course particularly attractive and valuable to those already engaged in active electrical work.

It Is Up To You

The instruction work is laid out and given in a way easily understood. It is not a cut and dried book plan, but the lessons are prepared especially for the purpose for which they are used and additional instruction is given to the individual student, with a view of meeting his particular needs. I have the information to give and I believe the ability to impart it to others, a fact which is in a way proven by other institutions which have made use of my services in the design and perfecting of instruction courses. To understand this work, IT IS UP TO YOU to stick with me and I will surely stick with you till you understand any part of the work you have gone over.

Practical Men Take My Course and Recommend it to Others

Sixty percent of my students are actively engaged in electrical work and find the instruction I give well suited to their needs. Several of these men have had their fellow workers take the course also and they are taking the instruction together, making a class-room proposition of it and the results are in every way satisfactory to all concerned. One of these classes was started by a Chief Electrician, one of my students in Glen White, W. Va., who now has practically all the men under him taking my course. I believe the fact that these men who understand electrical work approve of my course to this extent is one of the strongest endorsements I could get.

FIFTY FIFTY

I work absolutely on a 50-50 basis with my students. You pay me the comparatively low price I ask, and I give you the instruction and other help as is stated in my catalog. No student is permitted to pay cash for his entire course on starting, the course being paid for in small monthly payments as you go along. Students have the privilege of discontinuing the work if they should find that it was not just what they were after, and their payments stop at the same time. This is my way of doing business and I would not want your money when I was not giving you the instruction.

Apparatus, Instruments, Material, Etc.

Certain electrical apparatus, instruments, material, charts, drafting implements, etc., as detailed in the catalog, are included in the course and are a part of the regular instruction for which there is no extra charge as it is covered by the regular monthly payments.

FILL OUT COUPON FOR ONE OF MY CATALOGS WHICH GIVES FULL INFORMATION.

BURGESS Electrical School
745 E. 42d St., Chicago, Ill.

YORKE BURGESS,
BURGESS ELECTRICAL SCHOOL,
745 East 42nd Street, Chicago, Illinois.

Gentlemen:—
Send me catalog describing your course in Electricity and Drafting.

NAME.....

ADDRESS.....

CITY.....

STATE.....

www.americanradiohistory.com

LEARN WIRELESS IN TEN WEEKS
Right In Your Own Home


Reproduced from the Washington Times, January 31, 1919—

SAYS RADIO WILL SOON SCRAP WIRES

"Scrap.

"That's all the telegraph and telephone poles, wires and instruments will amount to in a year if the program now being made in wireless communication continues."

Congressman Steenerson of Minnesota, ranking Republican member of the House Post-office Committee, made this prediction today. Wireless communication will have become so general by the end of the year 1919, Steenerson said that few persons will give much concern about whether the Government or private interests control the country's telegraph and telephone lines.

Limitation of Government control of these lines until the end of the present calendar year will have been forgotten, Steenerson added. If wireless telegraphic and telephonic communication is to continue along the present general lines

DECLINES TO COMMENT

Steenerson declined to comment upon the report that most of the telegraph and telephone companies would be glad to turn over their properties—which they now estimate to be worth about a billion dollars—to the Government, if they would be permitted to invest their capital in wireless communication.

"Such telephone and telegraph property will not be worth half as much as it is quoted at today, after wireless communication has demonstrated its usefulness and value," Steenerson continued.

This shows what big men think of the future of Wireless

The Age of Wireless Is Here

The experimental stage has passed. Wireless now equals in importance telegraphy, and telephony. It has assumed its place among the great commercial industries of the earth. So rapid has been the development and growth of wireless in recent years that there has been left in its wake a tremendous shortage of operators. Actually thousands upon thousands will be needed for permanent "peace time" positions offering wonderful opportunities for advancement:

No Previous Experience Necessary

You do not need any previous training or experience in order to become a successful Wireless Expert. By our practical ten weeks' Home Study Course you can quickly qualify for a good position at big pay. Many of our students have secured positions before completing the course.

Get Your Instruction From the Nation's Capital

Our Course Is Endorsed by Officials of the U. S. Government

The National Radio Institute, headed by authorities who have been closely allied with government training of students, has perfected an easily mastered course in wireless telegraphy whereby students are taught completely in ten weeks, either here in Washington at our large residence school or at home, by mail. Many of our students are ready to take up actual wireless work in much less time. The course is founded on actual practice, hence the rapid progress of the student.

Pay As You Go Along With Your Lessons

Our plans of payment bring a wireless education within the reach of anyone who desires to learn. A small payment down and small payments twice a month enable you to earn the cost of your tuition while actually learning to be a wireless operator.



Earn Up to $200 Per Month

In the short period of ten weeks we can make of you a wireless operator, a man with a profession, independent, and not subject to the rise and fall of wages in the labor market. Salaries are as high as $200 per month. We give you this training at home, by mail, in your spare time. It is not necessary for you to lose any time from your work to take the course. Then when you have received your diploma we help find you a good position.

Free Instruments to Every Student

In addition to text books, lessons and personal instruction, we send you a Home Practice Set consisting of a standard sending key and buzzer, and a Universal automatic wireless transmitting and receiving set. These instruments are free to every student. No other school can offer you what we do.

Wireless News Notes

The U. S. Shipping Board has recently announced an increase of nearly 30% in the pay of Merchant Marine Wireless Operators.

Nicola Tesla, world famous inventor, has recently perfected his Wireless Light, one of the wonders of the age.

Another new invention has been perfected whereby wireless messages may now be sent underground.

Due to the recent perfecting of the Wireless Telephone, we expect to soon be able to communicate with our Home Study students by wireless.

Mail This Coupon Today

NATIONAL RADIO INSTITUTE,
Dept. 70, Washington, D. C.

Send me, free of charge, your booklet, "Wireless, the Opportunity of the Age," with full particulars regarding your famous 10 weeks' Home Study Course, and your Special Free Instruments Offer.

Name .....

Address .....

Town ..... State .....

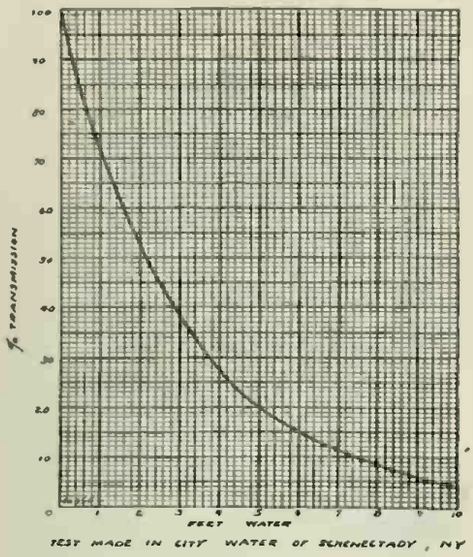
Valuable Wireless Book FREE

Our booklet, "WIRELESS, the Opportunity of Today," gives you complete information in regard to our course, the quick and easy methods by which you can master wireless, and other important facts you should know. It is free. Just mail the coupon. No obligation whatever on your part.

www.americanradiohistory.com

TRANSMISSION OF LIGHT THRU WATER.

The comparative transmission of light thru varying depths of water is a problem that science until recently knew but little



Showing Decrease In Transmission of Light Thru Water for Different Depths. A Problem Which All Submarine Inventors Are Interested In.

about. Now, thanks to Mr. S. L. E. Rose, of the General Electric Company's illuminating engineering laboratories, who describes his findings in the *General Electric Review*. Photometric readings were taken every six inches thruout the available range of 5½ feet of water in the cylindrical tank in which the tests were conducted. The water used was Schenectady city water, which is clear artesian well water. Sea water would transmit much less light owing to the apparent blue or greenish tint it possesses which tints bespeak a fairly considerable amount of suspended matter and consequently increased opacity.

The accompanying graphic curve shows vividly the relative transmission of light from a Mazda lamp, fitted with waterproof connections. A table of constants is given in the article, together with a formula for computing the illumination intensity for different depths of water when the initial intensity is known. The present graph shows, however, just how rapidly the illumination falls off in water for any given initial illumination. The particularly interesting feature of the results from a practical standpoint is the very considerable cut-off of light produced by a substance apparently so transparent, amounting for a single foot (0.05 m.) of water to 27.5 per cent. On this basis the transmission through 50 ft. (15.2 m.) of water would be only about one part in 10,000,000 of the incident light.

The rapid decrease in the transmission factor with increased light travel in water coincides with the well-known facts that, for a so-called transparent medium, the ocean permits the penetration of daylight to but a surprisingly short distance below its surface and that fish native to the depths are blind or carry their own illuminants.

HAMMOND RADIO CONTROLLED BOAT SUCCESSFUL.

Army and navy experts have reported the device of John Hays Hammond, Jr., for radio control of surface craft to be sent laden with explosives against enemy ships, a success, and predict similar results with submerged craft.

Secretary Baker wrote the House appropriation committee recently that the joint army and navy board was "convinced of the practicability of the control" of the surface craft, and added that there had also been demonstrations of the possibility of the control to a craft, completely submerged, except for an air in-take pipe.

Before finally deciding on the purchase of the patents for $750,000 the board desires further experiment with the submerged craft.

Construction of the submerged craft, which will be about 80 feet long by 7 feet in diameter, will take two years, according to Mr. Hammond, who told the committee, he had spent ten years and $400,000 on his invention.

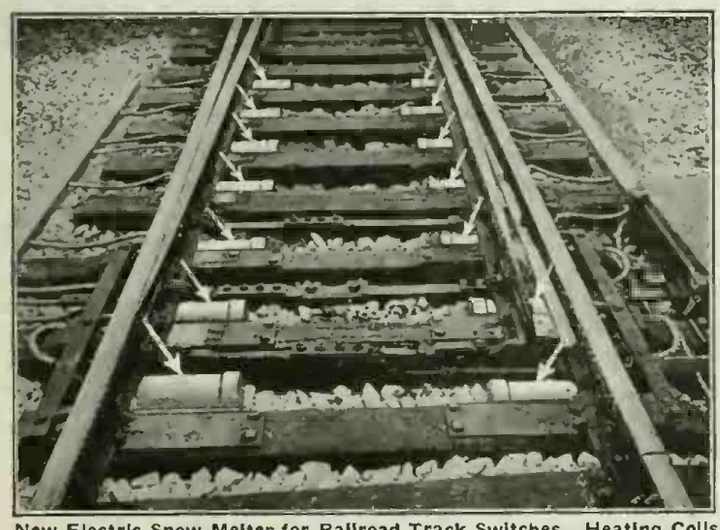
"The board considered the ability of the enemy to interfere with the control of the vessel by radio energy. Mr. Hammond's claims are that no interference can be had with the craft outside a radius of 100 to 150 yards from the source of the energy; that is, from the radio plant of a battleship, for example."

Major-General F. W. Coe said he had run the craft "all around vessels coming into the harbor at will." Mr. Hammond said an aviator after four hours' training on control, was able from a height of 9,000 feet and a distance of six or seven miles to exercise absolute control over the high-speed boat.

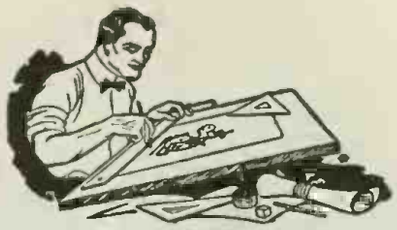
ELECTRIC SNOW MELTER FOR TRACK SWITCHES.

The electric snow melting device for track switches here illustrated is purely and simply an electric heater enclosed in a 3½ inch wrought iron pipe, 20 inches long. These heaters are placed between the ties, just under the rail. They are wired from a circuit as the amount and character of the supply current makes necessary, and a switch is placed in this wiring at some convenient point clear of the track. The current can be turned on as the snow storm starts by an employee as easily as an electric light. The heat generated does the rest.

The temperature in the heater rises about 100 degrees Centigrade in the first half hour and by the end of an hour is about 135 degrees Centigrade above the outside temperature. This heat is not enough to set fire to anything but is sufficient to melt the snow.



New Electric Snow Melter for Railroad Track Switches. Heating Coils Indicated By Arrows.



EARN $35 TO $100 PER WEEK

As a Mechanical Draftsman

Thousands of Men Wanted

You can learn Mechanical Drawing at home in your spare time through our practical Home Study Course and qualify for Big Pay. We have placed hundreds of our students in good paying positions. Government departments and private concerns are continually calling upon us for our graduates.

Become a Chief Draftsman

and get to the very top in this well-established and rapidly growing profession. The training given by the Columbia School of Drafting will give you just the knowledge you need to make good as a Chief Draftsman. No previous training is necessary. You can begin our course now and make rapid progress from the start under the Personal Instruction of the President of the School, Mr. Claflin, by mail. His carefully prepared lessons and personal letters of advice make each step easy and interesting.

Draftsmen Now Getting $35 to $100 a Week

with big chances for better pay as the demand grows. All big engineering, construction and manufacturing projects must first go through the drafting room before the workmen can commence. All such enterprises depend upon large numbers of draftsmen. Salaries are advancing steadily.

Drawing Outfit Free with Our Course

As soon as you enroll you will be sent our drawing outfit for your own use throughout the course. This entire outfit will be yours to keep. You are not obliged to return it after completing the course.

Not Only a Correspondence School

The Columbia School of Drafting is probably the largest residence school in the country specializing in the training of professional Draftsmen. Our Home Study Courses are an extension of the same instruction as given locally.

Illustrated Catalog FREE

Simply fill in the coupon below, return it to us and we will send you free a copy of our illustrated catalog which tells all about our practical Home Study Course and how you may secure our instructions at once on easy terms so as to quickly qualify for one of the big positions open.

Send This Coupon Today.

COLUMBIA SCHOOL OF DRAFTING
Dept. 982, 14th and T Sts., Washington, D. C.

Without obligation to me, please send me your Illustrated Catalog and tell how I may secure your practical training in Drafting and your help in securing a position as Draftsman.

Name .....

Address .....

City ..... State .....

www.americanradiohistory.com

110-V. TRANSFORMERS

8 Volt Secondary



Consumes so little current will not move ordinary meter.

$1.00 Postpaid

Only $1.00

No. 10 gives 3 currents — 8, 12 and 18 volts secondary. Ideal for experimental work. A standard transformer, guaranteed. Complete with plug, $2.00 postpaid. Order from this ad.

NATIONAL TRANSFORMER CO.,
Dept. 13, 3124 No. California Ave., Chicago

ELECTRICAL ENGINEERING IN ONE YEAR

training again open to civilians. Over 3000 men trained for electrical industries in experience of more than a quarter of a century. For men of ambition and limited time. Condensed course in Electrical Engineering enables graduates to secure good positions and promotions. Theoretical and Practical Electricity. Mathematics. Steam and Gas Engines. Mechanical Drawing. Students construct dynamos, install wiring and test electrical machinery. Course with diplomas complete.



Thoroughly equipped fireproof dormitories, dining hall, laboratories, shops. Write for catalog. 27th year opens October 1, 1919.

BLISS ELECTRICAL SCHOOL
260 Takoma Avenue, Washington, D. C.

WHAT IS A "KILOWATT" AND "KILOWATT-HOUR?"

(*Continued from page 897*)

will give a constant reading of 80 kilowatts; in other words, for a speed twice as great the watt-meter will show a constant reading twice as high, whereas the watt-hour-meter reading will be the same for the *same distance traveled.*

Applying the formula to this example for a speed of 10 miles per hour and a power consumption of 40 kilowatt-hours, we get

$$\text{Kilowatts} = \frac{40}{1} = 40$$

Making the same run in one-half hour we get

$$\text{Kilowatts} = \frac{40}{\frac{1}{2}} = 80$$

Dividing the total power consumed by one car in kilowatt-hours by the distance in miles, we get the power consumption in *kilowatt-hours per car mile.*

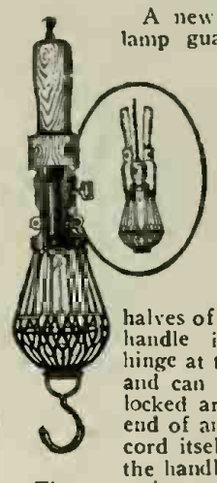
Applying the above terms to electric light, a 40-watt electric light is one that consumes electric power at the rate of 40 watts or 40 watt-hours per hour. A circuit having, say, twenty 40-watt lights in parallel will then consume electric power at the rate of $20 \times 40 = 800$ watts or 800 watt-hours per hour, or 40 watt-hours per lamp-hour. If an electric power station charges you ten cents per kilowatt-hour you can burn one 40-watt lamp

$$\frac{1{,}000}{40} = 25 \text{ hours, or twenty 40-watt lamps}$$

$$\frac{1{,}000}{20 \times 40} = 1\tfrac{1}{4} \text{ hours, for ten cents, since}$$

both conditions represent *one kilowatt-hour.*

SOMETHING NEW IN LAMP GUARDS.



A new departure in portable lamp guards is shown in the illustration of a split handle which can be quickly attached to a special expanded steel lamp guard supplied by the same concern.

This *portable* successfully fills a demand for a substantial handle guard which does not need to be wired. The halves of the guard including the handle itself, open from the hinge at the bottom of the guard and can instantly be closed and locked around the socket at the end of any extension cord. The cord itself runs thru grooves in the handle.

The convenience of this new product will be appreciated by the motorist in his garage as well as in every factory, mill or warehouse, because it permits light to be safely carried to dark corners, in stock bins, engine pits, etc. Fire danger is avoided and lamp users will readily see the advantage and economy, as the modest cost of the guard is quickly repaid thru prevention of lamp breakage.

ANOTHER "USELESS" PATENT.

A Chicago woman has patented a shoe with an electric battery in the heel to supply a mild current to a wearer's ankle as a tonic. Another "useless patnt!"

THE PHOTOELECTRIC SENSITIVITY OF VARIOUS SUBSTANCES.

SOME time ago an examination was made of various substances to determine their electrical sensitivity to light; and in view of the fact that some of the results obtained are at variance with the measurements made by Case, it seems desirable to publish a summary of these observations, which were made at the Bureau of Standards.

Two of the herein described substances were examined for change in electrical conductivity caused by the action of light upon them, and all of them were examined for *photoelectrical activity* when they were charged to a negative potential in an evacuated bulb and exposed to light, reports Messrs. Coblentz and Emerson in the *Journal of the Washington Academy of Sciences.*

When the substances were examined for an increase in electrical conductivity, a potential of 2 to 6 volts was connected thru a resistance of zero to 1,000,000 ohms into a circuit containing a d'Arsonval galvanometer and the substance under investigation. In most cases the substances were slightly conducting when not exposed to light, so that the *dark current* had to be annulled by joining a counter e.m.f. thru a resistance of 10,000 ohms to the terminals of the galvanometer. This counter e.m.f. was obtained by shunting across a resistance of 100 ohms which was in series with a cell of 2 volts and a variable resistance of zero to 70,000 ohms.

The source of light, when not otherwise

MAGNETIC RECTIFIER
Patented April 18, 1916



COLD WEATHER WON'T BOTHER YOUR STARTER
If you keep your battery charged up with an

F-F BATTERY BOOSTER

CONNECT to any lamp socket without removing battery from car or breaking any electrical connections. Changes alternating to direct charging current, and will completely fill your battery over night.

The Private Garage types cost only $24.00 and come complete with long cord and plug to fit any lamp socket, ammeter, which tells what current is flowing into the battery and charging wires fitted with clips, to snap on the battery terminals.

Thousands in use giving satisfaction.

Write today for Bulletin No. 12, or send us your order. Money back if you want it.

The France Manufacturing Company
Cleveland, Ohio

The House of Taylor



HOTEL MARTINIQUE
BROADWAY, 33D STREET, NEW YORK
One Block from Pennsylvania Station.

Equally Convenient for Amusements, Shopping or Business

157 Pleaaant Rooms, with Private Bath, $2.50 PER DAY.

257 Excellent Rooms, with Private Bath, facing street, southern exposure, $3.00 PER DAY.

Also Attractive Rooms from $1.50.
The Restaurant Prices Are Most Moderate.

400 Baths
600 Rooms

CORE WIRE

We have been fortunate in securing thru auction several tons of guaranteed pure, double annealed Norway Iron Core Wire and are selling this wire to "Experimenter" readers

AT PRE-WAR PRICES 20cts LB.

This wire is just the thing for spark coils, transformers, etc., and it is, of course, a very much more superior product than the usual iron wire. We absolutely guarantee the quality.

If you ever thought of building a spark coil, transformer, or similar apparatus, now is the chance to get the right material for it. As far as we know this is the only lot of Iron Norway Core Wire in the hands of any dealer at the present time, and none can be gotten until after the war.

We have only two sizes left:

26 INCHES 36 INCHES

Thickness about No. 21 B and S

If either of these sizes should be too long we advise cutting the wire down yourself by means of shears. It will pay you to do so as real Norway Iron Wire, sold by a few dealers last year, brought from 40c to 50c a pound. American core wire now sells for from 30c upwards per pound.

As long as the supply lasts we offer this wire as described above to our customers at the very low price of 20c a pound. Order at once.

ELECTRO IMPORTING CO., 231 Fulton St., N. Y. C.

www.americanradiohistory.com

specified, was a 16-c.p. carbon incandescent lamp, placed at a distance of 10 cm. from the substance under investigation. One disappointing feature of this investigation is that no substance was found which is comparable in sensitivity with the *potassium photoelectric cell* and with the *selenium cell.*

Gallium. This metal was solid, thus differing from the impure material, which is a liquid.

The results obtained proved disappointing, this metal being quite insensitive to light. When the cell was exposed to daylight the photoelectric current produced a deflection of only 4 to 5 mm., whereas similarly exposing a *potassium photoelectric cell* the photoelectric current was sufficient to give a deflection beyond the range of the scale.

Silver Sulfide. The sample examined was a thin flexible strip, 6 by 10 mm. in area. In one test the silver sulfide formed the negative electrode of a photoelectric cell (evacuated glass bulb about 5 cm. diameter with a ring of platinum wire for the anode). It was connected thru an iron-clad Thompson galvanometer to a battery of 340 volts. When exposed to daylight a deflection of perhaps 1 to 2 mm. was observed, but no deflection resulted from exposure to the standard carbon lamp.

Selenium. A crystal of selenium, prepared by Dr. F. C. Brown and having a receiving surface of less than one sq. mm., when exposed to the standard lamp gave a deflection of more than 50 cm., which shows its *great sensitivity* as compared with other substances.

The mounting of the selenium crystal consisted of metal electrodes between which the crystal was held by compression. When operated as a photophone, by connecting the selenium crystal with an Audion amplifier, a loud musical note was obtained.

Tellurium. This metal is said to change in resistance when exposed to light. The present tests were made upon a mirror of tellurium deposited upon a glass plate by cathode disintegration. Suitable terminals were attached to a sample about 4 by 50 mm. *No change in conductivity* was observed when it was exposed to light.

Boleite. The sample of boleite [3Pb Cl (OH).Cu Cl (OH) + Ag Cl], from Boleo, Mexico, examined was a single rectangular crystal 3 by 3 by 1.5 mm. It was held by compression between copper electrodes. *No change in conductivity* was observed when the crystal was exposed to daylight or to the standard incandescent lamp.

Stibnite. The size of one sample examined was 4 by 7 by 0.5 mm. Terminals were attached to it by heating a copper wire to incandescence in a gas flame and bringing it in contact with the plate of stibnite.

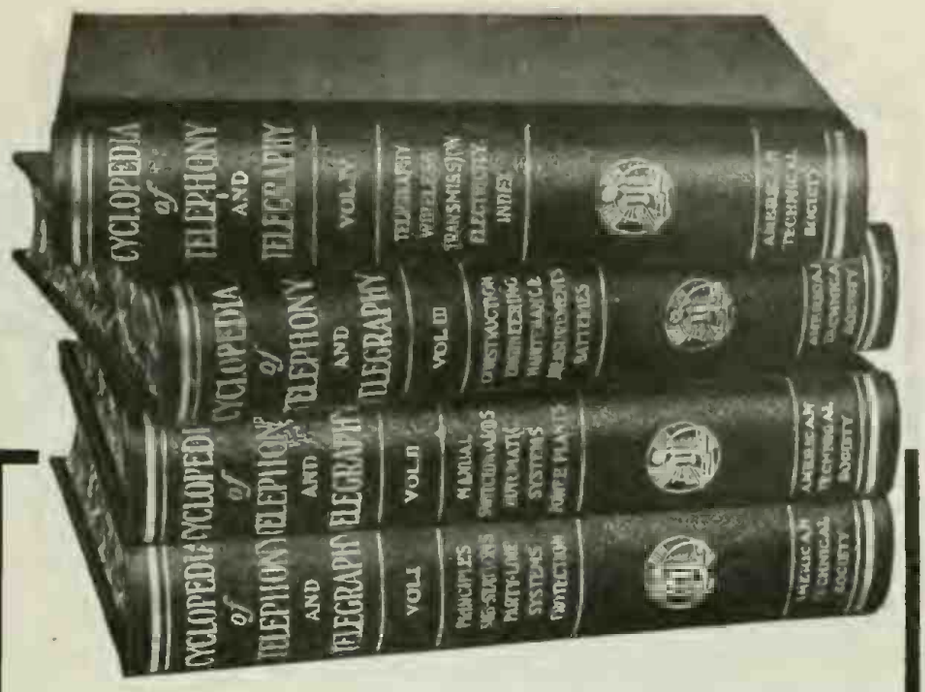
The standard carbon lamp caused a deflection of 5 cm. Stibnite may be considered as sensitive as *boulangerite*, to be mentioned presently, but the deflection drifted, due to the decrease in resistance with time already noticed by other observers.

Boulangerite. The specimen of boulangerite (3PbS. Sb_2S_3, Irkutsk, Siberia), investigated was obtained from the Smithsonian collection. Several samples were examined. In one sample, 4 by 7 by 0.8 mm., the electrodes consisted of copper wires melted into the material as just described. The radiation from the standard lamp gave a deflection of 10 to 20 cm.

Another sample, 1 by 1.2 by 2 mm., held by compression between two heavy electrodes of copper, when exposed to the standard incandescent lamp produced a deflection of 2 to 3 cm., which is comparable with the preceding when one considers the size of the exposed surfaces.

Altho this substance seems fairly sensitive, it did not appear to be sufficiently so to justify an investigation of its spectral sensitivity with a view of using this mineral as a selective radiometer.

Jamesonite. ($2PbS.Sb_2S_3$; Smithsonian



Telegraph and Telephone Books Sent to Experimentors for a Whole Week FREE

Absolutely free to use for seven days—no strings of any kind to this offer. Every reader of Electrical Experimenter can have a set of these great, instructive and intensely interesting books telling everything that the greatest experts in the business know about telephony and telegraphy. The coupon brings all four volumes right to your door. If they don't please you in every way, we stand the expense of shipping them back. See the list of things the books explain and our *free trial* offer below.

Will Make You An Expert

This Library of Telephony and Telegraphy will fit you to hold the biggest kind of job in this interesting and well-paying field. The 4 big books with 1,728 pages and 2,000 pictures, plates, diagrams, etc., bound in genuine leather, regular library style, explain everything you need to know.

Part of What They Contain Electric Telegraph—Wireless Telegraphy—Wireless Telephony — Elements of Electricity — Line Construction—Engineering and Maintenance—Electrical Measurements — Switchboards — Automatic Systems —Power Plants and Buildings—Special Service Features — Telegraph and Railway Work — Substation Equipment—Party Line Systems—Generators—Train Dispatching—Storage Batteries—Coils—Tests. Altogether a thousand different subjects are covered in detail.

Consulting SERVICE FREE With every set of the Cyclopedia of Telephony and Telegraphy we will give without any charge whatever a one year membership in the American Technical Society enabling you to consult our engineers and experts on any telephone, telegraph or wireless problem you want solved for one year. This membership usually sells for $12.00. It is yours free with the books.

DON'T SEND MONEY

Don't send one cent with your free trial request. The coupon is all you need to get the books. Just fill out all three lines and mail it to us. We will ship the books to either your home or shop by express collect and you can use them as if they were your own for a whole week. Then if you want to send them back do it. It's all right with us and we will pay the expense of shipping them back ourselves. If you want to keep the books send us only $2.00. You can send the balance of our special $12.80 price the same way—$2.00 each month.

We reserve the right to withdraw this price at any time. In fact we cannot maintain it after the present edition is sold. Act now while the low price holds good.

AMERICAN TECHNICAL SOCIETY
Dept. X-3384
Chicago, U. S. A.

This Coupon is all You NEED

Send it Now

American Technical Society,
Dept. X-3384
Chicago, Ill., U. S. A.

Please send me the four-volume set of "Telephony and Telegraphy" for seven days' examination, shipping charges collect. If I decide to buy, I will send $2.00 within seven days and balance at $2.00 a month until $12.80 has been paid. Then you will send me a receipt showing that the set of books and the Consulting Membership are mine, and fully paid for. If I want to get along without the books, I will return them at your expense after seven days.

Name.....

Address.....

Reference.....

www.americanradiohistory.com

FREE TO THE RUPTURED

DON'T WEAR A TRUSS

FREE TRIAL



Do Away With Steel and Rubber Bands That Chafe and Pinch

You know by your own experience that the truss is a mere makeshift—a false prop against a collapsing wall—and that it is undermining your health. Why, then, continue to wear it? STUART'S PLAPAO-PADS are entirely different—being medicine applicators made self-adhesive purposely to prevent slipping and to hold the distended muscles securely in place. No straps, buckles or springs attached. No "digging in" or grinding pressure. Soft as Velvet—Flexible—Easy to Apply—Inexpensive. Continuous day and night treatment at home. No delay from work. Hundreds of people, old and young, have gone before an officer qualified to acknowledge oaths, and swore that the PLAPAO-PADS cured their Ruptures—some of them most aggravated cases—and of long standing.

Send Today For FREE PLAPAO--No Charge for it--Now or Ever

Simply write your name and address below. Send this advertisement for absolutely FREE TRIAL PLAPAO and 48-page Book on Rupture. No charge for it—now or ever. Nothing to be returned. "Be wise today 'tis madness to defer." Address, PLAPAO CO., Block 844, St. Louis, Mo.

Name..... Address.....

The Breakers

Atlantic City's Newest Fire-Proof Hotel



Ocean Front. Unusually attractive during the Autumn and Winter seasons.

American and European Plans

Luxurious lobbies, spacious verandas and sun parlors overlooking the ocean. Charming afternoon musicales and evening concerts. A palatial residence for those seeking rest and recreation. Sea water baths. Fireproof garage. Illustrated booklet sent on request.

"THERE'S MONEY IN IT"

AT HOME LEARN TELEGRAPHY AT HOME

MORSE AND WIRELESS

TEACH YOURSELF



In half the usual time, at trifling cost, with the wonderful Automatic Transmitter, THE OMNIGRAPH. Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would.

Adopted by U. S. Gov't. 4 styles. Catalogue free.

OMNIGRAPH MFG. CO.
39L Cortlandt St. New York



1-50 H. P. Motor $4.00 complete as shown

If you are in need of a small motor for experimental purposes, this is your chance to get one at a very low price. Wound for 110 volt A. C. or D. C. Built exactly the same as a large motor; twenty-two section commutator, laminated field and armature construction, drum wound armature.

We have only a limited quantity to offer at this price which means that you must act quick if you wish to secure one at this low price.

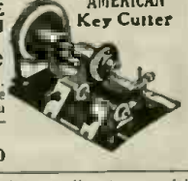
BODINE ELECTRIC COMPANY
2254 WEST OHIO STREET CHICAGO, ILLINOIS

GREEN AUTOMATIC MACHINE



ADD TO YOUR INCOME WITH LITTLE EFFORT $5 to $10 A DAY MADE EASY WITH

"AMERICAN" Key Cutter



New Improved Green Automatic Machine

Sharpens, Hones and Strops all kinds of safety razor blades, in one operation, from four to six blades per minute. For both Quality and Quantity, this machine is in a class by itself. There is nothing like it on the market. Let us send you our free booklet explaining everything including the "AMERICAN" Key Cutter—cuts square, angular or round slots.

AMERICAN SHARPENING MACHINE CO. (Inc.), Dept E E, 184 W. Washington St., CHICAGO

collection, from Cornwall, England.) The sample examined (size 2 by 7 by 1 mm.) had the copper wire terminals attached by fusing the incandescent wire into the material. The standard lamp gave a deflection of only 1 to 2 cm., which seems to indicate that this material is not so light-sensitive as is boulangerite.

Mixtures of galena and stibnite in various proportions were melted in a crucible and poured upon a plate of metal. Several samples, 5 by 10 by 0.5 mm., were examined, but none of them gave any indication of light-sensitiveness (change in resistance) when exposed to daylight or to the standard incandescent lamp.

Bismuthinite. Bismuthinite, Bi_2S_3, was obtained from the Smithsonian collection from Jefferson County, Montana. This is the most interesting substance examined, in view of the diverse results obtained and the explanation offered therefor.

The sample of bismuthinite examined consisted of a non-homogeneous mass of acicular crystals, which was easily crushed into numerous fine needle-like crystals. The first sample examined was a small mass of crystals (size 1 by 1 by 0.7 mm.) held by compression between two heavy electrodes of copper. When the crystal was exposed to the standard carbon lamp *no change in conductivity* could be detected with certainty.

A second sample, 3 by 6 by 1 mm., had the copper wire terminals attached by fusion, as already described. The e.m.f's applied were the same as for the preceding sample. When exposed to the standard lamp no change in conductivity was observed. These results being contradictory to those published by Case, who used a three stage Audion amplifier to detect the change in conductivity of the crystals, the foregoing experiments were repeated in the manner described by him. For this purpose the light from an acetylene flame shining thru a slit 2 by 10 mm. was focused upon the crystal by means of a triple achromatic lens, 6 cm. in diameter and 18 cm. focal length. The light was interrupted by means of a sectored disk having 15 openings and operated by means of an electric motor, the speed of which could be varied. The usual speed gave 240 interruptions per second. The crystal was connected to a three stage Audion amplifier and telephone receiver. A crystal of selenium or a selenium cell produced a loud note, but the samples of boulangerite and jamesonite, which by previous tests were light-sensitive, did not give a musical sound in the telephone.

The sample of bismuthinite with electrodes sealed on produced no audible note when exposed to light.

At least a dozen samples of bismuthinite held by compression between heavy copper electrodes were examined in connection with the amplifier. Of this number only two samples appeared to be light-sensitive. One sample produced only a faint sound in the telephone receiver. The second sample produced a loud note in the telephone. The sound was the loudest when the crystal was exposed along the line of contact with the copper electrode. Covering the crystal with red glass did not reduce the loudness of the note very much, indicating that the effect is due to heating of the material. Unfortunately, this crystal was crushed while under investigation. Prolonged tests on other samples gave negative results as regards the production of sound.

In view of the fact that the tests made with a sensitive galvanometer failed to show an increase in conductivity when bismuthinite was exposed to light, it appears that the change in conductivity which was observed when a certain specimen was exposed to intermittent flashes of light (photophone or, rather, radiophone) is

www.americanradiohistory.com

the result of a *thermal change* within the crystal, or perhaps a change in the *contact resistance* at the electrodes. In this connection the following experiments on thin strips of metals are of interest.

Platinum and Gold. In conclusion it is of interest to record the results obtained when using thin blackened strips of platinum and of gold-leaf as radiophones, by connecting them thru a battery to an amplifier.

These blackened strips were warmed intermittently by exposing them thru a rotating sectored disk to the acetylene flame, as already described.

When a sensitive platinum bolometer receiver was used as a radiophone, the sound produced in the telephone was not very audible. This no doubt was due to the great heat capacity of the material which prevented the rapid alternations in resistance and hence in electric current, from being of sufficient magnitude to affect the telephone receiver.

Using a lightly smoked strip (6 by 2.5 mm.) of gold-leaf, the ends of which were clamped between thin (0.02 mm.) strips of tin, the sound produced in the telephone receiver was as loud as was observed in the photophone made of selenium.

This device was mounted in a glass bulb which could be evacuated. As was to be expected, there was no marked difference in the intensity of the sound produced when operated in air and in a vacuum.

In the gold-leaf radiophone as used, the limit of audibility was attained for a light (radiant power) intensity of 4.8×10^{-5} watts. Using a larger receiver and amplifier and a larger current (which was 0.2 amp. in the present tests) thru the receiver, the sensitivity could be greatly increased.

MENTAL TELEPATHY—A SIMPLE CONCEPTION OF PSYCHICAL ACTIVITY.

By Dr. Charles H. Merlitz

IN the September issue of the ELECTRICAL EXPERIMENTER there appeared an extremely interesting article by Dr. A. Abrams on *Thought Transference and Other Phenomena.* Altho he gave many interesting experiments he did not show the relationship of this theory to the modern physical theories. It is the author's intention in the present article to present an explanation for this remarkable phenomena.

We know very little in regard to the functioning of the human mind. We have practically no insight into the mechanism of thought and memory. We do know, however, that the brain in functioning requires nourishment. Thus it follows that any operation of the brain is accompanied by the absorption of a certain amount of energy. However, *contrary* to ordinary laws, in storing a thought and in subsequently recalling it, *energy is absorbed.* These two processes are the opposite of each other, and it would naturally be supposed that in remembering energy would be dissipated.

To commit a thought to memory we repeat it several times, each successive repetition requires the expenditure of a certain amount of energy. Thus we may say that the energy expended after a number of repetitions equals:

$1^2 + 1^2 + 1^2 + 1^2 - - - - - -$ n times

Now when we remember it the process is the reverse, which gives us $(-1)^2$ which would equal 1^2, which means the *addition of energy.* Thus the act of remembering a fact more firmly implants it in the mind.

We may easily assume that there is a certain practical limit to the amount of effect that can he produced. This limit might be called the *saturation* of the brain. It would he reasonable to suppose from this that for each repetition or act of remembering the amount of energy stored is less than that of the preceding one, decreasing in geo-

VIOLET RAYS for Health Strength and Beauty



You can TREAT YOURSELF at home with the wonderful Violet Ray, most effective health-restoring agent known to science. At practically no cost, the great benefits of famous Violet Ray Treatment heretofore only procurable at big expense from physicians and beauty specialists, now secured in your own home. Look over the list of treatments on the coupon below. Send for particulars.

RENULIFE VIOLET RAY
High Frequency Generators

USE AT HOME

How Violet Ray Benefits

Electricity from your light socket is transformed into health and beauty-giving Violet Ray—powerfully effective, yet gentle, soothing, perfectly safe. Voltage is raised from lighting current, giving tremendous penetrative force. The irresistible, revitalizing powers of Renulife Violet Ray are carried at once to every nerve cell of body. Blood is enriched and purified by a flood of oxygen, functions restored to normal—extra supply of fresh blood quickly brought to area treated, removing congestion and supplying nourishment; combines the benefits of electricity, vibration, exercise, stimulation and oxidation.

Painless Electricity

Science has modified electricity that the weakest may stand its force without fear or pain. Violet Ray high frequency has no comparison with old, crude, electrical batteries and shocking current. Every jar and shock is removed. The effects are marvelously rapid. Relief can be given in one or more treatments. Often permanent improvement is accomplished in that time.

Offered on Liberal TRIAL PLAN
Learn the Wonderful Benefits by Actual Use.

To keep or restore your good looks and gain vitality, throw away medicine bottles—take this sensible scientific means. Every day's delay makes relief more difficult. Send for Booklet "Health via Violet Ray."

Lowest Priced—Most Effective Violet Ray for Home Use

Get FREE Book
Tear Out Coupon

Renulife Electric Co.
535 Marquette Bldg.,
Detroit, Mich.

Canadian Renulife Electric Co.
Ford City, Ontario

Opportunities for live sales representatives

COUPON FOR BOOK and Special Information

RENULIFE ELECTRIC CO.,
535 Marquette Bldg., Detroit

Please send without obligation, your book "Health," explaining Violet Ray treatments with Renulife Generators; also give full particulars as to its application for ailments checked below.

TREATS SUCCESSFULLY

..Abscesses
..Anemia
..Asthma
..Arteriosclerosis
..Baldness
..Blackheads
..Brain Fag
..Bronchitis
..Bunions
..Bruises
..Catarrh
..Colds
..Chilblains
..Dandruff
..Deafness and Ear Diseases
..Eczema
..Enlarged Prostate
..Facial Neuralgia
..Falling Hair
..Female Complaints
..Goitre
..Gout
..Haemorrhoids
..Hay Fever
..Infantile Paralysis
..Insomnia
..Lameness
..Locomotor Ataxia
..Lumbago
..Nervous Affections
..Neuralgia
..Neuritis
..Obesity
..Pain in Abdomen and chest
..Paralysis
..Piles
..Pimples
..Pyorrhea
..Rheumatism
..Scars
..Sciatica
..Skin Diseases
..Sore Throat and Throat Diseases
..Sprains
..Toothache
..Weak Eyes
..Wrinkles
..Warts and Moles

Name .....

Address .....

.....

www.americanradiohistory.com



Men Wanted for Airplane INDUSTRY

Wonderful opportunities —great scope for advancement—and big pay—await you in the airplane industry. This does not mean actual flying, but in any and all of the various branches of the industry. It is the coming profession—the future means of transportation. U. S. Mail is already being carried by airplanes. Factories are springing up everywhere and trained men are in big demand.

Openings in Many Branches You can get into this profession while it is still in its infancy as a mechanic, engineer, repairman, instructor, inspector, builder, contractor, salesman or professional aviator. The minute you understand the science and mechanics of aviation you can step into a high-salaried position.



We Guarantee Our Training

We absolutely and unreservedly guarantee that our Home Training Course will enable you to qualify for a good position as soon as you graduate. The Course itself has been written by noted aeronautical engineers, and covers the entire fundamentals of practical aeronautics. Every lesson is written and illustrated so clearly that you cannot fail to understand it. **But see for yourself.** Take ten lessons. Then if you are not satisfied you are not out one cent. We guarantee satisfaction.

Prepare Now for a Big Future

Only by specialized instruction can you expect to succeed in aviation or in any line of business. Training alone will fit you for a big job—and NOW is the time to begin. Check and mail the coupon for Big Free Bulletin and Money-Back Guarantee.

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. F-7444 CHICAGO, U. S. A.

TRAINING THE KEY TO SUCCESS

Please send Free Bulletin and explain how I can qualify for the position checked. ASC

....High School Graduate	....Lawyer
....Electrical Engineer	....Business Manager
....Elec. Light & Power Supt.	....Certified Pub. Accountant
....Hydroelectric Engineer	....Accountant and Auditor
....Telephone Engineer	....Bookkeeper
....Telegraph Engineer	....Stenographer
....Wireless Operator	....Fire Insurance Expert
....Architect	....Sanitary Engineer
....Building Contractor	....Master Plumber
....Civil Engineer	....Heating & Vent. Engineer
....Structural Engineer	....Automobile Engineer
....Mechanical Engineer	....Automobile Repairman
....Shop Superintendent	....Airplane Mechanic
....Steam Engineer	....General Education Course
....Draftsman and Designer	....Common School Branches

Name .....

Address .....



SAVE 25% to 60%
on slightly used
GRAFLEX-KODAKS
Cameras and Lenses of every description. Equal to new. Save money. Write now for **Free Bargain Book and Catalog** listing hundreds of money-saving bargains in slightly used and new cameras and supplies. All goods sold on 10 days' Free Trial. Money back if not satisfied. You take no chances dealing with us. We have been in the photographic business over 15 years. Write now.
CENTRAL CAMERA CO., Dept 174, 174 S. Wabash Ave., Chicago

Feldman's "Geyser" Electric Water Heater
Instantaneous Hot Water
FELDMAN MFG. CO.
1500 Times Bldg. New York City

Be an Artist
Comics, Cartoons Commercial, Newspaper and Magazine Illustrating. Pastel, Crayon portraits, Poster and Fashions Earn Big Money. Taught by Mail or Local Classes. Write for illustrated booklet, terms and list of successful pupils
ASSOCIATED ART STUDIOS, 13A Flatiron Bldg., N. Y.

metrical progression. Each repetition, however, is accompanied by the absorption of a certain amount of energy. Thus it follows that for each succeeding repetition there is a certain amount of surplus energy to be accounted for. It is this surplus energy that gives us an explanation for the process known as *Mental Telepathy*. Our question then resolves itself into the manner of transference or transmission of this energy.

Sir William Crookes has suggested that the transmission of this energy is effected by means of *ether waves* of *smaller magnitude* and *greater frequency* than those which constitute X-rays. These rays also possess the property of neither being reflected or refracted. Prof. Flournoy suggested that these waves are undulations starting from the nervous centers in the brain. The greatest objection to this theory of telepathy is that the intensity of the received impulses is not inversely proportional to the square of the distance, no perceptible diminution in the impulses being produced by distance. In actual experiments the intensity sometimes even increased with the distance. The explanation of this curious phenomena is extremely simple, however. Pocock has suggested that the sensibility and capacity of the brain for the reception of these transmitted impulses is extremely small, so small in fact that the receiver is saturated even at the greatest distance over which telepathy has been observed. The excess energy passes on—unable to produce any effect upon the already saturated brain. This explains why the intensity is not diminished by distance.

We may postulate then that Mental Telepathy is a case of *radiant energy*. These radiations emanating from the brain when the mind is concentrated, are therefore very penetrating and traverse great distances without perceptible decrease in intensity.

The reasoning which I have heretofore pursued has been from the purely theoretical standpoint. The fact that the brain actually radiates energy has been demonstrated by several scientists. Charpentier showed that the human body emits what he has called "N-rays." He found that the phosphorescence of certain substances is increased when they are brought into the vicinity of contracting muscles or one of the nervous centers of the cerebral cortex. He demonstrated this by the use of a simple piece of apparatus. A lead tube about two inches long covered at one end by a piece of paper or silk treated with phosphorescent calcium sulfate was employed. By placing this tube near nervous centers a marked increase in phosphorescence was observed. Di Brazza showed that when a phosphorescent, platino-cyanid of barium screen faintly illuminated by a distant X-ray tube was placed near certain portions of the head, that when the subject concentrated his will the luminosity of the screen was varied in relation to the subjects *psychical activity*. From this he concluded that the brain was the seat of active radiations. When the subject's attention is not concentrated no variation in the luminosity is noticeable. Di Brazza found that the activity was greatest around the temples, the eyes and behind the ears. This experiment may be repeated by exercising great care. It must be remembered, however, that the variations in luminosity are extremely small.

There have been many experimenters in this branch of science, many of whom have recorded remarkable instances of telepathy or *action at a distance*, as it is sometimes called. Professor Henry Sidgwick has collected a great number of instances in which hallucinations directly preceded death, and which he attributed to mental telepathy. Wessermann has recorded a singularly in-

The ANDERSON Steam Vulcanizers
We manufacture them—we own and teach you the Anderson Method of Vulcanizing—90% profit. And still you guarantee your work to outlast balance of the tire and collect full customary prices.
Ask us for literature and location of nearest Anderson State School. We urge you visit that city where you can see all other makes and learn their method, then visit the Anderson School there and learn our Method.
Go prepared to take 5 to 10 days' course of the ANDERSON METHOD. We guarantee to make a first-class vulcanizer out of you or refund your money. Our course will cost you $20 in either the day or night classes and any time thereafter you buy and pay us for a vulcanizer, your $20 will be refunded in cash. $235 and 5 to 10 days in Any Anderson State School of Vulcanizing will start you in this most profitable business. The Anderson Steam Vulcanizer Co., 23 Williams Bldg., Indianapolis, Indiana, U. S. A.
Please print your name. We receive many we can not make out.



Swing 4 in., 11 in. between centers, 17 in. total length. Shipping weight 13 lbs. Bed of lathe is machined. Workmanship first-class. Equipped with wood turning chuck. Can be fitted with 3 in. face plate and drill chuck as special equipment. Order one today. Price $6.00 cash with order. SYPHER MFG. CO., DEPT. C TOLEDO, OHIO



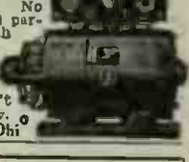
THE NEW MIDGET SLIDE RULE
has many exclusive features. It will add and subtract fractions and give decimal equivalents. It will also multiply, divide, add and subtract, solve problems involving any root or power (excepting—1) and will give Logarithms and the Sines, Tangents, Cosines and Cotangents of all angles. Made of metal. Size 3 1-4 inches. Send for free circulars. Price with complete instructions $1.00
Your money back if you are not satisfied.
GILSON SLIDE RULE CO., Niles, Mich



Says the Master Mechanic. The Greb Automatic Grip Puller is a One-Man Puller—Quick-acting, strong and simple in the extreme. May be locked in any desired position. A combination of two or three arms. Heavy Duty Size capacity 1" to 18"—Junior size capacity 1" to 7". Two sets of jaws furnished with each size.
Ten Days' Trial If your dealer or jobber does not have them we will send you one. Try it ten days. If not satisfactory, return to us and we will refund your money. We also make the GREB RIM PULL.
THE GREB CO., 230 State Street, BOSTON

Electricians Get up-to-date in HOUSE WIRING! Save TIME, MONEY, LABOR and MATERIAL by using our 98 GENUINE BLUE PRINT DRAWINGS, containing all the latest diagrams and connections known in house wiring—every diagram and connection up-to-the-minute as used by first class electricians for wiring BELLS, BURGLAR ALARMS, LIGHTS, ANNUNCIATORS, FIRE ALARMS and ELECTRIC GAS LIGHTING. These drawings are bound in the form of a flexible book (9 x 12) for convenience in using on the job. Send for them, and if they don't make you more efficient as a wireman and save you many times their cost as a contractor, return them and money will be refunded—you can't afford to be without them. ONE DOLLAR Postpaid. Send for circulars on other sets of drawings.
PATENT SPECIALTY COMPANY
P. O. Box No. 583 San Francisco, Cal.

Battery Charging Pays $100 to $200 Every Month
extra profits to garage men. You can get these profits—easily, quickly. No electrical knowledge required. Full particulars on request. $15 sent with this ad puts HB Seven-Battery Charger in your garage. Balance in 9 monthly payments of $20 each. Ten days' free trial. Absolute money-back guarantee. Don't delay and lose profits. Order now.
Hobart Bros. Co. Box 4E, Troy, Ohio



Build Your Own PHONOGRAPH
PARTS FOR ANY STYLE MACHINE
Build your own cabinets
We show you how
Circulars and Instructions 10c.
Motors, Reproducers, etc. sold
Electro Mechanical Parts Co.
Dept. E 160 No. Wells St., Chicago, Ill.

A STEFFEY MOTOR



on your wheel will convert it into a practical and successful high grade motorcycle that will cost you less to operate than the more expensive machines. Write at once and secure lowest factory prices. Excellent opportunity for agents. Send stamp.
STEFFEY MFG. CO., Dept. E. 5025 Brown St., Phila. Pa.

Army Auction Bargains



Tents	$4.25 up	C. W. revolvers	$2.65 up
Leggings	.18 up	Army 7 shot carbine	2.95 up
Saddles	4.65 up	Army Haversacks	.15 up
Uniforms	1.50 up	Knapsacks	.75 up
Teamharness	26.85	Army Gun slings	.30 up

Colts Army Revolver cal. 45 at $8.45.
16 acres Army Goods. Large illustrated cyclopedia reference catalog—428 pages—issue 1917, mailed 50 cents. New Circular 6 cents.
FRANCIS BANNERMAN & SONS 501 Broadway, New York

www.americanradiohistory.com

teresting incident. He wished to make the apparition of a young lady appear to a lieutenant living several miles away. At the time of the experiment a visitor happened to be with the lieutenant, who is said to have seen the apparition also. Many instances are recorded in which persons were hypnotized at some distance. All of these phenomena can be easily explained by the *brain wave* theory.

Besides the transference of thought, both sympathy and affection may be the outgrowth of these radiations from the brain. Whether our capacity for the reception of these impulses is increasing with the evolution of man, cannot be ascertained directly. It would seem probable, however, that with our increase in education and civilization that a conscious use of this *thought language* may be found. Who knows but that the man of the future may find a practical application for this radiation from the brain, and a higher and more delicately made creature may result who would effect mutual understanding by means of this marvelous and as yet but little understood *psychical activity.*

MY INVENTIONS

(*Continued from page* 865)

travel at a rate of about one thousand miles an hour, impracticable by rail. The reader will smile. The plan was difficult of execution, I will admit, but not nearly so bad as that of a well-known New York professor, who wanted to pump the air from the torrid to the temperate zones, entirely forgetful of the fact that the Lord had provided a gigantic machine for this very purpose.

Still another scheme, far more important and attractive, was to derive power from the rotational energy of terrestrial bodies. I had discovered that objects on the earth's surface, owing to the diurnal rotation of the globe, are carried by the same alternately in and against the direction of translatory movement. From this results a great change in momentum which could be utilized in the simplest imaginable manner to furnish motive effort in any habitable region of the world. I cannot find words to describe my disappointment when later I realized that I was in the predicament of Archimedes, who vainly sought for a fixt point in the universe.

At the termination of my vacation I was sent to the Polytechnic School in Gratz, Styria, which my father had chosen as one of the oldest and best reputed institutions. That was the moment I had eagerly awaited and I began my studies under good auspices and firmly resolved to succeed. My previous training was above the average, due to my father's teaching and opportunities afforded. I had acquired the knowledge of a number of languages and waded thru the books of several libraries, picking up information more or less useful. Then again, for the first time, I could choose my subjects as I liked, and free-hand drawing was to bother me no more. I had made up my mind to give my parents a surprise, and during the whole first year I regularly started my work at three o'clock in the morning and continued until eleven at night, no Sundays or holidays excepted. As most of my fellow-students took things easily, naturally enough I eclipsed all records. In the course of that year I past thru nine exams and the professors thought I deserved more than the highest qualifications. Armed with their flattering certificates, I went home for a short rest, expecting a triumph, and was mortified when my father made light of these hard-won honors. That almost killed my ambition; but later, after he had died, I was pained to find a package of letters which

(*Continued on page* 907)



Volume II 180 pages — Volume I 184 pages

both bound in red Athol-leather, gold title, good paper, handy size, 4½" x 7".

You Will Want Both Books

These handy reference books are of exceptional value to you, whether you are an apprentice or a highly skilled mechanic. Both books are edited by men prominent in the machinery field—men who know exactly what is most helpful to the beginner as well as the experienced man.

Volume II for Practical Machinists
Sequel to Volume I

180 pages of important technical data, tables relating to machine speeds, power transmission, drilling, turning and milling, materials, etc.

Volume I for Machinists' Apprentices
Now in 4th Edition

184 pages of material that shows "how to do it." Essential to the beginner, valuable to the experienced machinist. It deals with the layout and precise measurement of work.

Ask Your Hardware Dealer to show them to you, or write direct—50c. each

Catalog No. 21LE of Starrett Tools on request

THE L. S. STARRETT COMPANY
The World's Greatest Toolmakers. Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

NEW YORK LONDON CHICAGO

42-900

MAKE MONEY
REPAIRING TIRES

The high cost and limited supply of tires makes it necessary for motorists to conserve their tires and get maximum mileage. Present conditions offer tire repair men a big opportunity to make money. Experienced help not necessary.

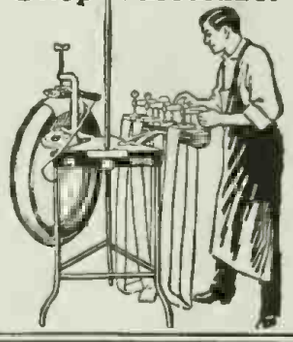
With this Shaler Electric Vulcanizer you can make money easy. It heats from city electric light current —*has automatic heat control*—no danger of fire or explosions.

Will mend any style or size of tire—both casing and inner tube. Handles 12 casings and 200 tubes a day. Anybody can operate it, and turn out perfect work. Price $65.00 complete —Subject to Trade Discount.

Write at once for catalog of our complete line of Shaler Vulcanizers, Steam or Electric for Repair Shops and quick selling models for motorists.

C. A. SHALER CO., 2203 Fourth St., Waupun, Wis.

SHALER Electric Shop Vulcanizer



What 15c will bring You from the Nation's Capital

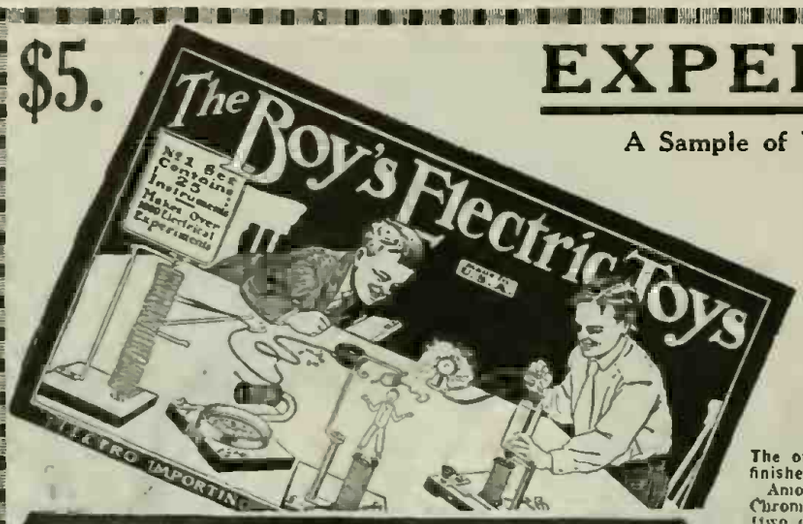
Washington, the home of the Pathfinder, is the nerve center of civilization; history is being made at this world capital. The Pathfinder's illustrated weekly review gives you a clear, impartial and correct diagnosis of public affairs during these strenuous, epoch-making days.

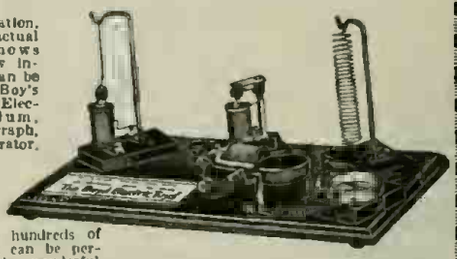
The little matter of 15c in stamps or coin will bring you the Pathfinder 13 weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth and only the truth; now in its 26th year. This paper fills the bill without emptying the purse; it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you would appreciate a paper which puts everything clearly, fairly, briefly—here it is. Send 15c to show that you might like such a paper, and we will send the Pathfinder on probation 13 weeks. The 15c does not repay us, but we are glad to invest in new friends. **The Pathfinder, Box 576, Washington, D. C.**

www.americanradiohistory.com

$5. EXPERIMENTERS!

A Sample of What You Can Do With This Outfit





This illustration, made from an actual photograph, shows only a very few instruments that can be made with the Boy's Electric Toys: Electric Pendulum, Electric Telegraph, Current Generator, Electric Dancing Spiral, Galvanometer, Space does not permit us to show the hundreds of experiments that can be performed with this wonderful outfit.

The outfit contains 114 separate pieces of material and 24 pieces of finished articles ready to use at once.

Among the finished material the following parts are included: Chromic salts for battery, lamp socket, bottle of mercury, core wire (two different lengths), a bottle of iron filings, three spools of wire, carbons, a quantity of machine screws, flexible cord, two wood bases, glass plate, paraffine paper, binding posts, screw-driver, etc., etc. The instruction book is so clear that anyone can make the apparatus without trouble, and besides a section of the instruction book is taken up with the fundamentals of electricity to acquaint the layman with all important facts in electricity in a simple manner.

We guarantee satisfaction.

The size over all of the outfit is 14x9x2¾. Shipping weight, 8 lbs. **No. EX2002 "The Boy's Electric Toys," outfit as described. $5.00**

IMMEDIATE SHIPMENTS



No. EX2002

THE BOY'S ELECTRIC TOYS" contains enough material TO MAKE AND COMPLETE OVER TWENTY-FIVE DIFFERENT ELECTRICAL APPARATUS without any other tools, except a screw-driver furnished with the outfit. The box contains the following complete instruments and apparatus which are already assembled:

Student's chromic plunge battery, compass-galvanometer, solenoid, telephone receiver, electric lamp. Enough various parts, wire, etc., are furnished to make the following apparatus:

Electromagnet, electric cannon, magnetic pictures, dancing spiral, electric hammer, galvanometer, voltmeter, hook for telephone receiver, condenser, sensitive microphone, short distance wireless telephone, test storage battery, shocking coil, complete telegraph set, electric riveting machine, electric buzzer, dancing fishes, singing telephone, mysterious dancing man, electric jumping jack, magnetic geometric figures, rheostat, erratic pendulum, electric butterfly, thermo electric motor, visual telegraph, etc., etc.

This does not by any means exhaust the list, but a great many more apparatus can be built actually and effectually.

With the instruction book which we furnish, one hundred experiments that can be made with this outfit are listed, nearly all of these being illustrated with superb illustrations. No other materials, goods or supplies are necessary to perform any of the one hundred experiments or to make any of the 25 apparatus. Everything can be constructed and accomplished by means of this outfit, two hands, and a screw-driver. (Continued in next column)

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 19 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 228 Big Pages, 600 illustrations, 500 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy." 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 19 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.



ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

I enclose herewith 6 cents in stamps or coin for which please send me your latest Cyclopedia Catalog No. 20 as described.

NAME .....

ADDRESS .....

STATE ..... E. E. 4-19

The "Electro" Radiotone
HIGH FREQUENCY SILENT TEST BUZZER



This instrument gives a wonderful high pitched MUSICAL NOTE in the receivers, impossible to obtain with the ordinary test buzzer. The RADIOTONE is built along entirely new lines; it is NOT an ordinary buzzer, reconstructed in some manner. The RADIOTONE has a single fine steel reed vibrating at a remarkably high speed, adjusted to its most efficient frequency at the factory. Hard silver contacts are used to make the instrument last practically forever.

Yes, the RADIOTONE is SILENT. In fact, it is so silent that you must place your ear on top of it to hear its beautiful musical note.

You will be astounded at the wonderfully clear, 500 cycle note, sounding sharply in your receivers. To learn the codes there is absolutely nothing like it. With the radiotone, a key and one dry cell and ANY telephone, a line learner's set is had. Two or more such sets in series will afford no end of pleasure for intercommunication work. Shipping Weight 1 lb.

Radiotone as described.....each **$.90**

IMMEDIATE SHIPMENTS

The "Electro" Telegraph



is not a toy, but a practical, honestly built telegraph outfit, which not only sounds but works like the big commercial instruments. By studying the code for 30 days you can become a first-class telegraph operator. Such operators are in big demand now. Outfit consists of TWO complete telegraph instruments each measuring 3½ x 2½ x 2¾. All metal parts are highly nickel plated, including key lever. Note hard rubber knob. Telegraph Code Chart, telegraph blanks and connecting wire comes with set, but no batteries. Outfit works on 2 dry cells (one cell for each instrument). The "Electro" is the ONLY Outfit that works both ways, each station can call; no switches, no extras. Nothing to get out of order. Guaranteed to please you or money back. **Price Complete as Illustrated (TWO INSTRUMENTS).... $1.25**

Shipping Weight, 2 lbs.

IMMEDIATE SHIPMENTS

The "Electro" Codophone (*Patents Pending*)

$1.50

What this remarkable instrument is and does.



The "Electro" Codophone is positively the only instrument made that will imitate a 500 cycle note exactly as heard in a Wireless receiver. The loud-talking receiver equipped with a horn, talks so loud that you can hear the sound all over the room, even if there is a lot of other noise.

THAT'S NOT ALL. By lessening or tightening the receiver cap, a tone from the lowest, softest quality, up to the loudest and highest screaming sound can be had in a few seconds.

FOR INTERCOMMUNICATION. Using two dry cells for each instrument, two Codophones when connected with one wire and return ground, can be used for intercommunication between two houses one-half mile apart.

One outfit alone replaces the old-fashioned learner's telegraph set, consisting of key and sounder.

The "Electro" Codophone is a handsome, well made instrument, fool proof, and built for hard work. Contacts are of hard silver ⅛ inch in diameter, that will outlast the instrument.

There is also a neat code chart and full directions enabling any intelligent young man or girl to learn the codes within 30 days, practising one-half hour a day.

Size: 6¾ x 3 x 2¾." Shipping weight, 2 lbs.

The "Electro" Codophone as described, complete..... **$1.50**

ELECTRO IMPORTING CO., 231 Fulton Street NEW YORK

www.americanradiohistory.com

MY INVENTIONS.

(*Continued from page* 905)

the professors had written him to the effect that unless he took me away from the Institution I would be killed thru overwork. Thereafter I devoted myself chiefly to physics, mechanics and mathematical studies, spending the hours of leisure in the libraries. I had a veritable mania for finishing whatever I began, which often got me into difficulties. On one occasion I started to read the works of Voltaire when I learned, to my dismay, that there were close on one hundred large volumes in small print which that monster had written while drinking seventy-two cups of black coffee per diem. It had to be done, but when I laid aside the last book I was very glad, and said, "Never more!"

My first year's showing had won me the appreciation and friendship of several professors. Among these were Prof. Rogner, who was teaching arithmetical subjects and geometry; Prof. Poeschl, who held the chair of theoretical and experimental physics, and Dr. Allé, who taught integral calculus and specialized in differential equations. This scientist was the most brilliant lecturer to whom I ever listened. He took a special interest in my progress and would frequently remain for an hour or two in the lecture room, giving me problems to solve, in which I delighted. To him I explained a flying machine I had conceived, not an illusionary invention, but one based on sound, scientific principles, which has become realizable thru my turbine and will soon be given to the world. Both Professors Rogner and Poeschl were curious men. The former had peculiar ways of expressing himself and whenever he did so there was a riot, followed by a long and embarrassing pause. Prof. Poeschl was a methodical and thoroly grounded German. He had enormous feet and hands like the paws of a bear, but all of his experiments were skillfully performed with clock-like precision and without a miss.

It was in the second year of my studies that we received a Gramme dynamo from Paris, having the horseshoe form of a laminated field magnet, and a wire-wound armature with a commutator. It was connected up and various effects of the currents were shown. While Prof. Poeschl was making demonstrations, running the machine as a motor, the brushes gave trouble, sparking badly, and I observed that it might be possible to operate a motor without these appliances. But he declared that it could not be done and did me the honor of delivering a lecture on the subject, at the conclusion of which he remarked: "Mr. Tesla may accomplish great things, but he certainly never will do this. It would be equivalent to converting a steadily pulling force, like that of gravity, into a rotary effort. It is a perpetual motion scheme, an impossible idea." But instinct is something which transcends knowledge. We have, undoubtedly, certain finer fibers that enable us to perceive truths when logical deduction, or any other willful effort of the brain, is futile. For a time I wavered, imprest by the professor's authority, but soon became convinced I was right and undertook the task with all the fire and boundless confidence of youth.

I started by first picturing in my mind a direct-current machine, running it and following the changing flow of the currents in the armature. Then I would imagine an alternator and investigate the processes taking place in a similar manner. Next I would visualize systems comprising motors and generators and operate them in various ways. The images I saw were to me perfectly real and tangible. All my remaining term in Gratz was past in intense but fruitless efforts of this kind, and I almost came to the conclusion that the problem was insolvable. In 1880 I went to Prague, Bohemia, carrying out my father's wish to complete my education at the University there. It was in that city that I made a decided advance, which consisted in detaching the commutator from the machine and studying the phenomena in this new aspect, but still without result. In the year following there was a sudden change in my views of life. I realized that my parents had been making too great sacrifices on my account and resolved to relieve them of the burden. The wave of the American telephone had just reached the European continent and the system was to be installed in Budapest, Hungary. It appeared an ideal opportunity, all the more as a friend of our family was at the head of the enterprise. It was here that I suffered the complete breakdown of the nerves to which I have referred. What I experienced during the period of that illness surpasses all belief. My sight and hearing were always extraordinary. I could clearly discern objects in the distance when others saw no trace of them. Several times in my boyhood I saved the houses of our neighbors from fire by hearing the faint crackling sounds which did not disturb their sleep, and calling for help.

In 1899, when I was past forty and carrying on my experiments in Colorado, I could hear very distinctly thunderclaps at a distance of 550 miles. The limit of audition for my young assistants was scarcely more than 150 miles. My ear was thus over thirteen times more sensitive. Yet at that time I was, so to speak, stone deaf in comparison with the acuteness of my hearing while under the nervous strain. In Budapest I could hear the ticking of a watch with three rooms between me and the time-piece. A fly alighting on a table in the room would cause a dull thud in my ear. A carriage passing at a distance of a few miles fairly shook my whole body. The whistle of a locomotive twenty or thirty miles away made the bench or chair on which I sat vibrate so strongly that the pain was unbearable. The ground under my feet trembled continuously. I had to support my bed on rubber cushions to get any rest at all. The roaring noises from near and far often produced the effect of spoken words which would have frightened me had I not been able to resolve them into their accidental components. The sun's rays, when periodically intercepted, would cause blows of such force on my brain that they would stun me. I had to summon all my will power to pass under a bridge or other structure as I experienced a crushing pressure on the skull. In the dark I had the sense of a bat and could detect the presence of an object at a distance of twelve feet by a peculiar creepy sensation on the forehead. My pulse varied from a few to two hundred and sixty beats and all the tissues of the body with twitchings and tremors which was perhaps the hardest to bear. A renowned physician who gave me daily large doses of Bromid of Potassium pronounced my malady unique and incurable. It is my eternal regret that I was not under the observation of experts in physiology and psychology at that time. I clung desperately to life, but never expected to recover. Can anyone believe that so hopeless a physical wreck could ever be transformed into a man of astonishing strength and tenacity, able to work thirty-eight years almost without a day's interruption, and find himself still strong and fresh in body and mind? Such is my case. A powerful desire to live and to continue the work, and the assistance of a devoted friend and athlete accomplished the wonder. My health returned and with it the vigor of mind. In attacking the problem again I almost regretted that the struggle was soon to end. I had so much energy to spare. When I undertook the task it was not with a resolve such as men often make. With me it was a sacred vow, a question of life and death. I knew that I would perish if I failed. Now I felt that the battle

(*Continued on page* 909)



HIGH SCHOOL COURSE IN TWO YEARS

Are you one of the 98% who didn't finish High School? If so you are badly handicapped. Without this training you are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance, in fact from all worthwhile positions.

GET THIS TRAINING NOW! You don't want to be handicapped nor do you have to be. Let the American School give you the training you missed. Our High School Course covers every subject taught in a resident school. It will broaden your knowledge, make you keen, alert and capable and fit you to earn a higher salary. You can complete the entire course in two years.

TAKE 10 LESSONS AT OUR EXPENSE

Test this Course at our expense. Take ten full examinations, then if you don't feel satisfied you are not out one cent. Training alone will make you master of your work, able to think and act for yourself, and competent enough to secure and hold the position you want. Whether you lack High School training or specialized instruction NOW is the time to get it.

BIG DEMAND FOR SKILLED WORKERS

The demand was never greater for skilled workers in every trade and profession. The pay was never higher—the opportunities never greater. Train and get into the game for all it is worth. We guarantee satisfaction. You do not risk one cent. Check and mail Coupon NOW. We will promptly send you full details and Free Bulletin.

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. H-7444 Chicago, Illinois

TRAINING THE KEY TO SUCCESS

Tell me how I can fit myself for the position marked X:

....High School Graduate	....Shop Superintendent
.... Electrical Engineer	....Lawyer
.....Telephone Engineer	.....Business Manager
.....Architect	.....Auditor
.....Draftsman	.....Certified Public Accountant
.... Building Contractor	.....Stenographer
.....Structural Engineer	.....Bookkeeper
.....Mechanical Engineer	.....Fire Insurance Adjuster
.... Civil Engineer	.....Sanitary Engineer
.....Steam Engineer	.....Automobile Engineer

Name .....

Address .....

GO INTO MOVING PICTURE BUSINESS

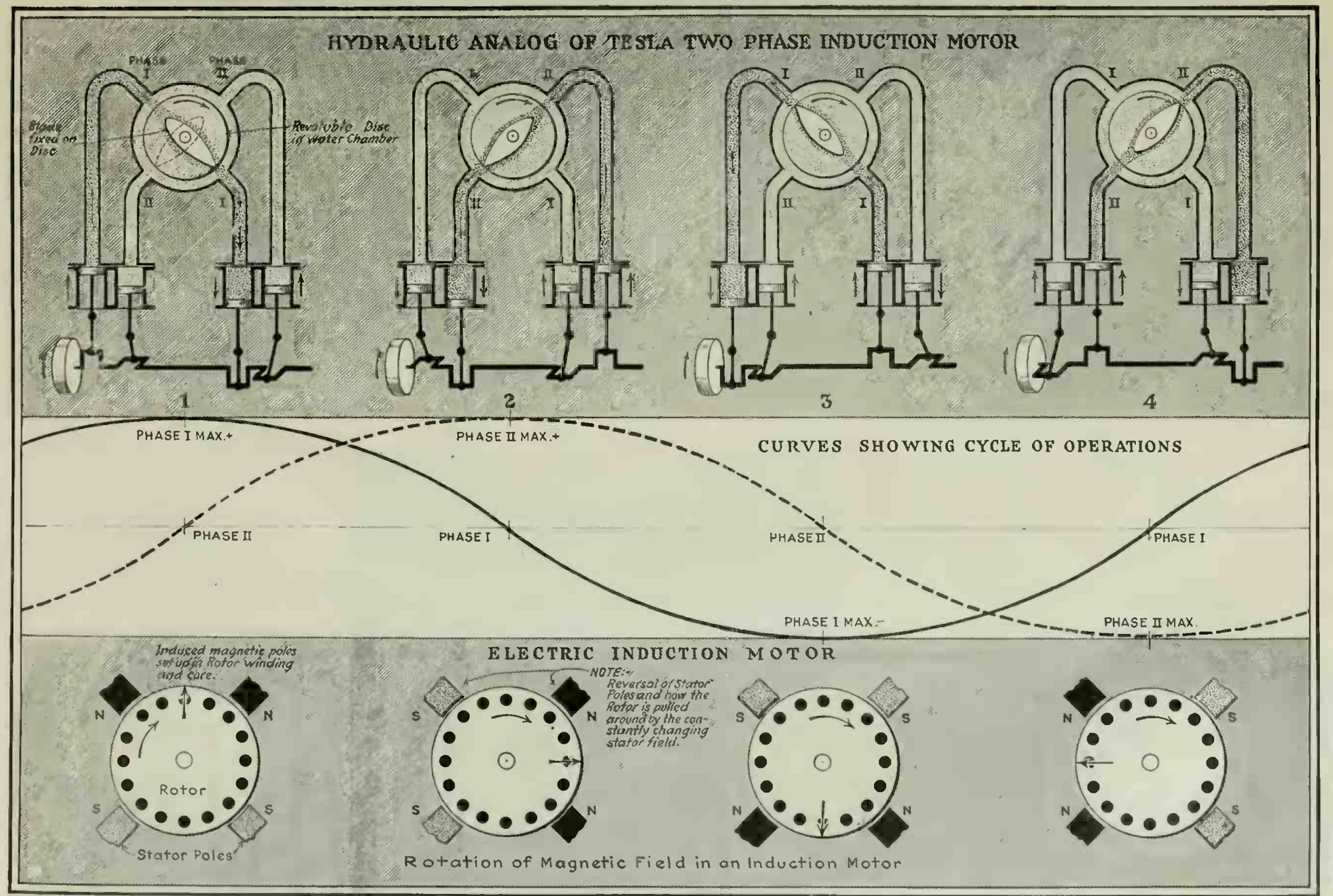
Small Capital Starts You

Our Catalog FREE. Show you how to earn $25.00 to $50.00 per day

on our easy payment plan. Begin now and get your share. We sell everything. Write today.

Atlas Moving Picture Co.
Dept. 49 538 S. Dearborn St., Chicago

www.americanradiohistory.com



The Purpose of This Analog Is to Portray, As Faithfully As Possible, the Phenomena of Tesla's Rotating Magnetic Field So As to Make Them Easily Understandable to the Average Reader. The Two Alternating Fluxes Are Represented By Streams of Water Having the Same Relation As to Phase, Amplitude and Direction. The Magnetic Polarity of the Rotor Is Imitated By the Employment of a Body So Shaped As to Behave, With Respect to the Streams, Exactly As the Rotor With Respect to the Poles. Moreover, the Corresponding Rotating and Stationary Parts Are Given a Similar Appearance and Are Disposed In Like Manner. To Make the Analog Complete, It May Further Be Assumed That the Liquid Is Compressible So That There Will Be a Phase Displacement Between Pressure and Flow As That Existing Between Electro-Motive Force and Current.

www.americanradiohistory.com

MY INVENTIONS.

(*Continued from page 907*)

was won. Back in the deep recesses of the brain was the solution, but I could not yet give it outward expression. One afternoon, which is ever present in my recollection, I was enjoying a walk with my friend in the City Park and reciting poetry. At that age I knew entire books by heart, word for word. One of these was Göethe's "Faust." The sun was just setting and reminded me of the glorious passage:

"Sie rückt und weicht, der Tag ist überlebt,
Dort eilt sie hin und fördert neues Leben.
Oh, dass kein Flügel mich vom Boden hebt
*Ihr nach und immer nach zu streben!**

* * * * * * *

Ein schöner Traum indessen sie entweicht.
Ach, zu des Geistes Flügeln wird so leicht
Kein körperlicher Flügel sich gesellen!"†

As I uttered these inspiring words the idea came like a flash of lightning and in an instant the truth was revealed. I drew with a stick on the sand the diagrams shown six years later in my address before the American Institute of Electrical Engineers, and my companion understood them perfectly. The images I saw were wonderfully sharp and clear and had the solidity of metal and stone, so much so that I told him: "See my motor here; watch me reverse it." I cannot begin to describe my emotions. Pygmalion seeing his statue come to life could not have been more deeply moved. A thousand secrets of nature which I might have stumbled upon accidentally I would have given for that one which I had wrested from her against all odds and at the peril of my existence.

* "The glow retreats, done is the day of toil;
It yonder hastes, new fields of life exploring;
Ah, that no wing can lift me from the soil,
Upon its track to follow, follow soaring!"

† A glorious dream! though now the glories fade.
Alas! the wings that lift the mind no aid
Of wings to lift the body can bequeath me."

TESLA ON HIGH FREQUENCY GENERATORS.

Editor, ELECTRICAL EXPERIMENTER:

It is to be regretted that a letter addrest to me by Mr. J. Harris Rogers, in your care, was published in the march number of the ELECTRICAL EXPERIMENTER, altho the concurrence of our views in some wireless features might have made this desirable to so wide-awake and enterprising a periodical as yours.

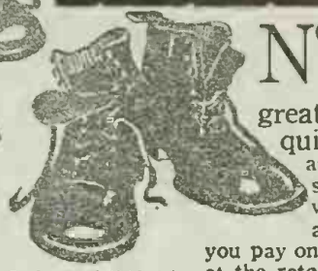
Mr. Rogers seems to be a very appreciative gentleman and nothing would be farther from my thoughts than to detract anything from his merit, but in a separate contribution, which I expect to prepare for your next issue, I shall express myself on this subject without prejudice and in the interest of truth. However, the article by your Mr. H. Winfield Secor on "America's Greatest War Invention—The Rogers Underground Wireless" contains a reference to "a novel and original high frequency generator" of Mr. Rogers' invention. May I not —to use the President's elegant expression —call attention to the fact that this device was described by me years ago, as will be evident from the following excerpt of a communication which appeared in the *Electrical Review* of March 15, 1899. In speaking of circuit controllers, I said: "I may mention here, based on a different principle, which is incomparably more effective, more efficient, and also simpler on the whole. It comprises a fine stream of conducting fluid which is made to issue, with any desired speed, from an orifice connected with one pole of a generator, thru the primary of the induction coil, against the other terminal of the generator placed at a small distance. This device gives discharges of a remarkable suddenness, and the frequency may be

(*Continued on page 914*)



Foreman and Superintendents $1800 to $5000 Yearly

Learn to Fill Bigger Shoes



Engineers (all kinds) $2000 to $5000 Yearly



Office Manager or Auditor $1800 to $5000 Yearly

NO matter what kind of work you are doing now, a set of these great home study books will quickly fit you for a bigger and better paying job. We will send any set you select for one week's FREE examination, and if you want to keep them you pay only the special reduced price—at the rate of 50 cents a week. This is your opportunity to make more money—grasp it NOW. Use these books and a little spare time and LEARN TO FILL BIGGER SHOES.

Carpentry and Contracting

Five volumes, 2138 pages and more than 400 illustrations. Prepares for Contractor, Building Superintendent and Carpenter Foreman. Regular price, $25.00. Special price, $17.80.

Civil Engineering

Nine volumes, 3900 pages and 3000 illustrations, plates and diagrams. Prepares for Civil or Structural Engineer, Transitman, Estimator, Designer or Chief Draftsman. Regular price, $45.00. Special price, $29.80.

Telephony and Telegraphy

Four volumes, 1728 pages and 2000 illustrations, plates and diagrams. Prepares for Telephone Engineer, Wire Chief, Exchange Manager, Trouble Man or Telegrapher. Regular price, $20.00. Special price, $12.80.

Steam and Gas Engineering

Seven volumes, 3300 pages and 2600 illustrations, plates, diagrams, etc. Prepares for Stationary, Marine or Locomotive Engineer or Fireman. Regular price, $35.00. Special price, $21.80.

Law and Practice

(with Reading Course in 25 bound pamphlets). Thirteen volumes, 6000 pages and 24 illustrations. Prepares for all Bar Examinations. A wonderful aid to business men. Regular price, $72.00. Special price, $39.80.

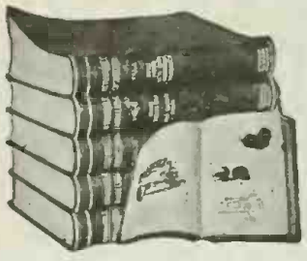
Practical Accounting

Four volumes, 1840 pages and 800 illustrations, plates and diagrams. C. P. A. questions and practical problems. Prepares for Accountant, Bookkeeper or Cost Clerk. Regular price, $20.00. Special price, $12.80.

Pay Raisers

These books are written by well known authorities—the top-notchers in each line. They will help you make more money. You can't fail to understand them, because they are written in plain, everyday language. Thousands of photographs, diagrams, charts, etc., help to make difficult points as simple as A-B-C.

See our Free Examination—no money down offer below



Ask Our Experts

With these books goes free of all charge a $12.00 Consulting Membership in the American Technical Society. If any question puzzles you—write us. Our corps of experts and engineers will solve any problem. Ask all the questions you want for a whole year. This service is absolutely FREE.

Automobile Engineering

Five volumes, 2400 pages and 2000 illustrations. Prepares for Garage Foreman, Automobile Mechanic or Chauffeur. Invaluable to car owners. Regular price, $25.00. Special price, $17.80.

Machine Shop Practice

Six volumes, 2300 pages and 2500 illustrations. Prepares for Machine Shop Superintendent or Foreman, Foundryman, Pattern Maker, Tool Designer or Tool Maker. Regular price, $30.00. Special price, $19.80.

Sanitary, Heating and Ventilating Engin'ring

Four volumes, 1454 pages and more than 1400 illustrations, etc. Prepares for Sanitary Engineer, Heating and Ventilating Engineer, Master Plumber or Plumber. Regular price, $20.00. Special price, $13.80.

Mechanical and Architectural Drawing

Four volumes, 1678 pages and more than one thousand illustrations. Prepares for Architectural or Mechanical Draftsman. Regular price, $20.00. Special price, only $13.80.

Electrical Engineering

Seven volumes, 3000 pages and 2600 illustrations, plates and diagrams. Prepares for Electrical Engineer, Power Plant Superintendent, Substation Operator or Electrician. Regular price, $35.00. Special price, $19.80.

Accountancy and Business Management

Ten volumes, 3680 pages and 1987 illustrations, forms, etc. Prepares for Certified Public Accountant, Auditor, Office Manager, Accountant, Credit Man or Bookkeeper. Regular price, $50.00. Special price, $24.80.

DON'T SEND ANY MONEY!

Write the name of the books you want on the coupon and mail it today. We will send the books at once, express collect, and you can use them just as if they were your own for a whole week. If you decide you don't want to keep them, send them back at our expense. If you like the books, as thousands of other men have after examination, just send us $2.00. You can send the balance of the special reduced price the same way—$2.00 each month (50 cents a week).

Start right now and learn to fill bigger shoes. There will be a better job looking for you if you do. Be ready to meet it when it comes. *Send the coupon now.*

American Technical Society, Dept. T3384, Chicago, Ill.

American Technical Society, Dept. T3384, Chicago, Illinois

Please send me set of _____ for 7 days' examination, shipping charges collect. I will examine the books thoroughly and, if satisfied, will send $2 within 7 days and $2 each month until I have paid the special price of _____. If I decide not to keep the books, I will return them by express at your expense. Title not to pass to me until the set is fully paid for.

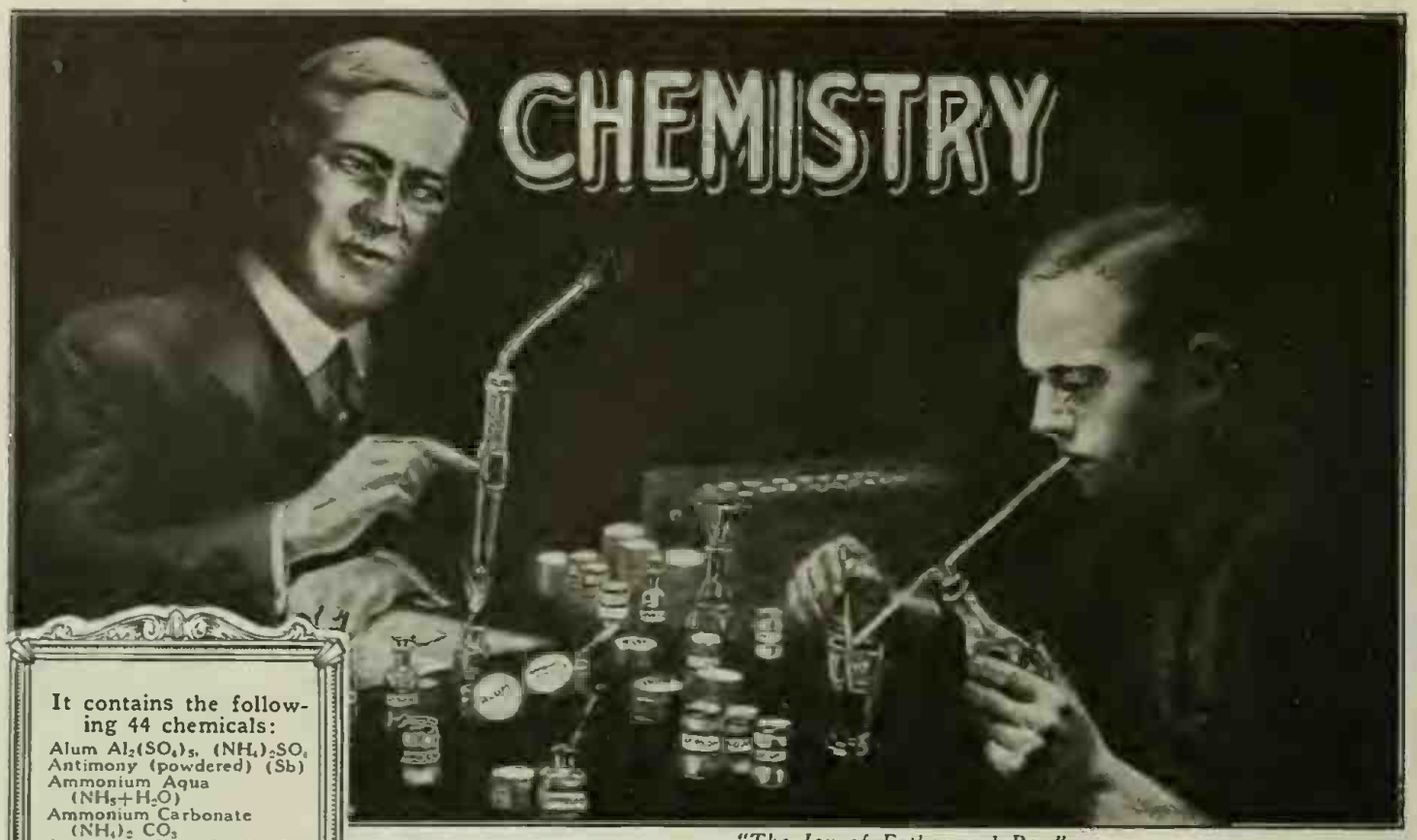
Name _____

Address _____

Reference _____

SEND THE COUPON NOW

www.americanradiohistory.com



"The Joy of Father and Boy."

"ELECTRO"

Chemical Laboratory

We present herewith to our friends our new E. I. Co. Chemical Laboratory which contains real chemicals and apparata to perform real chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.

It contains the following 44 chemicals:

Alum $Al_2(SO_4)_3$, $(NH_4)_2SO_4$
Antimony (powdered) (Sb)
Ammonium Aqua (NH_3+H_2O)
Ammonium Carbonate $(NH_4)_2CO_3$
Ammonium Chloride (NH_4Cl)
Ammonium Sulphate $(NH_4)_2SO_4$
Barium Chloride ($BaCl_2$)
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride ($CaCl_2$)
Calcium Oxide (CaO)
Calcium Sulphate ($CaSO_4 2H_2O$)
Charcoal (Carbon) (C)
Chloride of Zinc ($ZnCl_2$)
Copper Sulphate ($CuSO_4$)
Ferrous Sulphate ($FeSO_4$)
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5(OH)_3$
Hydrochloric Acid (HCl)
Iodine (I)
Iron Chloride ($FeCl_2$)
Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
Magnesium Carbonate ($MgCO_3$)
Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
Nickel Chloride ($NiCl_2$)
Oxalic Acid ($H_2C_2O_4$)
Sodium Bicarbonate ($NaHCO_3$)
Sodium Borate ($NaBO_2$)
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate ($NaNO_3$)
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride ($SnCl_2$)
Sulphate of Nickel ($NiSO_4$)
Sulphate of Zinc ($ZnSO_4$)
Sulphuric Acid (H_2SO_4)
Tin (Granulated) (Sn)
Zinc (Metal) (Zn)
Zinc Carbonate ($ZnCO_3$)

The following apparata are furnished:

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube
Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure
Glass Tubing
One book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

DESCRIPTION OF THE OUTFIT:

The outfit consists of forty-four (44) Chemicals all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) enough to make dozens of experiments with each. See list of Chemicals herewith.

The apparata furnished are all of the best obtainable make and of standard laboratory size and shape. A list of the 17 pieces of apparata furnished with this outfit is printed also herewith.

The Instruction book is a real **Chemistry Course for the Beginner.** Some of the Contents are: **Division of Matter:** This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. **Chemical Nomenclature.** This explains in simple language the derivation of the chemical names of the Elements and their compounds. There is a chapter on **Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms,** etc.

A good part of the book is devoted to Weights and Measures. The Metric System, the English system and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights, Volume, Capacity and Length; Per Cent solutions; Conversion of Measure expressed in parts; Poisons and their antidotes; Technical and common name of chemical substances; Formulas for Cleaning various substances, etc., etc.

Among the **100 Experiments** are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to Make Chlorine Gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

The price is still $5.00

Shipping Weight 10 lbs.

(Can be shipped by Express only.) Send your order today to:

TRADE MARK **THE ELECTRO IMPORTING CO., Mfrs.** TRADE MARK
231 FULTON STREET NEW YORK CITY

See our full page Ad, on page 906 for Free Cyclopedia

www.americanradiohistory.com

PRACTICAL CHEMICAL EXPERIMENTS.

(*Continued from page* 894)

tee, and must furnish certificates of good character and honesty. These secrets have been handed down faithfully from one generation to another for hundreds of years.

QUESTIONS AND ANSWERS IN CHEMISTRY.

Standard Soap Solution.

Q. 1. Roy Munsell, Henryetta, Okla., wants to know the method of preparing the Standard Soap Solution as mentioned in the lesson on water testing of the "Experimental Chemistry" lessons.

A. A strong solution of this soap is first prepared by rubbing together in a mortar, 75 grams of the so-called "lead plaster" (which consists practically of lead oleate), which may be obtained from your druggist, and 20 grams of dry potassium carbonat. When the two are thoroly mixed a small quantity of methylated alcohol is added, and the mixture worked to the consistency of a thin smooth cream. More spirit is then added, and the contents of the mortar rinsed, using more of the spirits for this purpose. This is then collected in a bottle and the mixture placed aside to settle. The clear liquid is decanted off thru a filter, and the sediment finally washed upon the filter with more spirit. The volume of the liquid may now be made up to 200 or 250 cc., by adding a mixture of equal volumes of spirit and water.

Solvay Process.

Q. 2. C. H. Hathaway, of Peoria, Ill., desires information regarding the Solvay Process.

A. Sodium Chlorid, commonly known as table salt, is the source from which the sodium alkalies are derived. The starting point of this process is therefore salt—in the form of a good strong salt brine. If you open a bottle of ordinary smelling salts and inhale the vapor, you will immediately recognize the second fundamental of the process in the form of Ammonia, similar to the gas which is contained in the common household ammonia. The third and last fundamental is ordinary carbonic acid gas, the same as is used to make soda water fizz. For the purpose of this process it is obtained from limestone, by heating the stone to a high temperature. Thus we see that Salt, Ammonia and Carbonic acid gas are the three fundamentals upon which the process is based.

The salt brine is saturated with ammonia gas and carbonic acid gas is then blown into this solution of ammonia in the brine.

The process does not take place in one step, but the final products are Sal-ammoniac and crude bicarbonat of soda. The crude bicarbonat of soda separates out as a white powder and the sal-ammoniac remains dissolved. The Ammonia takes the place of the sodium in the salt, and the sodium combines with water and carbonic acid to form the well-known baking soda (Sodium Bicarbonat).

This is separated from the liquids by filtration. It is then necessary to prepare this for a commercial product by heating it in a furnace where it loses all its water and carbonic acid gas. The product is now known as sodium carbonat, or soda ash, the finished product of the Solvay process, and the starting point for other forms of sodium alkalies. (The liquid coming from the filtration process contains the sal-ammoniac, and this is distilled with lime to recover the ammonia to be used over again—no ammonia remains in the soda.)

Mercury Vapor

Q. 3. Gordon Jones, Jr., Cordele, Ga., wants to know how Mercury Vapor is obtained.

A. Under a pressure of 760 mm., mercury boils at 357.25 degrees C., giving off a colorless vapor. Mercury gives off vapor even at ordinary temperatures, and a gold leaf suspended over mercury in a stoppered bottle, gradually becomes white upon the surface, owing to its amalgamation with the mercurial vapor. This vapor is poisonous, giving rise to salivation, such as loosening of the teeth, etc.

Buttermilk in Butter.

Q. 4. Theodore Coughlin, Rochester, N. Y., wants to know why buttermilk is objectionable in butter.

A. Buttermilk is very objectionable as it begins to decompose almost immediately, and sets up fermentation, in the butter itself. See article at head of this month's "Chemistry Department."

BACK NUMBERS CONTAINING "EXPERIMENTAL CHEMISTRY SERIES.

The "Experimental Chemistry" series, by Albert W. Wilsdon, started in the June, 1916 issue of the ELECTRICAL EXPERIMENTER and has run continuously since that date. Prices on the back numbers containing these respective lessons, many of which have been of the greatest value to High School as well as Correspondence School and University Scholars, as has been proven by many letters which we have received from readers of all classes, will be furnisht upon receipt of stamped and addrest envelope. If you wish a first-class and clearly explained treatise on Experimental Chemistry, procure all of the lessons and bind them together. Many valuable and original tables and formulas are included in these lessons which the author has found of particular value in his commercial experience as a chemist.

SCIENCE IN SLANG.

(*Continued from page* 885)

one way only where the electrodes are of unequal temperature. With the audion, music has even been transmitted with charming effect, and over many miles. With a clever man at the adjusters, a long dash can be construed into a melody. An A flat can be made to sound like a Z sharp; in other words, you would be unable to hear it. As yet they have not got it down so pat that they can run the sound waves into the visual strata and make 'You Made Me What I Am To-day, Now Aren't You Satisfied?' evolve into a likness of Bill Hohenzollern, or "They Are Wearing Them Higher in Hawaii" into an X-ray.

"Tesla, De Forest and Marconi do not hold the whole stage in the wireless field. Prof. Fessenden has bushels of patents in the Pat. office on the stuff, and there are a lot of other guys who have earned the price of a meal from some little thing that makes

(*Continued on page* 918)

POPULAR ASTRONOMY.

(*Continued from page* 869)

eye. The play of auroral lights around the poles is plainly visible and the earth's atmosphere reflects a rim of light to the moon at the time of *new Earth*. Owing to the lack of atmosphere on the moon, there is no diffusion of light and the earth therefore stands out in sharp contrast to a sky of inky blackness in which the solar corona

(*Continued on pag* 912)

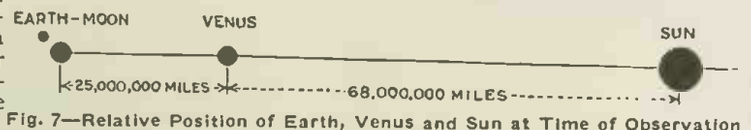


Fig. 7—Relative Position of Earth, Venus and Sun at Time of Observation at Opposition.



"I Can Succeed!"

"What other men have done with the help of the International Correspondence Schools, I can do. If the I. C. S. have raised the salaries of other men, they can raise mine. If they have helped others to advance, they can help me. To me, I. C. S. means 'I CAN SUCCEED.'"

Make up your mind right now that not another day shall pass until you have made *your* start toward success.

For 27 years men in offices, stores, shops, factories, mines, railroads, and in the Army and Navy have been winning promotion and increased salaries through the I. C. S. More than 100,000 men and women are getting ready *right now* with I. C. S. help for the bigger jobs ahead.

No matter where you live, the I. C. S. will come to you. No matter what your handicaps, or how small your means, we have a plan to meet your circumstances. No matter what career you may choose, some one of the 280 I. C. S. Courses will surely suit your needs.

When everything has been made easy for you—when one hour a day spent with the I. C. S. in the quiet of your own home will bring you a bigger income, more comforts, more pleasures, all that success means—can you let another single priceless hour of spare time go to waste? Make your start right now! This is all we ask: Without cost, without obligating yourself in any way, put it up to us to prove how we can help you. Just mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6183, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

ELECTRICAL ENGINEER	SALESMANSHIP
Electric Lighting and Rys.	ADVERTISING
Electric Wiring	Window Trimmer
Telegraph Engineer	Show Card Writer
Telephone Work	Sign Painter
MECHANICAL ENGINEER	Railroad Trainman
Mechanical Draftsman	ILLUSTRATING
Machine Shop Practice	Cartooning
Toolmaker	BOOKKEEPER
Gas Engine Operating	Stenographer and Typist
CIVIL ENGINEER	Cert. Pub. Accountant
Surveying and Mapping	TRAFFIC MANAGER
MINE FOREMAN or ENG'R	Railway Accountant
STATIONARY ENGINEER	Commercial Law
Marine Engineer	COOD ENGLISH
Ship Draftsman	Teacher
ARCHITECT	Common School Subjects
Contractor and Builder	Mathematics
Architectural Draftsman	CIVIL SERVICE
Concrete Builder	Railway Mail Clerk
Structural Engineer	AUTOMOBILE OPERATING
PLUMBING AND HEATING	Auto Repairing
Sheet Metal Worker	Navigation
Textile Overseer or Supt.	AGRICULTURE
CHEMIST	Poultry Raising

Spanish French Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____

IT PAYS TO READ "E. E." ADVERTISEMENTS

www.americanradiohistory.com

PATENTS

Hand Books on Patents, Trade Marks, etc., sent free. Our 70 years of experience, efficient service, and fair dealing assure fullest value and protection to the inventor. Patents procured through us receive free notice in Scientific American.

MUNN & CO., 618 Woolworth Bldg., N. Y.
Washington Office, 625 F St., Washington, D. C.

Patents Promptly Procured

Send sketch or model for actual search of U. S. Patents. Highest references. Personal service. Moderate fees. Write for Free Patent Book.

GEORGE P. KIMMEL, Patent Lawyer
99-S Loan & Trust Bldg. Washington, D. C.

PATENTS

Inventors Invited to Write for Information and Particulars
Highest References. Best Results.
Promptness Assured.
WATSON E. COLEMAN
Patent Lawyer
624 F Street N. W. Washington, D. C.

$50 PAID for ONE DRAWING

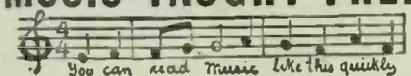
Illustrators—Cartoonists—Commercial Artists make big money. Learn NOW at home in spare time by our new instruction method. Handsome booklet free explains everything. Write for it today. Get our Special Free Outfit offer.
Washington School of Art, Inc.
1405 H St., N. W. Washington, D. C.



SPECIAL KON-VER-TER SLIDE RULE

"Hamilton" Improved Slide Rule instantly adds, subtracts, divides, multiplies, converts fractions or decimals of an inch or both. Gives sines, co-sines, versed sines, co-versed sines, tangents, co-tangents, secants, co-secants of angles. Square root, cube root, roots to the fifth powers, logarithms, circumferences, area and diameter of circles. Most complete slide rule of its kind ever made. This rule is five and four-tenths inches in diameter. Instructions with each rule. PLAIN UTILITY RULES $1.00 SPECIAL DE LUXE, white celluloid $2.50 Postpd. Agents and dealers wanted.
J. C. HAMILTON & CO., 7 Water St., Dept. E., Boston, Mass

MUSIC TAUGHT FREE



In Your Home. Write today for our booklet. It tells how to learn to play Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced pupils.
American School of Music 57 Lakeside Bldg., Chicago

NEW SCIENTIFIC WONDER "X-RAY" CURIO



PRICE 12 C. SILVER ONLY—BIG FUN
BOYS! You apparently see thru Clothes, Wood, Stone, any object. See Bones in Flesh.
A Magic Trick Novelty given FREE with each X-Ray.
MARVEL MFG. CO., Dept. 52, New Haven, Conn.

MARKO
STORAGE BATTERIES
ARE GOOD—TRY ONE
Paul M. Marko & Co., Inc.
1402-1412 Atlantic Ave.
Brooklyn, N. Y.



EARN MONEY

Stamping Names on Key Tags. $50
Either sex. Spare time. Some make
Send 25c for Tag with your name on and instructions. Returned if required. Epx. Key Tag Co., Cohoes, N. Y.



TYPEWRITERS

$10 AND UP. ALL MAKES. SAVE $25 TO $50 on rebuilt at the factory by the well-known "Young Process." Sold for low cash—installment or rented. Rental applies on purchase price. Write for full details and guarantee. Free trial. YOUNG TYPEWRITER CO., Dept. 817, Chicago

STAMPS

50 diff. Belgium (large bi-color), China, Jamaica, Portugal, Venezuela, etc., 10c; 100 diff., nice packet, 20c; 1,000 well mixed, 40c; 100 var. U. S., 50c; 1,000 hinges, 10c; Agts. wanted, 50%. List free. I buy stamps. L. B. Dover, Overland, Mo.

and the stars appear even in the lunar day.

To one equipt with an opera glass on the moon many of the wonders and beauties of our planet would be revealed: the shadows of our lofty mountain peaks would be seen falling across the adjacent plains and passing ram or snow storms would temporarily veil certain portions. Were our most powerful telescopes placed on the moon we could easily distinguish small islands and lakes and cities, as well. All objects five miles or so in diameter would be well within the reach of our great telescopes and we can imagine that the lunar inhabitants would spend a considerable portion of their time in attempting to solve the nature of many mysterious markings that come and go over the face of their nearest neighbor. It is indeed a pity that the opportunity to study a living planet at close range is granted to a world devoid of all forms of life while the great telescopes of our own planet sweep searchingly over a barren mass of lifeless rocks presenting no signs of growth or decay, a desolate and uninhabitable waste.

We have considered how our planet appears from the two other planets that are most likely to be the abode of life, Venus and Mars, and how it would appear if seen from our satellite the moon.

It will not take us long to consider how we would appear from the major planets—Jupiter, Saturn, Uranus and Neptune. The greatest possible distance the earth could depart from the sun viewed from Jupiter would be a little less than twelve degrees. Mercury, as we know, is not an easy planet to observe, yet it departs at times nearly thirty degrees from the sun. Moreover it is so near to the earth that when it is seen near its elongations it appears as a bright first magntitude star. Our planet earth on the other hand is so distant from Jupiter that it would be just barely visible to the naked eye if seen against a black sky. When we consider that it never gets more than twelve degrees from the sun under the most favorable circumstances as viewed from Jupiter and must therefore always be searched for in the light of the sun's rays we see the hopelessness of expecting to see our planet earth from the distance of Jupiter without telescopic aid and were it possible to set up our telescopes at the distance of Jupiter we would find that our little planet earth was not only a most elusive little body but also quite uninteresting when found. It would appear only as a very small half moon with a suspicion of a few dark shadings here and there. As we travel outward from Jupiter to the planets Saturn, Uranus and Neptune our interest in the little planet decreases rapidly. It appears to shrink more and more in size in the telescope until at the distance of Neptune it has become so tiny and so near to the sun that it is hardly worth a search in the telescope.

(The next Installment will appear in the May number.)

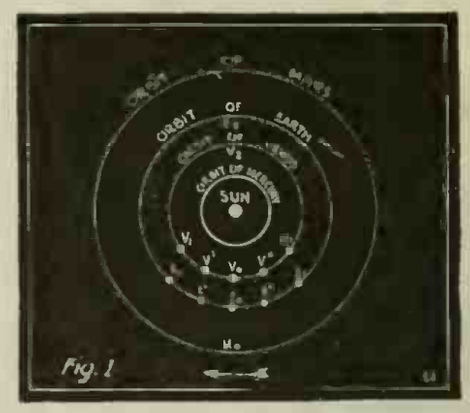


Fig 1. Diagram Showing Relative Positions of Mars and the Three Inner Planets, Earth, Venus, and Mercury, the Three Morning and Evening Stars of Mars. Assuming Mars to Be In the Position M_0 the Planets Are Best Seen When on the Near Side of Their Orbits, Positions E, E', E'' and E_3 for Earth and v, v', v'' and v_3 for Venus. At E_0 and E_3 Earth Is Invisible from Mars, Being In Inferior and Superior Conjunction with the Sun Respectively. At E, and E_2 It Is at Its Eastern and Western Elongations Respectively and at E' and E'' It is at the Greatest Brilliancy. When Venus Is at Its Greatest Brilliancy V' and V'' and the Earth Is in the Far Part of Its Orbit. Beyond E, and E_3 Venus Appears Brighter to the Martians Than Our Own Planet, but When the Earth Is Near E' and E'' It Surpasses Venus in Brightness Because It Is Then Considerably Nearer to Mars.

Experiments in Boston have shown that electric trucks deliver coal at a saving of 3.2 cents per ton mile from the expense of horse delivery and seven cents per ton mile cheaper than gasoline trucks.



Fig. 2. Changes In Size and Appearance of the Disk of the Planet Earth As Seen from Mars In Various Parts of Its Orbit. (1) At Superior Conjunction (E_2 In Fig. 1) Planet Invisible from Mars. (2) Just Before and After Superior Conjunction With the Sun. In This Position the Disk Is Quite Fully Illuminated, But It Is Comparatively Small and Indistinct Being On the Far Side of Its Orbit from Mars and Near the Sun. (3) At Times of Elongation (E, E_2 In Fig. 1). The Earth Is Now At Its Greatest Angular Distance from the Sun and Well Placed for Observation from Mars. (4) At Times of Greatest Brilliancy (E' and E'' In Fig. 1). The Planet Is Now At Its Best for Observation. (5) Just Before and After Inferior Conjunctions. The Planet Is On the Side of Its Orbit Nearest to Mars. But Is too Near the Sun for Good Observations. (6) At Inferior Conjunction (E_0 In Fig. 1) Nearest to Mars But In Line With Sun and Therefore Invisible from Mars.
The Illuminated Portion of the Planet's Disk Is Always Turned Toward the Directions of the Sun.

Ultra-violet rays are being blamed for the fading specimens in European museums, and a search is being made for a glass for cases that will cut off the rays and at the same time be colorless and inexpensive.

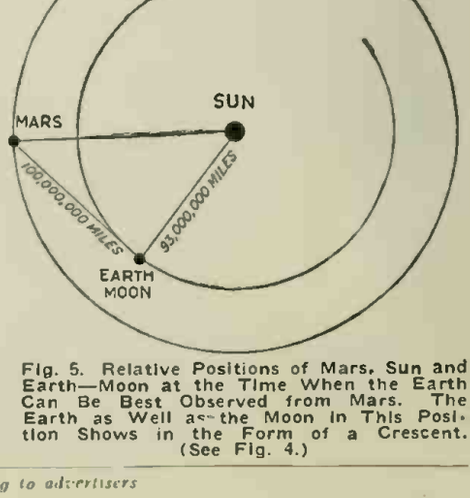


Fig. 5. Relative Positions of Mars, Sun and Earth—Moon at the Time When the Earth Can Be Best Observed from Mars. The Earth as Well as the Moon In This Position Shows in the Form of a Crescent. (See Fig. 4.)

www.americanradiohistory.com

PATENT ADVICE





Edited by H. GERNSBACK

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries address to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are publisht here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTICE TO CORRESPONDENTS

Questions on Patent Advice are answered in this department every month, and naturally each question must take its turn. We have received so many letters during the past months that it is absolutely impossible for us to answer them all in the "Experimenter." Thus, for instance, the answers appearing in this issue are of letters going back as far as July, 1918. We would therefore urge our correspondents to bear this in mind, and if an answer is wanted quickly, correspondents should make themselves acquainted with the rules printed above.

Angle Finder.

(305) Geo. E. Zeigler, Urbana, Ohio, submits a device which he calls an *angle-finder*. It is an instrument to show on a scale directly the degree of any angle. Such an instrument could be used in connection with drafting work, building, construction, etc. Our advice is asked.

A. In the instrument described, use is made of a spirit tube with the usual air bubble, and by displacing the apparatus, the angle can be read off in a certain manner. This device itself is not new, and a similar one has been used on autos to read the percentage of the grade, and we do not think it would be possible for this reason to obtain a patent.

Submarine Shell.

(306) J. R. Pell, Jr., Parkershurg, W. Va., has submitted an idea on a submarine shell which only explodes fifteen feet under water. Diagram submitted shows the electrical connections which are acted upon chiefly by salt water, making a contact as soon as the shell comes within about 15-ft. under the water. Our advice is asked.

A. There is nothing fundamentally new shown in this device, and there are much better ones made which have been used freely in the war.

Electric Depth Bomb.

(307) Geo. W. Curtis, Detroit, Mich., has invented a depth bomb. In this particular bomb, when it is dropt, salt water enters thru the water inlets, and being conductive, completes a circuit between certain contacts. These contacts may be regulated by a water regulator in such a way, making it possible to explode a homb at any depth.

A. Nothing new is shown in this idea, and we doubt very much if a patent can be obtained upon it. There are many patents on electrical depth bombs of this kind.

Flue Cleaner.

(308) Wm. H. Roberts, Chandler, Ind., has invented a device which he terms a "flue cleaner." In short, the idea consists of a fan arranged in the chimney in such a manner that the soot is cleaned out automatically, so that the latter will not clog the air passages of the flues. Various means are shown to carry out the idea.

A. While highly ingenious, we doubt if the device will work. Soot will he precipitated along the walls, fan or no fan, to our mind, and we do not think that the problem can be solved satisfactorily in this manner.

Steam Boat Brake.

(309) Otto I. Kirby, St. Vincent, B. W. I., submits an idea of a brake for steamers or boats. The idea in short is to have large steel vanes folded up against the body of a ship in normal position. If the boat is to be stopt, the vanes automatically open up at right angles to the boat, and the ship, thereby exposing an additional surface to the water, consequently must slow down.

A. This idea is a good one but unfortunately it has been described before, and to our mind no patent can be obtained upon it today. We do not think the device works out in practise.

Grass Cutter.

(310) John C. Reno, Spring Brook, Wis., has an idea of an arrangement to clean out grass that grows over the sidewalk. The device is to be made of sheet steel and by having a triangular nose, in our correspondent's opinion, such a tool would clean out the grass very readily in the corners between roadway and curb.

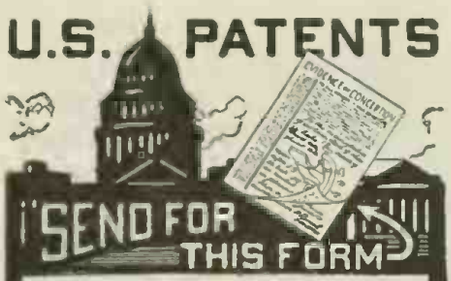
A. While no doubt this device would work satisfactorily on the ordinary concrete sidewalk, there would certainly be trouble if the road was compromised of cobblestones for instance. Otherwise, we find no trouble with the device, and think that a patent can be obtained upon it.

Fire Truck Device.

(311) M. Dunbar, Lorain, Ohio, writes: "I wish your advice about a patent on an electrical device that will immediately start the engine of a fire truck. My idea is, as soon as the alarm rings it closes the circuit which starts off the engine of the fire truck. Please advise if this idea is patentable."

A. Providing such a device can be made rugged enough, so that it conforms with the Fire Department's exacting requirements, we believe that such a device should prove of considerable benefit, altho most of the Fire Departments now have devices whereby the fire under the engines is started within a few seconds after the alarm has sounded.

U.S. PATENTS



Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

LANCASTER & ALLWINE

255 OURAY BLDG.,
WASHINGTON, D. C.

PATENTS COPYRIGHTS TRADE MARKS DESIGNS

U.S. PATENTS

Our facilities for securing patents enable us to give prompt and reliable service at reasonable rates. Inventors are invited to write to us regarding questions appertaining to securing patent protection. All matters receive prompt attention. Send sketch for preliminary examination.

Books free on request

A. M. BUCK & CO.

Patent Attorneys

205 Second National Bank Bldg.,
Washington, D. C.



RAISE BELGIAN HARES For U.S.

HUGE PROFITS easily and pleasantly made We furnish stock and pay you $6.00 a pair and express charges for all you raise. Contract and book "Fortunes in Hares", by mail Free.

NATIONAL FOOD & FUR ASSOCIATION
Dept. 116 MILWAUKEE, WISC.

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE ON CONCEPTION." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention we will give our opinion as to its patentable nature.

Our illustrated Guide Book, HOW TO OBTAIN A PATENT, sent Free on request. Contains full instructions regarding Patents, Trade-Marks, Foreign Patents, Our Methods, Terms and 100 Mechanical Movements illustrated and described. Articles on Patent Practice and Procedure, and Law Points for inventors.

An actual search of United States patents made in all cases before preparing application for patent

Electrical Cases a Specialty Highest References Prompt Attention Reasonable Terms

FREE COUPON!

VICTOR J. EVANS & CO., Patent Attorneys

New York Offices: 1001 to 1007 Woolworth Bldg. Pittsburgh Offices: 514 Empire Bldg. Philadelphia Offices: 135 S. Broad St.

Main Offices: 779 Ninth Street, N. W., Washington, D. C.

Name ..... *Address* .....

www.americanradiohistory.com

PATENTS

TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
164 Owen Building, Washington, D. C.
2276-8 Woolworth Bldg., New York City

PATENTS

INVENTORS: Send us sketches or a model of your invention and a description of the device for advice in regard to the best way of obtaining patent protection. Our practical experience covers a period of twenty years. Our hand-book on patents is sent free on request. All communications strictly confidential. Write us today.

TALBERT & TALBERT
Patent Lawyers
4287 Talbert Bldg. Washington, D. C.

PATENTS

LACEY & LACEY

Attorneys-at-Law—Patent Practice Exclusively
Solicitors of

U. S. and Foreign Patents
Trade-Marks, Copyrights

639 F Street, N. W., Washington, D. C.

Write Us for Our Free Inventors' Book
PATENT-SENSE
ESTABLISHED 1869

Competent Patent Service
By a Former Examining Official of the U. S. Patent Office
NORMAN T. WHITAKER
Lawyer and Engineer
480 Whitaker Bldg. Washington, D. C.
Branch Office, 87 Nassau St., New York City.
INQUIRIES INVITED

DRAFTING
Inventions and Ideas Developed!
Mechanical, Electrical, Patent Office and Engineering Drawings of Every Description.
COMPETENT DRAFTSMEN AT YOUR SERVICE
A. G. HAGSTROM
116 Nassau St. New York City
Telephone Beekman 4559

Acetylene Bunsen Burner.

(312) Richard E. Mathes, Excelsior, Minn., writes: "I have devised a scheme whereby an acetylene gas plant for bunsen burners and gas in a small chemical laboratory may be installed at very low cost. This is meant especially for the amateur who does not have gas in his home. Is this practical? Could I sell a patent for it? If so, what would it be worth? Could I use an ordinary bunsen burner as part of the patent without infringement?"

A. We see nothing fundamentally new about this idea, as burners of this kind have been used for years, and such a device is well known in the art. We are quite positive that a patent could not be obtained upon it.

Double Lock.

(313) Chas. H. Morgan, Newton, Iowa, sends in an idea on a Double Hasp Lock which can be operated from both sides of the door. He wants to know if this device can be patented.

A. We see nothing fundamentally new in this, and furthermore doubt the utility of the device. We also doubt if a patent can be obtained on it.

Envelope.

(314) José Mata, San Francisco, Cal., submits a sample of an envelope. He wishes us to give him our advice if such an envelope could be patented and if it is feasible. As will be noted, a string with a knot at each end is glued into the envelope when made.

A. This is a good idea but it is not new. Similar devices have been on the market for a long time, and some years ago very many magazines used a string of this kind to open up the mailing wrapper, simply by having a thread incorporated into the magazine wrapper. This thread was pulled in a similar fashion as the string of our correspondent's envelope. We are positive no patent can be obtained on this device.

Automatic Fuse Replacer.

(315) Wm. Sambur, New York City, says: "I would like to know if an automatic fuse replacer which instantly inserts new fuses after extracting burnt out fuses would be patentable. This device could be manufactured at a cost of $3.00. Would this be a good selling article? I await anxiously the next issue of the ELECTRICAL EXPERIMENTER for my answer."

A. Without having the necessary details, it is impossible for us to give advice. Correspondents should bear in mind that merely by giving vague indications, it is extremely dangerous for us to give advice as well as for correspondents to accept it.

Smoke Stack.

(316) Walter A. Buckheim, Boulder, Colo., asks us: "Please let me know thru your magazine if the following idea is patentable. It is desired to construct a chimney or factory smoke stack with rifles or vanes which will impart a rotary motion to the escaping gases. In forced draft plants the gases can be given a rotary motion by mechanical means. In this way a miniature whirlwind will be created which will hold the gases in a narrow column and carry them to a great height, where especially, if they are poisonous, they will be out of everyone's way. The gases will in effect pass thru a chimney made of air."

A. This is a clever idea, but it has one great fault, namely, it won't work. No matter what arrangement were used and even if you were to expend 10,000 H. P. to push the gases out of the smoke stack, if a moderately strong wind was blowing the gases would positively be forced sidewise, and if the wind was blowing earthward, the gases in this case would be blown earthward too. You cannot hope to raise a gaseous column into the air and prevent its swaying sidewise by any known means. For this reason smelters and chemical industries having to do with poisonous gases build their chimneys as high as possible. There are some cases known where a chimney has actually been laid up the side of a moderate mountain in order to let the gases escape at the top as far away from human habitation as possible.

Radio Break-In System.

(317) C. E. Mitchell, Miami, Fla., submits for our advice the following idea: "I have a break-in system for use in wireless telegraphy that does away with anchor gaps and other troublesome apparatus used in break-in systems. It consists of the ordinary heavy wireless key, with an attachment at the rear, working something similar to a compound lever. When the key is raised the antenna is connected to the receiver, the detector unshorted, and circuit to power transformer opened. In this manner the receiver is always in a receptive condition at the instant the key is raised. The idea provides for an extension in length to the ordinary wireless key and may be installed in any circuit with ease and does not hamper the pressure adjustment of the key. This means of break-in will prevent considerable interference and loss of time.

A. This is not at all a new idea and the Patent Office is full of break-in systems of this kind. A great many similar ones have been described in the past volumes of the ELECTRICAL EXPERIMENTER. Many of these systems are very good, as is our correspondent's, and many are actually in use, particularly amateurs seem to like them.

NEW PULL SOCKET HAS CURRENT TAP.

In many cases it is desirable to connect an electrical appliance to a single-lamp wall bracket or ceiling fixture without interfering with the lamp. A very convenient way for doing this has been provided by means of the new pull socket current tap illustrated. It is a combination pull socket and plug receptacle built into a single compact body. It is also supplied with a ⅛", ¼", ⅜" or pendent cap. The pull chain controls the current to the lamp socket proper, whereas the terminals of the receptacle in the side of the body are continuously in circuit.

An advantage that this type of socket gives is that it eliminates the annoyance of the long cord running from side-wall outlets. By means of the new fitting, current can be supplied directly below the fixture



to operate various table appliances or other portable devices such as are in general use, without sacrificing the use of light from the lamp itself. It thus eliminates the annoyance of groping about in the dark while trying to plug into the socket.

AERONAUTICAL EXPOSITION AT NEW YORK.

Army Day at the Aeronautical Exposition in Madison Square Garden and the 69th Regiment Armory, New York City, brought several thousand uniformed spectators at the afternoon and evening sessions. Secretary of War Newton D. Baker was to have been the guest of honor, but at the last minute he notified the officials of the exposition that he had been summoned by the President for a conference. Major General Thomas Barry, Commandant of the Department of the East, accompanied by members of his staff, represented the Secretary of War.

At the wireless telephone exhibit in the 69th Regiment Armory, Lieutenant J. F. Adams entertained the spectators by reading news from a daily newspaper to ships in the harbor and places on land equipt with apparatus. The spectators, by means of a sounding horn, were able to hear the answers he received.

Brigadier General Guy Livingston, who represented the British Air Ministry in this country, was an interested spectator at the afternoon session. He said that he believed the Atlantic would be crost by airplane or dirigible within the next two or three months.

TESLA ON HIGH FREQUENCY GENERATORS.

(*Continued from page* 909)

brought within reasonable limits, almost to anything desired. I have used this device for a long time in connection with ordinary coils and in a form of my own coil with results greatly superior in every respect to those obtainable with the form of your letter, make a few statements referring to such make-and-break devices in general, and various forms based on this new principle."

I may add that a great many forms of this apparatus were constructed and employed by me for a long time, proving very convenient and useful. Water does not give particularly good results, being incapable of causing very abrupt changes, but electrolytes have the property of diminishing enormously in resistance when they are heated and the effects are much more intense. Salts of lithium are especially efficient.

NIKOLA TESLA.

New York, February 20, 1919.

www.americanradiohistory.com

HEL-MET THE KAISER



Send one to your boy in camp; all the boys will want them. Anyone against the Kaiser or Germany should wear this pin. Same size as picture. Handsome metal, black letters. Will wear for years. Men and women wear them — causes laughter wherever seen.

Price 10 Cents

Voice Thrower 10c



Learn to throw your voice into a TRUNK, under the bed, out in the hall or anywhere. Lots of FUN fooling the Teacher, Janitor, Policeman, Parents, Neighbors, or Friends.

THE VENTRILO

is a little instrument that fits into the mouth out of sight. BOYS or GIRLS can use it. NEVER FAILS! A 32-page book on Ventriloquism sent with the VENTRILO for TEN Cents.

NEW FORD JOKE BOOK 1919

All the latest jokes on the Ford auto. Hundreds of them, and all good ones. Spring a new one on your neighbors.

Large book with colored cover by mail, 10c.



Devil Resigns to the Kaiser



Everyone who reads this book is wild over it. Contains the following:— The Kaiser's Dream, A Letter from the Devil to the Kaiser, Kaiser's Prayer, How Satan Resigns to the King of Devils, The Kaiser, etc. Many other stories, jokes, etc., about the German Emperor. Book mailed 10 cents, postage 2 cents extra.

ROGEN X-RAY



Price 10 Cents

HERE, BOYS, is just what you want. With this instrument you can apparently see through clothes, see the bones in your fingers. Think of the fun you can have with it. Sample, by mail, TEN CENTS.

SKULL RING



Here is a handsome, up-to-date Ring, representing a Skull and Cross-Bones. Has stones in the eyes and looks something frightful. Women won't like it, but for men or boys it is a great novelty. Sample, by mail, 15c.

Gee! What a Wad!



This is STAGE MONEY

Looks like the GENUINE STUFF. Some Green backs and some Yellow backs. Create a BIG sensation among your friends. The girls will all be after you when they see the wad. BIG roll of 15 pieces by mail, 10 cents.

Boys Own Toy Maker



and Nine Other Books for 10c

Tells how to make a Telephone, Magic Lantern, Kites, Sail Boat, Stilts, Electric Telegraph, Pop Gun, Red Fire, Galvanic Battery and many other things. This book, with nine other interesting books, mailed for 10c.

ENCHANTED BARREL



The Most Wonderful Pocket Trick Made

CHANGE A CENT INTO A DIME

Ask your friend to drop a dime in the barrel. When he takes it out, Behold! It is a CENT. You make 9 cents every time you fool them. Never fails. They cannot get on to it. Sample barrel, with directions, only.... 10c

Any three of the above articles for 25c or any six for 50c

Royal Novelty Co. 250 EAST AVENUE SOUTH NORWALK, CONN.

Get This Car

And the AGENCY In YOUR Territory



Drive a new 1919 Birch SUPER-FOUR and make good money selling Birch cars to your friends and neighbors. They are fully guaranteed. Prompt shipments. Write quick for full information.

36 h.p., 115 inch W.B., 32x3½ tires

BIRCH MOTOR CARS Dept. 325 81 E. Madison St. CHICAGO - ILLINOIS

LEARN WATCH REPAIRING



You can learn by our modern and original system of instruction every part of the Watch Repairing Trade at home as good or better than at a shop. You can earn money while learning and secure a well paying position or start in business after completing our course of instruction. Good watch repairers are always in demand and earn from $20 to $35 per week. For particulars apply to the

Milwaukee School of Watchmaking 166 Mason St., Milwaukee, Wis.

NEW YORK TO CHICAGO VIA THE AIR IN 12 HOURS.

(*Continued from page* 856)

this important subject. Mr. Hawley said:

"Aërial transportation is here and here to stay," said the president of the Aero Club, speaking along general lines. Aërial transportation bears the same relation to land and water transportation that the wireless bears to the regular mail and telegraph. It is unlimited by obstacles on land and water; curves are eliminated, and there are no grades to climb after reaching your flying level.

"It has been estimated that aërial express could be carried profitably at a charge of $2 a pound for packages of a given size between New York and Chicago. A twin-motored 'plane can make the New York-Chicago trip without stopping, carrying a thousand pounds of express matter.

"The postoffice has been operating an aërial mail between New York and Washington daily since May 15, 1918, and has cut down the time of transit to two hours. Only small planes are used, which are more expensive than the large ones, when operated on the ton-a-mile basis. Yet the cost has been cut down to 40 cents a mile. It is cheaper than taxicab rates.

"British dirigible balloons, some of which are capable of carrying sixty tons of useful load at a speed of sixty miles an hour, may soon ply between Great Britain and the United States, carrying passengers, mail and express."

HOW ELECTRICITY SERVES WORLD'S LARGEST HOTEL.

(*Continued from page* 858)

own, as they obtain the required electric power and steam for heating and other purposes, from the railroad companies near the respective railroad terminals of which they are located. The Hotel Pennsylvania has a high tension transformer vault in the sub-basement as well as a large switchboard for controlling the power and light supply to the various parts of the building, and there is an auxiliary 500 K.W. steam-driven generating unit installed in the power plant.

My guide suggested that we next visit a typical "guest floor", and so we took an *express elevator* to the ninth floor, there being nineteen floors in all. On each floor there is a lady floor clerk, who has charge of everything on that particular floor, and is responsible for all the service in that particular part of the hotel. Obtaining keys for several of the rooms, we set out to look them over, and as the writer had heard of the far-famed "servidor", long before he had even thought of visiting the hotel, he asked the guide to explain this first of all. The "servidor", as its name implies, is a scheme for rendering service between the guest and the hotel attaches without introducing the objectionable personal touch, which is all right in the public rooms of the hotel, but rarely ever on the guest room floors, excepting when a waiter may have to bring in a table to serve a meal or something of that sort. The accompanying illustration includes a detail drawing of the servidor, which at the same time is also the "door" of the room, and "believe me, Xantippe", that door is one of the greatest masterpieces in all Hoteldom, and thereby hangs a tale, to wit:—In the first place the servi-"door" is made of steel, and finished in a perfect imitation of hard wood such as mahogany, or in some cases walnut, and so cleverly camouflaged that you cannot perceive the difference, unless you knock your head against it. The guide demonstrated all of the features of this most marvelous door at the request of the writer. This door swells out on both sides, giving a depth of ten inches between the inner and outer curved panels, which extend the full height of the door. These hinged steel panels are provided with an interlock, so that the outside or hall door *in the*



STRONGFORT
The Perfect Man

Don't Be Handicapped

You will always stagger under the worst kind of a handicap, if you remain a puny, weak, ailing, skinny, miserable apology for a man. Big men, in the terrific competition of business life today, must be virile, strong, full of health and life and jump and ginger. Weaklings haven't the ghost of a show, *in any position; they* never can advance, their jobs may be taken from them any day and given to some man the boss knows is going to forge ahead.

ARE YOU HANGING ON TO YOUR JOB?

If you are just managing to stagger through your work each day, with constipation, indigestion, biliousness, lack of energy or frazzled nerves taking all the pep out of you, that job of yours will get away some day before you know it. Three million or so husky, hearty, healthy men will soon be back from the camps and the fighting lines in France, *looking for jobs*, and they're the kind of boys employers want!

MAKE YOUR JOB HANG ON TO *YOU!*

That's the only way to rid yourself of the constant fear of being fired. Build yourself up into a MAN, capable of doing all your work and more; show your employer that you are full of vim and vitality; that your body can stand any strain and that your brain is clear and keen, full of new ideas for the business. Make him feel that, and nobody could PRY your job away—the only way you'll lose it will be to take another higher up.

STRONGFORTISM WILL ENABLE YOU TO DO IT

Strongfortism will show YOU, as it has shown thousands of other men on the ragged edge of being fired, how to make yourself too valuable for any employer to lose sight of. No matter how deep a hole of dismal despair you may be in just now, no matter if you feel that you have burned out the last spark of vitality in you by dissipation or early excesses—*Strongfortism can make you over, BUILD YOU UP*, strengthen every vital organ in you and make you fine and fit again.

No druggist's dope or patent bottled humbugs in the Strongfort way—just living life as Nature meant it to be lived and getting the greatest enjoyment out of it. Send for my FREE BOOK "Promotion and Conservation of Health, Strength and Mental Energy." It will show YOU how thousands of other discouraged men have made themselves whole and well and strong again.

LIONEL STRONGFORT

Physical and Health Specialist

854 Park Building Newark, N. J.

BOYS Build and Fly Your Own Training Plane



Train yourself in Aviation. Be an Amateur Aviator with an Aeroplane of your own. Learn how Aeroplanes are built; learn the principles of construction, operation and control. We sell IDEAL Accurate Scale Drawings, and Building and Flying Instructions which show you how to build a perfect Model Aeroplane, 3 ft. size, that will rise from the ground by its own power and fly like a big one. Send now for the Drawings and Instructions for the one you want to build.

Drawings and Instructions for
Curtiss Military Tractor
Blerlot Monoplane
Nieuport Monoplane
Taube Monoplane
Curtiss Flying Boat
Wright Biplane
Cecil Peoli Racer
25c EACH
Set of Seven $1.50
postpaid

Ideal Model Aeroplane Catalog 5c—None Free

Tells about Model Aeroplanes, Racing Aeroplanes, Flying Toys, and parts and supplies to build them with. 48 pages. Sent only upon receipt of 5 cents.

IDEAL AEROPLANE & SUPPLY COMPANY
76-82 West Broadway New York City

Learn Watchwork, Jewelrywork and Engraving Optics and instrument repair. A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL, Dept. E., Bradley Institute, Peoria, Ill., for latest catalog.



Wanted—Railway Mail Clerks

$1100 to $2000 Year

Common Education Sufficient

Sure Pay Life Job. Pull Unnecessary.

FRANKLIN INSTITUTE
Dept. D-101, Rochester, N. Y.

Sirs: Send me, without charge, (1) Sample Railway Mail Clerk Examination questions; (2) schedule showing places of all U. S. Government coming examinations; (3) list of other government jobs now open, and (4) free book describing them.

NAME.....

ADDRESS.....

www.americanradiohistory.com

MY NEW BOOK
"Muscular Development"

will tell you how to get a wonderful muscular development like mine, perfect health, abundance of vitality and great strength as I have.



EARLE E. LIEDERMAN
Why not look as healthy and be as strong as I am?

The results of my system are shown on my own person and that is recommendation enough. To give every one the opportunity to profit by what I have learned, I will mail my book, for a limited time only, on receipt of

10c Stamps or Coin

This wonderful book will help you. It is profusely illustrated and contains pictures of many of the world's strongest men whom I have trained. Send for it to-day. Right now, while it is on your mind.

EARLE LIEDERMAN, Dept. 207, 203 Broadway, N. Y.

Not Toys But Real Apparatus

the same as used by all operating companies. You had better send us your order immediately to insure prompt delivery, as this equipment will not last long at these prices.

110 Volt Hand Generators....3 bars, each	$3.00
4 bars, each	4.00
5 or 6 bars, each	5.00
Telephone transmitters with arms, each..	.75
Good ringers complete with bells, each....	.50
Telephone receivers, each.....	.75
Condensers, ½ to 2 M.F., each.....	.50
Induction coils, each.....	.50
Relays, each	1.50
Repeating coils, each.....	2.00
Real complete C.B. wall type telephone...	4.50
Slightly used dry cells, per dozen.....	1.25

Please send money-order or cash with your order

ELECTRICAL SPECIALTY COMPANY
Dept. E, 128 So. 11th St., Philadelphia, Pa.
Dept E, 48-50 So. Front St., Columbus, Ohio



MATYSEK
The Way to STRENGTH

Take the SHORTEST, SUREST path to superb physical development.

BE EFFICIENT

SUCCESS! The achievement of that which we desire. ARE YOU SATISFIED?

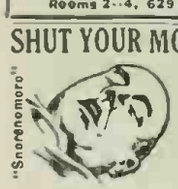
EXTRA! JOIN! TODAY!

Matysek Physique Exercise
SUPERIOR DEVELOPMENT CONTEST
76 Prizes

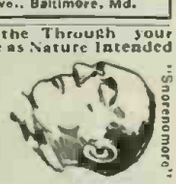
Everybody has a chance—Lean, Normal, Fat, Strong. For Booklets of further information write NOW. Entries close April 10th. You will not regret your enrollment. Enclose 6c in stamps for mailing.

PROF. MATYSEK
Rooms 2-4, 629 N. Lakewood Ave., Baltimore, Md.

SHUT YOUR MOUTH! Breathe Through your Nose as Nature Intended



Avoid dangerous mouth breathing which courts deadly infection of lungs and throat thru improper breathing.



The air is full of virulent germs, mouth breathers inhale them and are in constant peril. Wear without annoyance a "Breathe-Rite" made of gold wire and aluminum pads. Indorsed by physicians.



Best Supply Houses Have Them. Booklet Free. Price $2.00
BREATHE-RITE CO., Dept. 1, Ann Arbor, Mich.

Telegraph Pictures
BY ELECTRICITY

A complete set of two machines of this marvelous equipment for only $19.50. Instructive, mystifying and useful. This picture of President Wilson was telegraphed by these machines. Will transmit pictures, maps, drawings and hand writing. Picture telegraphing is the coming science. Write today.



J. LEISHMAN CO., Dept. T Ogden, Utah

ENINGER WILL SAVE
BIG MONEY SAVINGS FOR YOU

$40



Used and rebuilt motorcycles, single and twins, $25 to $160. Used bicycles, $5.00; tandems, $10. All machines guaranteed in good working order. New bicycles and motorcycles at Factory prices. You save dealers' profits. Motorcycle and automobile tires too, $3.00. Complete line of parts and supplies.

Send for catalog

Doninger Cycle Co., Rochester, N.Y.

YOU 25 TO 50 DOLLARS

AK TABLETS FOR Grippe Cold in the Head
Headaches Neuralgias Spanish Influenza
Women's Aches and Ills Rheumatic and Sciatic Pains

Ask Your Druggist for A-K Tablets
(If he cannot supply you, write us)

Small Size **10c** Dozen Size **25c**

Fac-Simile

See Monogram AK on the Genuine
The Antikamoia Remedy Company, St. Louis, Mo.
Write for Free Samples



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle massage. Can be used with or without electric current.

All users of the **Lek-Tro-Shav** speak well of it

A barber says—"Have shaved for years and have never used any shaving device near its equal."
A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."

No. 1 Made for use from Light Socket.
No. 2 Made for use from Dry Battery.

Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.

VIBRATING ELECTRIC RAZOR CO.
Dept. 122. Omaha, Nebr.

EASIEST SHORTHAND





Learn in 5 evenings home study; then acquire speed with Key Shorthand. Amazingly simple, easy. Approved by experts. Write dictation, messages, etc., rapidly as spoken after brief pleasant practice. Favorite method for personal use; make notes at lectures, meetings; keep confidential diary. Big help in any profession or business; aid in your career. Used in Army, Navy, courts, commercial schools; by public and private stenographers, teachers. Slight cost. Mail Shorthand—for busy people, including YOU. Proof Lessons, Courses and Brochure with Testimonials free, postpaid. Address: KING INSTITUTE, EL 300, Station F, NEW YORK CITY

Combination A. C. and D. C.
Eight Inch DESK FAN



detachable plug and 8 ft. of cord. Will operate on A.C. or D.C. current. 100 to 125 volts, 30 to 60 cycles; weight 10 lbs.; black enamel finish; height 11½ in. A real fan—not a toy. Price $6.50. Agents wanted.

THE TEWNO CO.
150 Chambers St., New York

PHOTO CRAFT
THE NEW PHOTOGRAPHIC JOURNAL

Devoted to the Art of Picture Taking and Nature Work with the Camera.
Four Competitions with Valuable Cash Prizes Leading to a Fifth.
Send 10c for three months' trial subscription.
Photo Craft Magazine, Ann Arbor, Mich.



Publishes cash art assignments, lessons and articles on Cartooning, Designing, Illustrating, Lettering, and Chalk-Talking. Criticises amateurs' work. Full of interesting and helpful information for artists and art students. Satisfactory or money refunded. 10 cents a copy, $1 a year. *Send $1 NOW, stamps or bill.*



STUDENTS ART MAGAZINE, Dept. 441, Kalamazoo, Mich

door cannot be opened by a servant until the inner door is shut and locked. What you can't get via the servidor—ain't! There are two shelves in the servidor which might accommodate a special order of ice cream soda or near-beer from the tap-room, but mostly, so my guide explained, the servidor is intended for clothes intended to be prest over night, or at any time by the hotel valet, and for soiled linen.

The *modus operandi* of the servidor follows:—Suppose you, the guest, have a suit of clothes which you wish prest, and have just arrived at the hotel, and wish to retire at once. You call the telephone operator via your room telephone, and inform her that you have a suit of clothes which you desire prest by the house valet. She does the rest. You go to bed and forget about it. Next morning you awake and open the inner door of the servi-"door", and "pressed-O"! there is your suit as spick and span as ever before, and perhaps if you are lucky, you might find a couple of five dollar silk shirts and a nice roll of clean collars in your servidor, but how could you be expected to be able to tell to whom they beong out of 3,500 guests! Ennerhow, as Abie Kabibble might say, the guests at this hotel are all rich anyway. At least they look it!X? But this is only the start of the tale of the servidor, for you can press one of two buttons on the inside of the door, and open or close a sound-proof ventilator. Also there is another very elaborate and clever mechanical conception incorporated in the knob and lock of the door—this takes the form of a small pin about the size of a lead pencil, placed just under the knob on the hall side of the door. If one of the attachés (in everyday English, the chambermaid), tries to enter the room while it is occupied, she will ascertain this fact without having to rattle the knob about fifteen dozen times, and chuck you into a French fit, wondering if one of the Bolshevik gentlemen is calling on you with a bomb. She simply presses her finger on the projecting pin, just under the knob. If the pin resists the pressure of the finger, then the room is occupied; if not, it is unoccupied. Simple, yes, but someone spent a lot of time to "dope" this out.

The conveniences to be found in the guests' rooms, no matter whether large or small, are all similar, and designed to give the utmost comfort and homelike atmosphere. The basin in each bath room is fitted with three spigots, the two outer ones giving hot and cold water, while the center spigot yields *ice water*, cooled in the hotel's large private refrigerating plant driven by electricity, located in the basement. The rooms as well as all of the halls are cleaned by vacuum cleaners, thus doing away with all dust, besides keeping the carpets and draperies thoroly clean and germproof.

The double rooms do have the cutest little "twin beds" you ever laid eyes on. Each one is fitted with a handsome brass reading lamp attached to the head of the bed, and provided with a silk shade and chain pull socket. Yes, you can read in bed if you want to at one of these palatial hotels. Between the beds or alongside of the single beds, there is a telephone and night lamp table, which also comes in conveniently to hold the immortal "ice water" pitcher. In some of the suites of rooms inspected, the furnishings are very attractive, including large pedestal style dresser lamps with silk shades, on the bureau for milady, and all in all the guests can really feel at home, just as much as if they were in their own residence. We should not forget the electric curling iron heater and the electric fan. Perhaps if you feel so disposed, you would like to have something piping hot made in the chafing dish. If so, one of the maids will bring you an electric chafing dish, which can be easily connected to a special electric floor outlet provided for just such a purpose.

www.americanradiohistory.com

The "Room Service", as it is called in all modern hotels, and which covers the serving of meals in rooms, is very carefully worked out, in the "Pennsylvania" and the "Commodore". At the "Pennsylvania" the system works out in this fashion: Suppose for a moment you are the guest, and that you decide to have breakfast served in your room. You call up the telephone operator and give her your order. She writes it down on her memorandum pad, and as soon as you have finished, she writes it on her telautograph *transmitting platen*. Then two important things immediately happen—*two* telautographs reproduce in writing your exact order for the meal, from coffee to cigars, one telautograph announcing your order in the "room service" kitchen in the basement,—while the second telautograph connected to the same circuit, *but situated on your room floor*, reproduces the order in writing before the "floor clerk" on your floor, and this is the first notice that she receives that you have ordered a meal. The system works out very beautifully in this way, and gives the greatest expedition possible to rapid service. Each floor has its own service pantry, which contains all ordinary things such as bread and butter, and which are supplied from this pantry. In this room there are also automatic high-speed electric dumbwaiters communicating with the "room service" kitchen in the basement, and as soon as any broiled meat, such as chops, steaks, etc., are prepared in the main kitchen, they are whisked skyward *via* the automatic dumbwaiter to your floor. As soon as the dumbwaiter reaches the floor, a buzzer starts signaling the fact, buzzing continuously until the door is opened; the victuals are removed and the door closed, after which the dumbwaiter is dispatched kitchenward. By means of a flexible cord and plug and a set of jacks, one for each of the 19 floors, the kitchen service dumbwaiters may be dispatched roof-ward *and caused to stop at any floor automatically*, simply by inserting the plug in the jack corresponding to that particular floor. When the meal is ready, one of the room service waiters stationed on your floor serves the meal in your room, and invariably of course, a table has to be provided for this purpose. Eventually, we presume, the servidor idea will be extended and amplified, so as to permit the serving of meals, altho this is questionable for the reasons already stated.

Returning toward the lower regions of the hotel, my guide piloted me down a long hallway on one of the lower floors, and we inspected the children's open-air playground, arranged in one of the large courts of which there are several, and ended up this part of our inspection trip, by looking over the large ladies' and gentlemen's "plunge", provided with large deep pools, and every convenience imaginable. The "plunge rooms" in general are provided with steam rooms, hot rooms, massage and silent rooms, drying and rubbing rooms, etc., while the women's plunge apartment contains specially fitted dressing and rest rooms, as well as a manicure and hair-dressing parlor and chiropodist.

Just as we were leaving the plunge rooms, we were surprised by seeing two nurses passing down the hall just ahead of us. Upon inquiry we found that the hotel management had not even overlooked such a possibility, and one to be conjured with when such a large number of guests are considered. Not only was it surprising that the hotel should include a "hospital," but it also developed that there is a physician always present. Thus the guests have always available hospital and medical attention for any emergency. Of course, for any protracted illness, the patient would have to be transferred to one of the regular city hospitals. One does not even have to leave the building in order to get a prescription filled, as there is a large and complete drug store on the street floor, which is accessible from the interior.

In various parts of the hotel, where the architects have found room for them, one suddenly bumps into unsuspected scenes of activity. On some of the lower floors, as well as in spare rooms on the roof, one finds carpenter shops, painters and decorators shops, an up-to-date upholstery shop, yes, even a silver-plating room (for taking care of the vast amount of silverware used in the dining rooms), employees' club rooms, plumbers shop, etc., etc.

A few words may be said here concerning the elaborate kitchen equipment at these hotels, and it is indeed a great revelation to see how cleverly the engineers who designed these departments have worked out their problems. For example, all the soiled dishes from any of the dining rooms are practically never touched by human hands, after once being removed from the dining tables. They are placed in metal carriers resembling large drip pans as soon as they pass the dining room service door. Here they are placed on continuous moving platforms, which travel along at a constantly changing angle, so as to utilize the power of gravity, and eventually the dishes reach the dish-washing department, which is quite an establishment all by itself. The dishes are washed by plunging them into large tanks filled with steam and boiling water. Every germ is thoroly killed as soon as he hits the tanks, and the dishes are then rinsed in other tanks filled with boiling water, which is so hot that the dishes are dried as soon as they emerge from the tank, due to the rapid evaporation of the water vapor remaining on them. The clean dishes are then whisked away on another continuous moving platform, which takes them back to their respective kitchens. The scenes in these great kitchens are ones that you will not readily forget, once having visited this important department of the great hotel organization. Here we see dozens of French chefs preparing the various meats and cooking them. It would be a great revelation to any housewife to see how rapidly the cooking is accomplisht. Steam, gas and electricity are used in the various ranges and stoves used for cooking the various foods, and there is a special kitchen fitted with all electric ranges and stoves, which is called the "home cooking kitchen". This kitchen is one of the features of the "Pennsylvania" and is in charge of an expert dietician. Any guest who has gastronomic trouble or for other reasons may desire to have a piece of pie "like Mother used to make" with its full quota of calories and other toothsome units, can have just what his stomach craves. When the writer visited the kitchen, it was near dinner time, and the chefs were busy cooking squabs by the hundreds in the gigantic ranges, chops by the same number, and steaks by the dozen, not to mention French-fried potatoes by the bushel. Other activities of the Culinary Department include ice-cream making, pastry and candy making, etc., etc. One of the most wonderful sights in this important section of any hotel, and particularly in this giant of all hostelries, is the storage room, where wagon-loads of vegetables are kept, not to mention several auto-truck loads of meats and fish. Large, thoroly ventilated refrigerators, kept cold by the ammonia compressor plant operated by the hotel, maintain a constant degree of cold in them.

Of course, there are the usual wine cellars, one of which extends the whole block, not to mention large rooms filled with snow white linen, shining silver and glassware and crockery, enough to stock an average department store.

414 PAGES
145 ILLUSTRATIONS



$1

ELECTRICITY!

HERE'S just the book on Electricity that you need to answer your many questions—to solve your knotty problems, to teach you new kinks, to be your memory for tables, rules, formulas and other Electrical and Mechanical facts that some people try to carry in their heads—and fail.

With this "Little Giant" I. C. S. Electrical Engineer's Handbook in your pocket, toolchest, on your work bench, drawing table or desk, an hour or a day need not be lost "digging up" some forgotten rule, some unfamiliar fact; you'll just turn to the very complete index and get it "in a jiffy." Just a few of the subjects treated are:

Electricity and Magnetism; Electrical Symbols; Batteries; Circuits; Magnets; Direct and Alternating Currents; Dynamos and Motors; Belts; Shafting; Electroplating; Electrical Measurements; Meters; Arc and Incandescent Lamps; Mercury Arc Rectifiers; Transformers; Insulation; Electric Cars; Single and Multiple-Unit Control; Transmission; Rail Welding; Tables of Wires—Sizes, Capacities, etc.,—Mathematical Rules; Formulas, Symbols; Tables of Constants, Equivalents, Roots, Powers, Reciprocals, Areas, Weights and Measures; Chemistry; Properties of Metals; Principles of Mechanics; First Aid, etc.

The Electrical Engineer's Handbook is one of 22 I. C. S. Handbooks covering 22 Technical, Scientific and Commercial subjects. (See titles in coupon below.) They have the contents of a full-size book condensed into pocket-size ready to go with you anywhere and be at your instant command. Substantially bound in cloth, red edges, goldleaf stamping, printed from new, clear, readable type on good quality book paper and illustrated wherever a picture will help.

No Risk Money-Back Offer!

The price of the famous I. C. S. Handbooks, of which more than 2,000,000 have been sold and are in practical everyday use, is $1 per copy. So confident are we that you will find them exactly what you need for ready reference in your work, that we stand ready to promptly and cheerfully refund your money if for any reason you are not fully satisfied with their value. Simply send a letter or the coupon below, enclosing $1 for each book wanted. If at any time within 10 days you wish to return the books, your money will be refunded.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6185 Scranton, Pa.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6185, SCRANTON, PA.

I enclose $_____ for which send me postpaid the Handbooks marked X, at $1.00 each. I may return any or all and get my money back within ten days from receipt:

☐ Electrical Engineer's	☐ Advertiser's
☐ Teleph. and Teleg. Engineer's	☐ Business Man's
☐ Mechanic's	☐ Bookkeeper's
☐ Steam Engineer's	☐ Steno. and Correspondent's
☐ Westinghouse Air Brake	☐ Salesman's
☐ Civil Engineer's	☐ Window Trimmer's
☐ Coal Miner's	☐ Cotton Textile Worker's
☐ Concrete Engineer's	☐ Farmer's
☐ Building Trades	☐ Poultryman's
☐ Plumber's and Fitter's	☐ Mariner's
☐ Chemist's	☐ Automobiles

Name_____

Street and No._____

City_____ State_____



Do You Want to Know

HOW TO DEVELOP

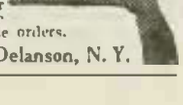
Vitality, Energy, Endurance, Nerve Strength, Muscular Strength, Perfect Physique?

My FREE BOOKS, "The Whys of Exercise" and "The First and Last Law of Physical Culture," tell you if you are weak or underdeveloped, how to grow strong; if strong, how to grow stronger. They explain how to develop the lungs and muscle, the strong heart and vigorous digestion—in short, how to improve health and strength internally as well as externally. SEND TODAY—NOW—for these FREE BOOKS. Enclose 4c in stamps to cover postage.

PROF. H. W. TITUS
56-58 Cooper Sq. Dept. C02. New York City

MAKE $5 TO $10 PER DAY EASY, SELLING A WONDERFUL NEW INVENTION.

The Q. S. Target Pistol shoots shot 100 feet; wooden arrows, 20 to 30 feet with surprising power and accuracy. Send 10c (coin) for sample, terms, etc. Our Q. S. Special, 25c for the older boy and grown people. 3c extra for postage and packing single orders.

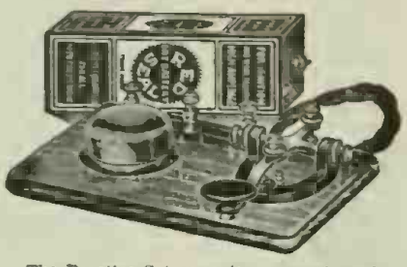


The Q. S. Novelty Pistol Co., Delanson, N. Y.

www.americanradiohistory.com

Mesco Telegraph Practice Set

For Learning Telegraph Codes



The Practice Set comprises a regular telegraph key, without circuit breaker, a special high pitch buzzer, one cell Red Seal Dry Battery, and four feet of green silk covered flexible cord.

The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes.

List No. Price

342 Telegraph Practice Set, with Battery and Cord.....$3.24

Weighs 4 lbs. packed.

Price does not include postage.

MESCO Combination Practice Set for learning the Morse and Continental Visual and Audible Codes



This outfit is the only reliable instrument which will enable students to become proficient operators in the U. S. Naval Service, because it is equipped with a buzzer and miniature lamp enabling the user to master both the visual and audible signals quickly.

List No. 52—Practice Set with Red Seal Battery and Cord.....$4.05

Weighs 4 lbs. packed. Price does not include postage.

Send for the New Edition of Our Catalog W28

It is pocket size, contains 264 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

Send for the Catalog Now

Manhattan Electrical Supply Co., Inc.

NEW YORK: 17 Park Place | CHICAGO: 114 S. Wells St. | ST. LOUIS: 1106 Pine St.

San Francisco Office: 604 Mission St.

WANTED IMMEDIATELY

Civilian wireless operators are in great demand owing to the expansion of our Merchant Marine. Pay has increased to $110 per month and all expenses.

Write for booklet giving full particulars about

The Best Radio School in New York City

East Side Branch Lenox 6051

Y. M. C. A.

86th St. and Lexington Ave. New York

WIRELESS BOOKS *Send for Catalogue*

PRACTICAL WIRELESS TELEGRAPHY By E. E. Bucher and THE WIRELESS AGE for one year, $2.75. *Regular price. $3.75.*

BUY NOW and Save a Dollar

WIRELESS PRESS, INC., 33 ELM ST., NEW YORK.

SCIENCE IN SLANG.

(*Continued from page* 911)

the wireless more of a success, but who have not had the public notified that they pulled a good one.

"Old Doc. Fleming got a good one in the form of a 'valve,' which is a lot like the audion. It was a close second in the patent office and only lost first place by much wrinkles and perspiration on the part of a wise old judge who weighed the proposition like a pair of assayer's scales.

"Then suddenly just when we kiss the dear old war good-bye, in drops old man Jimmy Rogers. He steps up on the platform, puts up his hand and says, says he: 'Sh, boys, before you put up your aerial zingmagics, see me! Nix on those aerial wires!' We say: 'Thehellusay. Whazzematter with our good old aerial?'

"'Not much,' says Jimmy, 'except that aerials are all wrong. Besides you don't need 'em. Just you take a hundred feet of rubber covered auto cable and bury it three feet underground into a trench, savvy? Hook the loose end to what was once your aerial connection and, presto, in come the messages louder'n a goat on a tin roof. *And* you receive *twice* as far as before, AND the old girl static, who used to tease the life out of you, is gone for good, along with the war. Simple, if you know how!'

"I guess that is about all for to-day—now for tomorrow. We may be able to carry around in our pockets a 'phone that will enable us to talk to our colored friend in Africa—when we are in Siberia or Sing-Sing. The present wireless is a great success—so was the Roman chariot, but the Handley-Page aircraft has it over the old go-cart in more ways than altitude.

"Where are we in the art of cultivation? We thought that we had it down like a scenario until Luther Burbank showed us that cactus did not have to have their stickers and the little posies that we wear on our coat lapels could aspire to the rainbow. Way back in the old ignorant days, when a gink thought that it was no worse to marry his sister and raise a colony than we consider a divorce or Wall Street play, there lived an old bird who observed that a little hoeing and so forth would not hurt a wheat stalk and that other growths were helped thereby. I don't remember the guy's name—it was so long ago—but it seems he was an Egyptian. I would not say for sure though.

"Now look how long ago it was when we got out of the boyhood stage in the electrical game—there are a string of years ahead of us yet—perhaps some electrical Burbanks will show up. Don't get it in your head I am slighting Edison, Tesla, Steinmetz, Marconi, De Forest, Fessenden, and others who now have the WATT under the microscope and wearing their glasses at that. What would Caesar have done had he possest a machine gun or a telephone—what would Edison do with the observations and discoveries of the years to come? Men, we are moving! Moving as men have never moved before!"

PREPARED TO DELUGE GERMANS WITH GAS.

Statements that America next spring would have smothered the German front with undreamed of quantities of poison gases, that Edgewood Arsenal thru gas production would have brought about the capture of Metz, that America alone would have had ten tons of mustard gas to Germany's one, and that our chemists had surprises of which German scientists never dreamed—all these facts were recently disclosed by the War Department.

Colonel Bradley Dewey, who was in charge of gas defense production, said that a mask had been evolved which required no nose clip and no piece in the mouth. A man could wear it indefinitely and could sleep in it.

FREE

To Every Experimenter Reader

COMBINATION OFFER

Send at once for this interesting and valuable collection. Send only four cents in stamps to cover postage. There is no further charge.

N-S Co. Catalogue C-3

War edition. Thousands of experimenters the world over already have this edition. Don't miss getting it now. Lists wireless goods, electrical and experimental supplies, educational toys, unique novelties. Also contains much useful information. *Free on request.*

Latest price revision supplement

Applying to Catalogue C-3. Contains latest last minute price changes so that you will know exactly what each item in the catalogue is going to cost you without troublesome and delaying correspondence. *Free on request.*

Code Chart

Very neat and practical. Presents all three telegraph codes. Pocket size so that you conveniently can carry it with you while learning. *Free on request.*

Chemistry Supplement A1

Presents a very fine list of pure chemicals and approved apparata for the experimenter. Our "one price-for-all-chemicals" plan will please you, we know. Makes ordering simple and utmost value assured. Complying with the request of hundreds of our experimenter friends we have established a chemistry department. Stocks are of the freshest, assuring good results. You should have our list. *Sent free on request.*

Chemical Experiments

Describes a series of the best classical experiments in chemistry. Clear, concise directions. Very instructive for the beginner. Compiled by an expert chemist. *Free on request.*

Litmus Paper

Free sample of our best quality chemists alkali and acid test papers. Used in every laboratory. Generous sample litmus paper *free on request.*

All the above free for the asking

Send 4c in stamps to cover postage. No obligation. Only 1 set sent to any one address. Just write "Send Free Combination offer" and enclose postage.

The Newman-Stern Co.

Formerly *The Electro-Set Co.*

1874-76 E. 6th St. Cleveland, O.

Super-Sensitive Microphone ONLY $7.50



This instrument is offered at an extremely low price. It is excellent for building your own amplifier. Can also be used in many experiments where a sensitive microphone is required.

Detectagraph, $15

This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord. Receiver, Headband, Case and Battery.

Send for One Today and Convince Yourself.



Detectagraph $15



THE $15 MICROPHO DEAF-PHONE

is a super-sensitive instrument which has been developed to meet the demands for a practical and efficient hearing device at an extremely low price. It is equal to any $35 instrument made and superior to most of them. The outfit consists of One Super-Sensitive Transmitter with cord connector; One Super-Sensitive Ear Piece with small black cord; One Black Single Headband; Black Case and Two Batteries. WRITE TODAY FOR FREE BOOKLET

G. BOISSONNAULT CO.

26 CORTLANDT STREET NEW YORK

Makers of Super-Sensitive Microphone Apparatus

WIRELESS TELEGRAPHY

Our 14 weeks course prepares you for MERCHANT MARINE paying $110 per month and expenses. RADIO INSPECTORS receive $1,200 to $3,500 per year. Our instructors are licensed by U. S. government; school fully equipped and largest of its kind in America. Tuition small and payable weekly. We guarantee to qualify you. Board and room in Washington at reasonable rates while taking the course. Particulars on request. SERVICE RADIO SCHOOL. 902 Pa. Ave. N. W., Washington, D. C.

www.americanradiohistory.com

DO RADIO WAVES TRAVEL ABOVE THE EARTH OR THRU IT?

(*Continued from page* 872)

stalling later stations under such conditions, to examine very carefully the topography or rise and fall of the country over which this radio system was to operate. Fig. 5 shows a more ideal condition for the operation of a radio station in a valley, and one which has proven to be entirely successful in practise. Here the surface waves have a chance to follow the contour of the ground, as shown, and the antenna in consequence receives a full quota of energy from the waves as they pass across it. It is conceivable in the case illustrated at Fig. 4 that the etheric space-wave component at B, may become totally a space wave without a grounded foot, and this would account all the more readily for the station in this case not receiving any signals.

Some very interesting experiments were made some years ago on the relative efficiency of *ground antennae* and which were reported in the journal *"Jarbuch Für Drahtlose Telegraphie und Telefonie"*, and the essence of these tests is illustrated diagrammatically at Figs. 6 and 7. The investigator, Kiebetz, working with such antennae, utilized one form composed of insulated conductors placed in an open trench, as shown in Fig. 6, and later he covered the trench over with boards and piled soil on top of it. The more soil he placed on top of the trench, the weaker the signals became, until finally *none were received at all.* This showed apparently that if wireless signals were to be received by an ordinary ground antenna, it must be placed in close proximity to the earth's surface, as I have already described in the opening part of this article, or else in a more or less shallow trench, the top of which is open and not covered with any conductive substance or material. The diagrams, Figs. 6 and 7, show how the gliding composite waves, with their ground components, cut across the antenna wires in the open trench, while in the closed trench, the ground waves or "feet" glide over the raised contour of the soil as shown, and how the ground components, reaching but a short distance below the surface as previously explained, do not cut across the buried aerial conductors, and therefore no currents are generated in them, as the tests prove.

One way in which a submarine may pick up wireless messages is shown at Fig. 8. Here the composite radio waves glide over the water with their ground components, as shown by the dotted lines. Now, if the submarine trails a heavily insulated wire, as shown, the upper end of which is supported on two or more floats, then it naturally becomes possible for this wire to pick up energy from the radio waves travelling in the direction of the wire, and signals will be received. As mentioned above, it is also possible, that by having the floats partly weighted so as to keep the antenna wires a short distance below the surface of the water, that wireless messages can then still be picked up, due to the partial penetration of the grounded components of the waves into the water, in a readily apparent manner. It is very doubtful if the submarine will be able to pick up any radio messages, if it lies at any considerable depth in the water, say below 50 feet, with the antenna wire trailing along behind it, as the penetration of the wave base has been shown to be usually but a few feet below the surface, especially over salt water. It must be clearly understood, however, that experiment as well as theory both show that the penetration into moist earth or water *increases with increasing wave length.* Hence it is that of late, as the wave lengths



Brandes "Superior" Head Set, complete with head band, $6. A professional set within the means of every amateur. 2000 ohms.

BRANDES

on a

Wireless Headset

means

SENSITIVENESS

And sensitiveness means more than an ability to receive weak signals. It means being able to bring out a clear, unblurred sound, easily distinguishable in spite of static disturbances.

The sharp, readable tone obtained by Brandes receivers is due to long and careful experiment—and to the fact that both diaphrams are matched for tone and pitch.

TRY A BRANDES HEADSET--AT OUR RISK

Test Brandes receivers against any other make. If you do not find the Brandes superior in clearness, sensitiveness, and range, your money will be returned without question.

Order a Brandes Headset today—or send 4c for Booklet "E" with complete description of Brandes receivers.

C. BRANDES, INC.

Wireless Receiver Specialists

ROOM 814 32 UNION SQUARE NEW YORK

Complete line of Brandes receivers for those in Western States and Pacific Coast. Catalogue "E" on request.

Balboa Building FORD KING San Francisco, Cal.

Radio Amateurs!

BUY PARTS AND MAKE YOUR OWN SETS

Large Stock of High-Grade Radio Materials Left on Our Hands Because of Cancelled Government Contracts

BARGAIN PRICES WRITE FOR COMPLETE PRICE LIST



SMALL

Variable Air Condenser

90°, aluminum plates, rigid construction, capacity .0005 mf. Can be used one in primary and one in secondary for varying capacity. A high grade, assembled condenser at a lower price than most cheap ones. Complete with knob, scale and pointer, ready to mount on panel.....Each $4.00



Galena Crystal Detector Units

complete. Crystal mounted inside weather proof cage. Knob and contact spring mounted on micarta base with binding posts. Close regulation, wide range of adjustment, variable pressure. Each $1.80

Crystal detectors licensed under patents of the Wireless Specialty Apparatus Company of Boston



Split Head Band

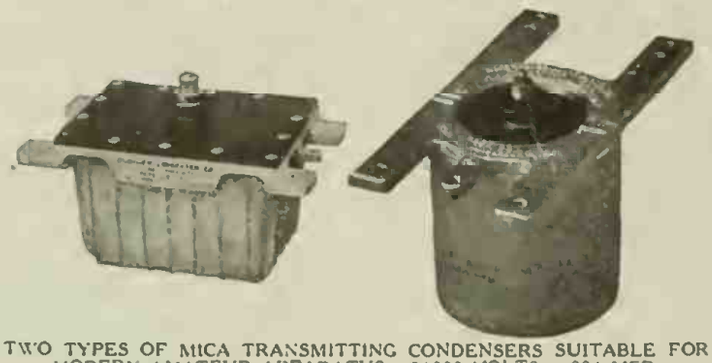
Best grade light weight nickel-plated adjustable ear pieces — will fit any head phone.

50c each

DE FOREST RADIO TEL. & TEL. CO.

1391 SEDGWICK AVENUE - - - - - NEW YORK CITY

www.americanradiohistory.com



TWO TYPES OF MICA TRANSMITTING CONDENSERS SUITABLE FOR MODERN AMATEUR APPARATUS. 21000 VOLTS. .004 MFD.

Make Your Wireless Apparatus Send Further
Last Longer and Work Better

The wireless amateur and experimenter is once more busy constructing apparatus for use the moment that orders go forward allowing amateur stations to open.

The kind of apparatus you used before the war doubtless answered your purpose nicely, but just consider the tremendous advancement made in the art during the past two years and you will appreciate your modern apparatus must contain several new types of equipment to bring it up to date.

DUBILIER
MICA CONDENSERS

proved their real worth in the Navy, the Signal Corps, and as a part of the equipment of the fighting Airplanes both here and abroad since 1916.

You can now purchase a genuine DUBILIER MICA CONDENSER for your new set for any voltage and capacity. They replace Leyden Jars with greater efficiency and without brush discharge and with negligible losses. They are compact and indestructible.

Made in any capacity and up to 1,000,000 volts. Special condensers supplied for experimental work.

Used in practically every Government installation.
DUBILIER MICA CONDENSERS are now ready for your use.

	Type A	Navy Type
.002—21000 volts.....	$11.00	$18.00
.004—21000 volts.....	20.00	35.00

DUBILIER CONDENSER CO., Inc., 217 Centre St., New York
For Great Britain, Address DUBILIER CONDENSER COMPANY, Ltd.,
1 & 3 Stephen St., London, W. I., England

Boys! You Can Make Your Own Electrical Apparatus with the aid of these wonderful books
Home-made Electrical Apparatus
By A. M. Powell



Three wonderful big books, chuck full of just the sort of information you have been looking for and at a price within reach of your pocket book. Each volume is printed on heavy paper, contains 75 pages and over 60 illustrations, complete working drawings for making every sort of electrical apparatus. Written so you can understand them. The price is only 25 cents per copy—practically the cost of publication. See partial table of contents below and order now. The supply is limited.

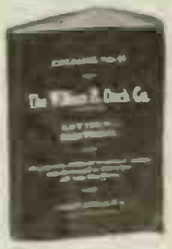
Vol. I Contains *working drawings* and directions for making all sorts of Static Machines, Static Apparatus, Home-made Batteries, Storage Cells, Transformers, Rectifiers, etc.

Vol. II contains *working drawings* and directions for all sorts of Voltmeters, Ammeters, Galvanometers, Switches, Rheostats, Telegraph Keys, Sounders, Telephones, Shocking Coils, Spark Coils, Experiments, etc., etc.

Vol. III contains *working drawings* and directions for making all sorts of Dynamos, Motors, Electric Engines, Miniature Lighting Plants, Wireless Telegraph Apparatus, Tesla Coils, Wireless Telephone, Electroplating, Experiments, etc., etc.

Any of these wonderful books will be sent to you *postpaid* for 25 cents.

COLE & MORGAN, Inc., *Publishers and Booksellers*
P. O. Box 473, City Hall Sta., New York City



Get your wireless stations
In Readiness Now.
Be prepared and avoid delay.

DUCK'S big 300 page Wireless and Electric Catalog is now, as it always has been, the largest and most complete and dependable Wireless Catalog published. Mailed for 12c in stamps or coin. Not sent otherwise.

Everything in wireless *worth while* is listed in this catalog. The experienced amateur will tell you to see our catalog before buying. You are thereby insured against an unwise purchase. It is the *Beacon Light* to guide you right in the selection of your wireless apparatus. No bigger or better values are obtainable elsewhere.

If you have our catalog No. 11, you have our latest catalog. Do not write for another. Send for a revised price list. It is yours for the asking.

THE WILLIAM B. DUCK CO., 230-232 Superior St., Toledo, Ohio

of the larger stations have been increased, these horizontal receiving antennae can be sunk deeper and deeper before effective screening is observed. Hence the periodic "rediscovery" of the astonishing efficiency of the horizontal receiving directive antenna.

So far as I have heard the first use of the horizontal receiving antennae was at Block Island in July, 1903, where we connected the receiver direct to a telephone line running across the island from the wireless station towards the Point Judith (R. I.) transmitter. Fine loud signals were thus received.

In 1905 I used a bare copper wire lying directly on the ground at New Haven, and then determined within a few degrees the direction of the transmitting station, by swinging this wire around a circle, the center of which was the receiving instrument and ground stake. The signals were loud when the wire lay in the plane of the station, in *either* direction to or from the station—practically the same for both. But when at right angles to this plane of propagation nothing at all was received.

But to return to your editorial, "Wireless Around the World", it is highly unfortunate that the esteemed advertising propensities of the Marconi interests should have made capital over this performance of their station in the year 1918, when similar performances had been on numerous occasions a matter of record for at least two years prior to that date.

I give below a news clipping sent to me back in 1916 by a wireless operator at Awarna, New Zealand, which is self-explanatory. I have received many communications from this section which, unfortunately, I have not felt authorized to publish, recounting similar "anti-podal" radio-transmission.

"In connection with Commander Cresswell's statement regarding the reception at various Australian wireless stations of messages sent out by Nauen and other places in Germany, it is stated that similar messages are received nightly at several of the New Zealand radio stations, especially Awarua, which is probably the best equipt in the Dominion. The distance from Nauen to Awarua is about 12,000 *miles, which, if it does not constitute an absolute record, is very near it. The secret of these remarkable results which in less troublous times (referring to the World War) would excite world-wide interest, lies in the De Forest ultra-audion receiver—one of the most remarkable and simple pieces of apparatus invented since Marconi's first experiments. Dr. de Forest is an American, who lives at New York. His "ultra-audion" has the power not only of receiving the far-flung waves, but can also be used as a wireless transmitter for the voice—a field as yet practically unexplored."*

In fairness to facts wherever an epoch-marking feat of this sort is accomplisht, whether in science or in any field of discovery, I am sure you will agree that it is highly important that due credit should be given to the *first* performance and not to a repetition which happens to be generously advertised years thereafter.

Perhaps your article lays unwarranted stress on the improvements which the Alexanderson alternator today enjoys over the arc transmitter. After witnessing what the big arc transmitters are doing in Europe, as well as in the United States, together with their simplicity and ruggedness and the facility with which any wave length can be instantly obtained, it is doubtful in my opinion whether the alternator will soon supplant the big arcs; at least, except in stations where one wave length only is required.

www.americanradiohistory.com

MURDOCK
Radio Receivers



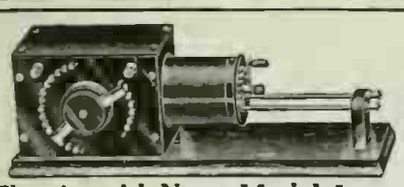
Noted for their extreme sensitiveness and unfailing dependability. At the very reasonable prices, they are the best receiver value in the world.

Buy **now** for present and future needs.

Other Apparatus of Equal Merit Available for Experimenters, Schools, and Colleges.

Ask for Bulletin No. 18.

WM. J. MURDOCK CO.
55 Carter St.
Chelsea, Mass.



The Arnold Navy Model Loose Coupler
IS MY SPECIALTY
BUT

I also make short wave regenerative receivers, Variometers and apparatus to order, and carry the finest line of accessories on the market.

J. F. ARNOLD
2082 Lexington Ave., near 125th St., N. Y.

BOOKS!!!

of every kind. English Translations (word for word):—"CAESAR" (1st 8 books), "CICERO", or "VIRGIL", $2.00 each, postpaid. "Sexual Disasters", $2.00 each, pp. All kinds of sex books, and the latest fiction. Tell us your needs. Monongahela Novelty Co., Box 299, Monongahela, Pa.

ELECTRICITY IN FAR-AWAY BOMBAY.

The great success with which the introduction of electric power from the generating station on the Ghats is being developed in Bombay is revealed by the report of the Tata Hydro-Electric Power Supply Company. The energy now being supplied to motors in Bombay amounts to 48,000 horsepower. Thirty-six mills are receiving power, and only the difficulties arising from the war prevented development being more rapid.

THE HOW AND WHY OF RADIO APPARATUS.

(*Continued from page* 875)

them in the proper manner for giving a good indication. At this point, it is well to mention that no matter which form of detector is used in conjunction with the wave meter, that the wave meter itself must be kept at a sufficient distance from the exciting circuit, no matter what its form or make-up, so that there shall be just sufficient current picked up by the wave meter oscillating circuit to give a good clear indication in the detecting or indicating device. If the wave meter is held too close to the exciting circuit, then several wave lengths or harmonics of various wave lengths may be heard, and an incorrect reading obtained.

For many purposes it is desirable and necessary to excite the wave meter so that it will radiate a wave length of known value, such as in various radio measurements, etc. Fig. 5 shows a standard method of exciting the wave meter. Here we have a high note or other form of buzzer connected with a few cells of dry battery, and a key or switch. This circuit is shunted across the variable condenser of the wave meter as the diagram indicates. This arrangement will cause oscillations to be set up in the oscillatory circuit of the wave meter, and an auxiliary inductance can be placed near the wave meter inductance so as to link the two inductively, and thus transfer the energy electro-magnetically from the wave meter circuit to the auxiliary circuit, and which energy shall have a wave length and frequency of known value.

At this juncture, the matter of arranging the wave meter cabinet, and especially the variable condenser and its scales, etc., should be considered. In this connection we may refer to Figs. 6, 7 and 8, wherein several important and simplified methods of arranging the variable condenser scales, especially direct reading scales, are given. Fig. 6 shows a method used by the writer for several years with good satisfaction. In the scheme the variable condenser scale is specially made up on heavy bristol board or celluloid, (or else hard rubber with the graduations scratched in with a scriber and then filled with Chinese white), and instead of having simply the angular spaces marked off in degrees, and then having to refer to a calibration chart in the usual way, the corresponding wave length values for the coil are read off from the calibration chart (see Fig. 9) and marked off on the scale as shown in Fig. 6. Then as the indicator attached to the variable condenser knob is moved over the scale, and by noting which inductance coil is in use at the moment, the corresponding wave length may be read off directly as soon as the maximum resonance point is indicated by the detecting circuit. The indicator, Fig 6, comprises a piece of heavy sheet brass, soldered or otherwise secured to the shaft of the variable condenser, and the outer end of the arm is cut to the form shown, with the two side edges bent over to retain a piece of ordinary glass. With a glass cutter, a straight line is scratched across the center of the glass, and this may be darkened

Draftsmen Earn $35 to $100 Weekly!

DRAWING

You can get this big pay. All you need is the new 1919 edition of the Cyclopedia of Drawing and a little of your spare time. The cost is only 7 cents a day. You learn at home and pay this small amount while learning. See the FREE EXAMINATION offer below.

Architectural and Mechanical Drawing

4 big volumes each 5¼x8¼ in., bound in genuine American Morocco and trimmed in gold. 1578 pages and over 1000 illustrations, plates, diagrams and blue prints.

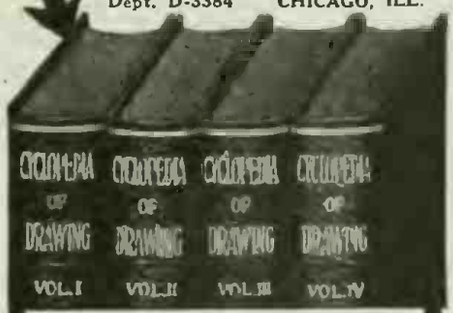
The only books that thoroughly cover Mechanical, Structural and Architectural Drawing in a non-technical way. You don't have to know anything about the subject to understand them. They begin at the begining and tell you everything about Blue Print Reading—Mechanical Drawing—Machine Design—Machine Drawing; Structural Drafting; Architectural Drawing ing and Lettering—Shades and Shadows—Perspective Drawing—Freehand Drawing—Pen and Ink Rendering—Typographical Drafting—Drawing Instruments and Their Uses and hundreds of other things connected with the work.

Use One Week FREE

You can use these books for a whole week free without sending one cent. Just send the coupon below and all 4 volumes will come to you at once by express collect. Use them as if they were your own—go through them thoroughly and send them back at our expense if you don't want to keep them. If you do keep the books send us only $2.00. You can send the balance of our special introductory price—only $13.80 the same way—**$2.00 each month.**

Remember you don't take any chances. The risk is all ours and the benefits will all be yours. SEND THE COUPON TODAY.

American Technical Society
Dept. D-3384 CHICAGO, ILL.



American Technical Society
Dept. D-3384 CHICAGO, ILL.

Please send me the 4-volume Cyclopedia of Drawing for 7 days' Free Examination, shipping charges collect. I will send you $2.00 in 7 days and $2.00 each month until the special price of $13.80 is paid, and you will send me a receipt showing the books are mine. If I decide not to buy I will return the books in 7 days.

Name.....

Address.....

References.....

TELEGRAPHY AND RADIO

DAY AND EVENING CLASSES
SEND FOR PROSPECTUS
IN SUBJECT INTERESTED

EASTERN RADIO INSTITUTE
899-B Boylston St. Boston, Mass.

Wireless Individual instruction continues under the general supervision of E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Co.

Y. M. C. A. TELEGRAPH SCHOOL
Marcy Ave., near Broadway, Brooklyn, N. Y.

READ THE CLASSIFIED ADS. ON PAGES 932 - 934

www.americanradiohistory.com

Amateurs — Manufacturers
WIRELESS PARTS
Knobs — Bases — Insulation



This fine Base in composition hollowed to hold small condenser, 4¼" x 2" x ½". Postpaid 30c



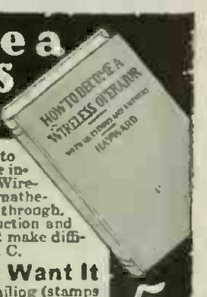
Base 3¼" x 2" x ½" Postpaid 32c

Knob, 1¼ x ½ with 8-32 threaded bushing and extra inserts to hold contact securely. Postpaid 20c

Manufacturers send for discount in quantity.

A. H. CORWIN & CO.
5 Kirk Place Newark, N. J.

HOW TO Become a WIRELESS OPERATOR



A practical book—boiled down to the real facts and giving all the information you need to become a Wireless Operator. No tiresome mathematics or useless data to wade through. 238 pages of interesting instruction and 196 pictures and diagrams that make difficult things as simple as A. B. C.

Money Back If You Want It

Send $1.75 and 10c extra for mailing (stamps or money order) with your name and address. The book will come at once postpaid. Use it 5 days and send it back if you want to. Your money returned if you don't keep it.

AMERICAN TECHNICAL SOCIETY
Dept. W-504 CHICAGO, ILL.

5 Days Trial

"The Livest Catalog in America"

WIRELESS

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 180 Big Pages, 500 illustrations, 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy," 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 20 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.

Send 6 cents in stamps or coin for which we will send our latest Cyclopedia Catalog No. 20 as described.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

SELENIUM CELLS

Guaranteed 99% pure selenium

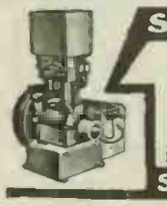
Made by people who know their business, for the most difficult work, requiring very sensitive, quick acting cells. Standard cells, $5 each. Special cells to order.

THE SELENIUM LABORATORIES.
New York Offices, 56 West 45th St.

MATHEMATICS MADE EASY

The Arcascope—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 85 cents Postpaid. Order today before you forget.

Dept. S. L. J. LEISHMAN CO., Ogden, Utah



SMALL ENGINES

Perfected Gasoline Engines—½, 1 and 1½ h. p.—for Farm and Shop use. Price, $27.50 and up. Also

WASHING MACHINES

We ship on trial. Send for Booklet and Special Offer.

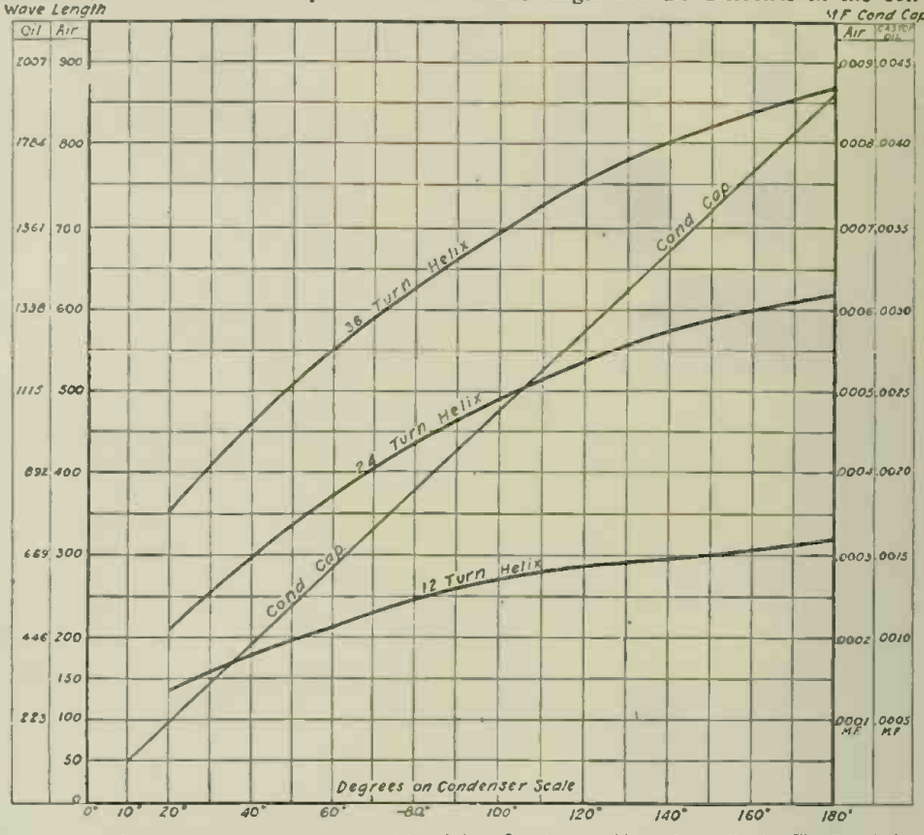
SIEVERKROPP ENGINE CO.
1401—19th St., Racine, Wis.

STARTER for FORD CARS

if necessary with a little black pigment. A piece of fine wire can also be drawn across the glass and soldered in place.

Fig. 7 illustrates a clever arrangement which also provides a direct-reading wave meter, and here the calibrated dial corresponding in its lay-out to that shown at Fig. 6, is secured to the variable condenser shaft *below* the shelf of the cabinet. A small oblong window is cut thru the cabinet shelf as shown, and a brass slide is placed underneath this shelf so as to be readily operated by hand, in such a way that the small window cut in the slide can be slid into any one of three positions, depending upon which scale and which inductance is being used at the moment. Fig. 8 shows an automatic arrangement, which is easily made by the radio student and whereby each of the three inductances is fitted with pin contacts, one of the pins in either case being made of a different length for each of the three coils. As each inductance is placed in the cabinet thru the spring contacts shown, the longer lug will actuate a lever system connected to the window slide shown at Fig. 7, and thus automatically move the slide to the proper position to read the corresponding wave lengths for that coil.

The calibration curves for the wave meter here described are given at Fig. 9. These values can be transposed to a special variable condenser scale if desired, of course. The variable condenser calibration curve is given as well as the wave length graph for each of the three inductances. As is well known, the capacity of a condenser may be increased by adding a liquid dielectric, such as *castor oil*, which has a coefficient K value of 5; or in other words, if the variable condenser is filled with castor oil, its capacity will be increased five times over that of air. The capacities for the condenser filled with castor oil (as well as air dielectric) are given at Fig. 9 on the right. Also in this way the student will have a greatly increased wave length range on the wave meter for any given coil, when the condenser is filled with castor oil, as the second column of wave length figures on the left indicates. The manner of using the calibration graphs is as follows: Consider that a maximum resonance point is indicated by the detecting instrument connected to the wave meter circuit, when the condenser needle stands at 105 degrees, with the 24 turn inductance in use. Glancing upward from the 105 degrees marked at the base of the chart, and noting the point where this line intersects the curve for the 24 turn helix, we find that the equivalent wave length for air dielectric in the condenser is 500 meters, and for castor oil in the condenser 1115 meters.



Calibration Curves for Wave Meter and Variable Condenser Here Described. To Read Any Wave Length Value from These Graphs, Note the Condenser Reading at Which Resonance is Indicated. Then Determine the W. L. Value Corresponding to the Intersection of the Vertical and Horizontal Lines with the Proper Inductance Graph, Fig. 9.

Direct-Reading Decremeter—The chart shown at Fig. 10 is described in a recent book entitled "Radio Instruments and Measurements," Circular No. 74, issued by the United States Bureau of Standards, and a copy of which can be obtained from the Government Printing Office, Washington, D. C., at small cost. This chart makes a *direct-reading decremeter* out of any wave meter. Fig. 10 shows how the chart may be attached to the upper rotary plate of the variable condenser; its zero graduation being set to coincide with an indicator mark or hair line thru a window in the top of the condenser case, when the rotary plates are all the way out from the fixt plates. Also it should be seen that the hair line in the window coincides with the straight edge of the semi-circular fixt plates. Full description of this arrangement is given in the work above referred to, as well as all the usual methods of measuring decrement.

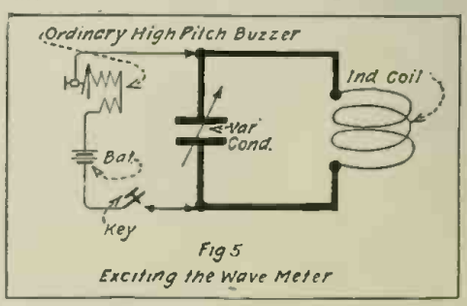


Fig 5
Exciting the Wave Meter

Hook-up for Exciting the Wave Meter so That It Will Emit Waves of Known Length.

www.americanradiohistory.com

Health In A Glass Tube

The interesting story of a man "too busy to bother" who appreciated perfect health, energy and vitality only after he lost it—and how he won it back in a startling way

By FRANK HARTLE

YOU probably know dozens of people like my friend John Brainard. Strong, robust, a human dynamo for work, a real bulldog for stamina, and a very likable fellow in spite of his entire lack of sympathy for sickness and sick people. He regarded sickness as a mild sort of crime and had such faith in his own excellent health that he had about as much sympathy for sick people as, according to Mark Twain, David had for Goliath. If you happened to mention that you didn't feel extra well Brainard would say, as courteously as was absolutely necessary, "T'bad, very sorry"—and you could almost *see* the entire matter sail out of his other ear. Sickness and suffering were foreign to John Brainard and he couldn't understand it in other people, that was all.

But as Josh Billings once said, "Health is like munny. We never hav a true idee uv its value until we lose it." And quite suddenly John Brainard realized what ill-health is. Too much overwork, inconsiderate hours, immoderate meals, and general inattention to his health finally "told on him." One day I went to his apartments and found him in bed with a severe attack of sciatica, but fuming with rage in spite of the intense pain. "Why should I have this?—I've been as healthy as a horse all my life. Why should *I* be sick?—hang it, I *won't* be sick," and he jerked himself to a sitting posture only to fall back in pain upon the pillow.

For a week John Brainard lay in bed in intense agony. Those of you who have suffered from acute sciatica or rheumatism know what it is. The doctor came and went, but Tuesday and Friday when I called, John only said, with a weak attempt at his former cheerfulness, "Nothing doing, Frank. They haven't pushed the right health button yet. Who was that fellow anyway who said something about 'a man too busy to take care of his health is like a mechanic too busy to take care of his tools.'"

Next day while at lunch with George Conrad, our mutual friend, I mentioned about John's still being so very ill. "Listen, Frank, old boy," he said, "I don't want to be presumptuous or anything like that and I certainly believe that the Doc will fix John up fine, but there's a treatment which entirely cured my wife of chronic neuralgia, and now it's bringing total cure to my cousin, another sciatic sufferer. I think if John would give it a trial it might help him some." Ten minutes further conversation with Conrad convinced me and I went right over to John's home to "spring it."

"John," I said quietly, as I tip-toed into his bedroom, "I've got the very thing. Conrad has given me some real facts about what electric violet rays are doing for people and I think—"

"Oh," he interrupted, "I don't know. I don't imagine it can help me."

"Of course you don't know. And you never *will* until you try. Now don't talk foolish, Johnny, old scout. Won't you even believe your friends? This violet ray treatment has *proved* what it is."

And then I went on to tell him all I had learned about violet ray treatment—how it had been invented by the great Tesla in 1890, how it was being used with wonderful success by eminent physicians all over the world, how he could use it on himself and it wouldn't shock him like electricity in other forms, how it would surely at least *help* his own sciatica when it had *cured* other folks' sciatica, neuralgia, hay fever, asthma, neuritis and dozens of other diseases, and finally I told him how it would bring back to him his old "pep," vigor, and "knock-'em-dead" vitality. Then John rolled over and said, "All right, if it brings me out of this blamed bed a well man I'll swear by it for life. Cart in the dynamo, or whatever it is."



"When I ran that glass tube over my 'hide'," said John, "it felt just like a local anaesthetic on a wild tooth."

"Its nothing of the sort," I insisted. "It's a handy little tube-shaped thing that attaches to that electric socket right over your head. And you can apply it yourself right to your 'hide' without feeling a bit of a shock."

Three days later I had gotten a violet ray instrument from Chicago and John used it on his legs and thighs. "Say," he cried, after the first treatment, "I thought electricity always shocked a fellow. Why, when I ran that glass tube over me and the violet rays flashed around, it just felt like a local anaesthetic on a wild tooth. If this keeps up—oh, boy!"

John Brainard got up for good three days ago for the first time in over two weeks. Five days' treatment with the violet rays put him on his feet.

"Where is your 'rheumatiz,' John," I remarked yesterday.

"Dunno, Frank, I can't find it anywhere. It just 'violet-rayed' itself away, I guess," he said, pointing to the instrument in the bathroom.

"I see you keep it attached."

"Yes, you see my wife discovered that the best beauty specialists in town used it, and she—well, my wife's a woman you know."

* * * * *

Violet rays have brought *good results* in almost every disease and Violetta, being the most advanced instrument produced and selling many thousands ahead of all others, is certain to bring you the health-giving results you have always wished. But we do not want you to take our word for it. Judge for yourself—try it for ten days in your home before you decide one way or the other.

Now, through the Violetta, you can have in your own home, the wonderful violet-ray treatments exactly as given by eminent physicians and beauty specialists throughout the country. Now you can rid yourself of Chilblains, Colds, Corns, Constipation, Dandruff, Deafness, Eczema, Eye Diseases, Hay Fever, Headache, Goitre, Insomnia, Lumbago, Nervousness, Neuritis, Obesity, Paralysis, Piles, Pimples, Pyorrhea, Rheumatism, Skin Diseases, Sore Throat, and many other ailments.

Multiply your bodily health—vitalize your nerves—double or treble your energy and vitality. Sleep better, increase your strength, improve your appetite and digestion. Soothe your nerves, reduce or increase your flesh, tone and strengthen the entire system, beautify your complexion. All with the Violetta.

Trixie Friganza, the famous actress, says, "Cheerfully will I add my praise for Violetta. It's the best 'pain chaser' and 'soother' I've ever had the good fortune to find. It's wonderful. It cured my brother of neuritis. As for myself, I use it for facial treatments and general massage. I cannot say too much for it." Frank Borzone, of Seattle, Washington, says: "I purchased the Violetta for my wife who was suffering from an acute attack of sciatica. From the very first treatment it induced peaceful rest and she is entirely well now." Scores of letters like these are received each day.

The Violetta is not a vibrator. It is not a machine that contracts the muscles—it does not shock—it does not pound the muscles—it is absolutely painless.

Eminent physicians from all over the country apply the Violetta with wonderful results. Dr. Bert H. Rice, of Vinton, Iowa, says: "I have good results with the Violetta. Almost instant relief in Facial Neuralgia." Dr. Daniels, Lisbon, North Dakota, says: "Have used the Violetta in such cases as Goitre, Bronchitis, Pleurisy, Neuritis, Neuralgia and Lumbago, and find it very beneficial. In fact, I would not be without it in my office." Dr. G. B. Duncan, Kewanee, Ill., says, "The Violetta is the finest thing I ever used to relieve congestion in any part of the body; and to relieve pain. Treatments are so pleasant that all of my patients like it."

Write today for a very interesting little booklet explaining fully about the Violetta and how you can try it for ten days before you decide. Read some of the amazing results produced in almost every disease. Read how the Violetta can be attached to any electric socket and also used where there is no electric light. Read how this little instrument, shaped somewhat like a thermos bottle with a glass tube and bulb at the end, pours electric energy and vigor into every muscle, fibre, cell, and pore of your body, read how you do not have to obligate yourself in any way until the Violetta has proven its value in your particular case.

Write for this interesting booklet now. Fill out the coupon printed below for your further convenience, *and mail at once.* Address, Bleadon-Dun Company, Dept 2C, 11 So. Desplaines St., Chicago, Ill.

BLEADON-DUN CO.,
Dept. 2C, 11 So. Desplaines St., Chicago.

Please send me your free booklet about the Violetta and ten days' trial offer.

Name.....

Address.....

.....

www.americanradiohistory.com

CUT YOUR OWN HAIR



If you can COMB your hair, you can CUT your own hair with this marvelous invention. You can cut your hair any length you desire, short or long, and finish the job as nicely as any barber in one-fourth the time before your own mirror, with the

UTILITY Hair Cutter

You can keep your hair well trimmed for a lifetime with this marvelous invention for actually **less than any good barber would charge you for a single hair cut.** Very easy to manipulate. Use it just like a comb, pushing it through the hair, downward, in the direction the hair lays. It is impossible to leave any "nicks" or "cat steps" in your hair, as there is a special Guard that guides the cutter blade evenly over the scalp.

35c POSTPAID

Extra Blades: **5cts. Each** **50c the Doz.**











Cut Children's Hair

at home and save time, trouble and expense of taking them to the barber shop. It works so easily and the job is done so quickly that the children enjoy having their hair cut. The adjustment feature, whereby the blade can be set to cut the hair to any desired length—short, medium, or long—makes it possible to do as perfect work as the barber, not to mention the tremendous saving.

As a Safety Razor You can use the Utility Trimmer as an ordinary Safety Razor, and it will give you as good a shave as the most expensive Razor you can buy. You can shave the face or neck, or finish around the temples.

EASY TO HONE AND STROP BLADES

No trouble at all to keep the blades sharp. Just reverse the blade in the holder and proceed to strop as with an ordinary razor. Extra Blades are always obtainable and cost only 5 cents each, or 50 cents the dozen.

USEFUL FOR MANY OTHER PURPOSES

There are many other uses for the Utility Cutter that will suggest themselves to you. Ladies use it for removing hair from under the arms and elsewhere. It is perfectly safe, and cannot cut the skin. One customer wrote us that he found it just the thing for cutting corns, while housewives and dressmakers say there is nothing better for ripping seams and making buttonholes.

AGENTS AND DEALERS GET OUR PROPOSITION

This is one of the rare occasions when you are able to connect up with a really "Sell on Sight" article. Something that every man and woman will buy on sight, because it actually saves them money. Agents are coining money. Why not you? Handsome package, weighs but a trifle. Write at once for terms on the Trimmers and extra Blades.

JOHNSON SMITH & COMPANY
Dept. RK2 3224 N. Halsted Street CHICAGO

Just to Get Acquainted
we will mail you 4 issues of
THE PHOTO-PLAY WORLD
The one by which all others are governed - for $1.00
The Photo-Play World contains only the best pictures—Stories and Articles. Has a Staff of America's Foremost Writers.
Subscribe Now
35c a Copy $3.50 a Year
THE PHOTO-PLAY WORLD
Bulletin Bldg. Dept. E. E. Philadelphia, Pa.

HANDY BINDER
for the Electrical Experimenter
Holds and preserves 12 issues, each of which can be inserted or removed at will, without tools. Will keep your magazines perfectly for all time or just preserve them like new till you bind them permanently. Made of heavy material, extra strongly reinforced at the back and covered with handsome green cloth, suitably lettered in gold. **65c**
Add postage for 2 lbs.
Experimenter Pub. Co., Inc. Book Department 233 Fulton St., N. Y.

How to Get Rid of Moles

A simple, safe home treatment—15 years' success in my practice. Moles (also BIG growths) Dry Up.
Ask for Free Booklet of Full Particulars
WM. DAVIS, M. D.
4140 State Street Perth Amboy, N. J.

You can be quickly cured, if you
STAMMER
Send 10 cents coin or stamps for 70-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering for 20 years.
Benjamin N. Bogue, 753 Bogue Building, Indianapolis

It will pay you to read the advertisements each month

SEC'Y DANIELS TALKED BY RADIO TO PRESIDENT WILSON AT SEA.

Secretary Daniels transmitted a telephonic greeting to President Wilson at sea by naval radio on February 22. From his desk at the Navy Department the Secretary's voice was carried to the transport George Washington, nearly 800 miles off the Atlantic coast.

The long-distance radio telephone equipment had been set up when Mr. Daniels reached his office. With Rear-Admiral Griffin, Chief of the Bureau of Steam Engineering, and Commander Hooper, the radio expert of the bureau, supervising the experiment, the Secretary's regular desk telephone instrument was connected up thru the telegraph wires to the transmitting station at the seacoast, where his voice was projected by radio waves to the aërials of the George Washington.

The Secretary said a great welcome waited the President in Boston and again in Washington when he reached the Capitol.

Mr. Daniels repeated his sentences several times to make sure that he was understood.

"Good-bye," the Secretary said into the instrument. "I will see you Tuesday. Good-bye."

GRAND OPERA IN YOUR HOME.

(*Continued from page* 855)

microphone circuit could be loaded simultaneously with such an immense number of lines which practically constitutes a short circuit, and while the thing is possible in a limited way by means of induction coils, not more than two or three hundred subscribers could be linked up by such means. Therefore, the system heretofore was a failure.

The invention of the Audion, however, has changed this and by using audions to "boost" the circuits, it is now possible to connect a practically unlimited number of lines to one microphone transmitter and reproduce the music clearly in 50,000 homes at the same time.

The writer who interviewed high telephone officials was informed that the plan was entirely feasible and there was only one objection, which is not of a technical nature but rather a commercial consideration. Thus, the telephone engineers did not think it good business to tie up say twenty thousand to fifty thousand lines simultaneously for several hours at a time on account of the congestion that would probably ensue, but this is really only a small consideration and not of much importance if the enormous revenue that the companies will derive from this scheme is taken into consideration. While the subscribers now pay only between two and five dollars a month for service on an average, the telephone company could easily double this revenue for at least 20 per cent of all of their subscribers by installing the operatic service.

Today the man who owns a phonograph thinks nothing of spending between three to five dollars a month for records which are "dead". If he knew he could hear Caruso, Galli Curci or any of the other stars tonight in one of his favorite operas, he certainly would not object to spending 50 cents or even a dollar for the privilege, and at that he would think he was getting it cheap because he, with his entire family, would hear the music in his own home, without having to travel to and from the opera. Of course, if the system eventually comes into vogue, the opera alone will not be the only source of amusement to be drawn up by a telephone subscriber. Any of the musical shows or comedies, farces, etc., could all be heard over the telephone, altho admittedly not to such an enjoyable extent as grand opera, where it is the music that counts most.

www.americanradiohistory.com

As for the technical aspect, we now have very good sensitive microphones, which placed about the stage and orchestra transmit the sounds strongly and faithfully. The microphones are then connected thru the audion switchboard, similiar to the one shown in the lower center of our illustration, which is the identical audion switchboard now used in multiplex telephony where five conversations are held over the same wire. From here the circuit runs thru the telephone exchange shown in the upper center of the picture, whence the circuit enters the subscriber's home as shown at the left of our drawing.

Here we have a novelty suggested by the writer. In transmitting music over the telephone heretofore, it was not possible for more than one member of the family to listen to the music as there was only one telephone receiver. By means of modern loud talking telephones, however, it now becomes possible to lift off the telephone from the hook and place it over a sensitive transmitter, as here illustrated. The weak sounds picked up by this transmitter are strongly amplified and projected from the horn in great volume. Thus, it becomes possible for any one in the room to hear the music clearly and almost as loud as we do sitting in one of the further rows in the opera, where the hearing is not always good, as is well known.

As for the subscriber's amplifier as shown in our illustration, this may be made of the ordinary loud talking variety, having a simple hyper-sensitive microphone connected to a loud talking telephone, or otherwise it may be a microphone connected to an audion amplifier. The latter probably is the better of the two systems.

The amplifying cabinet can be hung near the telephone, in case of a wall set, or otherwise it can be of a different shape for table use if the telephone is of the portable type. The amplifier could be sold outright to the subscriber or otherwise rented to subscribers by the telephone companies.

We feel confident that a plan similar to the one outlined here will soon come into general use, as there is a positive demand, particularly in America, for good music and which demand as yet has not been satisfied.

But like all other large interests, the telephone companies are slow moving organizations and do not make innovations unless they know that a large part of the public actually wants them. Therefore, if you are in favor of this plan, we think it would be a good idea to write the headquarters of the telephone company, advising them what you think of this plan. If, however, you were to write to your local telephone company, not much impression would be made. If, on the other hand, you address your letter to the American Telegraph and Telephone Co., No. 12 Dey St., New York City, then there is a chance that a national movement would perhaps result from such letters. Local telephone companies cannot make a change in their present system as they are governed by the policy which originates at the New York headquarters. Perhaps your letter will help to bring the Opera into your home.

TELEPHONE GIRLS' WORK IN FRANCE.

It is difficult for us to realize the scope of the work that has been done and is still being accomplished by the telephone operators in France. To serve the needs of an army of two million men, and to connect that army up with the French by telephone was a matter that required no small amount of organization and planning on the part of the Signal Corps, says the *Telephone Review*. The distribution of the girls in the Signal Corps service asked for careful study and met with unqualified success.



Learn Public Speaking

10 LESSONS FREE

Write — quick — for particulars of this extraordinary offer; an opportunity you will never forget if you take advantage of it. Ten lessons in effective public speaking absolutely FREE to those who act promptly, to introduce our course in localities where it is not already known.

We teach you by mail to become a powerful and convincing speaker—to influence and dominate the decisions of one man or an audience of a thousand. We have trained hundreds and helped them to increase their earnings and their popularity. Learn, in your spare time at home, how to overcome "stage-fright" and conquer fear of others; how to enlarge your vocabulary; how to develop self-confidence and the qualities of leadership; how to RULE others by the power of your speech alone; now to train your memory. Our

WHAT THE COURSE TEACHES YOU.

How to talk before your club or lodge;
How to address board meetings;
How to propose and respond to toasts;
How to make a political speech;
How to tell entertaining stories;
How to make after-dinner speeches;
How to converse interestingly;
How to write better letters;
How to sell more goods;
How to train your memory;
How to enlarge your vocabulary;
How to develop self-confidence;
How to acquire a winning personality;
How to strengthen your will power and ambition;
How to become a clear, accurate thinker;
How to develop your power of concentration;
How to be the master of any situation.

New Easy Method

perfected and taught only by Prof. R. E. Pattison Kline, former Dean of the Public Speaking Department of the Columbia College of Expression, can be learned in 15 minutes a day. Prof. Kline is one of the foremost authorities in the country on public speaking and mental development. Do not let this chance escape you.

Offer Limited

Send This Free Coupon Now

This Special Offer of TEN LESSONS FREE is made strictly for advertising purposes and will be withdrawn without notice. Write now, before it expires, and receive full particulars with enrollment blank by return mail. No obligations of any kind. Just tear off and mail this free coupon—or a postal will do.

FREE LESSONS COUPON

North American Institute,
7444 Manhattan Bldg., Chicago

I am interested in your course in Effective Public Speaking and your offer of ten lessons free. Please send full particulars. It is understood that this request places me under no obligation of any kind.

.....

.....

www.americanradiohistory.com

Learn Telegraphy-Wireless

Right In Your Own Home, in your spare time

Remarkable opportunities are offered experienced wireless operators and telegraphers. The demand is greater than the supply—steady positions at increased pay and rapid advancement are assured.

DEPENDABLE KNAPP ELECTRIC SPECIALTIES

Combination Wireless-Telegraphy Outfit



will soon make you an accomplished operator. Teaches Light and Sound Signals, both Radio and Morse. Outfit consists of exceptionally fine Telegraph Key, Buzzer, 3 Binding Posts, Lamp, Lamp Socket and Control Switch —all mounted on a highly finished base. Two outfits can be operated at considerable distance apart for sending and receiving practice.

$3.00

This Same Outfit Without Lamp **$2.50**

Order to-day. Or your dealer can secure it for you. Descriptive circular and catalog of celebrated Knapp Motors and Electrical Specialties from 10c up mailed free on request.

Knapp Electric & Novelty Co.
523 West 51st Street New York City



KNAPP LEADER
Radiates real power-plant efficiency. Two Speeds and Reverse.
Price, Complete, $3.50

1/4 H.P., 110 volts, A.C. 60 cycle, single phase, 1750 R.P.M.

MOTORS



We have 1000 NEW WASHING MACHINE MOTORS. These are of standard manufacture and carry the regular factory guarantee. Shipped in original boxes. Complete as cut.

Bought from Bankruptcy Stock

Suitable for operating Coffee Grinders, Cream Seperators, Bottle Washers, Air Compressors Small Lathes, Etc.

Mail $3.00 cash or Money Order. We will send C.O.D. subject to full examination
MONEY BACK GUARANTEE

$18.50 EACH
Special Quantity Prices Regular Value $36

MANUFACTURERS' DISTRIBUTER

BARGAINS in Small Motors and Generators Write for Catalogue

CHAS. H. JOHNSTON - West End - Pittsburgh, Pa.

YOU HAVE A BEAUTIFUL FACE

BUT YOUR NOSE?





BEFORE



AFTER



IN THIS DAY AND AGE attention to your appearance is an absolute necessity if you expect to make the most out of life. Not only should you wish to appear as attractive as possible, for your own self-satisfaction, which is alone well worth your efforts, but you will find the world in general judging you greatly, if not wholly, by your "looks," therefore it pays to "look your best" at all times.

Permit no one to see you looking otherwise; it will injure your welfare! Upon the impression you constantly make rests the failure or success of your life. Which is to be your ultimate destiny? My new *Nose-Shaper*, "TRADOS" (Model 24) corrects now ill-shaped noses without operation, quickly, safely and permanently. Is pleasant and does not interfere with one's daily occupation, being worn at night.

Write today for free booklet, which tells you how to correct ill-shaped noses without cost if not satisfactory

M. TRILETY, Face Specialist **1162 Ackerman Bldg., Binghamton, N. Y.**



TYPEWRITER SENSATION

PROMPT SHIPMENT.

$4.00 per month buys a beautifully reconstructed, latest model visible typewriter, with back spacer, decimal tabulator, two-color ribbon, etc. Every late style feature and modern operating device. Sent on approval. Catalogue and special prices free.

Harry A. Smith, 738, 218 N. Wells St., Chicago, Ill.

HOW AIRPLANES FIND THEMSELVES BY RADIO.

(*Continued from page* 871)

"The use of directional effects of loops or coils for receiving radio signals has resulted in the development of a radio compass for airplanes which gives positive information to the aërial navigator and enables him either to locate his position by triangulation with respect to two beacon land stations or to fly at any given angle with respect to a certain beacon station.

"The apparatus consists of two principal parts—the antenna coils and the tuning and amplifying apparatus. The antenna coils are mounted in the fuselage of the Handley Page airplane, with suitable means for rotating in azimuth. The amplifier is extremely sensitive, consisting of a detector and six-stage amplifier. A novel feature of the amplifier is the use of iron-core transformers for frequencies of 100,000 cycles.

"The direction of the beacon land radio station is determined by maximum strength of signals, in a highly ingenious manner developed originally by the British. The precision of the directional effect is remarkable. In fact, the radio direction finder may well be called a radio eye."

EXPERIMENTAL PHYSICS.

(*Continued from page* 867)

to send and take messages in spite of the enemy's interference by sending out impulses of similar wave length and other distributing influences. The problem of using a non-inflammable gas for inflating balloons and dirigibles has been solved under the direction of a Physicist and a Chemist, both "fool professors".

The submarine has probably attracted as much of the attention of the scientific men as all other war inventions combined, both as to its detection and its destruction. The detection of the submarine is a definite physical problem, and it is estimated that about one-fourth of the Physicists of the Allies have devoted a considerable portion of their time to solve this problem alone. The problem had been attacked from three standpoints, light, sound, magnetism and electricity, three branches which almost comprise the entire subject of Physics. The destruction of submarines has been successfully accomplished by the use of the depth bomb.

In long range artillery work, temperature, moisture, and wind are to be carefully determined; this is done by physical apparatus. Wind direction and barometric pressure information is essential in a gas attack. This information is furnished by physical apparatus. Anti-aircraft gunnery is largely indebted to physical research and calculations for its effectiveness. The speed of the airplane must be ascertained, its direction of motion, its height above the ground, the speed of the attacking shell, and its path.

The airplane camera would be almost useless were it not for our knowledge of the branch of Physics known as *spectroscopy*. Pictures can be taken which the eye cannot see because of fog, cloud, haze or distance. By the use of the proper filters, the enemies guns camouflaged so as to be indiscernible to the eye are photographed and their positions located. The sound method of locating guns is very important. Three sounds are heard from a shell sent by the enemy. First we hear the hissing noise of the shell whizzing thru the air. Shortly afterward the boom of the gun is heard. (Since sound travels at about 1,100 feet per second and the shell's speed is greater than that). Finally we hear the sound of the exploding shell. If the time when the first of these three sounds is heard is recorded at several observing stations, from the speed of sound, and the difference in time recorded at these stations, the position of the

www.americanradiohistory.com

gun firing the shell can be calculated in a few minutes.

The Bureau of Standards, at Washington, a great national Physics institution, has certainly done its share in the war. Vacuum tubes were studied in detail, from the standpoints of sending, receiving, and amplifying wireless messages, and many important improvements were evolved. High frequency oscillographic equipment was developed. The characteristics of airplane bombs were studied, resulting in new methods of computing trajectories. New types of machine gun sights were invented. Instruments for recording the speed, altitude, direction, etc., of the airplane were perfected. Special ignition apparatus for the Liberty engine was invented. A carbureter was developed which gives a correct mixture by the simple motion of a single throttle whether the airplane is on the ground or up 3,000 feet. A fabric 25 per cent. lighter but stronger than linen, extra light but strong alloys, and non-corrosive alloys were invented. These are among the best of its accomplishments which have been made known.

Now that the war is over we shall daily hear of new, marvelous and quite astounding inventions, that have been evolved and perfected. The "fool professor" has now come before the public eye and is regarded with just and long deserved admiration and respect by it. Some, like Professor Millikan, have had exciting military times, such as quieting a "buck private" under the influence of liquor, being fed delightful sandwiches by fair white hands of Red Cross and other workers, etc., while others have suffered an existence under the S. A. T. C., and those more fortunate have spent their time in France near the front; all however have done their share nobly. In closing let us bear in mind that all that has been said of Physics and the Physicist applies equally well to the other sciences and scientists. *(Conclusion)*

EGGS PRODUCED BY ELECTRICITY.

The production of eggs by electricity may seem like an idea evolved in a madhouse, but it has been made a paying proposition at the Montana State College. By electric lighting of poultry pens, Professor W. F. Schoppe, poultryman of the state college, has created a sort of "daylight saving plan" for hens, whereby egg production has been increased more than twofold at a time when eggs were highest in price. In experiments covering the month of November last, Professor Schoppe showed a net gain of 28 cents per hen in value of eggs produced in ten lighted pens.

The experiment was tried on two pens of Leghorn hens, 160 in each pen. One pen was lighted with four 60-watt lamps, the other was left unlighted. The lights were turned on in one pen at 6 a. m. and switched off at 8.30 p. m. From the time the lights went on until they were dimmed at night, the hens in the lighted pen scratched away with all the energy of early spring or summer, showing a greater interest in the business of egg producing than ever.

The 160 hens in the unlighted pen produced during the month 443 eggs. The same number of hens in the lighted pen produced 1,306 eggs, a gain of 72 dozen. Hens in the lighted pen consumed little more food than their less active neighbors. The net gain was 28 cents per hen in egg production for the "electric" hens.

"I cannot say yet," said Professor Schoppe, "what effect this forced production will have on the hatching quality of eggs and upon the vitality of hirds, as those are problems that will require further investigation."

(See our May, 1918 issue for full details of the automatic electric lighting in hen-houses.—EDITOR.)

A TIMELY REINFORCEMENT.
A Copper Plated Stomach.

(Continued from page 877)

thanks to mother and the salt fish—*and* the cat.

You have to begin by discarding the whole idea of sheet copper. It would be all right, and any plumber could make up a good tummy in half a day—even including going back to the shop for his tools—but for the fitting of it, or inserting, or whatever you'd call it. That's a sticker; it's what's kept the invention back all these years.

But why not plate the copper on from the inside? Sure! There it was, right off the bat!

Fig. 1 shows the invention—patents pending—all worked out—perfectly simple. You procure an atomizer, A, and attach to it a long fine rubber tube, B. This tube is surrounded by a spiral wire, C, and both are covered by high-tension insulation, K.

At the further end, both the tube and the spiral wire are connected with the perforated metallic hollow sphere, E. The atomizer-bottle, F, is filled with a solution of sulfate of copper, and the spiral wire is connected with one pole of the spark-coil secondary, H. Around the patient's waist is then buckled the belt I, containing a strip of wire netting J, connected with the other pole of the spark-coil.

All being ready, the patient "swallows" the perforated ball, E, with enough of the tube to maintain communication with the outer world. The ball is then resting nice and cozy within the tummy. Mark the patient closely; a really delightful surprise is about to be handed to him? × ! Pressure on the bulb, G, projects a spray of copper sulfate from the perforations of the sphere, E, while at the same time a touch of the key, L, causes a shower of sparks to be thrown from the ball toward the metallic belt without. The sparks pass easily thru the patient's tissues, but not so the sulfate. This is decomposed by the electric current, and metallic copper is *deposited* on the gastric lining, forming a dense and highly polished surface, ready to tackle any food product short of Bangor red-eye and Irish confetti—brick-bats.

Perhaps you wondered why, before the operation, the patient took a few magnesia tablets, together with a peppermint "life-saver". This was to take care of the other product of the reaction, sulfuric acid—otherwise the patient might as well be fed to death as the way he is. The magnesia neutralizes the acid, producing a pleasant effervescence, which, being flavored by the peppermint, becomes the exact equivalent of an ice-cream "sody" fresh from the fountain.

So behold! at the end of the operation, when the patient finishes his cigarette and lets go the nurse's hand, there he is,—equipt with a perfectly-fitting copper stomach, enclosing a temperance-drink as a hint to guide him in the selection of future contents for it—like a new tin bank for little Willie, with a dime in it.

No, no, put aside that medal. Really I—well, if you must, you must. But I refuse to patent the idea in Germany. Absolutely. It's going to be dedicated to the free use of all free and civilized countries. "That's me all over—liberal, Mabel."

Note—The editor tried "Tom's" latest stunt. After he was dismist from the hospital, and was at last equipt with his copper "insides", he felt pretty weak! So he promptly swallowed a few pounds of zinc dust with his next meal. The copper tummy, the gastric juice—(an excellent electrolyte) —plus the zinc dust, makes a really excellent battery. It strengthened and revived the editor at once. It works so well that he has given up all food in preference to zinc dust. A slight change in diet is had with magnesium dust—it tastes better, and gives a much higher voltage. Iron filings were tried, but they made the editor "rusty"!

BOYS



Learn Drafting

Employers everywhere are looking for skilled draftsmen. They are offering good salaries to start with splendid chances for advancement.

Drafting offers exceptional opportunities to a young man because drafting itself not only commands good pay, but it is the first step toward success in Mechanical or Structural Engineering or Architecture. And drafting is just the kind of work a boy likes to do. There is an easy delightful way in which you can learn right at home in spare time. For 27 years the International Correspondence Schools have been giving boys just the training they need for success in Drafting and more than 200 other subjects. Thousands of boys have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon, then mark and mail it. This doesn't obligate you in the least and will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6182, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

☐ MECHANICAL DRAFTING	☐ SALESMANSHIP
☐ STRUCTURAL DRAFTING	☐ ADVERTISING
☐ SHIP DRAFTING	☐ Show Card Writer
☐ ELECTRICAL DRAFTING	☐ Sign Painter
☐ ARCHITECTURAL DRAFTING	☐ ILLUSTRATING
☐ SHEET METAL DRAFTING	☐ Cartooning
☐ BOILERMAKER DRAFTING	☐ BOOKKEEPER
☐ BRIDGE DRAFTING	☐ Stenographer and Typist
☐ MACHINE DESIGN	☐ Cert. Public Accountant
☐ ELECTRICAL ENGINEER	☐ TRAFFIC MANAGER
☐ Electric Lighting and Railways	☐ Railway Accountant
☐ Electric Wiring	☐ GOOD ENGLISH
☐ Telegraph Engineer	☐ Teacher
☐ Telephone Work	☐ Common School Subjects
☐ MECHANICAL ENGINEER	☐ Mathematics
☐ Machine Shop Practice	☐ CIVIL SERVICE
☐ Gas Engine Operating	☐ Railway Mail Clerk
☐ CIVIL ENGINEER	☐ AUTOMOBILE OPERATOR
☐ Surveying and Mapping	☐ Auto Repairing
☐ STATIONARY ENGINEER	☐ PLUMBING AND HEATING
☐ Marine Engineer	☐ Textile Overseer or Supt.
☐ ARCHITECT	☐ CHEMIST
☐ Contractor and Builder	☐ Navigation ☐ Spanish
☐ Concrete Builder	☐ AGRICULTURE ☐ French
☐ Structural Engineer	☐ Poultry Raising ☐ Italian

Name
Present Occupation
Street and No.
City State

Let Me train YOU in AVIATION



Capt. G. E. Campbell, formerly Third Ace of the Royal Flying Corps.

My advice to you is to start right now to take my

HOME COURSE IN AVIATION

and prepare to fill one of the big jobs later. Wonderful opportunities. Trained men in big demand. Prepare now for big future. Lessons are easy to understand. Write TODAY for my FREE BOOK, "The Science of Aviation," and I will send it and write you a personal letter that will interest you. Address:

CAPT. GEO. F. CAMPBELL, Chief Instructor, National Aero Institute, 538 S. Dearborn St., Dept. 7444, Chicago



INSYDE TYRES Inner Armor for Auto Tires. Double mileage, prevent blowouts and punctures. Easily applied in any tire. Thousands sold. Details free. Agents wanted. Amer. Accessories Co., Dept. F3, Cincinnati

www.americanradiohistory.com

JOHNSON SMITH & CO.'S Annual Condensed PRICE LIST of FINEST FLOWER, GARDEN & VEGETABLE SEEDS

All prices postpaid to any address in the world.

Calabash or Pipe Gourds



A luxuriant and rapid growing climber; thrives anywhere. Produces the ornamental gourds from which the famous African calabash pipes are made. Grow this interesting vine and dry and prepare your own. Seeds, with instructions, 15c pkt., 3 for 40c.

Japanese Nest Egg Gourd



Very curious. Produces fruit same size & shape and color of nest eggs. Matured fruit does not crack. Will serve for years as a nest egg, stocking darner, or ornamental purposes, etc.

Seeds 15c pkt., 3 pkts. for 40c.

DEVIL'S CLAW



An ornamental plant, bearing beautiful flowers which are succeeded by large seed pods that, when young, are fine for pickling. They are delicious in soups, stews, etc., and make fine pickles. Pkt. 10c, 3 for 25c

Johnson Smith & Co., Chicago

Butterfly's Own Bush



This plant is a veritable refuge or haven for butterflies, and it attracts all the most beautiful types of butterflies to the neighborhood. Bees, too, are very fond of it. It is a pretty plant bearing pretty double flowers, ranging from white to rich crimson, deep red and pink, lilac and other delicate shades.

10 cents, 3 for 25 cents postpaid.

Shoo Fly Plant



A very remarkable Botanical curiosity you should have. Though quite odorless, flies will not remain in a room where it is grown.

Bears very pretty blossoms; blooms summer and winter. Grows rapidly from seed.

SEEDS 15c packet, 3 for 40c, postpaid.

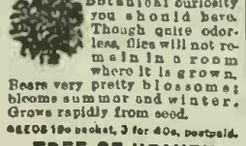
CROWN OF THORNS



A very curious and remarkable window plant, can be trained over any desired form. Bright scarlet flowers. An object of rare and striking beauty, easily grown. It grows wild in Judea, and it is said that it was from this plant that the crown of thorns was made which was worn by our Saviour.

Packet 10 cents, 3 packets for 25 cents

TREE OF HEAVEN



This splendid ornamental tree is a native of China, and is called the Tree of Heaven, on account of its great beauty. Very hardy, thrives in any soil, no matter how poor and grows from 6 to 10 feet high from seed the first summer. The leaves are from 8 to 5 feet in any length, giving it a grand appearance. Nothing outside the tropics will fit for lawn decoration. Large panicles of bloom, followed in season by great clusters of colored seed pods, make the tree a continual thing of beauty. Packet, 15c, 3 packets for 40c, postpaid. Johnson, Smith & Co.

The Trembling Vine



A beautiful annual climber with lovely feathery foliage, that trembles in the breeze, showing masses of tubular flowers of scarlet, pink and white. The effect in most charming, the tubular flowers contrasting effectively against the bright, delicate, fern-like leaves. For training upon a light trellis the Trembling Vine cannot be excelled. For window decoration, or ornamental work of every description it is very pretty indeed.

Packet, 15c, 3 pkts for 40c, postpaid.

PORTULACA



Very popular for edgings, rock work, &c. Flowers are large and double, colors very brilliant red, orange, white, maroon, yellow, and various other shades. A bed of Portulacas makes a truly magnificent sight. Blooms very profusely.

Packet 10 cents, 3 for 25 cents

The Fountain Plant (Amaranthus Salicifolius)



Finest of all Decorative Plants. It is quite a curiosity either for lawn or home decoration on account of its rapid and very vigorous growth. Bears long wavy racemes of curious drooping branches, tipped with orange, bronze and crimson. Grows very readily, succeeds anywhere. Greatly admired for table or window decoration. 15 cents per package.

CATCHFLY PLANT

An Effective and Efficient Substitute for Fly Paper



A great curiosity. Flowers are a beautiful white, red or pink that makes them very desirable as house plants, or may be cultivated in open garden. The surface of the bladder underneath the flower is covered with a sticky material. This is where it gets its name. Catchfly, and small insects and ants that climb up become entangled and lose their lives in the fruitless effort to get at the sweets. By picking the flowers, that bloom very profusely, and placing them in a vase in a room, you have a fly catcher that is more effective and pleasanter than fly paper. The flies are attracted to the plant, and thus it is a simple matter, by having flowers in each room, to keep the house rid of the pests. The plant seems to be endowed with remarkable intelligence, for it does not harm winged insects such as butterflies, because it is necessary to have the pollen of the flower carried from one flower to another, in order to cross-fertilize, as this cross-fertilization is what makes the flower "set its seed." SEEDS, 15c packet, 3 pkts for 40c, postpaid.

GROUND ALMONDS



Amazingly Prolific—Easily Grown From Seed

The Ground Almond has a flavor that is MOST EXCELLENT, resembling the cocoanut. The meat is snow white, covered with a dull ar skin of brown color. It grows close to the surface and anything from 200 to 300 Almonds may be expected from a single nut. There is no trouble whatever in growing anywhere and in any kind of soil. May be planted any time, and in eight or ten weeks after time of planting you will have an ENORMOUS CROP of the MOST DELICIOUS ALMONDS YOU EVER TASTED. Seeds 15c Pkt.

Perfume Plant



Blooms only at night, giving forth the most delightful scented fragrance for quite a distance. Causes much comment. For house or garden. Also valuable for use of perfume made from it. SEEDS, 10c pkt., 3 for 25c.

SENSITIVE PLANT



Marvel of the Philippines. Leaves curl, fronds droop when touched. Apparently resents interference.

A handsome shrub for house or garden; very curious and interesting. Seeds, 15c a pkt., 3 for 40c.

Chinese Fragrant Tree Fern



Just introduced. Noted for its rapid growth. An exceptionally pretty ornamental plant. Foliage is rich dark green. Forms grand pyramidal bushes about 6 feet high. Handsome; very desirable for decorative purposes, wreaths, etc. Seeds 15c pkt., 3 for 40c.

Weather Plant



NATURE'S WEATHER PROPHET

By mysterious changes that take place, this remarkable plant accurately forecasts the weather many hours in advance. Will grow anywhere all the year around. An interesting house plant. Bears large, fragrant, pink, butterfly shape flowers.

Seeds, 15c packet, 3 for 40c, postpaid

Tom Thumb Calliopsis



Very showy, low-growing, compact bush, covered with golden yellow flowers with deep crimson centers growing to a height of six inches. Seeds, 10 cents pkt, 3 pkts for 25 cents, postpaid.

FOXGLOVE



Produces long spikes of richly colored flowers, excellent for cutting. Particularly showy and desirable for use among shrubbery and in partly shaded spots. However, it will grow just as well in the open. Easy to cultivate, requires little attention, produces mass of flowers throughout the season. 10c pkt.

Early Blooming Mammoth Carnations



A wonderful strain, producing flowers two weeks from seed, at least 80 per cent of the flowers being double. All of the beautiful shades of carnations will be found in this assortment. 10c pkt, 3 pkts for 25c, postpaid.

Electric Light Plant



Remarkable curiosity, grows to the height of four feet, covered with large spikes of flowers six to eight inches long, in lovely shades, pure white at base and rose to bright red at top of flower. 10c pkt.

BRUSSELS SPROUTS



Miniature cabbages formed on the stalk of the plant. Delicious eating when cooked. Boiled like cabbage or cooked in cream same as cauliflower. The plants are grown in rows two feet apart and the sprouts in the row. Packet, 10 cents, three packets for 25 cts, postpaid.

CANARY BIRD VINE



Highly ornamental creeper with beautiful cut leaves and pretty, delicate flowers of a canary yellow, bearing a striking resemblance to a canary bird with wings half expanded. Makes a desirable window decoration. Grows up to twenty feet high.

Packet, 10 cents, three for 25 cents.

BALLOON VINE



"Love in a Puff." Ornamental, rapid growing, climbing vine, producing pretty white flowers, followed by remarkable seed vessels or inflated membranous capsules that look like small balloons. Packet, 10 cents, three for 25 cts.

BRILLIANT POPPY MIXTURE



Collection is made up of all varieties that will give a constant bloom from early until late in the season.

One of the easiest flowers to grow, and for a variety of colors nothing can compare with the delicate form and color of these blooms. Packet, 10 cts, three packets for 25 cents, postpaid.

Giant Climbing Nasturtiums



For covering trellises, fences, arbors, &c., and other places to be hidden. Very strong and vigorous, with large, dark green foliage, producing great quantities of giant flowers of all colors. Packet, 10 cents, three packets for 25 cents, postpaid.

ORANGE KING MARIGOLD



Fine type of Marigold, bearing dense double flowers of a rich, deep golden-orange color. Very desirable for cut flowers. Grow anywhere, blooming profusely and continuously.

Pkt, 10c, three pkts for 25c, postpaid.

The Great Japanese Umbrella Palm

A Graceful House or Conservatory Plant

Easily Grown From Seed Winter or Summer



The Japanese Umbrella Palm is a semi-aquatic plant. It is easily grown from seed either in a bowl of water or in very damp soil. Probably the most usual, as well as the most interesting method, is to cultivate the plant in a bowl or jardiniere filled with water, with two or three inches of good garden soil at the bottom. The seeds soon commence to germinate, and the plant shoots up stems two to three feet high and rapidly assumes a most pretty palm-like appearance, as shown in the engraving. The tops of the stems are surmounted by a whorl of umbrella-shaped leaves, of a waxy appearance. We will send a package of this seed, with full instructions for culture, for only 15c or three packets for 40c postpaid.



VINE PEACH VEGETABLE ORANGE OR MANOO MELON



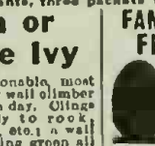
One of the best of all vegetables. Resembles oranges in color, shape and size; grows on vines. Presents a most tempting appearance when canned; makes delicious preserves and sweet pickles, and fine for pies. Nothing like them; grows from seed in 80 days; enormously productive; can be used in every way as the peach, but not quite as sweet and not used raw. Packet, 10 cents, three packets for 25 cents, postpaid.

Boston or Japanese Ivy



Fashionable, most hardy wall climber of the day. Clings tightly to rock, brick, etc., a wall of living green all summer, turning in autumn, to a flaming, gorgeous crimson. SEEDS, 10 cents packet, three packets for 25 cents, postpaid. J. S. & Co.

FAMOUS MEXICAN FIREFLY PLANT



Beautiful hedge plant, grows 8 to 10 feet high and resembles a closely clipped ornamental evergreen. The globe-shaped or pyramidal bushes are close and compact, and of a pleasing light green color. May be grown singly or in the form of a hedge or background. In early autumn the whole bush becomes carmine or blood red, hence its name of Mexican Fire Plant, or "Burning Bush," as it is sometimes called. Selected seeds, 10c packet, three packets for 25 cents.

The Matchless Dwarf Giant Tomato



A magnificent variety. Grows about two feet high, very strong and produces large sized fruit; larger than any other dwarf tomato. The fruits grow in large clusters and weigh from 9 to 12 ozs. each. Flesh is firm and solid, no core, delicious flavor; almost seedless. Pkt., 10c, 3 packets for 25c, postpaid.

Grand Rapids Lettuce



Easiest variety of all to grow the finest flavored on the market. Produces an abundant crop of green leaves, which retain their sweet flavor even after it has become quite old. Makes a practical substitute for lettuce. A single packet will keep your family supplied the whole season.

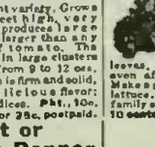
10 cents packet, 3 packets for 25 cents

Bouquet or Red Cluster Pepper



The Peppers are a very pretty coral red color, formed in clusters of from 12 to 30 on the upright fruits to each cluster. Very hot and pungent. Unusually prolific, the small but compact bush being literally covered with cone shaped fruit. An enormous crop produced; still keep for use all through winter. Elegant for borders or with pot herbs. SEEDS, 10c pkt., three packets for 25 cents, postpaid.

Salsify or Oyster Plant



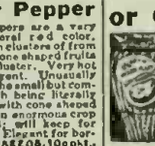
One of the most delicious vegetables; gets its name from the similarity of its flavor to oysters, frequently hard to tell the difference. Exceptionally wholesome, nutritious, satisfying. A very hardy plant that can be left in ground all winter and dug as needed when ground thaws. 10 cents packet, three packets for 25 cents, postpaid.

The Giant Spider Plant



A very remarkable and curious plant. Derives name from peculiar shape, the long, curving stamens suggesting spiders. Flowers are a deep, purplish pink when they first open, but fade to light pink. Seeds, 10c packet, 3 pkts. for 25c.

Mixed Squash Seeds



You will get all the different shapes, freaks, colors and sizes imaginable. A dozen different varieties included, early and late; you will derive much pleasure from their cultivation.

Mixed Seed, 10c, 3 packets for 25c.

Giant Crookneck Summer Squash



Selected strain of this delicious vegetable. Produces fruit nearly double the size of the old standard "Crookneck." Plants are bushy and compact. Fresh, rich, golden yellow; quality and flavor is unsurpassed. Grow readily in almost any soil.

Packet, 10c, 3 packets for 25c, postpd.

White Velvet Okra



Most delicious vegetable that is very fashionable and popular. Is easily grown. The pods are used for soups and stews. Noted for its fine flavor and tenderness.

Pkt., 10c, 3 for 25c, postpd.

New Japanese Giant Radish



The great Sakurajime Radish from Japan. The largest radish grown, often attaining the enormous weight of 15 pounds, and sometimes 20 or 30 pounds. Not merely a curiosity, but a radish of extraordinary quality. The flesh is solid, firm and brittle, and of most excellent flavor. Will grow or thrive in any soil or climate.

Packet, 10c, 3 pkts. for 25c, postpaid.

New Garden Huckleberry

Grows from seed first year. A new fruit that can not be excelled for Pies. Very prolific, yielding an immense crop of fruit. Grows and thrives in all climates and on all kinds of soil. The fruits grow larger than the common Huckleberry or Blueberry. If cooked with apples, lemon or anything sour, they make the very finest jelly.

Pkt. 10c, 3 for 25c. p.pd.

APPLE PIE MELON

A wonderful novelty that you will find a delight in cultivating. Vine and fruit are similar to a watermelon. Has a most delicious flavor, resembling the flavor of apples. Each vine produces 6 to 18 bushels of melons, producing on an average about 900 pounds of fruit. One melon will make as many pies as a half bushel of apples. Flesh is white and solid and of excellent quality for making pies, sauces, preserves, etc. They keep fresh and solid all winter, so can be used when wanted, and, owing to their value as stock food, any surplus not used for home cooking can be fed all winter to stock; in fact, it will pay to raise them for this purpose alone. Packet, 10 cents, three packets for 25 cents, postpaid.

Japanese Pop Corn

Nothing delights the children more. When well popped it becomes nearly twenty times its natural size. In the long winter evenings it keeps the children amused for hours watching the kernels burst into white balls, that are as light as a feather. Every family will enjoy planting it and caring for it and watching it grow.

Packet, 10c, 3 packets for 25c.

Banana Musk Melon

Quite a curiosity. Looks and smells like a banana. Peculiar shape and its delicious flavor make it well worth your while cultivating. Flesh is deep and of exquisite flavor. Very high prices are obtained in choice city markets, as high as a dollar sometimes being demanded for one single specimen.

Packet, 10c, 3 pkts. for 25c.

LUCCULAS SUMMER SPINACH

Two distinct vegetables from the same plant at the same time. The leaf portion of the foliage is cooked and served in the same manner as spinach; the stalks are delicious when cooked and should be served in the same manner as asparagus.

Packet, 10c, 3 packets for 25c.

Giant Asparagus

A few stalks of this rich and delightful vegetable on toast, or served with drawn butter, will make the greatest epicure punctuate each bite with a smack of satisfaction. One of the grandest table luxuries that you can buy. Has delicately tender stalks with exquisitely delicious flavor.

Packet, 10c, 3 pkts. for 25c.

Early Chantenay Carrots

Very tender and delicious, one of the best early Carrots in existence. Grow about 6 in. long, are stump-rooted, very smooth, deep red fine grained sweet and sugary and not apt to crack open while growing. Unsurpassed for table use.

Packet 10c, 3 pkts. for 25c, postpd.

Chicago Pickling Cucumber

Undoubtedly the best cucumber for pickles. It meets the most exacting requirements of the most critical pickle makers, who supply fancy and highest priced goods to the market. The vines set fruit when young and continue bearing longer than other varieties.

Packet 10c, 3 pkts. for 25c postpaid.

Giant Pascal Celery

Stalks are very large and solid, crisp and of rich, nutty flavor. Blanches easily and quickly. The heart is golden yellow and has a very attractive appearance.

Packet, 10c, 3 packets for 25c.

Chinese Giant Pepper

Very prolific for so large a pepper. Flesh is unusually thick, mild flavor and makes a very fine salad, sliced and served like tomatoes. Glossy scarlet.

Packet, 10c, 3 pkts. for 25c.

Jerusalem Cherry

A miniature tree that bears red and green berries continually in winter and summer. Foliage is always green. The fruit, however, is not edible. Especially fine for ornamental purposes.

Packet, 10c, 3 for 25c postpaid

Garden Lemon

An enormous yielder, cultivated much the same as Musk Melon. Has a most desirable acid flavor, thus dispensing with sliced lemon. Unexcelled for general canning purposes.

Packet, 10c, 3 packets, 25c.

Snake Cucumber

Curious as well as useful. Elegant for slicing when quite young. Coils like a serpent up to 7 feet in length. A novelty well worth cultivating.

Packet, 10c, 3 packets for 25c.

Dusty Miller

One of the prettiest of ornamental leaved plants. The leaves are white and are beautiful for vases, edgings, ribbons, or mixed with cut flowers.

Packet, 10c, 3 pkts. for 25c.

A few other reliable seed novelties you should cultivate. *All 10c per packet, p.pd.*

FLOWER SEEDS

Imperial Sweet Sultan
Forget-Me-Not
Ornamental Cotton
Scarlet Runner Bean
Evening Primrose
Mixed Tall Nasturtiums
Passion Flower Vine
Fuchsias
Little Blue Star
Wall Flower
Sweet Alyssum
Grandiflora
Harvest Moon Vine
Candytuft
Armeria
Cosmos (Mixed)
Pulse Dragon Head
Sunflower
Cardinal Climber
Columbine
African Marigold
Baby Golden Glow
Dianthus
Hybrida Superba Calliopsis
Carnation Poppy
Gruwelia
Dwarf Nasturtiums
Sundial Flower
Canterbury Bells
Satin Flower
Angel's Breath
Large Flowering Verbena
Everlastings
Joseph's Coat (Amaranthus)
Everlasting Sweet Pea
Giant Sweet Pea
Butterfly Pea
Bouquet Stocks
Lobelia
Heliotrope
Prize Balsams
Sweet William
Four O'clock
Hibiscus (Marsh Mallow)
Tobacco Plant

VEGETABLE SEEDS

Georgia Collards
Whitleaf Chicory (or French Endive)
Corn Salad
Kohl Rabi
Emerald Isle Kale
Tom Thumb Pepper
Moss Parsley
Enormous Peas
Snowball Cauliflower
Kentucky Wonder Climbing Bean
Giant Crimson Rhubarb
Golden Bantam Sweet Corn
English Vegetable Marrow
Large Red Wethersfield Onion
Emerald Gem Musk Melon
Tree Egg Plant
Marrow Fat Parsnips
Swiss Chard
Turnip Rooted Celery
Mammoth Pumpkin
Italian Leek
Breakfast Radish
Long Scarlet Radish
Oyster Kadire
Mammoth Prize Tomato
Red Peach Tomato
Water Cress
Curled Garden Cress
Grape or Cluster Tomato
Prize Radish
Mixed Table Carrots
Extra Early Pea
Coffee Berry
Earliest Watermelon
Luscious Table Beet
Egyptian Winter or Tree Onion

Nitto's Plant & Flower Food changes ill-nourished plants into Luxuriant Beauties, producing masses of blooms that will equal any. Causes plants to bloom early and ahead of others. Friends marvel at Success. Brings out New Foliage and Flowers, and causes a Marvelous Transformation. Pkge. 15c, 3 for 40c.

JOHNSON SMITH & CO., Dept. E5, 3224 N. Halsted Street, CHICAGO

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com



JAPANESE ROSE BUSHES

The Wonder of the World

Japanese Rose Bushes **bloom all the year round.** Just think of it. Six weeks after planting the seed, the plants will be in **full bloom.** It may not seem possible, but we positively **guarantee it to be so.** They will **bloom every ten weeks,** Summer or Winter, and when three years old the bush will be a **mass of roses,** bearing from 5ve hundred to a thousand roses on each bush. The flowers are in three shades — white pink, and crimson. The plants will do well both in and out doors We guarantee at least three bushes to grow from each packet of seed. **Price, 10c** packet, 3 pkts. for **25c** postpaid.

10 Cts.

SCARLET FLAX



Showy annual for flower beds and masses, brilliant crimson scarlet flowers, great profusion. Blooms very quickly.

Packet, 10 cents, 3 packets for 25c p.pd. Johnson Smith & Co.

PYRENTHRUM



Large, very bright and showy, very much like daisies and asters. Colors range from white, light pink, to deep red, with bright yellow centers. Flowers are 3 or 4 inches across. One of the best plants for edgings, or for cut flowers, on account of its beautiful yellow foliage. **Packet, 10c, 3 for 25c. Johnson Smith & Co.**

GIANT ZINNIA



A very showy annual. Flowers retain their beauty for weeks, and a profusion will be produced until frost. As double and as brilliant as Dahlias.

Packet, 10c, 3 pkts. for 25c, postpaid.

ICE PLANT



Very fine, effective basket plant. Foliage is very ornamental, being covered with ice-like globulies, prized for garnishing. Valuable plant for dry, sunny situations on banks, rockwork, old walls and ruins, etc., also for sunny borders. Peculiarly brilliant in sunshine.

Packet, 10c, 3 pkts. for 25c, postpaid.

CIGAR PLANT



A very fine genus of plants, remarkable for their beauty, freely blossoming ornamental appearance. bears large numbers of tube-shaped flowers of a bright scarlet color with white and purple ends. Always in bloom, cultivated indoors or outdoors. Good for bedding and hanging baskets; very desirable pot plants. **Packet, 10 cents 3 pkts. for 25c p.pd. Johnson Smith & Co.**

Torch Lily or Flame Flower



Has quite a variety of names, the most common of them being "Torch Lily," "Red Hot Poker," "Flame Flower," etc. Flowers are borne in compact form on stout 3 and 4 foot stems, having the appearance at a distance of orange and scarlet tinted cacti.

Pkt. 10c, 3 pkts. for 25c, p.pd.

NICOTIANA



Beautiful annual with sweet scented, large, star-shaped flowers. Blooms very profusely throughout the summer, affording a continuous display of brilliant flowers, flowers are nearly as large as a Petunia, and many are delightfully scented

Packet, 10c, 3 packets for 25c, postpaid

MIXED GERANIUMS



Have no rivals; when a show of colors is desired none can surpass them. Grow readily from seed and their foliage makes them the most desirable plants for house or pleasure ground. Nothing better for baskets, bouquets, vases, etc. Colors include various shades of crimson, scarlet, pink, rose, salmon, blush, white, etc. **Pkt., 10c, 3 pkts. for 25c, p.pd.**

Giant Empress Cockscomb



Very handsome either for pot plants or specimens in beds, where they excite the curiosity of visitors more than almost any plant that can be grown. Very desirable for growing indoors; grow in pots practically all winter Colors, brilliant scarlet, crimson, rose, orange, bright yellow and lemon. **Packets, 10 cents, three packets for 25 cents, postpaid.**

RAINBOW CORN



A charming grass that forms an object of great beauty in mixed beds and borders or planted in groups on lawns. Leaves are striped yellow, green, pink and rose. Not unlike maize or corn in growth. **Packet, 10c, three for 25c.**

PAMPAS GRASS



Comes from South America; very pretty ornamental grass, producing the most beautiful silvery plumes. Very tall and stately, and can be cultivated in this country; a very pretty table decoration, and can be cultivated in pots. **Packet 10c, three packets for 25 cents, postpaid.**

Celosia Spicata



Very pretty and unique variety of Cockscomb family. Introduced from India; bears countless blooms of silver white, with rich carmine tip. Easily cultivated; grown in or outdoors. Blooms practically the antire year if properly cared for **Packet, 10 cents, three packets for 25 cts. postpaid. J.S. & Co.**

THE REMARKABLE FIREFLY PLANT Blooms at Night

Fills the Atmosphere with Fragrant Aroma



One of the most rapid growing vines known. Under favorable conditions this vine has been known to grow OVER 26 FEET IN A SINGLE WEEK. In a very short space of time indeed the Vine has climbed to a great height, and is covered with IMMENSE FLOWERS, from 6 to 7 inches in diameter It is, indeed, a great novelty, for, unlike other plants, the flowers OPEN IN THE EVENING, and remain open until about noon the following day. In dull weather they will remain open all day. It is a most INTERESTING SIGHT to watch the opening and closing of the flowers as the clouds appear and disperse. As the flowers open they give forth the most DELIGHTFUL AROMA and the whole atmosphere around is full of scented fragrance. It is always the object of favorable comment, and much curiosity is aroused by people passing at night time as to the cause of the charming aroma, frequently stopping in an endeavor to satisfy their curiosity **PRICE, 10 CENTS packet, two packets for 25 CENTS, POSTPAID.**

Mammoth Peanuts



Peanuts can be easily cultivated. Their culture is very simple and exceedingly interesting. Mammoth Peanuts grow to an astonishing size. It is a good producer, very prolific, and the giant nuts have a thick, heavily ribbed protecting shell. The plant is very attractive, the leaves being of odd shape and a handsome green shade, tinted through the center with white. You will derive much pleasure cultivating this interesting species. **Seeds 10c skt., 3 pkts. for 25c**

Monster Mixed Petunias



No flower garden is complete without a bed of Petunias. Few plants can compare with them for beauty. Bright yellow centers, Flowers are 5 or 6 inches across. One of the best plants for edgings, or for cut flowers, on account of its beautiful yellow foliage. **Packet, 10c, 3 for 25c. Johnson Smith & Co.**

DAHLIA



One of the most beautiful of all flowers. If seeds sown early in the spring will bloom the first year. Our seed is of the finest strain, and produces large flowers of the richest shades. **Packet, 10c, 3 packets for 25c, postpaid.**

Johnson Smith & Co., Chicago

LARKSPUR



Remarkable for beauty, diversity of shades and decorative qualities. Blossoms are of immense size, single, double and semi-double. The colors range from white and lavender through every shade of blue, some having several shades on stem. Very effective in borders and planted among shrubs. The graceful spikes of bloom are much valued for vases. **Packet, 10c, 3 pkts. for 25c p.pd.**

SNAP DRAGON



Charming old fashioned flower. They have dark and glossy leaves and curiously shaped flowers, with finely marked throats. Bloom the first season. Splendid for borders, bedding, pot culture for house decoration, and are largely forced during the winter for cut flowers. Their delicious fragrance renders them extremely well adapted for cut flowers. **Packet, 10c, 3 pkts. for 25c, postpaid**

California Poppy



The state flower of California. A very attractive annual for beds, edgings or masses. Flowers profusely, foliage fine cut and of bluish color. The flowers are very large, measuring about three inches across, of a canary yellow color with a blotch of golden orange at the base of each petal. Valuable for bedding; from seeds sown in the spring they flower profusely until late in the autumn. **10 cents packet, 3 pkts. for 25c, postpaid. Johnson Smith & Co.**

Periwinkle or Old Maid Flower



Does well in bright sunshine; the drier and hotter the summer is the more the plants flower. A handsome bushy plant with glossy foliage. Blooms the first season. As bedding plants for the garden they rival the Geranium. They make very attractive pot plants. White, pink and mixed.

Packet, 10c, 3 pkts. for 25c postpaid.

COLEUS



For indoor decoration, for the adornment of the greenhouse or sitting-room, the Coleus plants are in the greatest demand. Will grow indoors all through the winter. You can grow them outside, and by taking a few slips, you can start them in pots and they will grow without the slightest trouble. Some of the combinations are very gorgeous. **Pkt., 10 cts, three pkts. for 40 cts, postpaid.**

STOKESIA, or CORNFLOWER



Very handsome, resembling Asters in appearance. Flowers are rich blue, like a giant cornflower, while others include charming shades of lavender, violet, white, and a new pink variety. **Packet, 10 cents, three packets for 25 cents, postpaid.**

Angel's Trumpet



Lovely garden plant, bearing enormous lily-like blossoms on five seven in. across and a foot in length, like a tremendous trumpet, some white as snow, others purple, some golden, others white bordered with lilac. Exceptionally fragrant; a single plant in bloom will scent up a whole lawn or garden. **Packet, 10c, three packets for 25c, postpaid.**

African Daisy



Remarkably handsome annual; forms bushes two feet high Foliage is of a soft downy, of whitish color; flowers, borne on long stems, rising well above foliage, large and showy. Flowers last for over a week when cut. **Packet, 10 cents, three packets for 25 cents, postpaid.**

"Tiger" Flower



Handsome and showy plant, easily cultivated; flowers are large, reddish brown, with golden yellow tiger-like markings, hence its name. Produces an abundance of bloom, in fact the plant is never out of bloom.

Packet, 10c, 3 packets for 25c.

Moss Verbena



Spreads over the ground, forming a carpet of lovely moss green, above which the delicate clusters of purple-blue or pure white blossoms are borne in great profusion. Delicate fragrance when cut.

Packet, 10c, 3 pkts. for 25c.

SURPRISE FLOWER GARDEN Over Hundred Varieties of Mixed Flower Seeds

MANY RARE AND CURIOUS NOVELTIES

An Abundance of Flowers Assured Throughout the Season



A mixture of easily grown annuals that bloom very soon after sowing the seed; others vary in their time of blooming. Those who cannot give the constant care necessary for finely arranged flower beds will be delighted with the Surprise Wild Flower Garden. Will prove a continual surprise and pleasure, as new varieties and the old garden favorites flower successively throughout the season. There are over a hundred varieties of seeds. Many of the plants may be taken inside as house plants and will bloom during the winter. Fine for children, also teachers for school gardens. **Packet, 10 cents, three packets for 40 cents, postpaid. J. S. & CO.**

JOHNSON SMITH & CO., Dept. E5, 3224 N. Halsted St., CHICAGO (OVER)

TEXAN PRIDE PHLOX



Charming, hardy annual. Colors are very rich, bloom of very long duration, rendering them a most desirable acquisition. Very beautiful for bouquets. Colors vary from pure white to deep crimson. Once planted require no further attention for several years. **Packet, 10 cents, three packets for 25 cents, postpaid.**

LOVE IN A MIST



Borrounded with beautiful webbing, feathery foliage. The flowers are very curious looking, having pods in the center. The charming pods in the center. The charming combined effect, no doubt, accounts for name. **Pkt., 10c, 3 pkts. for 25c, postpaid.**

White Gem Feverfew



A fine, old-fashioned bedding or border plant, always in flower. Blooms quickly. Grown outdoors in summer and indoors in winter. A fine pot plant. Grows a foot and a half high. Stems are literally covered with very double, pure, snow-white and golden-yellow flowers. *All the year round* **Packet, 10c, 3 pkts. for 25c, postpaid.**

Chinese Wistaria



For trellis, porches, arbors, trees or buildings, is magnificent when in bloom, bearing long clusters of purple flowers. Luxuriant and rapid growth. Flowers early in long, drooping racemes, resembling a bunch of grapes.

Packet, 10c, 3 pkts. for 25c, postpaid

SCARLET SAGE



A bed or border of Scarlet Sage is always a complete attention. Nothing can equal the gorgeous effect of a bed of Scarlet Sage when in full bloom. The large, flaming masses of scarlet bloom against green surroundings of lovely foliage is matchless. Grown in almost any position; flower on the walk or in borders. Also add to the attractiveness of a shrubbery if planted in clumps in the vacant spaces. The various shades of green and the blending scarlet have a most pleasing effect. Fine pot plants. **Pkt., 10c, 3 pkts. for 25c, p.pd.**

LANTANA



Showy and shrubby bedding and basket plant with Verbena-like flowers in shades of white, red and yellow. Very agreeable aromatic perfume. Rapid-growing, constant-blooming, excellent for growing in pots or for garden decoration. **Packet, 10c, 3 packets for 25c, postpaid.**

Bachelor's Button



Everlasting flower, globe shaped, useful for dried winter bouquets. Retain their color the whole winter. Also good for fresh cut flowers. Endures drought well; succeeds in any soil.

Pkt., 10c, 3 pkts., for 25c pp.d.

Black Eyed Susan



Beautiful trailing plant for hanging baskets, large vases, low fences, verandas, rustic work or green-house decoration. Flowers are orange, white, buff, etc. Height, 6 ft.

Packet 10c, 3 pkts. for 25c, postpaid

Wild Cucumber Vine



Rapid climbing vine reaches height of 30 feet in a season. Clusters of white scented flowers followed by an abundance of ornamental, prickly seed pods that are most interesting to children who like to see them burst. Left on the vine the seeds burst of their own accord and falling to the ground come up the following season. Ideal for trellises or places where a dense shade is desired. **Pkt, 10c, 3 pkts. 25c.**

Jap Virgin's Bower



Most beautiful of all flowering vines. Flowers are white, 5 to 6 inches across, are borne in great wreaths and clusters. The colors are rich royal purple, white or and pearly-white.

Packet, 10c, 3 pkts. for 25c, postpaid

Gorgeous Giant Pansies



These lovely flowers are favorites, not only for their brilliancy and variety, but for the durability of their bloom and the wonderful range of color and marking. A great diversity of all the very best giant and gorgeous varieties. Colors range through all the shades known in Pansies. Wonderful combinations; many of them are rare and new. **Packet, 15c, 3 pkts. 40c, postpaid.**

Asparagus Sprengeri



The best plant for hanging baskets. Masses of lush, gleaming foliage drooping in a very graceful manner. The foliage when cut for decorative purposes will last for weeks in water. The seed pods are very pretty red berries adding to its beauty. **Packet, 10c, 3 pkts. for 25c, postpaid**

Fire on the Mountain

A magnificent plant after the Poinsettia variety. Called "Fire on the Mountain," on account of deep fiery scarlet leaves. The plant presents a darling ray of green and scarlet leaves; effect is very startling. Very showy in the garden, or mixed with cut-flowers for bouquets. **Packet, 10c, 3 pkts. for 25c, postpaid.**

Snow on the Mountain

Beautiful plant for borders or beds. Beautiful leaves, veined and margined with white; pretty white flowers and has appearance of snow from a short distance. **Pkt., 10c, 3 pkts. 25c, postpaid**

Japanese Climbing Cucumber

Unpeelably strong and vigorous growing vine; grows twice the size of ordinary varieties, growing readily on fences, poles, trellises, etc. One hill will keep an entire family supplied all summer.

Seeds 10c, 3 pkts. for 25c.

Ostrich Plume Cockscomb

Unique variety of Cockscomb. Develops great, feathery plumes early in the season; grows like a pyramid, about 2½ ft. high. Can be cultivated in pots. Will bloom practically through the winter.

Packet, 10c, 3 packets for 25c, postpaid.

The Great Wonderberry

A luscious berry that may be grown and ripened from seed in any soil or climate in 3 months. The flavor is fine and unsurpassed for eating raw, cooked, canned or preserved in any form. The fruit is blue-black in color, and tastes like a luscious, rich blueberry. One bush will produce an enormous amount of fruit, yielding great masses of rich fruit all Summer and Fall.

Packet, 10c, 3 pkts. for 25c, postpaid.

Bush Musk Melon

A vineless Musk Melon, grows in bushes, and thus can be cultivated in the smallest garden. The fruit, is of the popular "Jenny Lind" type, but larger, averaging 6 inches in diameter. The flesh is very deep, edible almost to the rind and is colored light green, flushed with salmon toward the center. The quality is superb, luscious, sweet and juicy. Packet of seeds, with full directions for culture, **15 cents, 3 packets for 40 cents, p.pd.**

SUNBEAM GLADIOLUS

Makes a magnificent show in the flower garden or on the lawn. Bears 20 to 60 grand flowers to each stalk. Flowers beautiful beyond description; the colors are gorgeous and markings marvelous. Lend themselves to artistic decoration; from a decorative standpoint are simply exquisite. Bloom early and profusely. **Pkt., 10c, three pkts. for 25 cents, postpaid.**

MIGNONETTE

Mignonette is French for "Little Darling," that typically describes this dainty little flower. Very sweet scented; fragrance makes it indispensable for bouquet and cutting. **Pkt., 10 cts, 3 pkts. for 25 cts, postpaid.**

CACTUS FROM SEED

Very curious, odd looking, strange species of plants; will grow anywhere with little or no care. Flowers are of exquisite beauty and delightfully fragrant. You will be astonished at the odd looks of the Cacti just sprouting. **Packet, 10 cents, three packets for 25 cents, postpaid.**

APPLE BALSAM

Ornamental, quick growing climber, is grown mostly for the effect of the fruit, which is yellow; looks not unlike an apple, hence its name. When ripe stop seeds and shows the seeds and blood-red interior. **Pkt., 10c, three packets for 25 cents, postpaid.**

PANSY-VIOLETS

Produces beautiful Pansy-like blossoms of the most delightful colors, including blue, black, rose, purple, lavender, maroon, all-yellow, gray, crimson, orange, white, lemon, etc., while some are striped, edged and spotted. Many are very fragrant. It is hardier than the pansy and blooms for a longer period. Planted in masses they form perfect mats covered with myriads of flowers.

Packet, 10 cts, 3 for 25 cts. J. S. & CO.

WIND FLOWER

Beautiful Irish Poppy-flowered varieties produce in abundance large single, semi-double and double flowers in an endless variety of colors. Some are mottled, striped, fringed, etc. For cutting they are fine. **Packet, 10 cents, three packets for 25 cents, postpaid.**

Allegheny Vine or Mountain Fringe

Very graceful and hardy climbing vine. Feathery foliage is like the Maidenhair Fern. Bears pretty rose-pink and white tubular-shaped flowers. Nothing better for covering fences, trees, tree stumps, etc.

Pkt., 10c, 3 pkts. for 25c, p.pd.

Japanese Morning Glory

A new mammoth class of noble flowers. Grows 20 ft. by midsummer. Rich, dark green leaves, marbled a silvery white and yellow. Giant size flower, and continues in bloom until destroyed by frosts. The colors are exceptionally rich and flowers as large as teacups.

Pkt., 10c, three packets for 25c, postpaid.

Enormous Prize-Medal Cabbage

Enormous "Prize Medal" Cabbage grows to enormous size and quality any other variety on the market. Grown for us by a specialist in cabbages. Has been known to reach the enormous wt. of 60 to 90 pounds per head, with a diameter equal to that of a bushel basket, while 30 lbs. per head is by no means rare. If you wish to have the finest tasting as well as largest in the whole neighborhood, try a package, and you will not be disappointed.

SEEDS, 10c packet, 3 packets for 25c.

"Wong-Bok" Chinese Cabbage

Novelty from China and should be be grown in every garden. Seems to be a cross between Celery and Cos Lettuce. Flavor is more mild than any other cabbage. **Can be served** on the table and eaten raw or cooked like cabbage, spinach or lettuce or made into salad. Grows very rapidly, easy to cultivate. You can create quite a sensation by cultivating this remarkable novelty. Seeds, 15c packet, 3 pkts. for 40c.

Butterfly Flower

Sometimes called Poor Man's Orchard. Forms compact plants literally covered with countless beautiful orchid-like flowers, all delicately fringed and curiously marked with crimson, lilac, purple and yellow, resembling butterflies in their bewildering range of color. **SEEDS, 10 cents, three packets for 25 cents, postpaid.**

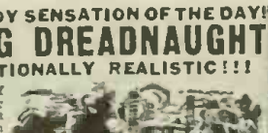
Ever Blooming Hollyhock

Hardy garden flower, blooms from seed the first season; flowers often measure five inches across, with a great variety of beautiful shades and tints. They bear pyramid-shape spikes of large flowers somewhat like rosettes. Continuously covered with large flowers. **10 cents, three packets for 25 cents, postpaid.**

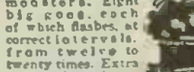
JOHNSON SMITH & CO., Dept. E5, 3224 N. Halsted St., CHICAGO (OVER)

GREATEST TOY SENSATION OF THE DAY!
FIGHTING DREADNAUGHT
SENSATIONALLY REALISTIC!!!

Here is a model of Uncle Sam's fighting monsters. Eight big guns, each of which flashes, at correct intervals, from twelve to twenty times. Extra ammunition always obtainable. Absolutely harmless. Can be operated indoors or out. Now boys! Here's your chance to see a battleship in action, and the best of it is you can OWN the ship and command the grim monster! By navigating two of more Battleships, you can stage an EXCITING NAVAL BATTLE in your own home. Price complete with Searchlight and Ammunition, 25c, three for 60c, or a fleet of 5 ships for $1.20 postpaid. Extra ammunition, 5 cents per pkt.



TOOTH-ACHE STOP



Stops the Pain, Stops the Tooth

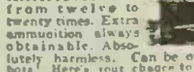
Squeeze a little on surface of tooth; the Ache Stops instantly, the pain's hardest. Formula used in septic Filling. Absolutely harmless. Have it ready for the next tooth-ache. 25c per tube, postpaid.

Mysterious Ghost



This is not a pretty object, but there is fun in it for people who like practical jokes. The Ghost will be displayed in a perfectly darkened room, where a ghastly pale bluish radiance, very spooky indeed, will be seen when you show all about it, but a regular starter for those who come upon it unexpectedly. A great joke to play on your mother-in-law. Price only 15 cents each, or three for 40 cents.

"SAFETY 1st" PINS



A clever novelty. The National Safety First Movement has made them very popular. Your coat, vest or shoe pop promptly with the movement of the hand for wearing a reminder to strangers and the like. Two sizes, both gold plated and 14k in enamel colors. Be sure, two for 10c postpaid.

INKLESS PENNANT PEN

WRITES with WATER One pen does you die. Makes its own ink. Write fashionable violet color. Better and cheaper than fountain pens. Writes a long letter with one dip in plain water. No trouble—no bother—no mess. A pleasure to use. With Nickel Plated Reservoir Holder 10 CENTS. 3 for 25c

SIMPLEX TYPEWRITER ONLY $2.50



Cheap But Good. So Simple a Child Can Use It. We Guarantee the Writing.

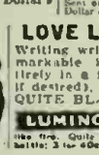
Though an unpretentious little machine, the Simplex is a thoroughly practical Typewriter, in every respect to that of any $100 machine. It does not merely promise at the price, but will positively do more and turn out better work in less time. It is so simple that a child just able to read can write with it. You can learn all there is to know about it in FIVE MINUTES, and an hour's practice will make you an expert operator. Every business man must have a typewriter. It is highly profitable to do so, as it creates a favorable impression that the firm is a commercial and up to date concern. We desire to say that the Practical Typewriter fully deserves its name as it is fit to do the correspondence of any business or professional, and to any part of the world. You should not miss the chance of getting a bargain. The letters of the alphabet, the numerals 1 to 10, and punctuations marks are arranged that the operator must touch the proper key in rotation, one after the other, each time, enabling him to write rapidly. The rollers hold the paper in position while writing and at the end of each line a slight turn of the roller moves the carriage which makes a click and carries the paper forward, giving the proper line spacing so that the lines are all an equal distance from each other, as desirable in letter writing. Each key operates a separate bar, with full printed letters on face of key. Size of machine when closed, 12 inches long, 6 inches wide, 3 inches high. Weight, 4 pounds. Sent by express only. Price $2.50. Johnson Smith & Co., Dept. E 6, 3224 N. Halsted St., Chicago

INVISIBLE INK



The most confidential messages can be written with this ink, for the writing MAKES NO MARK. Cannot be seen unless you know the answer. The ability for many hours. Very necessary to all amateur and private members. Contains enough for many pages. Great fun for playing practical jokes. Only 15c bottle; 3 for 40c postpaid.

LOVE LETTER INK



Writing written with this remarkable ink vanishes entirely in a few weeks (sooner if desired), leaving the paper QUITE BLANK. 15c p. pd.

LUMINOUS INK Writing can be READ like fire. Quite invisible at daytime. Very handy for love letters. Only 15c bottle; 3 for 40c postpaid. ONLY IN A DARK ROOM. writing shines

JOHNSON SMITH & CO.

MULTIPLYING BILLIARD BALLS
The Best Feat of its Kind



This trick is as startling as it is surprising. The performer hands around the ball for examination, and upon receiving it returned to him he seizes it by the tips of his thumbs and fingers and a second ball mysteriously appears. These are held in full view of the audience by the tips of the fingers of the left hand, and even while being placed in position, another ball mysteriously appears. Finally the magician apparently suffers from some kind of spasm and yet another ball is the result. The feat can then be reversed, the balls disappearing one after another until none remains. The whole interesting trick that is quite easily performed by following the directions that accompany the apparatus. Complete, 25 cents, postpaid. JOHNSON SMITH & CO.

COOD LUCK RING



Occult and Novel Design

A regular $5.00 ring and uncommon find, made of solid nickel silver. Skull and cross-bone design, with two bright black eyes that sparkle out of the eyes. A never failing object of interest. It is said by many to bring Good Luck to the wearer. Hence the name Good Luck Ring, and whilst we will not positively guarantee that it is certainly a lucky ring that you will take a pride in wearing. They were made for sell at 50 cents, but as a special bargain we will supply them to customers mentioning this paper at the low price of ONLY 20 CENTS, postpaid. JOHNSON SMITH & CO.

SQUIRT RING



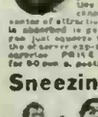
You may have a lot of fun with One Dollar worth of Squirt Ring. It consists of a hollow ring, plated ring, attached to a rubber ball, arranged that the latter is quite out of sight when the ring is in proper position. Both are attractive looking ring as this cannot be detected. While the victim is admiring the ring, a few pumps squeeze the rubber ball and the concealed water squirts in a very great quantity. PRICE 20c. Postpaid, 2 for 30c. Johnson Smith & Co., Dept. E 6, 3224 N. Halsted St., Chicago

Wonderful X-Ray Tube



A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparent y the bones of your fingers, the lead in a lead pencil, the interior opening in a pipe stem, and many other startling illusions. A mystery that no one has been able to satisfactorily explain. Price 10 cents, 3 for 25 cents; 1 dozen, 75 cents. Sent by mail, postpaid.

Sneezing Powder



Place a very small amount of the powder in the back of your friend's coat collar. How it tickles the air, and everyone in the room or railroad coach is bound to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they have not the least idea of the cause, but think they have caught it one from the other. Every one laughing and sneezing you yourself will be taken for the cause of your life. The serious, pompous meetings, as they adjourn, will be all over—there is a gathering of people. It is the greatest joke of the year. Price postpaid 15 cents; 3 for 30c. JOHNSON SMITH & CO.

STAGE MONEY



With a bunch of these bills, it is easy for each person of limited means to appear prosperous. By flashing a roll of these bills at the proper time and peeling off a genuine bill or two from the outside of the roll, the effect created will be found to be all that can be desired. Prices postpaid: 12 Bills 10c; 50 Bills 25c; 125 for 50c or $3.50 thousand.

NEW BOOK ON ROPE SPLICING

USEFUL KNOTS, HITCHES, SPLICES, ETC.

How Different Knots Are Made and What They Are Used For. Knots to Use and Knots to Avoid.

A most practical handbook giving complete and simple direction for making all the most useful knots, hitches, rigging, splices, etc. Over 100 illustrations. All about wire rope attachments, lashings, hitches, etc. 27 Heraldic Knots illustrated. Of great value to mechanics, riggers, campers, boatmen. Price 20c p. pd.

Johnson Smith & Co., Dept. E6, CHICAGO

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night The very latest discovery in the scientific world. Will never tarnish. Quite unobtainable except at an exorbitant price, we have at last succeeded in producing a LUMINOUS PAINT, which, applied to the surface of any article or object of entire light, rendering it positively visible in the DARK. THE BRAVEST THE NIGHT, THE MORE BRILLIANT IT SHINES. Quite simple to use. Apply a little upon the dial of your watch or clock and enable you to tell the time by night. You can paint the push buttons of electric bells, match boxes, and innumerable other articles, make your door knobs visible, and in fact, a little mixing of this luminous paint will enable you to make numerous articles. Price 25c. Larger size 50c and $1.00 postpaid. Johnson Smith & Co., Dept. E 6.

MUSICAL KAZOO



With the Musical Kazoo you can, without practice whatever, play any piece of music you whistle or hum, play a solo right from the start, imitate any band or entire orchestra, sing songs, dance, etc. Nothing to learn. It is simple to operate. Anybody can do it. Produces excellent music. You do not blow into it, but sing, speak, whistle or hum and a most delightful imitation is heard which astonishing results at parties, meetings, home, club or camp. Entertainments, dances, serenades, picnics, outings, excursions, fun the living for children and others. Invaluable for clubs, lodges, etc. A perfect toy for children or instrumental accompaniment, either with or without other musical instruments. Price 10c p. pd.

MAGIC FLUTE



Wonderfully Sweet Toned and Musical

A marvelous musical instrument. This instrument produces genuine music, whether it be the joyous notes of a quick step of the gay and charming hornpipe fact, any class of music can be played upon the Humana tone without practice, as it is simply a self-playing instrument. When played with a piano accompaniment, or any other musical instrument, the effect is charming. Full printed instructions for playing sent with each instrument. Price 15c postpaid.

All the Latest Surprising and Joke Novelties

Planet's Serpents Eggs, box	10c
Monsters Water Pistol	10c
Glycerine Bombs very Realistic	15c
Pulse Meter (Feel your friends)	5c
Send Acts Puzzle (Latest)	10c
Mysterious Ghost, shows at night	15c
Rubber Razor very formidable	20c
Rubber Dagger (ornamental)	25c
Window Smasher (great joke)	10c
Lose the Microscope see behind you	10c
Great Mind Reading Mystery Card	10c
Thurston's Mysterious Trick Card	15c
Fighting Roosters, pair	10c
Cover the Spot Trick, 4 acts, one	10c
X Ray Novelty	10c
Trick Pencil	10c
Rubber Tacks (a good joke)	15c
Mesmerized Penny (defies the law of gravitation)	20c
Mysterious Tumbler and Vanishing Coin Trick	25c
Magic Paper Lifter (a one pound)	10c
Imitation Gold Teeth	15c
Great Surprise Puzzle	10c
Wire Puzzles, 10c. 12 different, $1.00	

JOHNSON SMITH & CO., Dept. E 6, 3224 N. Halsted St. CHICAGO

Boys, you can have Movies at your own home with this latest model

MOVING PICTURE MACHINE

Uses Standard Films same as the larger machines. Very easily managed. Simply turn the handle. Good Variety of Films always obtainable

PRICE Complete ONLY **$2.50** Postpaid anywhere including Two Films

Extra Films, 15c each postpaid



THIS IS A GENUINE MOVING PICTURE MACHINE and the motion pictures are clear, sharp and distinct. The Moving Picture Machine is finely constructed, and carefully put together by skilled workmen. It is made of Russian Metal, has a beautiful finish, and is operated by a finely constructed mechanism. The projecting lenses are carefully ground and adjusted, triple polished, standard double extra reflector, throwing a ray of light many feet, and enlarging the picture on the screen up to three or four feet in area. The light is produced by a safety carbide generator, such as is used on the largest automobiles. This throws a dazzling white light on the screen.

It is a solidly constructed and durable Moving Picture Machine. The mechanism is exceedingly simple and is readily operated by the most inexperienced. The pictures shown by this marvelous Moving Picture Machine are not the common, crude and lifeless Magic Lantern variety, but are life-like photographic reproductions of actual scenes, places, and people which never tire his audiences. This Moving Picture Machine has caused a raising enthusiasm wherever it was used.



JOHNSON SMITH & CO.

Dept. E 6 3224 N. HALSTED ST., CHICAGO

ANARCHIST BOMBS



Consists of a little glass vial, containing a liquid form a chemical so fierce that it will produce a most horrible odor. One dropped in a room full of people will cause mere consternation then a hurried exodus. The smell will entirely disappear in a short time. 3 Boxes for 25c, shipped by express only with a Dollar's worth of other merchandise.

ITCHING POWDER



This is another good practical joke. The intense discomfiture of your victims to endeavor but themselves to thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and the latter can be relied upon to do the rest. The result is a vigorous scratch, then some more severish, and still some more. 3 Boxes for 25c. Sent only by express. (Must order at least One Dollar's worth of other merchandise.)

"The Baby" Double Action Hammerless Revolver

A HANDSOME AND MOST EFFECTIVE WEAPON

$5.50

Measures but 4¼ Inches long



Takes regular .22 calibre cartridges

The new Baby Double Action Hammerless Revolver has been produced to meet the ever increasing demand for a revolver that would combine small size and light weight with the essential features of efficiency and practicability. It is small in size, yet is just as effective and serviceable as the most expensive weapon you can buy. Every lady should have a revolver and should know how to use it, and there is no safer or better one made than this. A great feature is its safety action the finger against accidental discharge, making it quite safe for young men and ladies. The illustration gives an idea of its appearance. It is nickel plated and used to be thoroughly appreciated. The ammunition used is the standard .22-calibre (short) cartridge obtainable anywhere, or you can have the cartridges from us (cartridges can be shipped only by express). The revolver fires ten shots in one loading. The operation of the firing mechanism is extremely rapid and absolutely reliable; six well aimed shots can be fired in about ten seconds. The revolver is very well constructed, with finest nickel plated fluted barrel of cylinder, and weighs only 4½ ounces. The Price of the Baby Revolver is only $5.50, sent by mail postpaid to any address. JOHNSON SMITH & CO.

THE EXPO WATCH CAMERA



The most wonderful and ingenious Camera made

It is but little larger than a watch, which it closely resembles. You can carry the Expo about in your pocket and take pictures without any one being the wiser.

One Cent a Picture

The Expo loads in daylight with 25 Exposure Films, costing 25c, thus the picture taking part of a whole day's outing may be had for the nominal sum of 1c—One cent a picture. 10 Exposure Films obtainable, it is supplicity itself to operate. Takes pictures through the view, where the Rapid Fire Lens is located. The photos (3/8 x 7/8) may be enlarged to any size.

Price **$2.50**

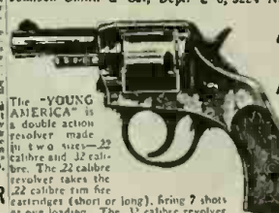
QUICK AS A FLASH

Time and Instantaneous shutters! Weighs but 8 ounces; nickel plated. Endorsed by amateurs and professionals the world over. Thoroughly practical—printing and developing of films just the same as ordinary camera—is daily use by the police, newspaper reporters, detectives, and the general public. Important tests have been secured with the Watch Camera by enterprising reporters on metropolitan newspapers, which have proven indoors or outdoors equal to any camera sold in the market, else or price notwithstanding.

Expo Watch Camera **$2.50** FILMS, 10 Exposures 15c, 25 Exposures, 25c
Postage 10c Extra Leather Pocket Carrying Case, 25c

Johnson Smith & Co., Dept. E 6, 3224 N. Halsted St., Chicago

"YOUNG AMERICA"



Double Action REVOLVER

.22 and .32 CALIBRE

A GOOD POCKET GUN

The "YOUNG AMERICA" is a double action revolver made in two sizes—.22 calibre and .32 calibre. The .22 calibre revolver takes the .22 calibre rim fire cartridges (short or long), firing 7 shots at one loading. The .32 calibre revolver takes .32 calibre S. & W. center fire cartridges, and accommodates 5 shots in the cylinder at one loading. Blank cartridges may be used if desired, indeed, there are many who use nothing else but blanks. You can take direct aim at a burglar and fire without causing bodily harm, yet the effect is usually the same, and the vagabond makes off, congratulating himself on his lucky escape. The "Young America" weighs approximately 9 ounces, and is one of the lightest weight revolvers of its type on the market. It is an excellent house arm or pocket weapon, and the most popular Fourth of July revolver. Octagon Barrel, accurately rifled, made of best steel, very highly nickel plated and polished. The handle is of fancy hardened rubber, but we can supply pearl handles that are beautiful and extremely popular, instead, if desired, at an additional cost of $2.00. The PRICE of the "YOUNG AMERICA" DOUBLE ACTION REVOLVER is $6.75. We pay postage anywhere. Johnson Smith & Co., Dept. E 6

Mysterious Trick Cards



This is one of the very best Card Tricks imaginable. It is very easily learned, simple to perform, yet most mystifying. You make the same cards change completely not less than five times. Full directions with each trick. Price, only 10 cents, or three for 25 cents postpaid.

Johnson Smith & Co., Dept E 4

THE "LITTLE GIANT" TYPEWRITER
A First Class Writing Machine For $1.25



A perfect little typewriter for $1.25. There are thousands of persons who would like to use a typewriter but where needs a full sized machine do not warrant the expense at either to the purchase and operation. To such persons we confidently recommend our Little Giant. It is extremely simple in construction, so that anyone can quickly learn to operate it and write as rapidly as they would with pen and ink. The letters of the alphabet most frequent y used being so grouped as to enable one to write rapidly, the numerals, 1 to 10, and the punctuation marks being together. With this machine your son, your daughter, your best girl (provided you have letters, address envelopes, make out bills, and do almost any kind of work not requiring a pen or pencil) can be supplied. With each typewriter we send a tube of ink and full printed instructions for using the machine. Price complete $1.25 by mail postpaid.

One of fifty or seventy-five dollar machine

SERPENT'S EGGS



Each box contains 12 Eggs, which are no larger than a grain of oats. When lit with a match, however, each one gradually hatches itself into a Snake several feet long, which curls and twists about in a most lifelike manner. Price per box 10c, postpaid. Johnson Smith & Co.

MYSTIC SKELETON



A jointed figure of a skeleton 14 inches in height, will dance to music and performs various motions and movements while the operator may be any distance from it. The figure may be manipulated by the spectators. When a hundred feet or so from the operator it is simply placed on a chair or table, when it will mysteriously become endowed with life, and commence to dance, etc. We send full direction with each skeleton, if the aid of which anyone can readily make it perform. 10c postpaid.

CIGARETTE ROLLER



Very neat and handy. Weighs less than a quarter of an ounce. It makes better cigarettes than you can buy and makes them easily and quickly. Just the tobacco you prefer and three bare cigarettes than ready made, and more of them, for the price of about half of your money. Just try one and make cigarettes just to your own liking. Price only 10c or 3 for 25c postpaid, with full instructions for use. JOHNSON SMITH & CO.

MIDGET ILLUSTRATED BIBLE
A Great Curiosity



The Smallest Bible in the World

The Midget Bible is a perfect gem, and a work of art. It is small enough to go in the size of a postage stamp and contains TWO FULL SIZED BOOKS AND FIFTY PAGES of the NEW TESTAMENT, profusely illustrated. The Midget Bible is a wonderful little book to send to bring good luck to the owner. Must be seen to be appreciated. Price, only 12 cents, three Bibles for 30 cents, one dozen Bibles for $1.00 or 100 for $8.00. Good money can be made selling these Midget Bibles amongst friends, church acquaintances, Sunday schools, bazaars, etc. Send for a few and try it.

The CONJURER'S CASKET

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment

ANYONE CAN DO THEM

50c



It is great fun mystifying your friends. Get this Conjurer's Cabinet, and you will be the cleverest fellow in your district. It contains the apparatus for 12 tricks, including The Disappearing Rose, that, when placed on the lapel of your coat, vanishes from sight at will; the Magic Vase and Ball Trick; a Wonder Ball to travel through a solid table; a Coin Vanished and is found in someone else's pocket; The Magic Wand with which you can apparently eat your finger almost to the end; the Wonderful Card Trick to card is placed in an envelope, and when opened an entirely different card altogether is found. The Disappearing Coin Box (a coin is placed in the little wooden barrel, and when opened a spot is found to have vanished entirely, or can be made to change to a coin of another denomination.); The Famous Mesmerized Penny that defies the law of gravitation (suspends from the palm of the hand, nose, cheek, wall, ceiling, etc.); The Glass Goblet and Vanishing Coin Trick (a coin is dropped into a glass of water, and when the water is poured out the coin has vanished); With the seven tricks described above we send full printed instructions for performing each trick, so that anyone can readily perform all the tricks to the great amusement of their friends and the public. Any boy or girl interested with this Cabinet of Tricks in his possession, can give a parlor entertainment not inferior to some regular magicians. Besides the tricks mentioned in the Cabinet, there are twenty-five other feats and illusions fully explained with full printed instructions, for which you can easily make or procure the necessary apparatus. Among them are The Mouse in a Pack of Cards, The Dream Card, The Hot Trick, To Knock a Tumbler Through a Table, One Cent Robbed Into Two, To Find the Number Thought of, Mysterious Wedding Ring etc. We also send the secret of performing three wonderful stage tricks, as follows: The Art of Cremation, The Vanishing Coin, Walking Out of a Room, and The Disappearing Lady (explained with an article of legerdemain and valuable hints to amateur conjurers. PRICE COMPLETE ONLY 50 CENTS.

JOHNSON SMITH & CO., Dept. E 6, 3224 N. Halsted Street, CHICAGO

The Newest Novelty Aerial Balloon



Flies gracefully in or outdoors. This is the VERY LATEST SENSATION IN BALLOONS. A brightly colored balloon that measures sixteen inches in length when inflated. It is blown up in the usual manner, and when released, the air pressure sends the balloon SOARING UPWARD like a big inch propeller SPINNING AROUND AT A LIVELY RATE. The effect is startling. It is a graceful act that makes the onlookers WILD WITH JOY. May be used repeatedly indoors or outdoors. An immensely interesting toy. Price 10c each, 3 for 25c postpaid.

JOHNSON SMITH & CO., Dept. E 6, 3224 N. Halsted Street, CHICAGO

New Vamping Card



PIANO PLAYING MADE EASY

No Teacher Needed Surprisingly Simple System

Persons having neglected their Musical Education need not despair, for with the aid of our new "VAMPING CARD" (owning the card portrayed over the piano keys), you can at once Vamp away to thousands of Songs, Ballads, Waltzes, Rag Time, Etc., etc., like a Professional Musician. No knowledge of music is required. After using it a few times, you will be able to dispense with the aid of the Vamping Card entirely. Only 10 cts. postpaid. Johnson Smith & Co., Dept E 6

The Hamilton Breech-Loading Rifle

A LONG RANGE LOW PRICE SMALL BORE

Will Kill Up To 200 Yards

Accuracy of Centering Insures Great Penetration



22 CALIBRE 16 IN. BARREL

PRICE ONLY **$4.75** Postpaid to any address

FIGHTING ROOSTERS



A full-blooded pair of fighting game cocks for ten cents. These lifelike fighting birds are real feathers, yellow legs and fiery red combs, their movements when fighting are perfectly natural and lifelike, and the secret of their movements is known only to the operator who can cause them to battle with each other as often and as long as desired. Independent of their fighting peculiarities they make very pretty mantel ornaments. Price for the pair in a strong box, 10 cents, 3 pair for 25 cents, by mail postpaid. Johnson Smith & Co.

LOADED CIGARETTES

Just Like Ordinary Cigarettes, But Such Bad Cigarettes!



A boy containing ten apparently genuine Cigarettes. They contain a cap which explodes when about one-third is smoked.

They appear so real, and afford as good a smoke (while they last) that the victim is taken entirely by surprise. A great laugh producer and entirely harmless. Price, box of ten, 20 cents, postage 6 cents.

JOHNSON SMITH & CO.

Potmend

Stops a leak in a minute



The finest repairer for ironware, Agateware, Enamelware, etc. Good for kettles, pots, pans, boilers, and every kind of ironware, also for tin, copper, aluminum, ice boxes, iron pipes, cracks in stoves, broken china, porcelain, price-lists, bisque, crockery, woodenware, marble, etc. Will not chip, fly, burn, bake or boil out. THIS MEANS IS THE STRONGEST EPOXY IN THE POT. Could not be simpler: just mix the powder with water. HARDENS LIKE IRON. Fire-proof, Water-proof. You can fill a big hole or a small crack. Mended places stronger than new. Replaces chipped enamel. Anyone can do it: FAILURE IS IMPOSSIBLE. Better and easier than solder. Three sizes, 10 cents, 25 cents and 50 cents.

Johnson Smith & Co., Dept. E 6 3224 N. Halsted St., Chicago

www.americanradiohistory.com

The Alkaline Storage Battery

(*Continued from page 878*)

Consequently the engine would have to be operated at various rates and at all times. This is uneconomical. By using a storage battery one may arrange to run the engine at its most economical (full load) rate and thus effect a saving to offset more or less completely any loss of current resulting from the use of a storage battery between the generator and the lights. Further, the storage battery tends to improve the character (the steadiness) of the light. With a small installation where the current passes directly from the dynamo to the wires supplying current to the lights, the latter are apt to manifest undesirable fluctuations in brilliancy because of irregularities in the running of the engine. By using a storage battery, one is able to use this fluctuating current in charging and then to get an even current from the battery.

A shunt-wound dynamo is the thing to use—else, when the voltage of the battery rises too high, it may "back up" and operate the dynamo (series type) as a motor, causing considerable damage. If a compound dynamo is already installed, or if it is desired to use such a machine for charging storage batteries, it can be done simply by disconnecting the series windings on the field coils, thus converting the machine into a shunt dynamo.

The dynamo which is used to charge a battery should always have an excess voltage capacity. Thus, if we are going to use a battery of 30-32 volts rating, it is good practise to employ a 45-volt dynamo for charging. In fact, we may largely consult convenience when charging a battery, provided we use a high voltage rather than a low one. A 110-volt dynamo may be employed, at times, for charging a 30-32-volt battery, thru a suitable resistance; tho perhaps it will not be the best thing to do.

The alkaline battery with which we are concerned is made up in a variety of sizes, of which that known as "A" is quite popular for electric automboiles and trucks. A numeral used along with the letter indicates the number of positive plates used in the cell. These numbers furnish a rough gage by means of which the comparative capacities of this type of cell may be determined. The reason underlying this is that amperage is determined by the total area of plate surface exposed to the action of the electrolyte. An A4 cell will have about half the capacity of an A8 cell, etc.

Charging.

The *positive terminal* of the battery is conected with the *positive line* of the supply current; and the *negative terminal* with the *negative line*. The positive pole of this type of cell is indicated by a *red bushing* and also by a + mark stamped in the metal of the container. A black bushing is used for the negative pole. A further means of determining the positive and negative poles is by means of the *form* of the little containers in the plates. The round tubes belong to the positive plates, and the flat pockets to the negative plates. If substantial heating is noticed at or near a cell pole during the charging operation, it is to be taken as indicative of an imperfect connection. If, however, all the connections are tight, then disconnect and determine whether there is dirt present and whether the metallic contacts are flat and rigidly clamped.

If there is any doubt as to which is the positive wire of the dynamo and which is the negative wire, the following simple test is recommended:—Connect one wire of the generator with some form of resistance. The free end of the unconnected wire of the resistance and the free end of the unconnected wire from the generator may now be brought close together in a cup of salt water. In a moment one wire-end will begin to turn bright. Bubbles will form at this wire. This is the *negative* one. The other is, naturally, the *positive* wire.

Normal Amount of Electrolyte.

The proper amount of electrolyte is such that plates will be ½ inch below the surface. During the charging operation the attendant evolution of gas will be likely to create a transient level. Tests for the level are to be made after the charging is all completed and the liquid has settled down. As it may not be easy to see conditions inside the cell, a good way to determine the depth of liquid over the plate tops is to use a piece of straight glass tubing with a bore of, say 3/16 inch or more. Introduce one end of the tube, holding it vertical, until the bottom of the tube is on top of a plate. Then close the top of the tube with the forefinger and withdraw the whole. At the bottom will be found a column of electrolyte whose height will be the depth of liquid over the plate top. When the right amount of electrolyte is in the container, this column will measure ½ inch. Simply a glass tube is required. No rubber cap or tube is needed in addition and the tube of an ordinary fountain-pen filler may be used. The rubber bulb is removed and the larger end of the tube is inserted into the electrolyte. The operation of charging, as already intimated, involves the production of gas. Some, at least, of this gas comes from the decomposition of water in the electrolyte into its constituent gases. These gases will naturally be lost, and the result will be a slight reduction in the total volume of the electrolyte in the container. Consequently, a very proper time to examine for height of solution is *subsequent to charging*. The remedy for this loss and any other loss due to withdrawal of water (as, for example, by natural evaporation) is the addition of pure water.

Adding Water.

When water is to be added to the contained electrolyte to bring the surface to the required height or to correct a solution that has become too strong, a special appliance—the "electric filling outfit"—may advantageously be employed. Only *distilled water* is to be used, whatever the method of introducing it. Of course, do not add water during charging, for the reason that the level can not be exactly determined at that time, as already explained. The addition of water will not, ordinarily, be required every time the battery is used. Usually, once or twice a week will be sufficient, unless the operation of the battery is very considerable. Other things being equal, water will be necessary oftener when the *constant current* method of charging is used instead of the *tapering current* method.

Two Methods of Charging.

To charge by what is known as the constant current method the rheostat is set a few amperes higher than the current it is proposed to deliver. The amperage will fall off as the charging goes on, but by readjusting the rheostat every 30 minutes or so to a point somewhat higher than the average desired, a fairly even flow may be maintained. To charge by what is known as the tapering current method, the rheostat is set a considerable amount above the desired average, say 50 per cent, and the current delivered without further adjustment. At the end it is proper that the current should be considerably below the average. An advantage of this method is the relief from attention during the charge.

LISTEN TO ME!



Be A CERTIFICATED ELECTRICIAN

THIS IS YOUR CHANCE OF A LIFE TIME

I am Chief Engineer of the great Chicago Engineering Works. I am in close official touch with the electrical world. I know how badly we need trained electricians who can take charge of important work as experts. Right now there is such a need for executive electricians that I am making a special effort to help meet the demand. I am publishing this special announcement to secure a certain number of ambitious men whom I will personally train by mail for the wonderful opportunities that are open.

I WILL MAKE YOU a Trained Electrician

I don't care how young or old you are, just as long as you can read and write and have a spark of ambition. I don't care where you live or what you do. I don't care if you don't know a blessed thing about electricity. Just give me a little of your spare time for a short period and I'll show you the quick way to success in electricity. You can qualify to earn **$36 to $100 a week** with opportunities for greater earnings.

I Train You by Mail!

Your spare time will do. No interference with your regular duties. I understand just what you must know and I have devised a wonderful way of instructing by mail. I positively guarantee your satisfaction.

Free *Wonderful Electrical Outfit*

Absolutely free. Not a penny cost to you now or later. To those who act at once I will give a wonderful set of Electrical Equipment with my compliments. Write me at once. I have only a limited number of sets to be given free. Drop me a post card or letter.

Write! You will have to act quick to get in on this opportunity. Write me today for full particulars. Drop me a post card. *Write Now.*

CHIEF ENGINEER COOKE,
Chicago Engineering Works,
Dept. 524
441 Cass Street, Chicago, Illinois

www.americanradiohistory.com

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section seven cents a word for each insertion. No advertisement for less than 50c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the May issue must reach us not later than March 22.

The Circulation of the Experimenter is over 100,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Automobile Accessories.

More Power, Less Fuel, No Carbon. No mystery, plain facts, results guaranteed. Write for booklet S. O. No-Leak-O Piston Ring Co., Baltimore, Md.

Fords Start Easy in Cold Weather with our new 1919 carburetors. 34 miles per gallon. Use cheapest gasoline or half kerosene. Increased power. Styles for any motor. Very slow on high. Attach it yourself. Big profits to agents. Money back guarantee. Thirty days' trial. Air-Friction Carburetor Co., 270 Madison, Dayton, Ohio.

Repair parts for all make cars, also engines. Carburetors, magnetos, bucket seats for racing cars. We also carry a large stock of slightly used tires and tubes at very lowest prices. Write for list. Haviland Supply Co., 2306 Seventh Ave., New York City.

Ford Car Repair Book sent free. This valuable, complete, well illustrated, book explains in a simple way the Causes and Cures of Overheating; Repairing Ford Timer; Curing Piston Ring Troubles; Carburetor Adjustment and Repairs; Connecting Rods; Transmission Troubles; Care and Repair of Rear Axle; Stopping Axle Grease Leaks; also covers practically every other phase of Ford Car repairing. Another feature is a chart showing exactly how much to pay for work done by rapair men. Send 25c coin for three month's trial subscription and get the valuable repair book free. Ford Owners' Magazine, 417 Montgomery Bldg., Milwaukee, Wisconsin.

Simplex Belt Power Transmitter for Fords, $12.50. Write for circular. Frank R. Weisgerber, Salina, Kans.

Agents Wanted.

Easy, Pleasant Work for mechanics, shop men, clerks, during spare hours, will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Co., 308 Bar St., Canton, Ohio.

$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Ave. D, Decatur, Ill.

Insyde Tyres, inner armor for automobile tires, double mileage and prevent punctures and blow-outs. Quickly applied. Costs little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, O.

American Inkless Pen—new invention. Everybody wants it. Sells $1. Agent's sample 60c. Agents. District Managers wanted. Attractive proposition. Buckeye Distributing Co., 1822 Noble Rd., E. Cleveland, O.

Agents! Get busy sell Wax O Polish direct to car owners. Resists dust and mud. Makes the car look new and glossy. Requires no rubbing, dries instantly. Good profits given to agents. Send for sample now. Price postpaid $1.00. Wax O Polish Co., 119 No. 1st St., Alberquerque, New Mexico.

Agents—Exciting fun flying a Yankee Aeroplane, flies like a real machine. Sample and money making plan, 25c. Yankee Mfg. Co., Milwaukee, Wis.

Make your own toothpowder and retail it. Great profits, receipt 25c. Mason's, Petaluma, Cal.

Agents—New invention puzzles world; wonderful chemical cloth; one rub over rain, snow blurred auto windshield, street car or engine window, presto! glass stays clear 24 hours; can't blur; agents making $120 weekly. Security Mfg. Co., Dept. 106, Toledo, Ohio.

Telegraphy.

Telegraphy, Wire and Wireless, and Railway Accounting taught thoroughly. Unprecedented demand for both sexes. Big Salaries. Oldest and Largest School—Est. 45 years. Catalog free. Dodges Institute, Seventh St., Valparaiso, Ind.

Postcards.

Everything in Postcards. Live-wire list free. Worth-while samples 25c. Mention subjects preferred. Mutual Supply Co., Bradford, Pa.

Help Wanted.

Nikola Tesla Correctly Chose his life work. I can help you to choose as intelligently as he chose. Complete character reading showing what natural abilities you possess. Tried and true method based on photos and handwriting. No magic guesses. Particulars free. Lowell P. Hoyt, Presque Isle, Me.

U. S. Government Positions. Men—women. $80 to $135 month. Paid vacations. Short hours. Pleasant work. Common education sufficient. Write immediately for list positions now open. Franklin Institute, Dept. D26, Rochester, N. Y.

Raise White Mice, big profits let me start you. Ray Boyle, Watertown, S. Dak.

Make Die-Castings. Sketch, Sample, Booklet, and Proposition, 12c. Byrd & Blair, Box 227 F. Erie, Pa.

Motion Pictures.

Motion Picture Film for home machines 200 feet $2.00, parcel post prepaid. Charles Gunby, 145 West 45th Street, New York.

For Sale Cheap, Motion Picture Films. Send 10c for sample and list. William Halstead, 88 Mamaroneck Ave., White Plains, N. Y.

February 24, 1919.

Mr. R. W. DeMott,
Advertising Manager,
THE ELECTRICAL EXPERIMENTER,
233 Fulton Street,
New York City, New York.

Dear Sir:

We take great pleasure in stating that our advertising in your classified department has been very successful.

To tell the truth, we have received more returns and at a lower cost than any medium that we are using.

Sincerely yours,

NATIONAL AERO INSTITUTE,
(Signed) John A. Tenney,
President.

Exchange Ads.

For Sale—Two loose coupler receiving sets, commercial type, best construction, and phones. Splendid condition. Low price. Unusual opportunity for amateur station. Call Saturday evening, 354 Convent Ave., near West 145th Street, New York City.

For Sale—Train, Camera, and other small stuff. Mahan Smith, Jefferson City, Mo.

For Sale—Telephone generators, $1.50; Battery telephone, 75c; Electrolytic interrupter, $2.00; $35.00 Chemistry Laboratory, $25.00; Brandes Superiors, $4.25; Telephone transmitter, 50c; Audion, $3.00; Double Barreled shot-gun, 12 gage, $7.00; 17 jewel Waltham, silverine case, $9.00; etc. Want—Typewriter. Welton, 708 Marion, Mattoon, Ill.

$300.00 Tent, 40 x 80, cheap, $30.00 takes it. 4-20 ft. center poles 9 ft. wall. Also twin cylinder motorcycle engine with magneto $10.00. V. G. Gustafson, 1402 N. Hickory St., Joliet, Ill.

Exchange—Thorough Bred Shetland Pony for 8 inch spark coil or $125.00. Deb. Cummins, Wilmot, S. D.

Write immediately for large list of electrical and chemical apparatus. Mr. Keogh, 328 Lorel, Chicago.

For Sale—Electrical Apparatus. Send stamp for list. Alfred Embovitz, Washington Depot, Conn.

Brand new 15 dial Omnigraph with 15 extra dials, $15. Write J. F. Maurer, Jr., 682 Broadway, West New York, N. J.

Sell—Loose Coupler, $4.00; Detector, 30c. List of Wireless apparatus 3c. Kenneth Tooker, Coshocten, O.

Will Sell or Trade a Fuller Johnson, overhauled, gasoline engine, 1½ H.P. Fred Sheel, 174 Martin Street, Milwaukee, Wis.

For Sale—One 50 amps.—110-125 volts—2 wire—D. C.—Duncan Integrating Wattmeter in first class condition. J. Paternoster, 511 West 160th St., N. Y. C., Phone 9651 Audubon.

Exchange Ads.—Continued.

For Sale—Blueprints of motor windings, see add under Blueprints, etc., this issue. Charles L. Chittenden, 811 W. 18th St., Kansas City, Mo.

Wanted—Mignon Receiving Cabinet RLC 5 or RLC 6. Cash. J. H. Newton, Suffolk, Va.

For Sale—1, 2, 3, 8, 9 Hawkin's Guides, cheap. Joseph Saltry, 319 Oak St., Scranton, Pa.

Wanted—Omnigraph and Records. State price and condition. J. A. Burgess, Provost, Va.

Sale—High tension magneto $5. Austin Randall, Bradford, Me.

For Sale—Small Climax talking machine and 20 records in A1 condition for $10.00. Also Telescope, Magazines, Electrical Apparatus. Emil Feldman, Manning, Iowa.

Sell—Omnigraph No. 2 Jr. Make me an offer. Myrl Priest, St. James, Minn.

For Sale—National Automatic Telegraph Transmitter with 25 records in continental code, practically new, $12.50. Leonard Ulstrip, Freewater, Ore.

For Sale—Complete sending and receiving set. Absolutely new. K. Jennings, Newton, Mass.

Wanted—Bound Volumes, 3 and 4 of Electrical Experimenter. Printing Outfit or Wireless Receiving Set. Everett Fritzberg, 727 Washington St., Northeast, Minneapolis, Minn.

For Sale—1 H.P. D. C. Electric motor; 1 motorcycle engine; also other things. George Coulin, 851 Columbus Ave., New York City, N. Y.

Sell—Complete Chemical Outfit, Wireless and Electrical Goods. Charles McLaughlin, Cadiz, Ohio.

For Sale—½ K.W. Open Core Transformer, unmounted, cost $6.50, $2.50; ¼ K.W. Closed Core Transformer, $7.50, $4; Pancake Oscillation Transformer, $3.75, $2; Jove Detector, 70c; 2500 meter Loose Coupler, $8, $4; .22 H. & R. 7 shot revolver, $8.50, $5; .22 Automatic Rifle, $17.00, $8.50; 3000 meter home made Loose Coupler, $5; all in fine condition. Guns' bores are perfect. Henry Cole, M-2 Box 380. Indianapolis, Ind.

Will Swap—No. 2 Folding Autographic Brownie and fishing rod and reel for wireless apparatus. Max Feldner, 1444 W. 13th St., Chicago, Ill.

Wanted—Parts type 400-500 Edison Primary Batteries, Michael Boland, Forest Avenue, Englewood, N. J.

2 K.W. Wireless Outfit. Full particulars by mail. Best offer or exchange for marine engine. W. Monroe Whaley, Maple Road, Linthicum Heights, Md.

For Sale—New 5 record Omnigraph, buzzer, key, 20 records, $15.00. Margaret Ewing, Norwichtown, Conn.

For Sale—Hytone Rotary Gap ½ K.W. Transformer, Pancake Type Oscillation Transformer. Unusually fine glass plate condenser NAA Coupler. All new, low price. V. Van Zandt, 1663 Winfield St., Los Angeles.

Sell—Good Remington Typewriter, $30. C. Gillespie, 72 Woodward, Buffalo, N. Y.

For Sale—Nonpareil printing press, number 22; eight fonts type and ornaments $25. Donald Peglow, LaPorte, Ind.

For Sale—Curtiss Biplane, 3 ft. Model $10.00. Miami bicycle $12.00. Post card projector electric, $4.00. Edw. Webb, New London, O.

Electrical Photographic and Chemical Apparatus, motors, fans, switches, spark plugs. Advise what you want or have for sale. H. C. Hancock, Bogota, N. J.

Exchange—$8.00 Omnigraph and dials for variable condensers or motor. W. T. Gravely, Danville, Va.

Sell—Twelve complete wrestling lessons, $5.00. Harry Schulte, 2460 Buchanan St., Baltimore, Md.

For Sale—No. 5 (No. S) Omnigraph worth $7 perfect condition. **Wanted**— perfect Thordarsen 1 K.W. sending transformer, state price. Wallace Heckman, Windermere Rd., Auburndale, Mass.

Wanted—Telegraph Apparatus. Write Gowan, 343 George, Peterboro, Can.

For Sale—Audion Bulb, Tuner, Condenser and double receiving phones. Cahn, 182 Pulaski St., Brooklyn, N. Y.

www.americanradiohistory.com

For Men.

Shave Yourself? Send ten cents to Mecntzen, Beaumont, Texas, for blood stopping styptic pencil.

Business Opportunities.

Victory—Mechanical Toy Soldier window attraction. 30 inches high. Salutes, turns head, points with finger, etc., as set. Well made, nicely dressed officers, privates, Uncle Sam, etc. Electrically operated. Does some stunt every half minute or oftener as set and will salute soldier and pay no attention to other if desired. Representative wanted in each city and town. Write for prices. The John M. Biggs Co., Box 324, Chattanooga, Tenn.

Dollars Yearly in Your Back Yard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. Metz, 313 East 89, New York.

Build up an Income in Oil—Others are doing it—Why not you? Today is the opportunity. Join our easy monthly payment plan NOW—it may mean hundreds in profits. Write for information. National Oil Drilling Co., Dept. K, Houston, Texas.

Incorporate your business under the common law. No organization tax; no franchise tax; no federal corporation tax; certificates not taxable; stockholders exempt from company debts; do business anywhere; directors reside where you wish; lowest cost organization possible. Common Law Organization Co., 4 Randolph, Detroit, Mich.

Patents For Sales: To buy or sell patents address Patent News-H, Washington, D. C. Only inventor's newspaper published.

Start a profitable business manufacturing "Puffed Crisp." Delicious confection. Whirlwind money-maker. Machine, instructions complete $6.50. Samples 10 cents. Bestever Products Co., 2526—E4, Polk St., Chicago.

We will start you in the cleaning and dyeing business, little capital needed, big profits. Write for booklet. Ben-Vonde System, Dept. H, Charlotte, N. C.

Why Sell Perfumes and Toilet Goods for others? make your own; get all the profits. Particulars, Laboratory Box 1316—X— Memphis, Tenn.

Hurry: Our First Issue. Plans and specifications for building National Advertising Weather Service. Sales talk picture of finished machine, etc. Profit $150.00 for manufacturer. Protected territory. Descriptive literature, terms and picture 25 cents. None free. National Sales Co., Box 421, Lima, Ohio.

If Interested in profitable money making plan send quarter. Coffer, 104 Main St., Flushing, L. I.

"Quick-Action Advertising—How it is Building Business for the Progressive Advertisers of America"; A little story of RESULTS, told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet, which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th Street, New York.

Enter a New Business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks, at small expense; no further capital required; no goods to buy, job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston.

Make Die-Castings. Sketch, Sample, Booklet, and Proposition, 12c. R. Byrd, Box 227, Erie, Pa.

$30.00 a week evenings. I made it with a small mail order business; continued my regular job daytime. Free Booklet tells how, 2 cents postage. Albert W. Scott, Cohoes, N. Y.

Gold and Silver Plating without costly electrical apparatus. Wonderful example of scientific achievement. Unparalleled opportunity to establish yourself in dignified lucrative business. Experience and capital unnecessary. Complete detailed instructions in both processes. One Dollar. Electroless Plating Co., 1646 Echo Park Ave., Los Angeles.

Branch Manager Wanted for old established Chicago Concern. We furnish full stock of goods, advertising matter, and equip store completely, in good location, all at our expense and pay you $40.00 a week salary, in addition to liberal share of the profits your store earns. Work can be started in spare time. No investment or previous experience necessary to secure this position. If you are a hustler and want an opportunity to make $5,000 to $15,000 a year we want you and will pay you well from the start. Send me your application today. S. Levy, Mgr., Department 784 Como Bldg., Chicago, Ill.

Experimenters: Would you like to earn $100.00 a month in your spare time at home. Send 25 cents (Coin) for instructions. Lloyd Stultz, Middletown, Maryland.

Business Opportunities—Continued.

Make Big Money opening safes and setting combinations. Wayne Strong, P. O. Box 1430, Los Angeles, Cal.

Men, get into the wonderful tailoring agency business, big profits taking orders and your own clothes free. We furnish fine sample outfit and everything free. No experience needed. Write today. Banner Tailoring Co., Dept. 186, Chicago.

Attention manufacturers—What have you to offer for Mail Order House? Must be easy mailing. Can use large quantities. Address, Guarantee Sales Co., 468 E. 117th St., Cleveland, Ohio.

Miscellaneous.

Luminous Paint makes watches, clocks, anything visible at night, 25c bottle. Luminous Paint Co., 2426-X Polk St., Chicago.

Your Opportunity—Used correspondence courses bought and sold. Dollars saved. Write now. Enclose stamp. MacMichael Educational Bureau, Dept. 44, Victor, N. Y.

Japanese Incense produces fragrant odour. Sample 10c. Box Yama, Postal Box, 281 Sta. C., Los Angeles, Cal.

Be Healthy! Know the surest way to success. Read "Sincere Words," 1919 wonder. 20c postpaid. Success, 1943 Patten St., Philadelphia, Pa.

Cats crave catnip. Send 10c for a "catnip mouse" (a lifelike cloth mouse, stuffed with catnip). More fun than a "barrel of monkeys," and your "kitty" will like it. Address: Percy Ewing, Decatur, Ill.

You Can Be a Winner. Gain Power and Individuality and become what you wish to be, through our system of Self-Development. Practical, positive benefits. Send 10c and birth-date for interesting Personality Sketch and first lesson in Efficiency. Thomson-Heywood Co., Dept. 350, Chronicle Bldg., San Francisco, Cal.

Catch Fish. Descriptive folder containing valuable information mailed for stamp. George Julian, Albany Building, Boston.

Blacksmith, Listen! Prepare for big wages in Navy and Arsenal with Toy's Modern Methods doing hard jobs easy. Forging and making solid welds, hardening and tempering to a standard, with colored tempering charts. All for one dollar. Sample free. W. M. Toy, Sidney, Ohio.

Wanted—Small Gasoline and Steam Engines. Cash paid for 1 to 4 cylinder light weight Motors. ¼ to 10 H.P. Johnston, West End, Pittsburgh, Pa.

Snow Plow. Removes snow from sidewalks, etc. Easy to raise or lower. Thoroughly tested. Can also be used as toy. A. H. Tallyn, Benson, Ill.

"Opportunity Adlets" bring quick results. Our 100,000 circulation, net. Other firms are making money—so can you. For proof address Classified Department, Electrical Experimenter, 233 Fulton St., New York City.

Wireless.

Amateur Radio will be Prohibited in Five Years unless amateurs organize for beneficial protection! Will amateurs be organized body able to protect themselves from this impending calamity? Write us for absolutely latest particulars concerning this latest question. Future amateur radio depends on you—the loyal amateur! Only a slacker will hesitate. You write immediately! American Institute of Radio Engineering. Omaha.

Complete receiving sets $8.50, $9.50 and up. Instruments, parts, minerals. Circular for stamp. Inquiries invited. Jenkins, 923 Purchase Street, New Bedford, Mass.

Mineral Detectors are not one hundred per cent efficient without a sterling silver catwhisker. Better than gold, 15c each. Gooding and Layton, 1604 Broome Street, Wilmington, Delaware.

DeForest Ship's Set Complete. Loose coupler, detector stand, reversing switch, variable condenser, etc., all mounted on hard rubber base and mahogany cabinet—very fine. Price $30. W. M. Ronan, 172 Front St., New York.

Better stock up now on switches and switch points for that new set. Circular describing the most perfect on the market sent free. Eureka Secondary Co., 6939 S. May St., Chicago, Ill.

Learn Wireless Telegraphy at Home Cheap—Through home course outlined which will not exceed $5.00 including the entire outlay. Don't waste time and money learning elsewhere. Use your spare time for this purpose. I tell you how to obtain this complete course and answer all questions free thereafter. Complete instructions and details, $1.00. Investigate. Satisfaction guaranteed. E. Jones, 818 Roosevelt, New Orleans, La.

Switch Points, Binding Posts. Switch levers, and small parts, send 2c for catalogue describing these and other goods. A. W. Bowman & Co., 23 Church St., (Harvard Square), Cambridge, Mass.

Amateurs, Complete Set of Blue Prints and Instructions for construction of (RA6) Regenerative Receiver, amplification 100, range 180-580 meters. Easy to construct. Just revised. Price $1.50 postpaid. Radio Research Laboratories, 2148 Fifth Avenue, Troy, New York.

Formulas.

500 Formulas, resilvering mirrors, renewing dry batteries, luminous paints, mechanics' soap, 25c, lists 2c. "Bestovall," 3311-E Belleplaine, Chicago.

Chemicals.

"Chemical Analysis honestly and correctly done" by Leland E. Tenney, Chemist, Colton, N. Y.

If you are in need of Chemicals you will be wise if you send your orders here. We handle the Chemicals that are most rare and most difficult to obtain. Send 5c for sample price list. Ziegler Experimental Laboratory, 47 Judson Street, Rochester, N. Y.

Electrical Supplies & Appliances.

Motor Winders: See ad under blueprints, etc., this issue. Charles L. Chittenden, 811 W. 18 St., Kansas City, Mo.

One Service Station Storage Battery Generator; High tension magnetos; S. D. Motor starter; D. C. Motors 110 v.; Motorcycle engines and parts. Telephone parts of all kinds, belt, pulleys, spark coils, 2 cylinder Thor Engine carburetor and magneto complete. Going to sell dirt cheap while they last. P. A. Paul, Lewisburg, Ohio.

For Sale: 250 Penlites exact representation of fountain pens complete with 2 cell guaranteed battery only 65c each, postage 4c extra. Extra batteries 20c. Also 50 2-cell fiber tubular flashlights 90c, and 15 3-cell flashlights $1.05. Postage 7c extra on either. J. A. McLardie, 424 Edgewater, Dayton, Ohio.

$2.00 75-ohm double pole watch case receivers—NEW—permanent magnet type, fine for wireless, prepaid, $1.25. Electro Sales Co., 1844 Cleveland Ave., Chicago, Ill.

Electrical Tattooing Machine and Supplies—Catalogue Stamp, Prof. Temke, Exp., 1019 Vine St., Cincinnati, Ohio.

Recharge 25 Dry Cells for Five Cents. Directions 10c. Gilbert, 28 Chestnut, Binghamton, N.Y.

All sizes of refillable fuses. Send 25c for sample plug fuse and 10 refills. State Amperage. Knoll and Palmer, 7076 Jenkins Arcade, Pittsburgh, Pa.

For Sale—Electrolytic rectifiers. glass jars, Knapp motor, 19, 21, 23, 25 and 35 D. C. C. magnet wire, 24 and 31 S. C. German silver wire, transformer iron, switchboard complete, miniature sockets, battery binding posts, spark gap, electric heater. J. L. Lange, 9 Roosevelt Ave., Jersey City, N. J.

For Sale—Electrical apparatus all kinds. List for purple stamp. Wm. Doty, 207 John St., Portland, Oregon.

Personal.

Are you self conscious—embarrassed in company—lacking in self control? These troubles overcome. C. E. Veritas, 1400 Broadway, New York.

Letter Specialists.

Letters That Land Orders and Money Orders—written for $4.00; three for $10.00. Guaranteed. Criterion Service, Dept. 3, West New York, New Jersey.

Real Estate for Sale.

Is This Your Idea of Florida? A little piece of land near the water, a boat, a garden, some strawberry plants, and perhaps a few chickens; a vine-covered cottage, pleasant neighbors; fish and oysters in abundance. plenty of quail and game—a simple, natural, wholesome life in the open the year round—Home, Health and Contentment. All this is within your reach at modest outlay in this beautiful land of sunshine and roses. We are on the Gulf and a navigable river; also on the Dixie Highway. Here we have the freedom, comfort and economy of country life, yet are only two hours by motor bus from big cities and resort centers like Tampa and St. Petersburg. Our community is new, but is one of the fastest growing in the State. Prices have not gone sky-high and living expenses are moderate. 100 Northern families already here. They like it—perhaps you will. May we send complete information? Board of Trade, Box 298, New Port Richey, Fla.

Motorcycles.

Motorcycles from $25 up—New and second-hand. Easy terms. large list to choose from. all makes. Send 4c stamps for Bulletin "A." Peerless Motorcycle Co., Watertown, Mass.

Song Poems Wanted.

Write the Words for a Song. We write music and guarantee publisher's acceptance. Submit poems on war, love, or any subject. Chester Music Co., 538 S. Dearborn St., Suite 265, Chicago.

Continued on page 934

www.americanradiohistory.com

Patent Attorneys.

Inventions Patented. Trade-marks Registered, Labels, Prints and Publications Copyrighted, reasonable fees; correspondence solicited; detailed information free; booklets. Jaynes & Jaynes, 702 Kellogg, Washington, D. C.

Patents Procured—Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C., or 2278-T Woolworth Bldg., New York.

M. F. Miller, Ouray Building, Washington, D. C. Patent Attorney, Mechanical and Electrical Expert. Best quality of work and results. Moderate charges. Advice free.

Millions spent annually for ideas! Hundreds now wanted! Patent yours and profit! Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. American Industries, Inc., 212 Patent Dept., Washington, D. C.

John M. McLachlen, Atty. at Law, Patents, Trade Marks, Copyrights, 410 McLachlen Bldg., Washington, D. C.

Patents—My fee payable in monthly installments. Send sketch for advice. Booklet free. Frank Fuller, Washington, D. C.

Patent Your Own Inventions. Save attorney's fees; we prepare applications; furnish full instructions and give satisfaction. Free information. Carl Larsen Co., Park Row Building, New York City.

Patent Attorney, Electrical Engineer, Mechanical Expert; Thorough Personal Service. Frank Ledermann, 21 Park Row, New York.

Patents. My fee payable in installments. Full particulars return mail. John Patten Duffie, Patent Attorney, Washington, D. C.

For Inventors.

We Have A Proposition that will probably interest you. Inquiries invited. The Wakefield Engineering Co., 922C—F St., N. W., Washington, D. C.

600 Mechanical Movements, also illustrations and explanations of 50 perpetual motions. My book, Inventors' Universal Educator, 4th edition, tells how to procure and sell a patent for your new invention. Government and other costs. Covers the matter from A to Z. 140 pages elegantly bound. Contains noted Court decisions on Patent cases. Mechanical Movements greatly assist inventors—suggest new ideas that might prove of great aid in perfecting inventions. Tells how to select an attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers. Price $1. Postage free. Fred G. Dieterich. 603 Ouray Building, Washington, D. C.

Inventors. Protect your idea before exposing it. Advice Free. Inventor's Patent Service, Park Row Building, New York City.

Inventions Commercialized. Cash or royalty. Adam Fisher Mfg. Co., 205 St. Louis, Mo.

Inventors join National Institute of Inventors, World Building, New York City; membership society 1,900 strong; will help protect, develop, finance and market your invention. Absolutely no charge. Write for booklet.

Patents for Sale.

Patent—Cork float oil gauge for Ford cars. Price right. L. A. Randall, Conimicut, R. I.

News Correspondents.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Scenery for Hire.

Collapsible Scenery for all Plays. Amelia Grain, Philadelphia, Pennsylvania.

Cameras, Supplies—Photo Developing.

Send us your next film for developing and printing. No charge unless you are satisfied with our work. The Photolo Co., 36 Garrison Road, Claredon, Virginia.

Mail Us 15c with any size Film for development and 6 velvet prints. Or send 6 negatives any size and 15c for 6 prints, 8 x 10" mounted enlargements 35c. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke, Va.

Camera bargain list free. Durso, Dept. 41, 25 Mulberry, N. Y. City.

Clean, Neat, Perfect Kodak Finishing at the lowest prices. Work returned the same day received. Send film for sample print and copy of Catalog on Developing, Printing, Enlarging and Hand Coloring, also copy for Photo Craft Magazine which will help you make better pictures. Photo Craft Co., Box 69, Ann Arbor, Mich.

Books.

What Every Draftsman Should Know. Very useful booklet. Price 12c postpaid. Wack Booklet Co., 1943 Patten St., Philadelphia, Pa.

Dear Reader—If Occult, New-Thought and Scientific books appeal to you, send for my catalog, it's free. I have books on Personal Magnetism, Concentration, Spiritualism, Clairvoyance, Seership, Will, Mind, Hypnotism, Mesmerism, Character Reading, Healing, Mysticism, Success, Salesmanship, Mechanics, Entertainment, etc. A. W. Martens, J-49. Burlington, Iowa.

World-Romic System, Masterkey to All Languages. Six Textbooks, $1.44. French Chart, 37c; Spanish, 37c; Aviation Dictionary, $1.50. French-English Aviation Dictionary, 61c. Languages, 143 West 47th, New York.

Books on Sex—Catalogue free. United Sales Co., Springfield, Ill.

Books for Real Live People. Lists free. J. E. Sheridan, 417 E. 151st, New York.

20,000 Formulas, Recipes and Trade Secrets in double-column, 530-page book, only $1. Postpaid. Clifford Camp Co., 32 Prospect St., Claremont, N. H.

To Get Better Pictures: Read the Amateur Photographer's Weekly; illustrated; weekly prize competitions; print criticisms; many unique features; $1.50 per year; three months' trial subscription 25c. Abel Publishing Company, 401 Caxton Bldg., Cleveland, Ohio.

Old E. E. Back Numbers: We have some valuable old E. E. back numbers on hand as follows: 1915—Jan., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec., price each 35c. 1916—Jan., Feb., March, May, June, Sept., Dec., price each 35c. 1917—Jan., April, May, Aug., Nov., Dec., each 35c. 1918—Jan., Mar., 35c; 1918—May, June, July, Aug., Sept., Oct., Nov., Dec., each 20c. 1919—Jan., Feb., Mar., 20c. We can fill orders at once upon receipt of your remittance, and if you have not these numbers already, now is your chance to get them, as they probably will be snapped up very quickly. Experimenter Publishing Co., 233 Fulton St., New York City.

Sexual Knowledge—By Dr. Faulkner. Plain facts about sex matters. Over 100 pages valuable information for men and women, married or single. Price 25c, in plain wrapper. United Sales Co., Springfield, Ill.

Leading Magical Magazine. You'll like it! All magicians do! Why? The value is there. Sample 10c; three months, 25c; year $1.00. The Eagle Magician, Dept. E, Minneapolis, Minn.

"Nature Book" facts every married and engaged person should know. 35c. Central Company, 599 Ninth Avenue, New York.

Blue Prints.

Blue Prints: ½ H.P. Gas Engine 30c, ¼ H.P. Steam Engine 50c, ⅛ H.P. Boiler and Engine 70c, all 3 $1.00. Circulars for stamp. Universal Gas Motor Co., 364 Monadnock, Chicago.

Blue Prints of Motor windings. 108 A.C. connections, 132 D.C. armature windings, complete 240 diagrams $5.00 cash. Send 25c for 12 samples or write for particulars. Charles L. Chittenden, 811 West 18th Street, Kansas City, Mo.

Make volt and ammeters. Simple practical instruction and blue print 25c. D. R. Hansell, 2328 N. Carlisle Street, Philadelphia, Pa.

Health.

Enjoy Vigorous Health. My new book "Muscular Development" tells how. Send for it today—10c. Earle Liederman, Dept. A, 203 Broadway, New York.

Tobacco or Snuff Habit Cured or no pay; $1.00 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

Pyorrhea—H. E. Kelty, D. D. S., M. D., pyorrhea specialist for 15 years, has developed a successful home treatment for pyorrhea. Purifying, healing, preventative. Full month's treatment and booklet $1.00. Circular free. Dr. H. E. Kelty, 106 Gladwin Ave., Leonia, N. J.

Cigarette, pipe or chewing habit conquered. Nature's method. Guaranteed. Write for free brochure. Edw. J. Woods, TA-300, Station F, New York.

Stammering.

St-Stu-t-t-tering and Stammering cured at home. Instructive booklet free. Walter McDonnell, 105 Potomac Bank Building, Washington, D. C.

For the Hair.

I was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have good hair-growing results. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E 32nd St., BA-300. New York.

Tricks, Puzzles and Games.

Tricks, Puzzles, Jokes, Toys, Games, Novelties, Doll and Cane Racks, Plays, Wigs, Stage Supplies, Escapes and Illusions. Large 1917 catalog free. Oakes Magical Co., Dept. 549, Oshkosh, Wis.

1000 Stage Tricks with 500 illustrations. Catalogue 10c, small catalogue free. Hornmann Magic Co., Sta. 6, 170 Eighth Avenue, New York.

Black Art Hindoo Experiments, 1919 Edition, 25c. Invisible Ink. Free Trick. Catalogue each order. Linhorst Magic X Shop, St. Louis.

Ventriloquism taught almost anyone at home. Small cost. Send today 3c stamp for particulars and proof. O. A. Smith, Room R-605, 801 Bigelow Street, Peoria, Ill.

100 Kinds Wire and Steel Puzzles. Catalog and leader 10c postpaid. Western Puzzle Works, St. Paul, Minn.

Phonographs, Needles and Supplies

Build Your Own Phonographs and manufacture them for profit. Drawing instructions, Parts, Price List, Blue Prints, etc., complete, sent free upon request. Write today. Associated Phonograph Co., Dept. E-1, Cincinnati, Ohio.

Build Your Phonograph. "Perfection" high-quality spring and electric Motors, Tone Arms, Reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Indiana.

Phonograph Owners: Test our wonderful, new Ring Point needles. Buy at wholesale prices and make money selling to your friends who hear how they improve tone. Scientific method, important discovery, very interesting. Single needle plays 100 records. Send 25c for samples and special offer. K. Kenyon Company, 31 Union Square, New York.

Wonderful $75 Phonograph. 42 inches high, 12-records album, needles, $45. Stamp. 631 Newhall, Milwaukee, Wis.

Motors, Engines and Dynamos.

Small Motors and Generators: 1000 New Motors and Generators from Bankruptcy Stock, ¼ H. P. A. C., $18.50 each; ½ H. P., $30.00. Battery Charging Sets—Robbins & Myers new outfits, all sizes, $30.00 each and up. Charging, Lighting and Moving Picture Arc Generators, $10.00 each and up. Motors for all phases of current. Immediate delivery Less than ½ regular prices. Write for late bulletin. Johnston, West End, Pittsburgh, Penna.

For Sale—The following 60 cycles, single-phase motors, 1800 r.p.m., new. 25-⅛-110 volts, 3½ h.p., 220 volts, 2¼ h.p. 220 volts, 2-1 h.p. 220 volts, 1-1½ h.p. 220 volts, 2-2 h.p. 220 volts. Electric Machinery Equipment Co., 714 W. Van Buren St., Chicago.

Wanted for Cash—Marine, rowboat, stationary, automobile, motorcycle engines or bicycle attachment motors. State condition, price, etc. Write, A. J. Temps, 305 Broadway, New York City.

Printing.

100 Bond Noteheads, 4 lines and 100 envelopes, prepaid, $1.00 Southwestern, 1413-H Berendo, Los Angeles.

100 Engraved Style Visiting Cards 50c; 100 Emblem Cards 70c. H. Gregory, Warwick, N. Y.

Stamps and Coins.

500 Finely Mixed United States or Foreign Stamps, 12c. Philatelic Star, Madison, N. Y.

California Gold, Quarter size, 27c; Half-dollar size, 53c; Dollar size, $1.10; Large cent, 1820, and catalogue, 10c. Norman Shultz, Kings City, Mo.

Stamps—61 all different free. Postage, 3c. Mention paper. Quaker Stamp Co., Toledo, Ohio.

Free—Packet Valuable Stamps to applicants 50% approvals. Benj. Forbes, 160 Devilliers, Pittsburgh, Pa.

Free packet of stamps to approval applicants. Laskaris, Union City, Pa.

Stamps 100 different, 8c; 200, 23c. Approvals. Michaels, 5600 Prairie, Chicago.

Acme Stamp Co.—Send stamp for pocket list. 494 12th St., Brooklyn, N. Y.

For Advertisers.

"Quick-Action Advertising—How it is Building Business for the Progressive Advertisers of America"; A little story of results told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th St., New York.

www.americanradiohistory.com

SKINDERVIKEN TRANSMITTER BUTTON

$1.00 ppd.

YOU can easily make a highly sensitive detectophone by using a Skinderviken Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. Think of the fun you would have with such an instrument! It's very simple, too, and inexpensive.

You can install an outfit in your home and hear the conversation being held all over the house. You can connect up different rooms of a hotel. *Our outfit was used by secret service operatives during the War. It is being used on the stage.* So much for its commercial adaptations! *You* can procure apparatus of the same type.

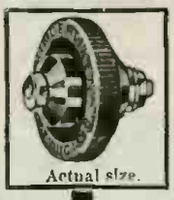




Fig. 3



Fig. 6

One of the main advantages of the Skinderviken Transmitter Button lies in its ultra-sensitiveness. You can place it in any position you like. It is the greatest invention in micro-phones and has won recommendations from men of high standing in the scientific world. It is being used all over the world. You can mount it most anywhere. In figures 3, 4 and 5 are shown some unusual and practical methods. Card board boxes, stove pipes, stiff calendars and hundreds of other places will suggest themselves to you. The buttons cannot be seen by any one in the room as they are so small and light. Only a small brass nut is exposed to the view.

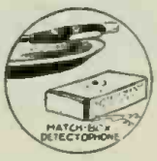


Fig. 4

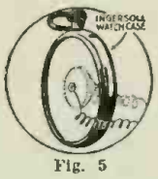


Fig. 5

BARGAINS

These prices are very low

All equipment is GUARANTEED. The apparatus is the same as sold by us to large telephone companies. 110 volt telephone generators.

3 bar	$1.75	Weight	6½ lbs.
4 bar	2.25	"	8 lbs.
5 bar	2.75	"	10 lbs.
Ringers 80 ohm	.35	"	1 lb.
" 1000 ohm	.75	"	1 lb.
Silk cords, 6 ft. 3 cond.	.20	"	3 oz.
" " 6 ft. 4 cond.	.20	"	3 oz.
" " 3 ft. 2 cond.	.10	"	1 oz.
Transmitters complete with Steco transmitter button	$1.50		12 oz.
Induction coils	.35		6 oz.

Full directions for connecting up the button for use as a detectophone are given in booklet No. 4 which is sent with each button. Figures 1 and 2 of this advertisement, two of the many illustrations in booklet No. 4, show the circuit connections of the detectophone.

The only instruments needed to complete a detectophone outfit, in addition to a Skinderviken Transmitter Button are a receiver, battery, and, if desired, an induction coil.

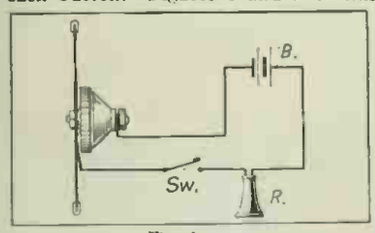


Fig. 1
Transmitter Button mounted on Diaphram. Simplest circuit.

AMONG electrical experimenters the button has created a sensation. It is not uncommon to receive unsolicited letters like these: "I received transmitter button today and I wish to inform you that it works great and is *the best I have ever seen or heard of for the price.* I will certainly recommend it to my friends. I wish to thank you for your good service."

$1.00 ppd.

"I have been using one of your transmitter buttons, and it has proved to be worth more than its value in my experimenting." "I received one (Transmitter Button) some time ago, and they are just O. K. for experimentary." "I bave been using one of your transmitter buttons for experimental work and it certainly lives up to all you say for it *and then some.*"



Fig. 7

Mr. H. Gernsback, editor of this magazine, who is the dean of electrical experimenters, said: "In writer's opinion, obtained by actual elaborate tests, your Transmitter Button is probably most efficient device of its kind on market today, due to its simplicity and other outstanding features. Should have a great future."

Figures 6, 7 and 8 suggest some very interesting experiments. That of reproducing music at a point far removed from the phonograph is very popular with experimenters. The Skinderviken Transmitter Button is mounted in a very small hole in the under side of the sound arm. (Note: This hole will not injure the quality of the music.) When the phonograph is being played, the sounds produced are transformed by the Skinderviken Transmitter Button into a varying electrical current. The receiver, which is located in another room, reproduces the music at that point.



Fig. 8

Figures 7 and 8 illustrate the methods of transmitting sound by means of the vibrations in a body while speaking. Speech will be reproduced by the receiver just the same as if the experimenter had spoken into a transmitter. In these experiments the Skinderviken Transmitter Button is mounted on a small iron disc.

The same circuit connections apply to all experiments, regardless of how the transmitter button is mounted.

The Skinderviken Transmitter Button operates on one or two dry cells. It often happens that two cells produce too much current and the sounds are deafening. We recommend either one fresh cell or two worn out cells.

We have the utmost faith in our transmitter button. We guarantee satisfactory service or we will refund the purchase price. Boys — Young and old—send in a dollar bill RIGHT NOW! You can't lose. If you're not satisfied, you receive your dollar back. Isn't that fair?

Send a 3c stamp for a copy of Booklet No. 4.

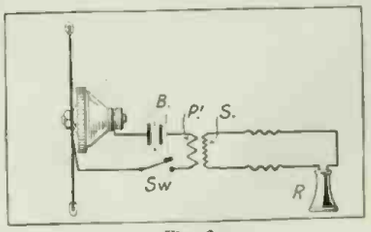


Fig. 2
Transmitter Button mounted the same but with Induction Coil.

USE THIS COUPON

STECO, 2134 North Clark St., Chicago, Illinois. (Use Pencil) E. E. 4-19
Gentlemen:—Please enter an order for
Enclose sufficient postage for mailing.

[ ] Skinderviken transmitter buttons	@ $1.00	prepaid	
[ ] 110 volt generators.....bars	@	Wt.....lbs.	
[ ] Ringers.....ohms	@	Wt.....lbs.	
[ ] Cords.....conductor.....ft.	@	Wt.....lbs.	
[ ] Induction coils	@ .35	Wt.....lbs.	
[ ] Transmitters with T. Button	@ 1.50	Wt.....lbs.	

Ship to.....

.....

.....

Send Booklet No. 4. [ ]

www.americanradiohistory.com

FREE TO YOU!

Read this Remarkable Offer!



OFFER No. 1

Wireless Course

The most comprehensive Wireless Course ever printed. Contains 160 pages, 350 illustrations. Size of book 6¾"x10". Very fine flexible cloth cover.

FREE with a year's subscription.
Add 5c for postage

OFFER No. 2

Experimental Electricity Course

This masterpiece contains 160 pages, 400 illustrations. Size of book 5"x9". Printed on extra thin paper, so book can be slipped into pocket. Handsome flexible cloth cover.

FREE with a year's subscription. Add 5c postage

OFFER No. 3

How to Make Wireless Sending Apparatus
By 20 Radio Experts

How to Make Wireless Receiving Apparatus
By 20 Radio Constructors

These books are by far the most successful wireless books on the market. Size of each book 5"x7", well bound on good book paper. Covers in two colors. We really cannot praise these books too highly. Each book contains 100 pages and from 88 to 90 illustrations. **BOTH** books **FREE** with a year's subscription. Add 5c for postage

This is a very limited offer. It may be withdrawn at any time, due to the tremendous cost of paper, which IS JUST DOUBLE WHAT IT WAS ONE YEAR AGO. We have only a limited supply of these fine books on hand; after they are gone we cannot reprint the books until conditions become normal again. **Now is your chance.**

The publishers of this journal have earned an enviable reputation of giving more than 100 cents' worth for each dollar spent with them. Profit by this liberal opportunity NOW; it may never be made again.

HERE'S THE OFFER

Subscribe to the ELECTRICAL EXPERIMENTER for one year, at the regular subscription price of $2.00 per year (Canada, foreign and N. Y. C. $2.50) and we will send you either books shown in one of the above offers. If you subscribe for two years, two offers will be given, etc.

If you are a subscriber at present take advantage of this wonderful opportunity anyway. If you do, we will extend your present subscription.

This Offer Limited. *Act Now.*

EXPERIMENTER PUB. CO.
223 FULTON STREET NEW YORK CITY

FILL IN — TEAR OUT — AND MAIL

4-19

Gentlemen:
Please enter my subscription to the ELECTRICAL EXPERIMENTER for the term of ... year.. for which I enclose herewith $.....
You will also send me at once FREE your book..... as per offer No.....
.....
.....
Name.....
Address.....

www.americanradiohistory.com



Every Electrical Man Wants These Books and we ship them for your inspection FREE



Flexible Covers — Handy Pocket-Size Volumes

10 Volumes — 3500 Pages — 4700 Pictures

$1 Per Volume

$1 Per Month

Just what you need to know to succeed in ELECTRICITY

EVERY electrician, every engineer, every mechanic should know about these wonderfully helpful instructive books, which give in plain words a complete working knowledge of electrical engineering in all its phases.

You run into some new electrical problem almost every day. The information you need to help you in your every day work is in

HAWKINS ELECTRICAL GUIDES

These books place electricity at your finger ends. They cover every imaginable subject, principle, theory, problem, trouble, and way of doing things electrically. Every subject is indexed so that you can turn right to it. They are a study course and a reference guide in one, written in plain every day language—no wasted words—only what you need to know—chock full of up-to-the-minute electrical knowledge. The guides are a complete course in electrical engineering. They will help you in every detail of the day's electrical work. You can't ask an electrical question that Hawkins Guides can't answer.

Pocket-Size Flexible Covers

The books are small enough to slip into your coat pocket—handsomely bound in flexible black covers.

You can carry each volume with you until you have mastered its contents. 3,500 pages of actual information and 4,700 illustrations. Once you see these books and put them into actual use you will never again want to be without them. Try it at our expense.

SEND NO MONEY

It will cost you nothing to receive these books—to look them over—ask them all the questions you can think of—use them in your work—study them—pick up some information that will increase your earning ability. We will ship you the entire set of 10 volumes entirely FREE.

This is a sign of our confidence in the guides. Pure gold does not object to being tested. Keep them for seven days and if you do not decide that you can't get along without them, return them to us and owe us nothing.

When you decide to keep them you only have to pay $1.00 down and remit the balance of $9.00 on the easy payment of $1.00 a month till paid for.

Use this coupon to get the books. It will pay you many times over.

THEO. AUDEL & CO.
72 Fifth Ave. New York, N. Y.

What Electrical Men Say

Helped Him Make Good

"It is only right for me to recommend highly the Hawkins Guides, for they have been of the greatest assistance to me in placing me in my present position as Superintendent of Construction Department of one of Ohio's largest Electrical Companies. I would like to see every man have a set of Hawkins Guides."
Geo. Knecht, Columbus, Ohio.

In the Naval Electrical Dept.

"The Hawkins Guides are great help to me in the Naval Electrical Department, which they cover very thoroughly."
C. J. Cornell,
U. S. Receiving Ship, Brooklyn, N. Y.

Superintendent

"I am now superintendent of the Dunnville Hydro-Electric Systems, and Hawkins Guides were a great help to me in holding down a responsible position."
W. E. Swartz, Dunnville, Ontario.

Wireless Operators

"I have worked wireless for ten years—but I wish I had these books years ago, as they have saved me a great deal of trouble." H. Marshall,
Steamer M & B No. 2,
Walkerville, Ont.

READ THIS PARTIAL LIST OF CONTENTS

No. 1 Contains 348 pages, 388 illustrations. Electrical signs and symbols—static and current electricity—primary cells—conductors and insulators—resistance and conductivity—magnetism—induction coils—dynamo principles—classes of dynamos—armatures—windings—commutation—brushes, etc.

No. 2 Contains 348 pages, 394 illustrations. Motor principles—armature reaction—motor starting—calculations—brake horsepower—selection and installation of dynamo and motors—galvanometers—standard cells—current measurement — resistance measurement — voltmeters — wattmeters—watt hour meters—operation of dynamos—operation of motors, etc.

No. 3 Contains 300 pages, 423 illustrations. Distribution systems—wires and wire calculations—inside, outside and underground wiring—sign flashers—lightning protection—rectifiers—storage battery systems, etc.

No. 4 Contains 270 pages, 379 illustrations. Alternating current principles—alternating current diagrams—the power factor—alternator principles—alternator construction—windings, etc.

No. 5 Contains 320 pages, 614 illustrations. A. C. Motors—synchronous and induction motor principles—A. C. commutator motors—induction motors, transformers; losses, construction, connections, tests—converters—rectifiers, etc.

No. 6 Contains 298 pages, 472 illustrations. Alternating current systems—switching devices—circuit breakers—relays—lightning protector apparatus—regulating devices—synchronous condensers—indicating devices—meters—power factor indicators—wave form measurement—switch boards, etc.

No. 7 Contains 316 pages, 379 illustrations. Alternating current, wiring power stations—turbines; management, selection, location, erection, testing, running, care and repair—telephones, etc.

No. 8 Contains 332 pages, 436 illustrations. Telegraph—simultaneous telegraphy and telephony—wireless—electric bells—electric lighting—photometry, etc.

No. 9 Contains 322 pages, 627 illustrations. Electric railways—electric locomotives—car lighting—trolley car operation—miscellaneous applications—motion pictures—gas engine ignition—automobile self-starters and lighting systems, electric vehicles, etc.

No. 10 Contains 513 pages, 599 illustrations. Elevators—cranes—pumps—air compressors—electric heating—electric welding—soldering and brazing—industrial electrolysis—electro plating—electro-therapeutic—X-rays, etc.

Also a complete 126-page ready reference index of the complete library. This index has been planned to render easily accessible all the vast information contained in the 10 electrical guides. There are over 13,500 cross references. You find what you want to know instantly.

THEO. AUDEL & CO.
72 Fifth Avenue
New York, N. Y.

Please submit me for examination Hawkins Electrical Guides (price $1 each). Ship at once, prepaid, the 10 numbers. If satisfactory I agree to send you $1 within seven days and to further mail you $1 each month until paid.

Signature .....

Occupation .....

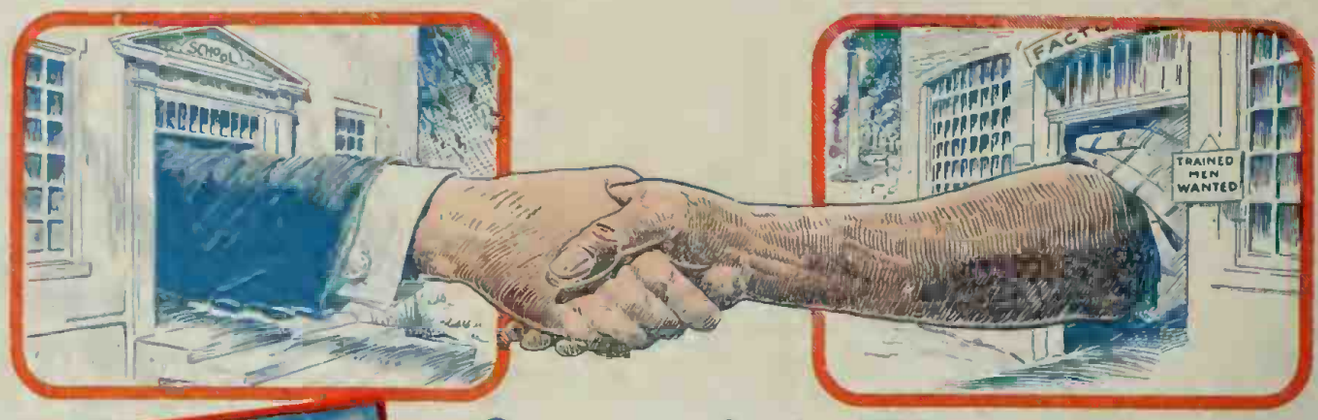
Business Address .....

Residence .....

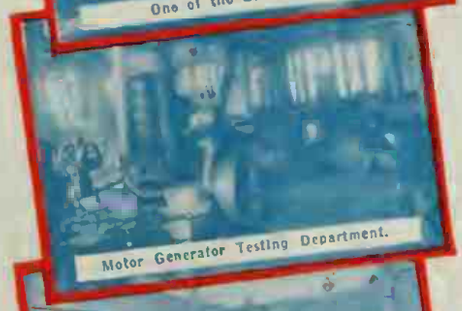
Reference ..... E. E. Apr.

SEND NO MONEY—USE THE COUPON

www.americanradiohistory.com




One of the Lecture Rooms.


Motor Generator Testing Department.


Drafting Department.

Coming! A World Era of Opportunity for Trained Electrical School Graduates!

Do you realize that this country, and practically all of the civilized world as well, is today facing a period of unparalleled demand for electrical engineers and trained electrical school graduates? Has it occurred to you that thousands upon thousands of engineers and electrical men are going to be needed soon, both here and abroad, to rebuild Europe's industries and restore her war-shattered commercial life? Have you heard what President Wilson says about after-the-war engineering? "It is of first consequence to the country that there be an adequate supply of engineers for the period of reconstruction which must follow the war."—Woodrow Wilson.

Prepare Now for This Extraordinary Opportunity—Learn the Electrical Profession as it Is Taught in America's Most Practical Electrical Institute.

Whether you take up Electrical Engineering, Expert Electrical Technique, or one of the Electrical Trades, your course in this school will be a complete, practical training for a definite kind of position. Under this institution's combined shop, drafting-room and recitation-room curriculum—with our high grade faculty of practical engineers, with our large splendidly-equipped shops and laboratories in which students learn to know electrical apparatus by actual, daily contact—an "S. O. E." Diploma has become a known badge of merit in the electrical industry.

B. S. Degree in 3 Years—Electrical Technician Diploma 1½ to 3 Years—Six Months' and One-Year Electrical Trade Courses.

Recognized "Bachelor of Science" degree given graduates of the Electrical Engineering Department, under laws of Wisconsin, in 3 years. Electrical Technician diploma given in 1½ to 3 years, according to whether student is only Grammar School graduate, or has some High School credits. (Diploma qualifies student for expert technical positions, such as Government Technician, Electro-Mechanical Draftsman, Power Plant Superintendent, Technical Salesman of Electro-Motive Power Installations, etc.) 1-year and 6-months' Trade Courses qualify students as Draftsmen, Linemen, Metermen, Motor Repairmen, Wiremen, Telephone Trouble and Repairmen, Armature Winders.

Two Reserve Officers' Training Corps Units Just Authorized in This School by United States Government.

The War Department has just authorized Junior and Senior R.O.T.C. units in this school. Students joining one of these units will be issued free uniforms and given a free six weeks' summer training camp trip each year. Members of Junior or Signal Corps Unit will receive free instruction in Wireless Telegraphy. **And after a period of 2 years' enrollment, all R.O.T.C. students recommended for same will receive a Government allowance of $12.00 per month.** Requires 3 hours' military training per week. Membership cancelled on leaving school. Mail coupon for full particulars. **New Term every 3 months.**

Earn While You Learn

Mail this coupon for full details of this school's splendid part-time employment plan, which enables students, to earn living expenses while pursuing studies.

WHY NOT CLIP THIS COUPON RIGHT NOW?

—TEAR OUT HERE—

SCHOOL OF ENGINEERING OF MILWAUKEE

83-373 Broadway, Milwaukee, Wis.

Tell me all about your "Earn-While-You-Learn" plan, and your

- ☐ Electrical Engineering Course—3 years
- ☐ Electrical Technician Course 1½ to 3 yrs.
- ☐ 1-year General Electrical Course
- ☐ Six Months Trade Courses
- ☐ Students' Reserve Officers' Training Corps

Name.....

Address.....

City.....State.....

Age.....Education.....

SCHOOL OF ENGINEERING OF MILWAUKEE

THE CAREY PRINTING CO. INC. NEW YORK

www.americanradiohistory.com

TK
7800
E54
V.7
1920

MAY, 1919
20cts.

ELECTRICAL EXPERIMENTER

SCIENCE AND INVENTION

OVER 175 ILLUST.

REG US PAT OFF.

ENGR STORAGE

OF TO... ISITY

THE THOUGHT RECORDER

See Page 12



OVER 100,000 COPIES MONTHLY — LARGEST CIRCULAT... ANY ELECTRICAL PUBLICATION

www.americanradiohistory.com

Learn Electricity



In the Great Shops of COYNE IN 3½ MONTHS

Thousands of Electrical experts are needed to help rebuild the world. Come to Chicago to the great shops of Coyne and let us train you quickly by our sure, practical way, backed by twenty years of success. Hundreds of our graduates have become experts in less than four months. *You* can do the same. *Now* is your big opportunity. Come—no previous education necessary.

Earn $125 to $300 a Month

In the Electrical business. Come here where you will be trained in these great $100,000 shops. Experts show you everything and you learn right on the actual apparatus. You work on everything from the simple bell to the mighty motors, generators, electric locomotives, dynamos, switchboards, power plants, everything to make you a master electrician. We have thousands of successful graduates. Just as soon as you have finished we assist you to a good position.

Become an Expert in 3½ Months

No need of taking from 1 to 4 years to become an expert, we have proved this in thousands of cases. The Coyne method of practical training eliminates all books, useless theory and other non-essentials and trains you in just what you need to know to become an expert.

Earn Your Way

Don't tell yourself you haven't got the money to come to Coyne. If you have ambition and the nerve of a real man, that's all you need. Dozens of our students every year work in their spare time and earn their living expenses. Dozens of others work in the day time, earn all their expense and attend our evening school. Our employment department will help you without charge.

Day or Evening Courses

Don't worry about the money. Anyone with ambition can learn here. Our tuition is low with small easy payments if desired. All tools and equipment is furnished free. Our students live in comfortable homes in the best section in Chicago—on the lake—just a few minutes' walk from our school.

Electricity, Drafting Motion Picture Operating Plumbing

We teach all these trades and professions quickly and in such a thorough, practical way that when finished you are ready to step right into a position of responsibility and big pay.

Send Today for Big Free Book

Write today, *now*, for the book. It tells what Coyne graduates have done. What you can do. Fill in the coupon, check the trade you are most interested in or send a postal card, do it *now*.

Learn Drafting

The country is crying for skilled draftsmen in all lines. Thousands of positions open with princely salaries. We give you the advantage of our big shops. No other school can do this. Now is the time to get into this big field. Experts train you under practical working conditions, no books and theory go here. Check drafting on the coupon below and mail it *at once* for full particulars.

BENNETT W. COOKE, *Director*

COYNE TRADE AND ENGINEERING SCHOOLS

Dept. 25 39-51 E. Illinois Street, Chicago, Ill.

MAIL COUPON FOR FREE BOOK NOW!

COYNE TRADE AND ENGINEERING SCHOOLS
Bennett W. Cooke, Director
Dept. 25, 39-51 E. Illinois St.
Chicago, Ill.

Please send at once your big Free Book—I am interested in

[ ] Electricity [ ] Drafting [ ] Plumbing
[ ] Motion Picture Operating
(*Check trade interested in*)

Name.....

Address.....

www.americanradiohistory.com

ELECTRICITY
AS EXPERTS KNOW IT

Learn electricity as you would in actual PRACTICE—in accordance with the methods employed by the highest paid electrical experts in America. The New McGraw-Hill Library of Practical Electricity contains the actual working facts which you need in order to succeed in the electrical field. Terrell Croft, formerly with the Westinghouse Company makes the conquest easy for you.



"See them First — Pay afterwards"

A new standard in electrical literature

The New Library of Practical Electricity by Terrell Croft marks a new era in electrical literature.

The great field of electrical engineering, with its limitless possibilities of earning power, is brought to you in a form that makes success easy. The Library is a creation—an achievement that is without parallel in technical literature, because it sticks to practice throughout its 3000 pages.

$2 per month starts you to bigger pay.



Croft's New Library of Practical Electricity. 8 vols.—3000 pages—2100 illustrations

A letter that means something to you—

McGraw-Hill Book Company, Inc.,
239 West 39th Street,
New York, N. Y.

Gentlemen: In an attempt to express myself about CROFT'S NEW LIBRARY OF PRACTICAL ELECTRICITY, I have never seen and do not believe there was ever printed in the English language, a more comprehensive set of books. It is a library that is just as valuable to the novice as to the expert, because it is all practice.

Respectfully,
GUY H. PEIFER,
Chief, Doplan Silk Corporation, Hazleton, Pa.

Now is the time to prepare for a high salary--- Now is the time to master electricty.

Old books won't do. Amateurish books won't do. Books compiled by "desk authors" or men with no practical experience will not serve your purpose.

Practical books are easiest mastered. Practical books, written by practical men, teach you accurately and rapidly. There is nothing in the Croft Library which you cannot understand. Terrell Croft tells you the secrets of success in electricity in plain words, figures and illustrations. Nothing is left to the imagination. There is no guesswork. There is no theory or higher mathematics.

Send now for these eight volumes. No matter how many books on electricity you possess, you are unfair to yourself unless you take advantage of this free examination privilege. No matter whether you are beginner or expert, these books will show you the clear road to success. Inspection will prove this.

McGraw-Hill Book Co., Inc.
239 W. 39th St., New York.

Not one cent in advance— Just the Coupon

Examine this new Library for ten full days without expense. Find out for yourself why it is now taking the lead in electrical book sales in America. Use the books as you see fit for ten days. Look at the hundreds of illustrations that clear up all the mysteries in electrical practice. Stick a couple of the volumes in your pockets, and refer to them during the day. Figure out in an instant the problems that have heretofore taken hours.

Then send us $2 per month for eight months, or return the set entirely at our expense. You risk nothing by returning the attached coupon.

ACT NOW

FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc.
239 W. 39th St.
NEW YORK

Gentlemen:
Please send me the Library of Practical Electricity (shipping charges prepaid) for 10 days' free examination. If satisfactory, I will send $2 in ten days and $2 per month until $16 has been paid. If not wanted I will write you for return shipping instructions.

Name.....
Home Address.....
City and State.....
Name of Employer.....
His Address.....
Your Position.....

LIBRARY SEP 2 8 1999 UNIVERSITY OF TORONTO

www.americanradiohistory.com

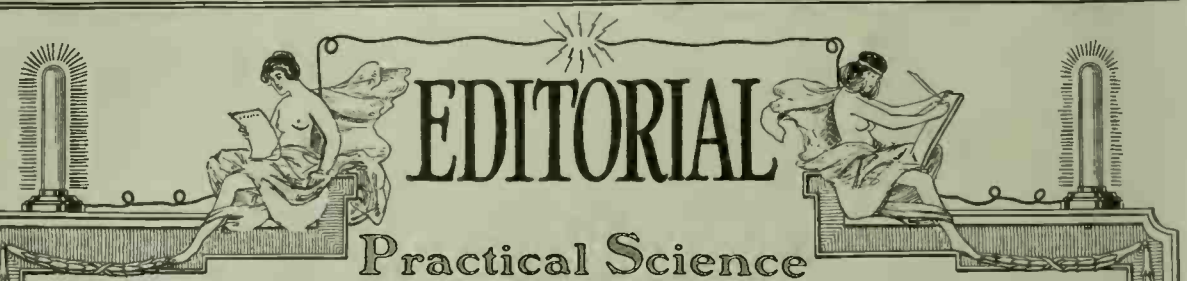
Electrical Experimenter

233 FULTON STREET, NEW YORK

Publisht by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer;) 233 Fulton Street, New York.

Vol. VII. Whole No. 73 **MAY, 1919** **No. 1**

THE THOUGHT RECORDER.....Front Cover
From a painting by Howard Brown
FUTURE RAPID TRANSIT..... 7
WILL MAN FREEZE THE EARTH TO DEATH?..... 8
By E. T. Brondsdon
HOW THE FRENCH LOCATED SUBMARINES..... 9
VEHICULAR TUNNEL UNDER THE HUDSON RIVER..... 10
By H. Winfield Secor
THE THOUGHT RECORDER—NO. 2 FUTURE INVENTIONS.. 12
By H. Gernsback
PARIS LETTER, by Jacques Boyer, Paris Correspondent of the Electrical Experimenter..... 13
LOCATING ENEMY GUNS BY FLASH AND SOUND..... 14
NOVEL ELECTRICAL TALKING SIGN..... 15
RELIEVING THE SUBWAY CAR CRUSH. By Sidney Gernsback 15
MY INVENTIONS, PART IV. by Nikola Tesla..... 16
THE NEW YORK AERO SHOW..... 18
MONSTER ESCALATOR FOR NEW YORK SUBWAY..... 20
BRITISH SUBMARINE LOCATER..... 21
PUTTING IT OVER ON FRITZ.....By K. K. Sammerin 22
COLD LIGHT—WHAT IT IS.....By Rogers D. Rusk, M.A. 23
POPULAR ASTRONOMY—ASTRONOMICAL DISTANCES..... 24
By Isabel M. Lewis
RECLAIMING METAL DUST FROM FLUE GASES..... 26
TRY THESE ON YOUR AUTO..... 27
THE TRUE WIRELESS—By Nikola Tesla.—Special Feature Article 28
AMPLIFIER BOOSTS SIGNALS 1,000,000 TIMES..... 31
MULTIPLEX RADIO SYSTEM ADOPTED BY U. S..... 32
NEW FRENCH AND AMERICAN AUDIONS..... 32
NEW REGENERATIVE VACUUM TUBE CIRCUITS..... 33
By Samuel D. Cohen
PRACTICAL CHEMICAL EXPERIMENTS—TESTING OF WOOL, COTTON AND LINEN.....By Albert W. Wilsdon 34
EXPERIMENTS IN RADIO-ACTIVITY. PART III..... 35
By Ivan Crawford
THE CONSTRUCTOR—THE "NOISELESS" PHONOGRAPH.... 36
By Thomas Reed
AUTOMATIC BELL RINGING ATTACHMENT FOR EIGHT DAY CLOCK.....By T. A. Neelin 37
HOW-TO-MAKE-IT DEPARTMENT—PRIZE CONTEST..... 40
WRINKLES, RECIPES AND FORMULAS. Edited by S. Gernsback 42
LATEST PATENTS..... 43
WITH THE AMATEURS—LABORATORY PHOTO CONTEST.... 44
SCIENCE IN SLANG—THE SPECKS IN SPACE..... 45
By Emerson Esterling
"THE ORACLE"..... 46



EDITORIAL

Practical Science

THE wonderful age in which we are living has never been paralleled in history. We have more comforts, more conveniences, more of everything than human beings ever had, since the creation of the world. Nevertheless, our lives become more and more complex, as time rolls on, while the average human being becomes more perplexed at the strange surroundings in which he finds himself.

Our electro-mechanical age brings forth new surprises constantly, and he who does not know the rudimentaries of mechanics, electricity and general physics is like a blind man in a circus. He hears what is going on, but all is meaningless to him—he cannot get the full benefit of the performance.

Where humanity now finds itself surrounded by machines, and by electrical wires at every hand, it behooves every man to know something about them. Thousands of lives are lost every year because laymen refuse to learn a little about science in general. They get killed because they fight short-circuits with water, when ten minutes of study would have told them that water is a conductor, and that a few handfuls of dry sand—which is a non-conductor—would have saved the life, *and* the house which burnt down due to the short-circuit. If the father had told his boy that a wet rope is a good conductor for electricity that boy would be alive today. Instead, the boy threw the wet rope over the high tension line, while holding it in his hand, and was killed.

If the six hundred auto owners who were asphyxiated last year—the casualties become larger each year—had known a bit of chemistry, they, too, would be living today. But they insisted upon running their engines in a garage with closed doors, and unfortunately, you can't smell carbon monoxid, even if it is deadly.

Then, too, hundreds of people perish in snow storms every year quite unnecessarily. Usually they freeze to death. The white man runs about in a frenzy when he knows himself lost. He becomes overheated, and the perspiration soaks his clothing. Finally he sinks down into the snow, exhausted, and if it is cold enough he is soon frozen stiff. Now Eskimos, who have learned a bit of science by hard experience, prefer to live pleasantly thru the worst snowstorm, with the temperature below zero. If the Eskimo becomes lost in the wilderness he knows better than to run about aimlessly. He promptly digs a cave into the snow, with the entrance away from the wind, using only his hands for tools. Inside of ten minutes he is safely ensconced in a comparatively warm shelter. He then closes up the entrance almost entirely, sits down, drops his head on his knees, and has a refreshing sleep. The next morning he digs himself out, and is on his way.

If the writer had not known something about electricity, he, too, might not be here to write these lines. As a boy he went down into an unoccupied cellar. The wind blew the wooden door shut, locking him in, as the iron latch was outside. The only other exit was an open window hole barricaded with stout iron rods, thru which the wind roared. The temperature was below zero. The cellar was empty, save for a few wooden crates, the object of the visit. The cellar being distant from the house and other habitations, the parents away, and the caretaker off for the night, there was every possibility of his freezing to death. No tools to break down the door, no matches to make a fire. But there was a portable light, with two large electric dry cells in a wooden box, which the writer had brought along to light his way.

He unraveled the stranded electric cord and extracted a single thin copper strand an inch long. With this he short-circuited the dry cells. The wire became white hot. A piece of paper was touched to it, which burst into flame; a broken piece of crate wood was ignited by the flame, and a fire soon roared. A burning crate set the cellar door on fire, and in ten minutes the adventure had come to a close.

H. GERNSBACK.

The ELECTRICAL EXPERIMENTER is publisht on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions, Canada and foreign countries, $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 20 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. A green wrapper indicates expiration. No copies sent after expiration.

All communications and contributions to this journal should be address to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

ELECTRICAL EXPERIMENTER. Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered U. S. Patent Office. Copyright, 1919, by E. P. Co., Inc., New York. The Contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.

The ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris.

Member of the Audit Bureau of Circulation.

www.americanradiohistory.com

The Secret of Being a Convincing Talker

How I Learned It in One Evening

By GEORGE RAYMOND

"HAVE you heard the news about Frank Jordan?"

This question quickly brought me to the little group which had gathered in the center of the office. Jordan and I had started with the Great Eastern Machinery Co., within a month of each other, four years ago. A year ago Jordan was taken into the accounting division and I was sent out as salesman. Neither of us was blessed with an unusual amount of brilliancy, but we got by in our new jobs well enough to hold them.

Imagine my amazement, then, when I heard:

"Jordan's just been made Treasurer of the Company!"

I could hardly believe my ears. But there was the "Notice to Employees" on the bulletin board, telling about Jordan's good fortune.

Now I knew that Jordan was a capable fellow, quiet, and unassuming, but I never would have picked him for any such sudden rise. I knew, too, that the Treasurer of the Great Eastern had to be a big man, and I wondered how in the world Jordan landed the place.

The first chance I got, I walked into Jordan's new office and after congratulating him warmly, I asked him to let me "in" on the details of how he jumped ahead so quickly. His story is so intensely interesting that I am going to repeat it as closely as I remember.



FREDERICK HOUK LAW

As educator, lecturer, executive, traveler and author few men are so well equipped by experience and training as Dr. Law to teach the art of effective speaking. His "Mastery of Speech" is the fruit of 20 years' active lecturing and instruction in Eastern schools and colleges preceded by an education at Oxford Academy, Amherst College, Columbia University, The Teachers College, Brown University, and New York University. He holds the degrees of A.B., A.M., and Ph.D.

Dr. Law is the author of two novels, two books of poetry, and editor of six school text-books. At present he is lecturer in English in New York University, Lecturer in Pedagogy in the Extension Work of the College of the City of New York, Head of the Dept. of English in the Stuyvesant H. S. and writer of the Weekly Lesson Plans for The Independent.

"I'll tell you just how it happened, George, because you may pick up a pointer or two that will help *you*.

"You remember how scared I used to be whenever I had to talk to the chief? You remember how you used to tell me that every time I opened my mouth I put my foot into it, meaning of course that every time I spoke I got into trouble? You remember when Ralph Sinton left to take charge of the Western office and I was asked to present him with the loving cup the boys gave him, how flustered I was and how I couldn't say a word because there were people around? You remember how confused I used to be every time I met new people? I couldn't say what I wanted to say when I wanted to say it; and I determined that if there was any possible chance to learn how to talk I was going to do it.

"The first thing I did was to buy a number of books on public speaking, but they seemed to be meant for those who wanted to become orators, whereas what I wanted to learn was not only how to speak in public but how to speak to individuals under various conditions in business and social life.

"A few weeks later, just as I was about to give up hope of ever learning how to talk interestingly, I read an announcement stating that Dr. Frederick Houk Law of New York University had just completed a new course in business talking and public speaking entitled 'Mastery of Speech.' The course was offered on approval without money in advance, so since I had nothing whatever to lose by examining the lessons, I sent for them and in a few days they arrived. I glanced through the entire eight lessons, reading the headings and a few paragraphs here and there, and in about an hour the whole secret of effective speaking was opened to me.

"For example, I learned why I had always lacked confidence, why talking had always seemed something to be dreaded whereas it is really the simplest thing in the world to 'get up and talk.' I learned how to secure complete attention to what I was saying and how to make everything I said interesting, forceful and convincing. I learned the art of listening, the value of silence, and the power of brevity. Instead of being funny at the wrong time, I learned how and when to use humor with telling effect.

"But perhaps the most wonderful thing about the lessons were the actual examples of what things to say and when to say them to meet every condition. I found that there was a knack in making oral reports to my superiors. I found that there was a right way and a wrong way to present complaints, to give estimates, and to issue orders.

"I picked up some wonderful pointers about how to give my opinions, about how to answer complaints, about how to ask the bank for a loan, about how to ask for extensions. Another thing that struck me forcibly was that, instead of antagonizing people when I didn't agree with them, I learned how to bring them around to my way of thinking in the most pleasant sort of way. Then, of course, along with those lessons there were chapters on speaking before large audiences, how to find material for talking and speaking, how to talk to friends, how to talk to servants, and how to talk to children.

"Why, I got the secret the very first evening and it was only a short time before I was able to apply all of the principles and found that my words were beginning to have an almost magical effect upon everybody to whom I spoke. It seemed that I got things done instantly, where formerly, as you know, what I said 'went in one ear and out the other.' I began to acquire an executive ability that surprised me. I smoothed out difficulties like a true diplomat. In my talks with the chief I spoke clearly, simply, convincingly. Then came my first promotion since I entered the accounting department. I was given the job of answering complaints, and I made good. From that I was given the job of making collections. When Mr. Buckley joined the Officers' Training Camp, I was made Treasurer. Between you and me, George, my salary is now $7,500 a year, and I expect it will be more from the first of the year.

"And I want to tell you sincerely, that I attribute my success solely to the fact that I learned how to talk to people."

****

When Jordan finished, I asked him for the address of the publishers of Dr. Law's Course and he gave it to me. I sent for it and found it to be exactly as he had stated. After studying the eight simple lessons I began to sell to people who had previously refused to listen to me at all. After four months of record breaking sales during the dullest season of the year, I received a wire from the chief asking me to return to the home office. We had quite a long talk in which I explained how I was able to break sales records—and I was appointed Sales Manager at almost twice my former salary. I know that there was nothing in me that had changed except that I had acquired the ability to talk where formerly I simply used "words without reason." I can never thank Jordan enough for telling me about Dr. Law's Course in Business Talking and Public Speaking. Jordan and I are both spending all our spare time making public speeches on war subjects, and Jordan is being talked about now as Mayor of our little town.

So confident is the Independent Corporation, publishers of "Mastery of Speech," Dr. Law's Course in Business Talking and Public Speaking, that once you have an opportunity to see in your own home how you can, in one hour, learn the secret of speaking and how you can apply the principles of effective speech under all conditions, that they are willing to send you the Course on free examination.

Don't send any money. Merely mail the coupon or write a letter and the complete Course will be sent, all charges prepaid, at once. If you are not entirely satisfied send it back any time within five days after you receive it and you will owe nothing.

On the other hand, if you are as pleased as are the thousands of other men and women who have used the Course, send only $5 in full payment. You take no risk and you have everything to gain, so mail the coupon now before this remarkable offer is withdrawn.

FREE EXAMINATION COUPON

Independent Corporation

Publishers of The Independent Weekly

Dept. L-1105 119 West 40th Street, New York

Please send me Dr. Frederick Houk Law's "Mastery of Speech," a Course in Business Talking and Public Speaking in eight lessons. I will either remail the Course to you within five days after its receipt, or send you $5.

Name .....

Address .....

..... Elect. Exp. 5-19

www.americanradiohistory.com

The Burgess BLUE BOOK

for all Practical Men and Electrical Students

(See review of this book by Editor in December issue of your Electrical Experimenter page 568)

I have prepared a pocket-size note book especially for the practical man and those who are taking up the study of electricity. It contains drawings and diagrams of electrical machinery and connections, over two hundred formulas for calculations, and problems worked out showing how the formulas are used. This data is taken from my personal note book, which was made while on different kinds of work, and I am sure it will be found of value to anyone engaged in the electrical business.

The drawings of connections for electrical apparatus include Motor Starters and Starting Boxes, Overload and Underload Release Boxes, Reversible Types, Elevator Controllers, Tank Controllers, Starters for Printing Press Motors, Automatic Controllers, Variable Field Type, Controllers for Mine Locomotives, Street Car Controllers, Connections for Reversing Switches, Motor and Dynamo Rules and Rules for Speed Regulation. Also, Connections for Induction Motors and Starters, Delta and Star Connections and Connections for Auto Transformers, and Transformers for Lighting and Power Purposes. The drawings also show all kinds of lighting circuits, including special controls where Three and Four Way Switches are used.

The work on Calculations consists of Simple Electrical Mathematics, Electrical Units, Electrical Connections, Calculating Unknown Resistances, Calculation of Current in Branches of Parallel Circuits, How to Figure Weight of Wire, Wire Gauge Rules, Ohm's Law, Watt's Law, Information regarding Wire used for Electrical Purposes, Wire Calculations, Wiring Calculations, Illumination Calculations, Shunt Instruments and How to Calculate Resistance of Shunts, Power Calculations, Efficiency Calculations, Measuring Unknown Resistances, Dynamo and Dynamo Troubles, Motors and Motor Troubles, and Calculating Size of Pulleys.

Also Alternating Current Calculations in finding Impedance, Reactance, Inductance, Frequency, Alternations, Speed of Alternators and Motors, Number of Poles in Alternators or Motors, Conductance, Susceptance, Admittance, Angle of Lag and Power Factor, and formulas for use with Line Transformers.

WHAT PRACTICAL MEN SAY ABOUT THE "BURGESS BLUE BOOK"

Received your "Blue Book" and must say it is the best book I ever saw. I showed it to a friend of mine and he refused to give it back to me but he paid me a dollar and told me to get another. Rather than be without this book I am sending Money Order for three of them so I can show them to two more of my friends and have one left for myself. Wishing you would mail them at once, I am Yours very truly,

JOSEPH BRAITH, Electrician,
Madison, Wisconsin.

Your "Blue Book" received and it is just the book I have been looking for. Please mail me three more by return mail for which I am enclosing Money Order. Respectfully,

V. E. JOHNSON, Western Union Tel. Co.,
Marion, Ohio.

Have received the copy of the "Burgess Blue Book" and am very well pleased with the easily found formulas and data contained in it. I am enclosing Money Order for four additional copies. Very truly yours,

THURE C. ANDERSON,
Ridgeway, Penn.

Dear Sir:—There can be no possible question as to the service you are rendering Electrical Workers. To date I have received 78 Burgess Blue Books and hope my friends will duplicate their order to you. Go ahead with this good work,
Yours truly,

EDW. C. RAY,
Brooklyn, New York.

I am enclosing three dollars for which please send me three copies of the "Burgess Blue Book". I showed the copy I got last week to some friends and three of them asked me to get them one. Very truly yours,

CHAS. H. DAVIS,
Los Angeles, Cal.

I received your "Blue Book" and after I looked over it I see that it is a very useful book. After I showed it to some fellows they wanted a copy also and I am enclosing Money Order for which please send me three at once. Yours very truly,

R. S. SWANSON,
St. Paul, Minn.

I received the three books I sent for and the next day I sold them. The fellows think they are well worth the price. Please send me three more for which I am enclosing Money Order. Yours very truly,

R. S. SWANSON,
St. Paul, Minn.

NOTICE

To help get the "Burgess Blue Book" to the men who need it the most, we have established a resale discount to which those who have purchased a book from us are entitled. In this way the "Blue Book" is sold by those who know its value and we feel that this arrangement is much more satisfactory to the purchaser, than if he bought it through the regular book-selling channels. The book practically sells on sight, as a man engaged in practical work realizes when he sees it, it contains information which is extremely useful and which is difficult to obtain.

The Burgess BLUE BOOK Will Be Shipped, Postpaid, on Receipt of *$1.00*

Send dollar bill, money order or check. *I guarantee satisfaction or will return your money* if you decide not to keep the book after using it for five days

BURGESS ENGINEERING CO., YORKE BURGESS, *Consulting Engineer*
747 East 42nd Street Chicago, Illinois

www.americanradiohistory.com

Was $100

Now $57



The Famous Oliver

For Free Trial—Then Save $43

This is the identical $100 Oliver, Model 9, our latest and best. We continue to sell it under the plan we adopted during the war.

We learned economies then in selling which enable us to save the $43 it formerly cost us to sell you an Oliver.

We learned that it was unnecessary to have great numbers of traveling salesmen and numerous, expensive branch houses throughout the country. We were also able to discontinue many other superfluous, costly sales methods. You benefit by these savings.

Only our sales plan has changed. Not the Oliver. Our new plan is to ship direct from the factory to you, depending upon the Oliver to be its own salesman.

You may order direct from this advertisement, without sending a penny. The coupon brings an Oliver for free trial.

When the Oliver comes to you, let it prove its superiority and saving. You be the judge, with no eager salesman present to influence you.

If you do not agree that it is the finest typewriter built, regardless of price, simply return it, express collect. Even the outgoing transportation charges will then be refunded.

The Oliver for $57 makes a $100 price appear extravagant. Remember this is not a second-hand or rebuilt machine. If any typewriter is worth $100, it is this brand new Oliver.

Furthermore, it is as easy to buy The Oliver as it is to try it. If, after trying it five days you decide to keep it, you merely pay $3 per month until the $57 is paid. This is less than 10c per day.

This Oliver is being bought by the thousands. Our plan, conceived when this country entered the war, has met a tremendous welcome. We have repeatedly increased our production facilities. Note at the left a few of the great concerns using the Oliver. And remember that it is being bought by thousands of individuals. It has been aptly called the people's typewriter.

In every particular, this splendid Oliver is the finest that 24 years of experience can produce. A better typewriter is impossible. It has all the latest improvements. It is noted for its handsome appearance, richly enameled olive green and polished nickel; its durability and workmanship. Do you know of any typewriter which combines so many advantages, yet offered at such a low price and easy terms?

This Oliver has a standard keyboard. So anyone may turn to it without the slightest hesitancy. It is speedy and has an untiring action—with lightest touch.

Don't buy—don't rent—until you have investigated this fine economical Oliver. Note that the coupon below brings either an Oliver for Free Trial, or further information.

Canadian Price, $72

The Oliver Typewriter Co.

675 Oliver Typewriter Bldg.

Chicago, Illinois

Some of the famous users

U. S. Steel Corporation

Pennsylvania Railroad

Nat'l City Bank of New York

Morris & Company

Encyclopedia Britannica

Boston Elevated Railways

Otis Elevator Co.

Corn Products Refining Company

Columbia Graphophone Co.

N. Y. Edison Co.

Hart, Schaffner & Marx

Diamond Match Co.

Baldwin Locomotive Works

American Bridge Co.

Over 700,000 Sold

(4.02)

Save $43 by using this coupon

THE OLIVER TYPEWRITER COMPANY
675 Oliver Typewriter Building, Chicago, Ill.

☐ Ship me a new Oliver Nine for five days free inspection. If I keep it, I will pay $57 at the rate of $3 per month. The title to remain in you until fully paid for. My shipping point is.....
This does not place me under any obligation to buy. If I choose to return the Oliver, I will ship it back at your expense at the end of 5 days.

☐ Do not send a machine until I order it. Mail me your book—"The High Cost of Typewriters—The Reason and the Remedy," your de luxe catalog and further information.

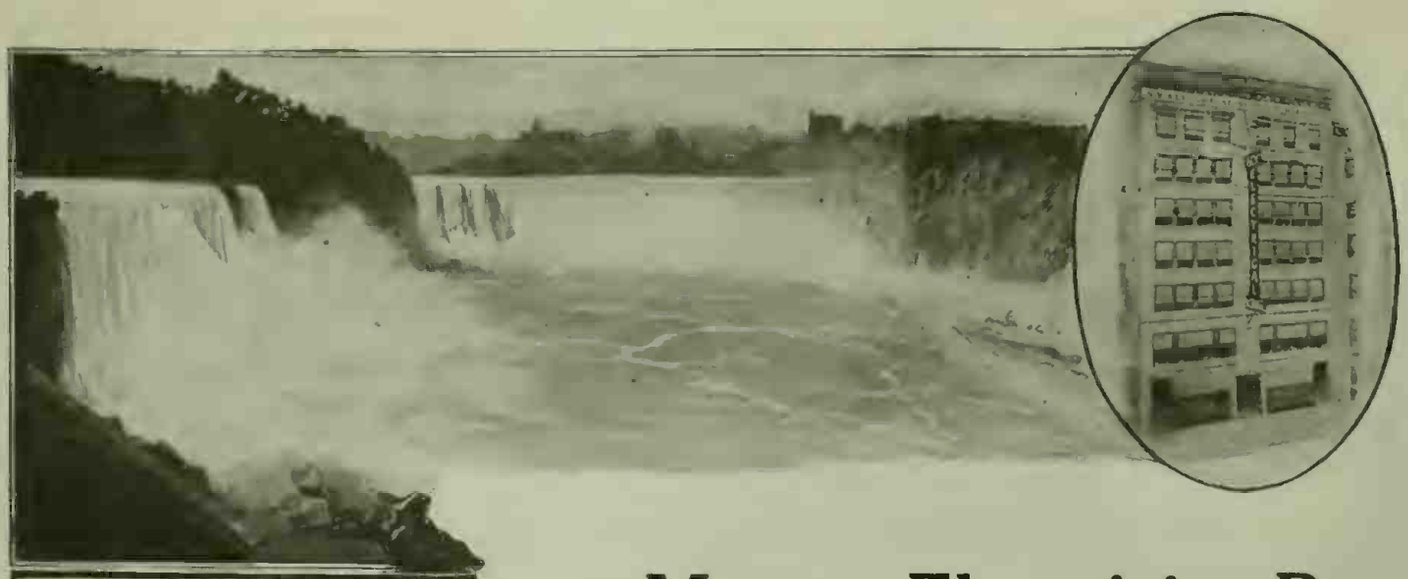
Name .....

Street Address .....

City .....State .....

Occupation or Business.....

www.americanradiohistory.com





Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 5,500 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Let us explain this course to you in person. If you can't call, send now for 64-page book—it's FREE to you

New York Electrical School

29 West 17th Street, New York

New York Electrical School
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

.....(NAME)

.....(ADDRESS)

www.americanradiohistory.com

ELECTRICAL EXPERIMENTER

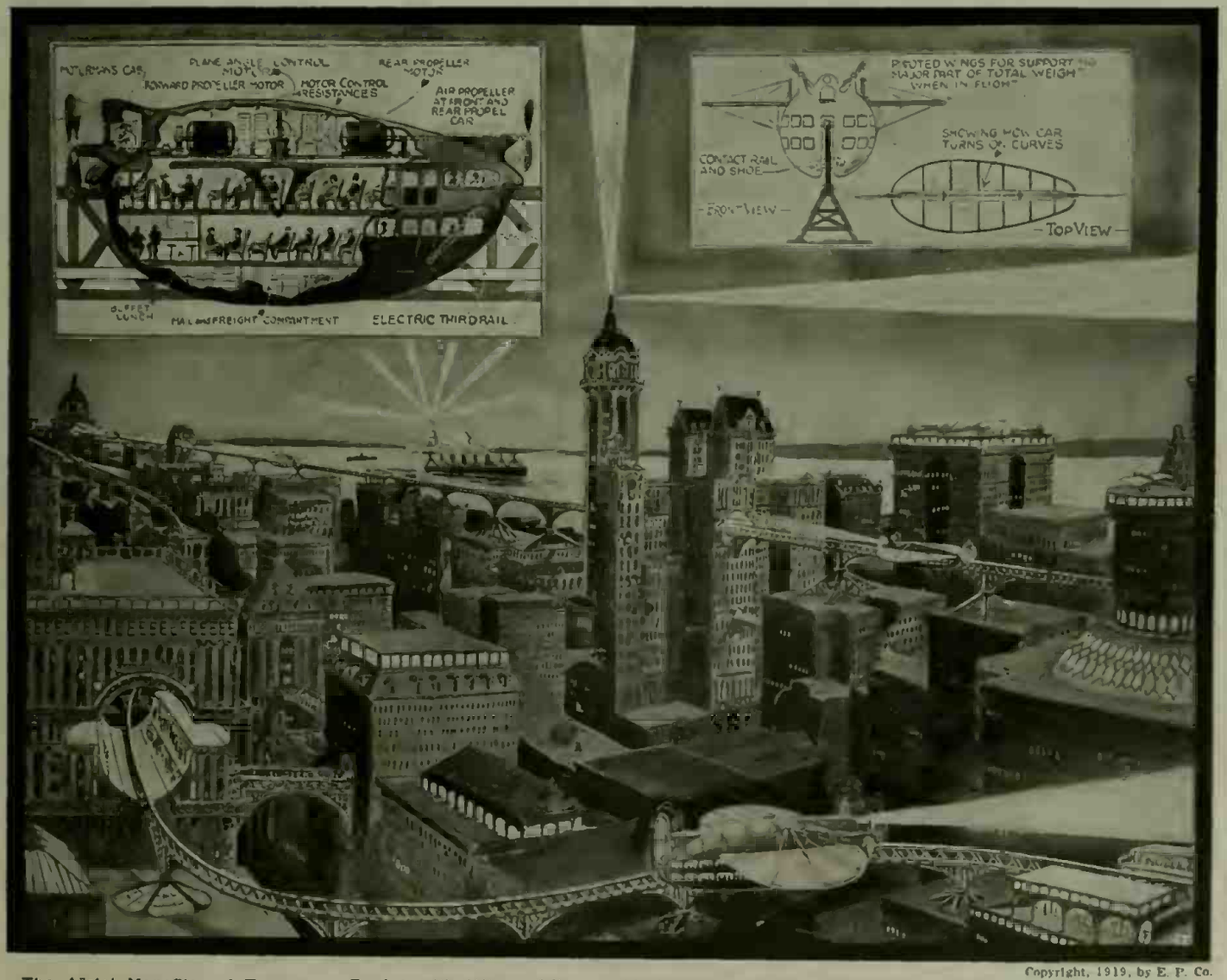
H. GERNSBACK – EDITOR
H. W. SECOR – ASSOCIATE EDITOR

Vol. VII. Whole No. 73 MAY, 1919 No. 1

Future Rapid Transit

PEOPLE who have traveled abroad will remember having seen the remarkable suspended aërial railway of Elberfeld (Germany), the cars having wheels on the roof instead of underneath, and but one rail being used. This form of construction gives, among other considerations, much greater flexibility to the speeding cars or trains, as for example when they wish to turn sharp curves at comparatively high speed. Possibly many will remember having seen this interesting suspended railway in the motion picture travelogues given by Burton Holmes. It has always seemed to us, however, that these cars have a little too much freedom of movement to make the ride as comfortable as it might be to the passengers, owing to the constant swinging or sidewise rolling motion produced by this cradle suspension arrangement. Apparently there are other people who have entertained similar ideas, for in the accompanying illustration there is shown a new development of a monorail car, which might be termed an "Aërial Monoflier," and which has been recently invented and patented by the celebrated French engineer, M. Francis Laur of Paris. As M. Laur points out in his description of the invention, his scheme relates to an improvement in a vehicle for use in high speed locomotion in connection with a monorail or single track. A very novel idea of the project is a passenger-carrying vehicle somewhat in the form of

(*Continued on page* 66)



Copyright, 1919, by E. P. Co.

The Aërial Monoflier of Tomorrow—Equipt with Wings, Like an Airplane, It Will Skim Along Thru the Air, Guided by the Monorail. The Cars Are Propelled by Motor-Driven Propellers, Which Derive Their Power from Third Rails, as the Car Glides Along at Speeds of 200 to 300 Miles Per Hour. When In Motion the Entire Weight Is Practically Carried by the Wings, the Same as In an Airplane.

www.americanradiohistory.com

Will Man Freeze the Earth to Death?

By E. T. BRONDSDON

"TO RENT: Ten-room suburban home. Three baths. Sun, sleeping and breakfast porches. Radium heating system (20 pounds) . . ." To find this advertisement, look in the classified columns of any metropolitan newspaper five or six centuries hence. Our great-great-grandchildren fifteen times removed will be worrying about paying the rent on some such dwelling. Have you paid your "Radium Rent" will be a common slogan then.

Radium power, light and heat for apartment and home will seem as much of a commonplace to them as soft coal furnaces seem to us. In tomes of ancient history they will read stories of how their ancestors struggled thru the smoky winter of 1918, and they will marvel at our lack of understanding. Soft coal then will have a place only in museums.

Twenty pounds of radium gives off an amount of heat in six months equivalent to that secured by burning four and one-half tons of the best Pocahontas or anthracite coal. The ten-room house mentioned above would be adequately heated, however, on twenty pounds, because a radium heating plant would be *one hundred per cent efficient*. Even with hot water and hard coal from eighty to ninety per cent of the heat our plants generate goes up the chimney. A radium system would have no chimney. Every single heat unit would be conserved for the interior of the house and distributed by any ordinary medium, such as register, radiator or the like.

In addition to this, the radium system would have the splendid recommendation that there would be no flues, traps or pipes to be cleaned, and no ashes would accumulate to make the householder angry on Saturday afternoon. Then there would be the greatest point of all. Once installed, this radium system *never would have to be replaced!* When one house began to disintegrate from old age, the mysterious metal could be taken out and installed in the system of a new house, and so on forever, unless some careless janitor took it out to clean and left it in the subway Coal men and ash carters would pass into that same merciful oblivion which shelters stage-coach bandits and Indians on the warpath.

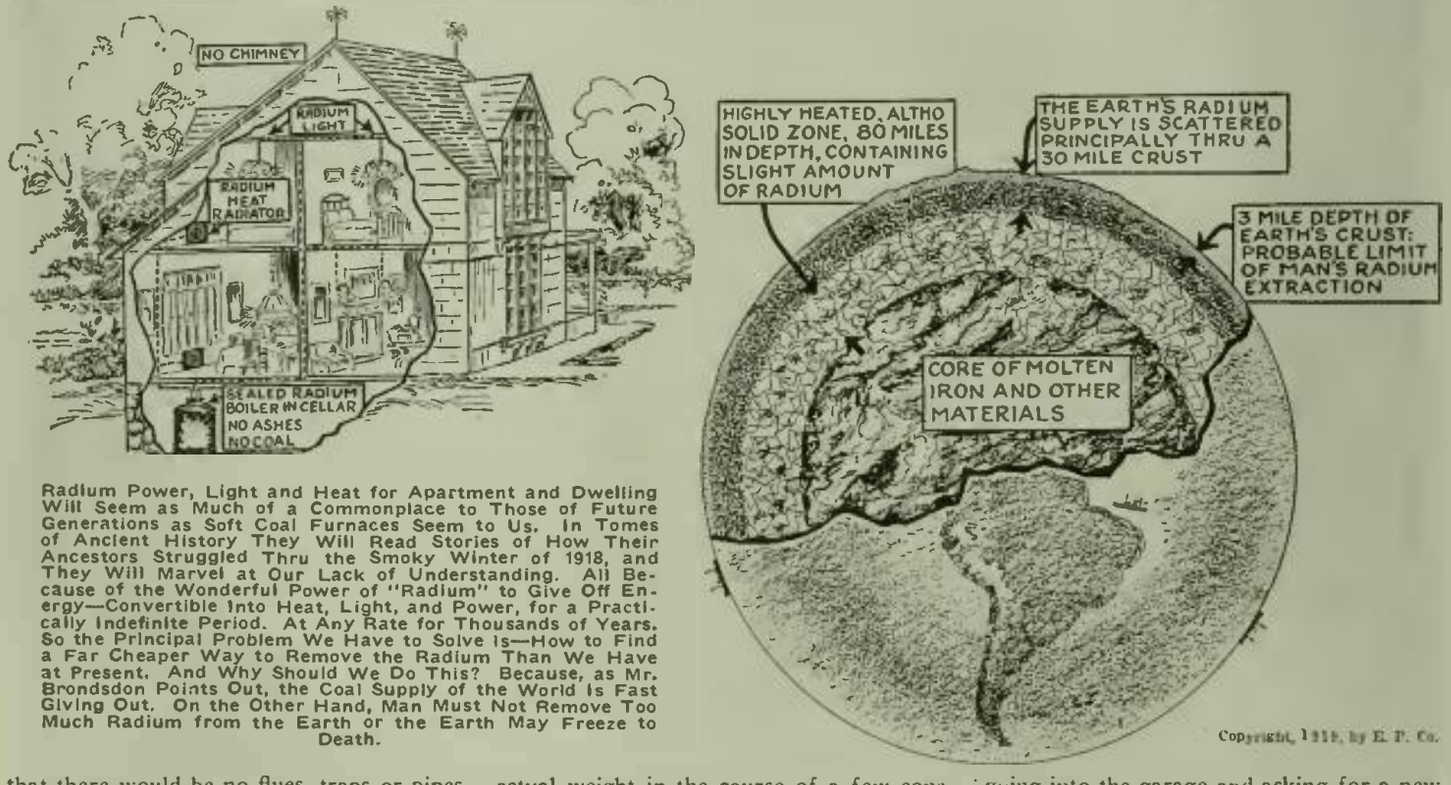
The reason why such a radium system would never have to be replaced is that radium is the one and only close approach to perpetual motion to be found on our globe. Look at a piece of radium one-thousandth the size of a pin point thru a *spinthariscope*. This is an instrument consisting of a high-magnifying lens and an aluminum disc covered with zinc sulfid. When viewed in this manner millions of tiny arrows of fire are seen to be flying from the radium and impinging on the zinc sulfid with an explosion like that of a fire ball from a Roman candle.

Tho each of the exploding projectiles of helium—radium somehow transforms itself into active atoms of this other element—looks nearly as large as the original divot of radium, you may glue your eye to the spinthariscope for hours—centuries, if you live that long—and you never will see any diminution in the discharge or in the size of the radium piece.* Scientists who have given the matter intensive study over long months and years say that they suspect radium of losing an infinitesimal part of its actual weight in the course of a few eons, but that human beings are going to have trouble gathering accurate data on the subject unless a dynasty of scientific Methuselahs is established.

The one big obvious objection at present to the use of radium for heating plants lies in the scarcity and tremendous cost of the metal. One ounce only would cost, at the present market price, approximately $40,000. The twenty pounds necessary for heating the ten-room house mentioned would retail at $12,800,000, were such a quantity procurable. Figuring interest at six per cent, the cost of that radium heating system for a year—excluding the original investment, which would not appreciably deteriorate—would be in the neighborhood of $768,000, or about 4,000 times the cost of coal heating today.

The only logical reason in the world for even allowing imagination to roam on this subject lies in the terrible and undisputed fact that *somewhere we are going to have to get heat if we are to live!*

So much space has been given in the last decade to learned dissertations on our rapidly decreasing supplies of coal and petroleum that it is useless to dwell on this. Suffice it to say that the last reports of competent authorities state baldly that we will surely be out of both *forever* at the conclusion of the present century, provided our present rate of consumption is neither raised or lowered. Since we have no assurance that the rate of increase of consumption will not keep on, we may bet safely that the year 1975 will see coal and oil so scarce that only millionaires can afford them. Coal then may be $500 a ton, and crude oil $25 a gallon. Alas for the "flivvers"! Imagine Mr. Autoist of that day going into the garage and asking for a new "can" of Radium for his "Radiobile." It can happen. (*Continued on page* 59)



Radium Power, Light and Heat for Apartment and Dwelling Will Seem as Much of a Commonplace to Those of Future Generations as Soft Coal Furnaces Seem to Us. In Tomes of Ancient History They Will Read Stories of How Their Ancestors Struggled Thru the Smoky Winter of 1918, and They Will Marvel at Our Lack of Understanding. All Because of the Wonderful Power of "Radium" to Give Off Energy—Convertible Into Heat, Light, and Power, for a Practically Indefinite Period. At Any Rate for Thousands of Years. So the Principal Problem We Have to Solve Is—How to Find a Far Cheaper Way to Remove the Radium Than We Have at Present. And Why Should We Do This? Because, as Mr. Brondsdon Points Out, the Coal Supply of the World Is Fast Giving Out. On the Other Hand, Man Must Not Remove Too Much Radium from the Earth or the Earth May Freeze to Death.

Copyright, 1919, by E. P. Co.

*This is not strictly the case, for the zinc sulfid spinthariscope we have to-day, for while the radium will last for thousands of years, the zinc sulfid will give out in a relatively short time. However, there are undoubtedly other substances which would last much longer than zinc sulfid. Another variable factor, variable in the sense that we have not lived long enough with radium yet to tell exactly how long it will last before losing its power, is the total life of this marvelous substance. Scientists tell us that in 1,800 years radium loses one-half of its activity. In another 1,800 years one-half of the remainder will have disintegrated, etc., etc. So that on this assumption the radium will have totally disintegrated in 22,000 years.—Editor.

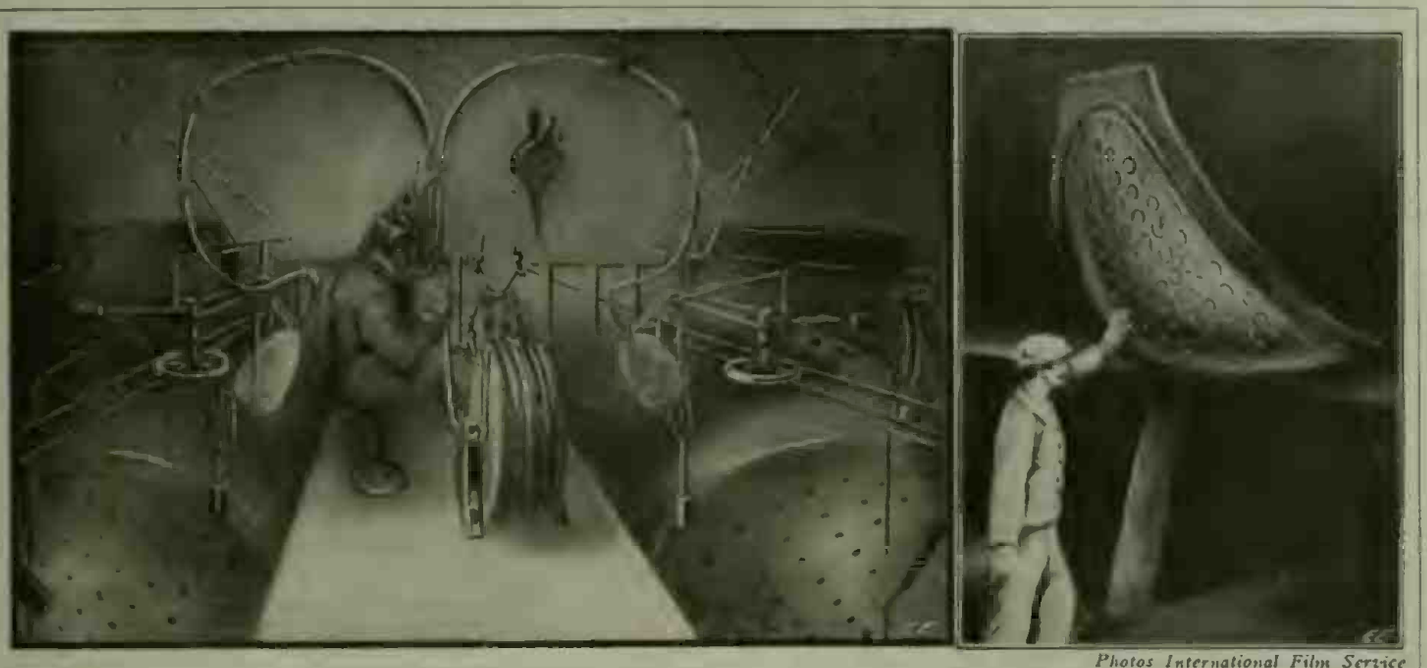
www.americanradiohistory.com

How the French Located Submarines

ONE by one the multitudinous scientific secrets of the great World War are finding their way to the public press, so that the student of science may at last have his appetite appeased in his quest of descriptive matter on some of the master problems which have been worked out and solved by engineers and scientific workers connected with army and navy developments. Probably no one problem in the whole war drew more attention from laymen and scientists alike than did the one of accurately discovering and locating the whereabouts of the Kaiser's U-Boats. The United States Naval Advisory Board received thousands upon thousands of suggestions, all telling how very simple it was to ferret out and locate the position of an enemy submarine, just by placing a microphone or set of microphones in the hull of a vessel and connecting these up with a set of telephone receivers, so that the sound produced by the submarine propeller and motor would be picked up by the microphones and thus heard in the receivers. Various methods were described for taking certain definite and very precise measurements along these lines, so as to work out mathematically or otherwise the position of the lurking sub-sea fighter. Considerable success was obtained with similar arrangements by the navies of the different countries participating in the World War, but the Walser gear—a special type of hydrophone used particularly for listening to submarines under water was developed and successfully used by the French Navy and other allied vessels for accurately locating enemy submarines at distances of one mile to three miles or more, depending upon the operating conditions and the size of the submarine.

The Walser Gear, whose construction has been kept secret during the war, is a directional apparatus for detecting and recording sounds heard thru water and thus locating the presence or approach of enemy ships. Many different devices for "listening" for enemy ships have been disclosed, but this apparatus, the invention of Lieut. Georges Walser, of the French Navy, is recognized as the most improved type and most practicable.

The sounds are received thru a number of vibrating diaframs fitted into holes pierced in a boss, or "blister" of sheet steel, which replaces a corresponding section of a ship's hull. The observer works in a sound-proof cabin stretching across the whole width of the ship, and wears a listening helmet attached to two trumpets. Into these trumpets the sounds are focust by the vibrating diaframs attached to the the "blister."



Photos International Film Service

The Walser Gear—a Type of Hydrophone Used for Submarine Listening. The Walser Gear, Whose Construction Had Been Kept Secret During the War, Is a Directional Apparatus for Detecting and Recording Sounds Thru Water and Thus Locating the Presence or Approach of Enemy Ships. This Apparatus is the Invention of Lieut. Georges Walser, of the French Navy, and is Recognized as the Most Improved Type and Most Practicable. The Sounds are Received Thru a Number of Vibrating Plates Fitted Into Holes Pierced In a Boss, or "Blister" of Sheet Iron, Which Replaces a Corresponding Section of a Ship's Hull. The Observer Works In a Sound Proof Cabin Stretching Across the Whole Width of the Ship, and Wears a Listening-helmet, Attached to Two Trumpets. Into These Trumpets the Sounds are Focused By the Vibrating Plates Attached to the "Blister." Left:—Detecting the Presence of Enemy Ships On or Under the Surface of the Sea. An Observer Using the Walser Gear in a Special Cabin Fitted Up as a Listening Post. Right:—On the Hull of the "Henriette II", a French Warship Which is Using the Apparatus, Showing the Exterior of the Sound—Collecting Boss or "Blister".

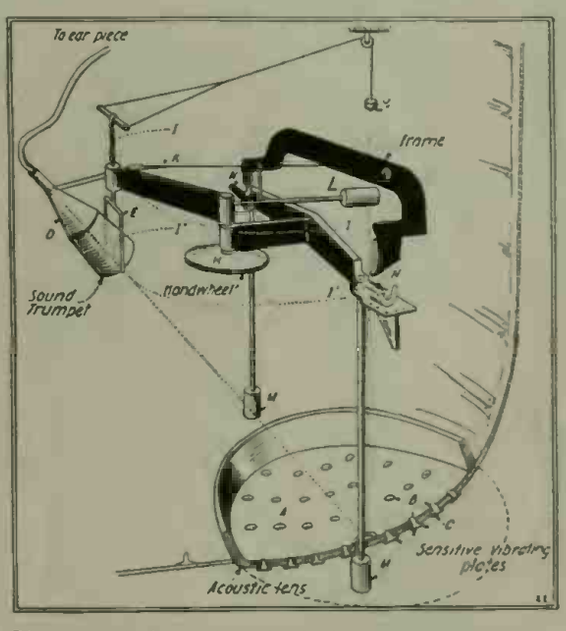


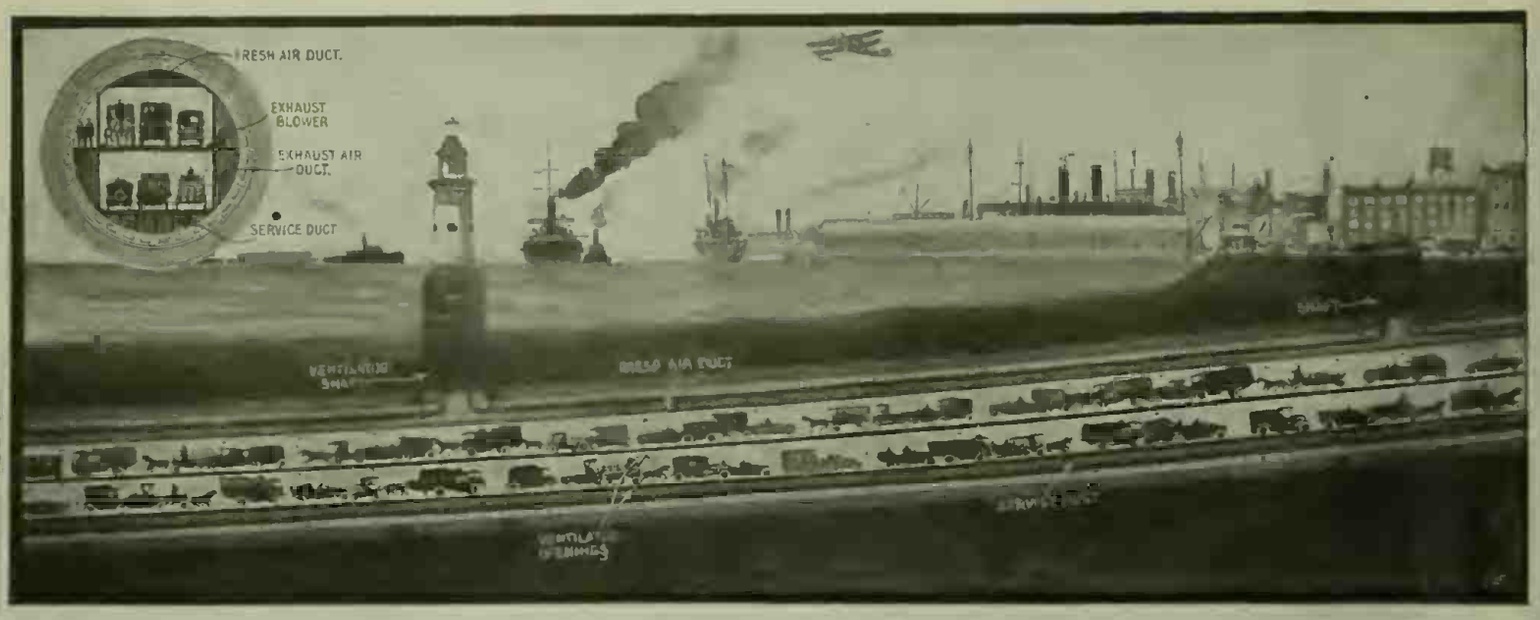
Diagram of One "Lens" of the Walser Submarine Detector and Locater, Showing the Carefully Worked Out Balancing Scheme for Supporting the Movable Sound Trumpet Over the Various Sound Focal Points.

Some of the disadvantages of the ordinary listening microphone arrangement for the detection of submarines are the following: Invariably the vessel on which they are mounted has to be stopt momentarily while a listening test is being made, in order that the ship's engines shall not drown out the sounds which the listening operator is endeavoring to pick up from the sea. It is interesting to mention in this connection, that some of the American listening devices of this type were so remarkably sensitive that even a small dynamotor used on the regular wireless apparatus on the vessel had to be mounted on springs, so that the extremely slight mechanical vibration set up by it would not interfere with the sounds picked up from the water on the submerged microphones fastened to the hull of the boat. Another fault found with the ordinary "hydrophone" is that the different sounds received simultaneously could not be distinguished very readily from one another, and even if but one sound was picked up, the direction from which the sound emanated was not very perfectly indicated.

Practically speaking then, one of the

(*Continued on page 82*)

www.americanradiohistory.com



The Accompanying Sectional View Shows Vividly How the New Vehicular Tunnel Under the Hudson River at New York City Will Look When Finished. There Seems to be No Question at Present as to the Possibility of Building This Tunnel, and the Only Remaining Details Are Engineering Considerations Such as Ventilation, Etc., Which Are Being Rapidly Solved by Some of the Crack Engineers of America, Including No Less a Personage Than General George W. Goethals, Builder of the Panama Canal, and Now Holding the Position of Consulting Engineer to the Interstate Bridge and Tunnel Commissions of New York and of New Jersey. Several Other Proposals Have Been Brought Forward for the Building of This Tunnel Under the Hudson River, But the Goethals Plan Seems to be the Most Feasible, and the One Most Likely to be Adopted. The Length of This Vehicular Tunnel Will be About 9,400 Feet from Portal to Portal, with a Distance of 5,500 Feet, or More Than a Mile Separating the Bulkhead Lines, If These Are Placed Back of the Shore Line. In View of the Fact that the Ventilation Problem Is at Present One of the Most Important, and the One Responsible for the Most Discussion Among Tunnel Experts, We Have Several Suggestions In the Present Article and Illustrations Which Might, If Adopted, Help to Bring About the Early Adoption

Hudson River

By H. WINFIELD
Associate Member American

THE bridging of the Hudson River, commonly known as the North River in New York City, is an engineering problem that has been before the people of the states of New York and New Jersey for probably more than thirty years. A bridge across this great water highway would no doubt have been constructed many years ago, if it had been found possible to raise sufficient funds to render this dream a living reality. Engineering experts have recently bestirred themselves with the thought of crossing the Hudson either by bridge or else by means of a tunnel, particularly a vehicular tunnel suitable for horse-drawn, electric and gasoline propelled vehicles. The bridge question seems to have been discarded practically altogether now, owing to its tremendous initial cost, which would be about $72,000,000 at least, compared to the initial cost of $12,000,000 for constructing a large tunnel under the Hudson on the newly revised plan proposed by General George W. Goethals, the well-known American engineer and builder of the Panama Canal. General Goethals has been appointed consulting engineer to the Interstate Bridge and Tunnel Commissions of New York and of New Jersey. There are many reasons why New York should have means of communication such as this, as its sister state supplies, either directly or indirectly, a very large portion of the food and other commodities for greater New York's population of 7,000,000, which is brought to the piers on the west side of the Hudson by numerous railroads. Right here there is a constant and prohibitive wastage of perishable food products, owing to the highly congested and inadequate terminal facilities afforded for their movement.

At the present time there is more or less agitation in the legislatures of both states between those friendly and unfriendly to the Hudson River project. So far the one great problem, according to some of the testimony being given, and which has seemed almost insurmountable, is the proper ventilation of this tube, especially where gasoline driven vehicles are to be permitted to exhaust devitiating gases into the air of the tunnel. But according to a very able engineering report on this project, given in the Journal of the Franklin Institute and prepared by Martin Schreiber, Chief Engineer of the Public Service Railway Company of New Jersey, the ventilating problem of such a tunnel as proposed by General Goethals and other engineers can be readily taken care of, as actual laboratory tests have proven, and which have provided a satisfactory basis for calculating the results of such a long tunnel as that under the Hudson. Also to back up the argument for building the tunnel, there is precedence afforded by the fact that London, England, has built two vehicular tunnels under the Thames River, one 6,200 feet long, and the other 6,883 feet long.

The editors make several new tunnel suggestions, which are shown in the illustration accompanying this article, whereby the gigantic ventilating problem could be overcome to a large extent by controlling the kinds of traffic that should be allowed to pass thru the tube. First, the writer would suggest that the engineers contemplating the building of this tunnel consider a cable-way, one of which would be provided on each roadway, east and west, for the purpose of hauling *gasoline operated* vehicles thru the tunnel, *without their engines being operated*, thus doing away with the production of the objectionable carbon monoxid and other poisonous gases emanating from their exhaust. It would not be an impossible, or even impracticable matter, if such an electric motor-operated cable-way, similar to the old cable-car systems, were used to haul the gasoline vehicles thru the tunnel to Jersey or to New York. It could be arranged to have the owners purchase a standard cable grip, which could be fitted on to any gasoline vehicle at nominal cost.

Another proposal, made by Mr. H. Gernsback, is one employing a *moving roadway* of sufficient width to accommodate gasoline auto trucks, the roadway being operated by electric motors spaced at suitable intervals along its length.

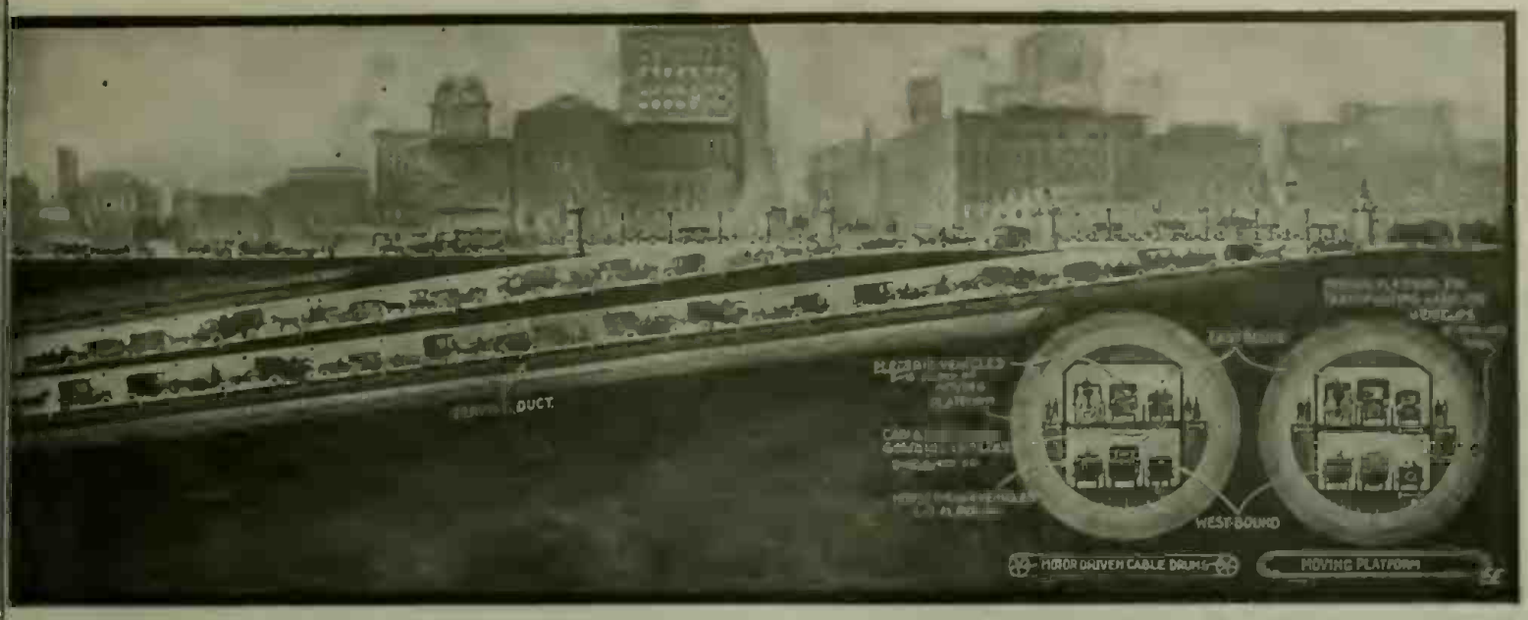
Another proposal suggested by the writer would be to utilize a trolley wire over the one line of traffic apportioned to gasoline vehicles on each roadway, and having the owners of these vehicles equip them with a trolley pole, but by the time the owners had installed an electric motor under the gasoline vehicles for use with it, it would probably be just as well for the tunnel operating engineers to ask the owners of such vehicles to invest in electric trucks for that particular traffic intended to go via the tunnel.

All of the tunnel proposals now under consideration agree on the location, which extends from Twelfth Street, Jersey City, to Canal Street, New York. The termini of the tunnel at both ends are located in the center of the trucking and freight districts. The New Jersey terminus is also happily located adjacent to the great freight yards of the principal railroads, and close to the main ferry lines, thus providing every chance for close co-operation. Besides, the great Lincoln and other much used vehicular highways lead to the location proposed for the Jersey City terminus.

The Hudson tubes as well as the Pennsylvania tunnels under the Hudson River, which are used for railway traffic exclusively, were driven by the well-known shield method. General Goethals, in his proposal for the new Hudson vehicular tunnel, has advocated the shield-driven double-deck single tube, as shown in the accompanying illustration. This tube is to have an internal diameter of 36 feet, with two 18-foot roadways, one super-imposed above the other, and a concrete floor between them. This proposal for the tunnel would permit of four lines of vehicles, two on each roadway, two of the faster moving type such as pleasure automobiles on the upper floor, and two of the slower moving vehicles, such as auto-trucks, on the lower floor.

Most of these under-river tubes have been constructed with cast-iron blocks built of segmental form, which were bolted together after being put in place, and which thus tended to resist any external hydrostatic

www.americanradiohistory.com



of the Tunnel Project. Among These Features Are the Following:—First, That a Ventilator Shaft be Placed a Comparatively Short Ways Out in the River at Either Approach, So as to Simplify the Ventilating Problem by Reducing the Length Between the Bulkheads. Second, That Gasoline Vehicles be "Hauled" Thru the Tunnels So as to Eliminate the Fouling of the Air by Obnoxious Exhaust Gases, Particularly Carbon Monoxid, by Means of a Moving Platform. Third, Haul Gasoline Vehicles Thru the Tunnel by a Cableway Similar to the Well-Known Cable Car System. Fourth, Cause the Gasoline Vehicles to be Fitted with a Trolley Pole and Electric Motor for the Purpose of passing Thru the Tunnel Without Discharging Obnoxious Gases. The Goethals Proposal Calls for a Concrete Block Tunnel, 42 Feet In Outside Diameter, with Two Road Levels, as Here Shown. One Roadway Will be for East-Bound Traffic, and the Other for West-Bound Traffic. Actual Laboratory Tests On a Short Length of Tunnel Have Shown That 750 H.P. Would be Required to Operate the Fresh Air and Exhaust Fans, with a Maximum Capacity of 360,000 Cubic Feet of Fresh Air Per Minute.

Vehicular Tunnel

SECOR

Institute Electrical Engineers

pressure with great power, much in the same way that the stones of an archway tend to support the arch. The outside of these segmental steel tubes is covered over with a fairly thick coating of concrete. Here is where the Goethals proposal differs radically from former practise, and there is considerable discussion now taking place as to the feasibility and practicability of his proposed design, which is as follows:

General Goethals' proposition is that the tunnel be constructed of O'Rourke concrete blocks in segmental form. Outside of this tube a gravel packing is to be placed. Some experts seem to doubt whether such a tube would be thoroly water-proof, and also what would happen in case of an earthquake or other severe concussion, as when a powder boat or supply of explosives might happen to blow up in the harbor, as has occurred several times during the war, when the concrete tube might crack with an appalling loss of life.

Detailed plans have been drawn up by the New York State Bridge and Tunnel Commission, under the direction of Major General George W. Goethals and John F. O'Rourke, which provide for the driving of the tunnel by the use of a shield forty-two feet in diameter—the method most usual when dealing with soft material. The material under the Hudson River is a soft silt and sand overlaid by still softer material of sewage origin, which is almost fluid. These conditions are complicated by the presence of ledge rock which is occasionally encountered. In a shield having a diameter of twenty-five feet, there is a difference in pressure between the top and bottom of ten pounds per square foot. This makes it difficult to guard against blow-outs and other accidents caused by the difference in pressure at the top and bottom of the shield, tunnel experts consulted by the state commissions have pointed out.

The diameter of the shield used in driving the Hudson tunnel was 17 feet; that of the Pennsylvania tunnel shields 23 feet 6 inches. The latter were the largest ever used under either the Hudson or the East rivers. The Rotherhithe tunnel, under the Thames River in England, was driven with a shield 30 feet in diameter thru clay mixt with shells, pebbles, loam, a much firmer material than that under the Hudson.

Of course, the traffic would have to be handled so that approximately half of the vehicles would move *eastward* and the other half *westward*. Once the tunnel is built, however, this becomes a problem for the traffic engineers of that year to solve. According to the Goethals plan, the fresh air duct is at the top of the tunnel, and fresh air is constantly pumped along this duct by means of powerful electrically-driven blowers and fans, while the foul air, including exhaust from the gasoline vehicles, is drawn out thru ducts at the bottom of the roadway. Besides, there are additional ventilating and foul air ducts at either side of the tunnel, walled off from the roadways.

To find out exactly what would happen in a section of such a tunnel with a number of gasoline vehicles operating their engines therein, a test building, corresponding in cross-section to the proposed tunnels and measuring 125 feet in length, was constructed at Newark, N. J. Eight automobiles were operated in this building, which could be shut off air-tight and fresh air pumped in at the top and the exhaust pumped out at the bottom, or vice versa. A number of elaborate tests of various kinds were carefully made by experts, including Professor Gellert Alleman, of Swarthmore, Pa., and Dr. H. Jermain Creighton, of Swarthmore College. From a very elaborate and convincing analysis on the various gases present in the tube after the automobiles had been operated for a period of forty minutes, Prof. Alleman reported that when all doors were closed and the ventilators opened, after the engines of eight cars had been *running light* for forty minutes, the condition of the atmosphere was almost normal, so far as physiological action was concerned, and the amount of carbon monoxide content not dangerous This calculation was further supported by the fact that eighteen persons who remained in the tunnel during the test for a continuous period of forty minutes experienced no unpleasant sensations from breathing the air. The contaminated air in this particular test showed .075 per cent. carbon monoxid, and 6 per cent. carbon dioxid, which proved that the per cent. of carbon monoxid was so small as to be negligible. With the data thus obtained, it was calculated that air supply fans with a maximum capacity of 360,000 cubic feet of fresh air per minute, and exhaust fans having 20 per cent. more capacity, would be required to ventilate the tunnel. The total amount of horse-power computed for operating these fans was 750 H.P. The length of the proposed tunnel under the Hudson, from portal to portal, would be approximately 9,400 feet, with a distance of about one mile, or somewhat over 5,000 feet between the bulkhead lines.

As aforementioned, London has built two vehicular tunnels under the Thames, one 6,200 feet long, the other 6,883 feet. Public interest in tunnels for New York was aroused about thirty years ago by Austin Corbin, who proposed tubes under both the Hudson and East Rivers. Scientists charted the bottoms of the two rivers and reported that tunnel construction was feasible. Perhaps it might have been undertaken at that time but for Mr. Corbin's death. Twenty years later William G. McAdoo undertook this work. President Cassatt, of the Pennsylvania, persuaded his directors to authorize the construction of tubes under the Hudson, also under Manhattan Island, extending under the East River to Long Island.

The total underwater section of the tube will be about 1 3/5 miles, and it is conservatively estimated that it will have a daily capacity of approximately 100,000 vehicles. Statistics compiled from data of 1917 show that during that year 4,800 vehicles crost over the five ferry lines between New York and New Jersey in the vicinity of the proposed tunnel every day. The material thru which the trench must be dug is soft silt and mud.

www.americanradiohistory.com

COMING INVENTIONS 2

THE THOUGHT RECORDER

By H. GERNSBACK

When the writer first conceived the idea of the thought recorder, he asked three prominent scientists regarding their views on recording thoughts electricolly. The letters are reproduced herewith excerpted. It will be noted that Nikola Tesla disagrees with the writer as to thought transmission at all, but his letter nevertheless will give considerable food for thought to many readers.

Dr. Lee de Forest, inventor of the audion, is not too sure about thought transmission.

Dr. Greenleaf Whittier Pickard, the inventor of the silicon and pericon detector, as well as many other wireless specialties, has several interesting ideas, and his letter will certainly prove a revelation, particularly to those interested in radio.

IN studying the evolution of the human specie we must go back to the time when man proper, as we know him, had not as yet arrived on this planet. Our great biologists have irrefutable evidence that everything in Nature works on a slow, laborious plan, one specie being developed slowly into another from the smallest animalculae up to present man. When man was still in the what we may call animal stage, i.e., when he was not "thinking," as that term is understood, he was wholly guided by instinct. His "thoughts," if so they may be called, were probably on a much lower plane than thoughts of the average dog. The chances are that the present day dog probably "thinks" much better than prehistoric man. We also find that thought and language go hand in hand. Crudely speaking, prehistoric man had no better language than any highly developed animal, such as a dog, cat or a horse.

Thru thousands of years of evolution, however, instinct developed into crude thought, and finally there came a time when prehistoric man really began to think, as we know the term. That was the time when he began to utter his thoughts by means of his voice. At first only a few crude words were formulated, and probably consisted of not much more than the gibberish of a chimpanzee. Little by little organized thought arrived, and words, translated into speech kept pace with the advancing thought of man. As the human race kept advancing at a slow pace, its thinking qualities increased little by little, and the senses correspondingly became more sharpened.

This is especially true of the human thinking machinery which perhaps has advanced more rapidly than the senses. Thus we find that certain senses have even been retarded, such as, for instance, sight, smell and hearing. When man lived his wild life it was very necessary for these senses to be much sharper than they are at present; hence our poor hearing, bad sight and very much poorer smell. On the other hand, as the battle for existence becomes more and more acute, and as moreover the battle is not as much physical as mental, it follows that the mind and its thinking machinery should naturally become more and more developed, which, in fact, it does. We may safely say that within the next hundred thousand years—which is only a small span of time in man's evolution—the human mind will be an entirely different sort of apparatus than it is today. Man's mental power will be infinitely greater than what it is at present. Already we have indications that man's thoughts, or the effects therefrom, do not necessarily have to remain *within* his skull, but that they actually radiate from the latter in a very imperfect manner. As the human race advances, there is no doubt that thought transference proper will become an accomplished fact. It has already been shown experimentally by Di Brazza, as well as Charpentier, that concentrated thinking will produce certain external effects, as for instance, a slight fluorescence on a zinc sulfid screen, or a suitably excited X-ray screen. This would tend to prove that thoughts are of an electrical nature, having probably a very short wave length. As most electrical effects in space are depend-

(*Continued on page 84*)

THREE FAMOUS SCIENTISTS' VIEWS ON THOUGHT TRANSMISSION

Altho I am clinging to ideals, my conception of the universe is, I fear, grossly materialistic. As stated in some of my published articles, I have satisfied myself thoroly thru careful observation carried on for many years that we are simply automata acting in obedience to external influences, without power or initiative. The brain is not an accumulator as commonly held in philosophy, and contains no records whatever of a phonographic or photographic kind. In other words, there is no stored knowledge or memory as usually conceived, our minds are blanks. The brain has merely the quality to respond, becoming more and more susceptible as the impressions are often repeated, this resulting in memory.

There is a possibility, however, which I have indicated years ago, that we may finally succeed in not only reading thoughts accurately, but reproducing faithfully every mental image. It can be done thru the analysis of the retina, which is instrumental in conveying impressions to the nerve centers and, in my opinion, is also capable of serving as an indicator of the mental processes taking place within. Evidently, when an object is seen, consciousness of the external form can only be due to the fact that those cones and rods of the retina which are covered by the image are affected differently from the rest, and it is a speculation not too hazardous to assume that visualization is accompanied by a reflex action on the retina which might be detected by suitable instruments. In this way it might also be possible to project the reflex image on a screen, and with further refinement, resorting to the principle involved in moving pictures, the continuous play of thoughts might be rendered visible, recorded and at will reproduced.

Nikola Tesla.

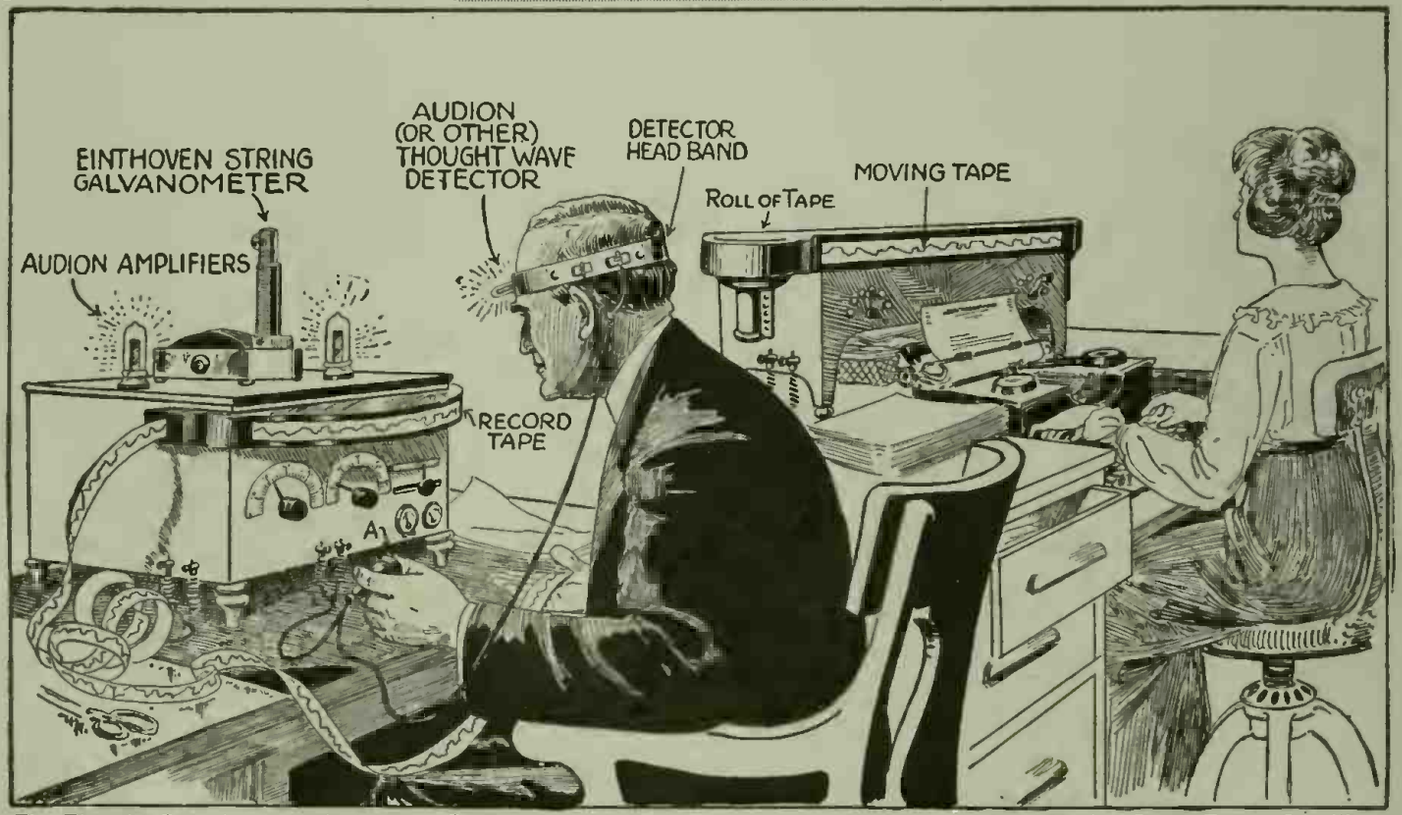
Your article should be an interesting one, particularly as to the audion suggestion. The audion, however, seems to have a certain wavelength limitation, so that unless the waves to be recorded lie between about 3×10^{10} cm. and 3×10^{2} cm., they are not apt to be "picked up."

A more likely range to search would be from 3×10^{2} cm. down to 3×10^{10} cm., that is, down to the harder Gamma rays, or to even shorter wavelengths, starting with the shorter Hertzian waves. Here the audion would be useless, save as a second stage in the detection, i.e., as an amplifier for some other form of detector.

Greenleaf W. Pickard.

While I have little doubt that there is such a thing in nature as transference of thought from one brain to another, I am not aware that sufficient data has ever been gathered on such a highly abstruse subject to permit forming any definite opinion.

Lee De Forest.



The Thought Recorder is an Instrument Recording Thoughts Directly by Electrical Means, On a Moving Paper Tape. Our Illustration Shows What a Future Business Office Will Look Like When the Invention, Which as Yet Only Exists In the Imagination, Has Been Perfected. By Pushing the Button A, the Tape is Started and Stopt Automatically So That Only Thoughts That Are Wanted Are Recorded.

www.americanradiohistory.com

Paris Letter

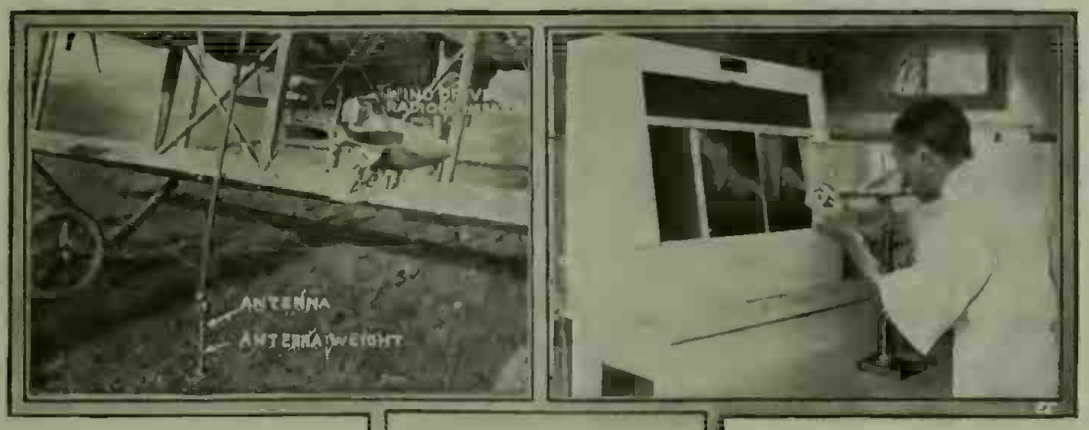
By JACQUES BOYER

Paris Correspondent of the ELECTRICAL EXPERIMENTER

Airplane-Radio.

Paris, February, 1919.

THE war having ended thru the conclusion of the armistice, the military censor now allows the publication of information concerning various technical matters of the French Army. In this and in the following monthly letters, we will unfold thru the ELECTRICAL EXPERIMENTER the latest European technical developments as they come to our attention.



French airplane radio generator of the wind driven type and antenna employed. The dynamo is fitted with a small air blade which spins it rapidly. The antenna and weight are lowered from a reel on the cockpit. Similar schemes are in use on American Airplanes. Fig. 1.

The "Radio-stereoscope" is the latest in French X-ray apparatus. By its means it now becomes possible to rapidly locate bullets or fractures — owing to the perspective of vision thus afforded. The X-ray plates are illuminated from behind, while the physician views them thru the special coördinating instrument shown. Fig. 3.

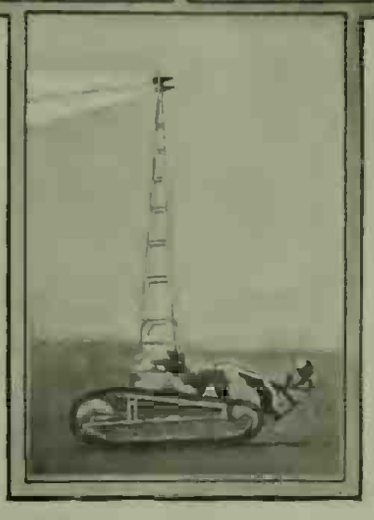
Particularly during the war, the censorship has been so rigid that many important inventions have never been even mentioned in the technical press. We shall be glad to describe these monthly for the benefit of EXPERIMENTER readers.

The accompanying photographs show the latest system of radio-telegraphy installed on French Airplanes during the war. Fig. 1 shows what is called the "radio-telegraph dynamo" on a Farman airplane.

All the French combat machines were equipt with this or similar apparatus. Between 25 and 150 kilometers could be covered by means of this apparatus weighing some thirty odd kilograms. For receiving the wireless waves the aviators of course used the audion, and by use of sound-proof helmets, it was possible to receive the orders clearly, notwithstanding the terrific noise of the airplane motor. The small dynamo shown in Fig. 1 is operated by means of a small air propeller, and this motor works entirely independent from the power plant of the airplane. As long as the airplane is in motion the propeller will turn due to the rush of the air, and thus even if the engine becomes stalled, the aviator can still use his wireless, for the 'plane while volplaning down furnishes enough energy to drive the small auxiliary dynamo. The wireless antenna trails behind the airplane thru the steel tube as seen in Fig. 1, at the end of which there is a small pulley. At the free end of the antenna wire there is a weight of two or three kilograms (4 to 6 pounds) which tends to keep the antenna more or less taut. The wire stays of the airplane themselves form the "ground" for the wireless system. All aviators in the air were constantly in touch with each other, and in order that one airplane should not be mistaken for another one, different wave lengths were used for each. Not only this, but other tricks as for instance, sending at a different intensity, was often resorted to by certain aviators in order that the ground station would know from which 'plane the signals emanated.

Signaling Tanks.

The "baby" Renault tanks now well known in the United States, played an important rôle in pushing back the Huns. They had not a little to do with the Allied victory and were constructed by the French engineer, Louis Renault. This well-known French technician created many different models, some of which carried cannon and machine guns, while others merely carried ammunition. One of the strangest ones constructed by him is the "*tank projecteur*" (signaling tank). It is shown in the accompanying photograph, Fig. 2. This tank is built along the lines of the "baby" tank,



The "Baby" Renault Tanks Played an Important Rôle in Pushing Back the Huns. Some of These Tanks Carried Cannon and Machine Guns. The "Tank Projecteur" Here Shown Was Effectively Used for Signaling Purposes. Fig. 2.

> The war has brought forth a great many surprises, many of which for military reasons having remained secret, and many will continue a secret for some time to come. Our readers no doubt are very much interested in many of the war devices brought out during the war by our European Allies. We have therefore made arrangements with our Paris correspondent, Mr. Jacques Boyer to send us an article each month on hitherto unpublished information. The first article of the series appears on this page.—*Editor.*

but in the back we find on an inclined steel truss a little dynamo driven by the machinery of the tank. Two "signaling projectors" are mounted at the top of a light metallic mast, the four lower legs of which are mounted on a revolving cupola which makes it possible for the mast to be immediately revolved in any direction. The top of the mast is 7½ meters from the ground. The two searchlights are arranged in such a manner that they can send out two independent light shafts, or the two shafts can be converted into a single shaft of light. In the inside of the tank we find our usual Morse telegraphers, operating a key which controls the light shafts. By means of this arrangement, the ordinary Morse or Continental Code can be sent out by breaking up the light shaft into "dots and dashes" the same as is done in the usual method of signaling with lights. Mr. Renault has incorporated several refinements into the search lights, one of which is an iris obturator whereby the volume of the light can be increased or decreased at will.

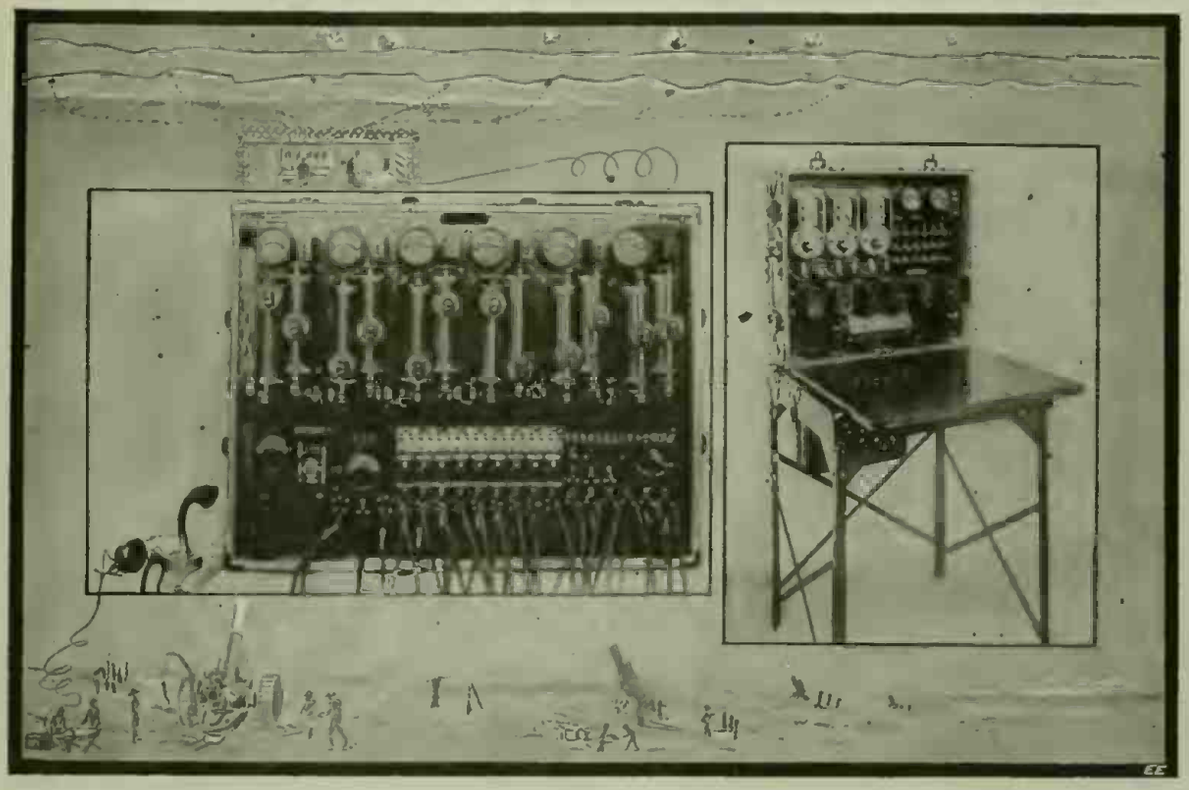
Radio-stereoscope.

This apparatus has been developed by the French engineer, M. Nemirovsky, the X-ray specialist of Paris. It has given wonderful results to the French military physicians, and it now becomes possible to locate metallic or other foreign pieces in the human body in a manner not possible before. The ordinary X-ray photograph shows only the foreign body, but it is impossible to tell how deep the penetration is, and often the physician cannot tell if a bullet is in front or in back of a certain organ. In other words, he does not know just how deep the bullet is embodied. Everyone who has looked thru the ordinary stereoscope will readily understand how objects "stand out" and how they reveal their exact location to the human eye.

It is this principle which is made use of by M. Nemirovsky, who has also greatly simplified the radio-stereoscope technique. Our illustration, Fig. 3, shows the method. Two X-ray pictures taken at one time by super-imposing two plates and afterward developing them are placed side by side in an arrangement termed a "*negatoscope.*" The plates are illuminated from behind by means of an electric lamp. The physician then regulates the radio-stereoscope by means of a thumb screw as shown, until he sees the bones, and all other parts as well. The foreign body then stands out in plain relief. The physician now examines the plates carefully and he obtains a clear mental picture which subsequently gives him an exact idea as to just how deep the foreign body is emplaced. If necessary during the operation, he can frequently inspect the negatives stereoscopically in order to guide himself should this be necessary.

www.americanradiohistory.com

Locating Enemy Guns by Flash and Sound



Switchboards Used for Flash or Sound Spotting of Enemy Artillery. Photo at Left Shows a Type B-T Sound Ranging Set Such as Used By the United States Army Signal Corps During the War. Many of These Switchboards Were Successfully Used At the Front. It Is Slightly Larger Than the Smaller Model and Requires a Little More Time to Set Up, But On the Other Hand It Combines Many More Telephone Circuits. A Single Section Has Located as High as 117 Guns of Enemy Batteries In 24 Hours. The Right Hand Photo Shows a Small Portable Switchboard, Known as a Flash Ranging Set. This Signal Board Is Used in Conjunction With an Observation Telescope for Locating the Flash of Enemy Guns and General Activities At the Extreme Front, and is Suitable for Night or Day Service.

THE accompanying photographs show respectively two of the war's newer developments, which even the veterans of the Spanish-American War were not familiar with. For one thing, of course, "flash ranging" and "sound ranging," as they are called, are really two military developments which were brought about by the fact that vastly greater numbers of guns were used in the great world war than were ever even dreamed of before.

Let us first consider the "flash spotter." The flash spotter usually takes up his location in the vicinity of front line trenches, or in a shell hole from which he can effectively use an observation telescope for minutely observing and locating in what direction the flash of an enemy gun occurs. The electrical switchboard shown herewith forms a part of the communication link with the artillery and general intelligence headquarters, so that the position of the enemy guns can be quickly made known, and either shelled at once by counter-battery fire by the artillerists, or else the location is accurately plotted on large maps for future consideration, depending upon the activity of the enemy gun or guns at the moment.

The flash spotter, if he happens to be located in a listening post or shell hole, or in fact in any other forward location, invariably has with him his trusty portable telephone connected by wire to the nearest communicating depot, where we find one of the small portable switchboards here shown. These switchboards are fitted with the proper regulating instruments for creating the best working conditions on the various circuits, and make provision for connecting and disconnecting a large number of circuits, in some cases, about 30 or 40 lines running out to various flash ranging observation stations, or in other cases as many as 100 or more lines. The work of the flash spotter is finished for any particular case when his observations, as to the angle in which the flash was observed, and a similar or different angle measured by a co-observer somewhere down the line, have reached the engineers. These experts, by means of special slide rules and tables, quickly solve the distance of the enemy gun and its definite location geographically by the information afforded thru the observation data submitted by two or more flash ranging observers. In other words, it is *triangulation*, which mathematical quantity has been raised to the n'th power by Uncle Sam's artillery experts.

The work of the "sound ranging" experts in locating enemy guns, both large and small, is somewhat different from that of the flash ranging corps. One of the switchboards used in connection with the sound ranging of enemy guns is illustrated herewith. Hundreds of these switchboards were successfully used at the front during the progress of the war. A single section of sound-ranging equipment located as high as 117 guns of enemy batteries in 24 hours.

(*Continued on page* 68)

World's Largest Generator

The accompanying illustration shows one of the largest water-wheel type generators ever built, and its gigantic dimensions may be judged by comparison with the figure of the man standing beside it. This is one of several water-wheel generators built for the Keokuk electric generating station of the Mississippi River Power Company. This mastodonic generator has 52 poles and delivers a current at 11,000 volts potential. This is a high voltage for a generator to produce, owing to the strains on the revolving windings, etc. Much higher voltages are frequently used for the transmission line, and voltages of 50,000 to 75,000 are common for such transmission, these extra high potentials being obtained by means of stationary transformers in the power station where the generators are located.

The large field or stator frame here shown forms the stationary part of the generator, and the rotating member which is also of gigantic size and mounted on a steel shaft several feet in diameter, is put in place and lined up with high accuracy when the stator frame of the generator is put in place and bolted to its foundation. These large machines are invariably built in sections which can be bolted together after they have reached the site of their installation.

The transformer comprises a laminated sheet iron core on which there are two windings or series of windings, one of which forms a low voltage primary which is connected with the generator, driven by a water-wheel or other source of primary power; while the second set of windings form a high voltage or secondary circuit, in which any desired potential current is induced by induction, the primary and secondary windings being linked magnetically by means of the iron core. Transmission lines are in use at the present day with potentials of 150,000 volts and higher.—*Photo Courtesy G. E. Co.*



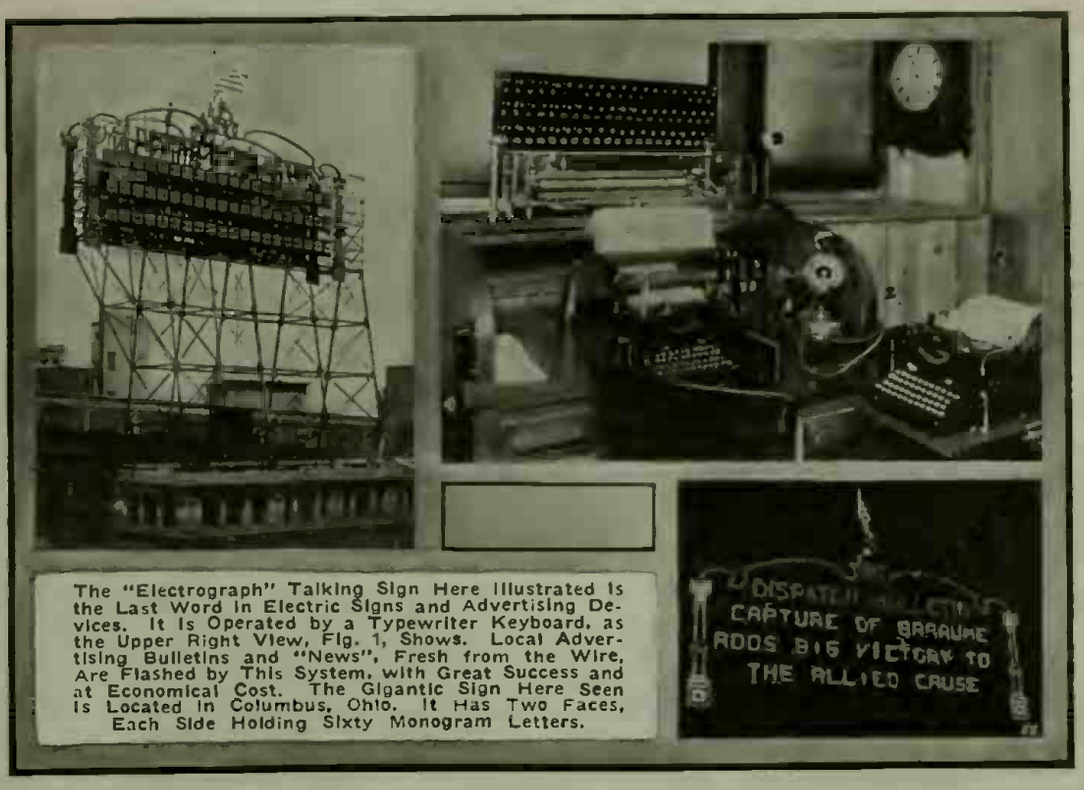
Note the Relative Size of the Man Compared to the Huge Stator of the Largest Water-Wheel Type Generator Ever Built. It Develops a Current of 11,000 Volts.

www.americanradiohistory.com

Novel Electric Talking Sign

THE accompanying illustrations, Figs. 1, 2 and 3, show the design, construction and method of operation of an electric bulletin board, operated by a typewriter, which is said to be the latest achievement in the electric sign industry. This new illuminated sign called the *Electrograph* has been erected on the Dispatch Building in Columbus, Ohio, and flashes the latest news, fresh from the press wires, and advertising bulletins for local and national concerns.

It may be stated that this Illuminated Sign has two sides, each side holding sixty monograms, arranged in three rows. Each monogram contains a clever arrangement of twenty-one lights, combinations of which form any letter or numeral and a few other characters, each one measuring two by three feet.



The "Electrograph" Talking Sign Here Illustrated Is the Last Word In Electric Signs and Advertising Devices. It Is Operated by a Typewriter Keyboard, as the Upper Right View, Fig. 1, Shows. Local Advertising Bulletins and "News", Fresh from the Wire, Are Flashed by This System, with Great Success and at Economical Cost. The Gigantic Sign Here Seen Is Located in Columbus, Ohio. It Has Two Faces, Each Side Holding Sixty Monogram Letters.

The photograph Fig. 1 shows the operating room. The typewriter method of operation distinguishes this device from others of similar character. A standard machine is used and contacts are made by striking the keys just as they would be struck in ordinary typing. An extra platen, bearing silver plugs, over which a stylus rides, selects the monograms automatically as the writing proceeds, thus throwing the letters in their proper places on the sign. The letters remain in place until the bulletin is completed and may be held any length of time; it is then released by pressing a single key.

It is of interest to note that a unit releasing device enables the operator to strike any one letter out and replace it with another without interfering with the other letters. Thus, if an error is made, it may be promptly corrected. The operator cannot see the sign as he works and so a pilot board has been provided directly in front of him, consisting of sixty green light bulbs, corresponding to the sixty monograms on either face of the board. When a letter is struck, with the platen set at any given position, the letter appears in the corresponding monogram and automatically lights the corresponding green light.

For illustration, it will be seen that if the platen is set with the stylus on No. 3 plug and the letter "K" is struck, "K" will appear in the monogram and green light No. 3 will burn. If it does not burn, the operator knows that the "K" failed to appear in the monogram and he strikes it again. When the operator writes a bulletin, the typewriter keys write on paper in the usual manner. This gives a complete record of everything that appears on the board. The record is used in checking advertising.

It is claimed that an ordinary bulletin may be written in ten seconds. It usually is left burning ten or more seconds after being completed. This indicates the amount of advertising and news that may be flashed in an evening.

Mr. Alton D. Spencer, of the *Evening Dispatch*, points out that the news feature gives the electrograph an advertising pull not possible with ordinary electric signs. Latest news from the peace table fronts is bound to attract attention, and while the crowds watch for news, they read the advertisements. On election night the electrograph is the center of attraction, as the returns are flashed more promptly than is possible by any other means. This service, of course, increases the value of the sign to the advertisers and gets more results from them than they could get from a sign hanging in front of their places of business and at less cost.—*By Frank C. Perkins.*

Relieving the Car Crush

By Sidney Gernsback

HAVE you ever seen a Subway crowd being herded into a car? Of course you have, if you are living in "little old New York." If not, thank the Lord and turn to the next page. You are not interested! Not at all! And then again you may get a notion to visit that "Burgh" one day; well, read on, it may interest you after all!

Let us go back to that Subway crowd on a rainy Monday morning between 8 and 9 A. M. and let us try to board a car at Times Square. There our train stops, packed brimful with its rain-smelling, sneezing and coughing cargo. You think there is not room for as much as another umbrella in the car you have selected. But behold the convulsory jerking and pushing going on in the middle of the car. Our well trained eye reads these signs, like an Indian would read footprints on the warpath: These spasmodic movements, this pushing, twitching and thrusting can mean only one thing: somebody wants to get off that train! And if somebody wants to get off, a half dozen other bodies want to get on, and usually do, too.



The Cure for the "Subway Crush".—There Are Three Doors on Each Subway Car: Two on Each End and One, About the Same Size as the Front and End Door Combined, in the Center. Let the Outgoing Passengers Use the End Doors Only, and the Incoming Travelers the Center Doors Only, as the Diagram Indicates.

Acting on this well established principle we push and get pushed toward the open car door. A melodious voice from the end of the car sings out: "Let 'em get off! Let 'em get off!" And behind you a gentleman wearing the snug uniform of a Subway gladiator pushes on: "Step lively!"

And right here it is where Kipling is wrong about that east and west business "who never shall meet!" Take it from an old Subway traveler: *they do meet!* They not only meet! They clash and they col-

(*Continued on page* 56)

www.americanradiohistory.com

My Inventions

By Nikola Tesla

IV. The Discovery of the Tesla Coil and Transformer

FOR a while I gave myself up entirely to the intense enjoyment of picturing machines and devising new forms. It was a mental state of happiness about as complete as I have ever known in life. Ideas came in an uninterrupted stream and the only difficulty I had was to hold them fast. The pieces of apparatus I conceived were to me absolutely real and tangible in every detail, even to the minutest marks and signs of wear. I delighted in imagining the motors constantly running, for in this way they presented to the mind's eye a more fascinating sight. When natural inclination develops into a passionate desire, one advances towards his goal in seven-league boots. In less than two months I evolved virtually all the types of motors and modifications of the system which are now identified with my name. It was, perhaps, providential that the necessities of existence commanded a temporary halt to this consuming activity of the mind. I came to Budapest prompted by a premature report concerning the telephone enterprise and, as irony of fate willed it, I had to accept a position as draftsman in the Central Telegraph Office of the Hungarian Government at a salary which I deem it my privilege not to disclose! Fortunately, I soon won the interest of the Inspector-in-Chief and was thereafter employed on calculations, designs and estimates in connection with new installations, until the Telephone Exchange was started, when I took charge of the same. The knowledge and practical experience I gained in the course of this work was most valuable and the employment gave me ample opportunities for the exercise of my inventive faculties. I made several improvements in the Central Station apparatus and perfected a telephone repeater or amplifier which was never patented or publicly described but would be creditable to me even today. In recognition of my efficient assistance the organizer of the undertaking, Mr. Puskas, upon disposing of his business in Budapest, offered me a position in Paris which I gladly accepted.

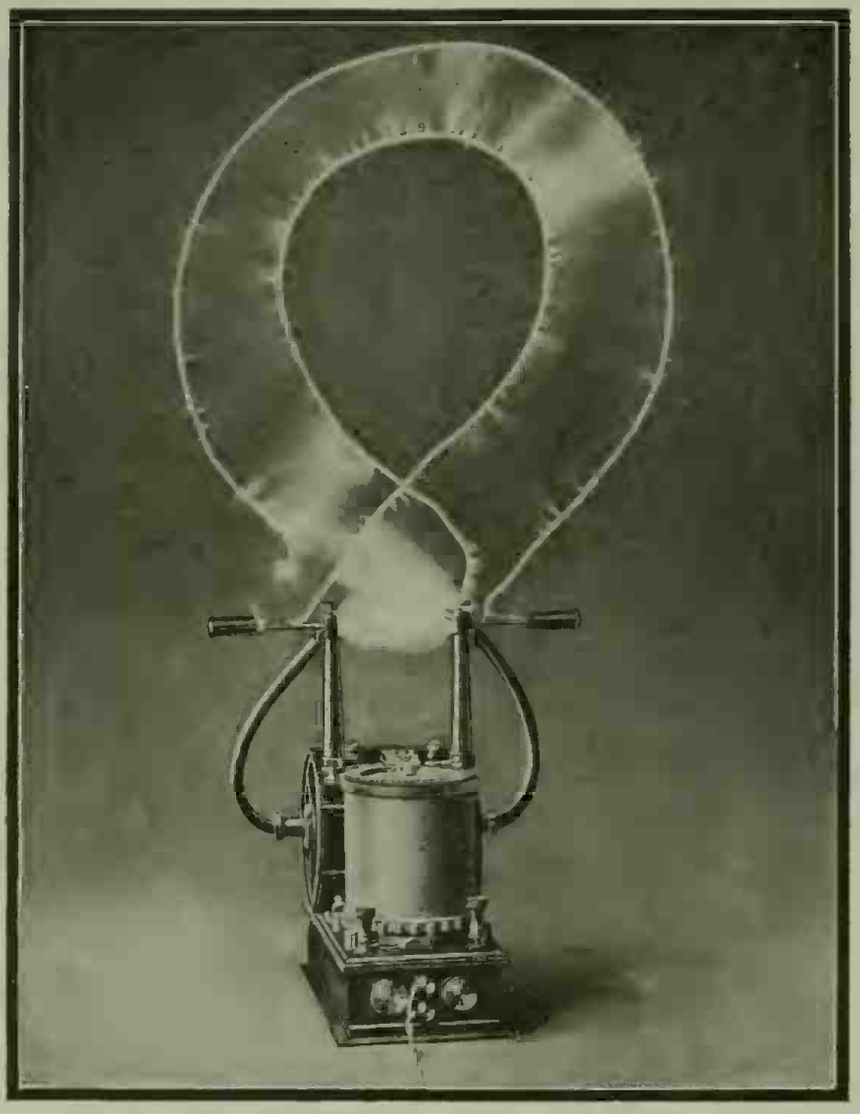


Fig. 1—Tesla Oscillation Transformer (Tesla Coil) Presented by Lord Kelvin Before the British Association in August, 1897. This Small and Compact Instrument, Only 8 Inches High, Developed Two Square Feet of Streamers With Twenty-Five Watts From the 110 Volt D. C. Supply Circuit. The Instrument Contains a Tesla Primary and Secondary, Condenser, and a Circuit Controller.

I never can forget the deep impression that magic city produced on my mind. For several days after my arrival I roamed thru the streets in utter bewilderment of the new spectacle. The attractions were many and irresistible, but, alas, the income was spent as soon as received. When Mr. Puskas asked me how I was getting along in the new sphere, I described the situation accurately in the statement that "the last twenty-nine days of the month are the toughest!" I led a rather strenuous life in what would now be termed "Rooseveltian fashion." Every morning, regardless of weather, I would go from the Boulevard St. Marcel, where I resided, to a bathing house on the Seine, plunge into the water, loop the circuit twenty-seven times and then walk an hour to reach Ivry, where the Company's factory was located. There I would have a woodchopper's breakfast at half-past seven o'clock and then eagerly await the lunch hour, in the meanwhile cracking hard nuts for the Manager of the Works, Mr. Charles Batchellor, who was an intimate friend and assistant of Edison. Here I was thrown in contact with a few Americans who fairly fell in love with me because of my proficiency in—billiards. To these men I explained my invention and one of them, Mr. D. Cunningham, Foreman of the Mechanical Department, offered to form a stock company. The proposal seemed to me comical in the extreme. I did not have the faintest conception of what that meant except that it was an American way of doing things. Nothing came of it, however, and during the next few months I had to travel from one to another place in France and Germany to cure the ills of the power plants. On my return to Paris I submitted to one of the administrators of the Company, Mr. Rau, a plan for improving their dynamos and was given an opportunity. My success was complete and the delighted directors accorded me the privilege of developing automatic regulators which were much desired. Shortly after there was some trouble with the lighting plant which has been installed at the new rail-

Copyright, 1919, by E. P. Co. All rights reserved

Mr. Tesla's articles started in our February issue

www.americanradiohistory.com

road station in Strassburg, Alsace. The wiring was defective and on the occasion of the opening ceremonies a large part of a wall was blown out thru a short-circuit right in the presence of old Emperor William I. The German Government refused to take the plant and the French Company was facing a serious loss. On account of my knowledge of the German language and past experience, I was entrusted with the difficult task of straightening out matters and early in 1883 I went to Strassburg on that mission.

The First Induction Motor Is Built.

Some of the incidents in that city have left an indelible record on my memory. By a curious coincidence, a number of men who subsequently achieved fame, lived there about that time. In later life I used to say, "There were bacteria of greatness in that old town. Others caught the disease but I escaped!" The practical work, correspondence, and conferences with officials kept me preoccupied day and night, but as soon as I was able to manage I undertook the construction of a simple motor in a mechanical shop opposite the railroad station, having brought with me from Paris some material for that purpose. The consummation of the experiment was, however, delayed until the summer of that year when I finally had the satisfaction of *seeing rotation effected by alternating currents of different phase, and without sliding contacts or commutator*, as I had conceived a year before. It was an exquisite pleasure but not to compare with the delirium of joy following the first revelation.

Among my new friends was the former Mayor of the city, Mr. Bauzin, whom I had already in a measure acquainted with this and other inventions of mine and whose support I endeavored to enlist. He was sincerely devoted to me and put my project before several wealthy persons but, to my mortification, found no response. He wanted to help me in every possible way and the approach of the first of July, 1919, happens to remind me of a form of "assistance" I received from that charming man, which was not financial but none the less appreciated. In 1870, when the Germans invaded the country, Mr. Bauzin had buried a good sized allotment of St. Estèphe of 1801 and he came to the conclusion that he knew no worthier person than myself to consume that precious beverage. This, I may say, is one of the unforgettable incidents to which I have referred. My friend urged me to return to Paris as soon as possible and seek support there. This I was anxious to do but my work and negotiations were protracted owing to all sorts of petty obstacles I encountered so that at times the situation seemed hopeless.



Fig. 2—This Illustrates Tests With Spark Discharges From a Ball of Forty Centimeters Radius in Tesla's Wireless Plant Erected at Colorado Springs in 1899. The Ball Is Connected to the Free End of a Grounded Resonant Circuit Seventeen Meters in Diameter. The Disruptive Potential of a Ball, Is, According to Tesla, in Volts Approximatelly V = 75,400 r (r Being in Centimeters), That Is, in This Case 75,400 x 40 = 3,016,000 Volts. The Gigantic Tesla Coil Which Produced These Bolts of Thor Was Capable of Furnishing a Current of 1,100 Amperes in the High Tension Secondary. The Primary Coil Had a Diameter of 51 Feet! This Tesla Coil Produced Discharges Which Were the Nearest Approach to Lightning Ever Made by Man.

German "Efficiency".

Just to give an idea of German thoroness and "efficiency," I may mention here a rather funny experience. An incandescent lamp of 16 c.p. was to be placed in a hallway and upon selecting the proper location I ordered the *monteur* to run the wires. After working for a while he concluded that the engineer had to be consulted and this was done. The latter made several objections but ultimately agreed that the lamp should be placed two inches from the spot I had assigned, whereupon the work proceeded. Then the engineer became worried and told me that Inspector Averdeck should be notified. That important person called, investigated, debated, and decided that the lamp should be shifted back two inches, which was the place I had marked. It was not long, however, before Averdeck got cold feet himself and advised me that he had informed *Ober-Inspector* Hieronimus of the matter and that I should await his decision. It was several days before the *Ober-Inspector* was able to free himself of other pressing duties but at last he arrived and a two-hour debate followed, when he decided to move the lamp two inches farther. My hopes that this was the final act were shattered when the *Ober-Inspector* returned and said to me: "*Regierungsrath* Funke is so particular that I would not dare to give an order for placing this lamp without his explicit approval." Accordingly arrangements for a visit from that great man were made. We started cleaning up and polishing early in the morning. Everybody brushed up, I put on my gloves and when Funke came with his retinue he was ceremoniously received. After two hours' deliberation he suddenly exclaimed: "I must be going," and pointing to a place on the ceiling, he ordered me to put the

(*Continued on page 64*)

THE proverbial trials and tribulations known to every inventor were not spared Tesla, the world's greatest inventor of all times. In this article we see him, arrived at young manhood, struggling along in a cold world. Already his fame has spread far and wide and his genius is recognized. But converting genius and fame into dollars and cents is quite a different matter, and the world is full of unappreciative and unscrupulous men. Tesla, the idealist, cared little for money and thus was promptly taken advantage of. But let Tesla himself tell you in his own inimitable style. It is a wonderful story.

In this month's installment Tesla also tells us how he made one of his most important as well as sensational discoveries—the Tesla Coil. Few inventions have caused such a sensation as this one which culminated in the only man-made lightning ever produced. The Tesla coil has so many uses and has been built in so many styles that it would take a catalog to list them all. From the spectacular high frequency stunts on the stage down to the "violet" ray machine in your home; all are Tesla coils in one form or another.

Wireless without the Tesla Coil would not be possible today. Without an oscillation transformer, spark gap and condenser—which is a Tesla Coil—the sending station would be crippled.

But it is for industrial purposes where the Tesla Coil will shine brightest in the future. The production of Ozone, the extraction of Nitrogen from the air in huge quantities—all are children of Tesla's fertile brain. His coil is the key to them all.

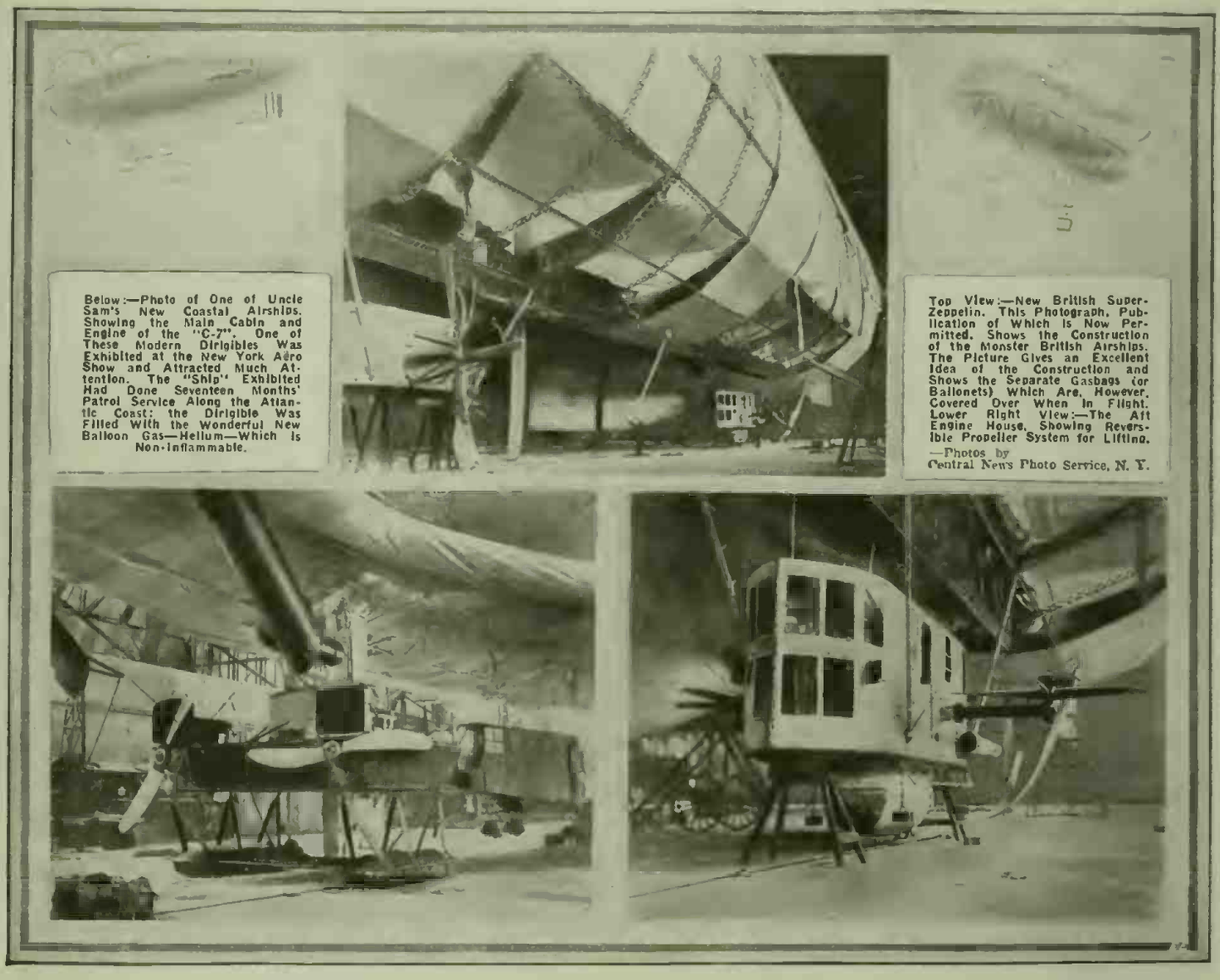
EDITOR.

www.americanradiohistory.com

The New York Aëro Show

THE aëronautical exposition which was held jointly in Madison Square Garden and the 69th Regiment Armory, New York City, March 1st to 15th, was the most successful aëro show and exposition ever held in the United States. Many remarkable exhibits were shown, including large bombing 'planes, small high-speed pleasure and scouting 'planes, besides a gigantic naval sea plane, of the stations at the Madison Square Garden or 69th Regiment Armory could be establisht with the flying 'planes or dirigibles, and in turn wireless telephonic speech was transmitted from the aircraft to the respective land stations. The effect on the public was startling, as while most of them had undoubtedly read of the wireless telephone, they did not have the slightest idea as to what the apparatus used for the purpose wonderful indeed, to stand in the crowd before the radio exhibit, and hear this conversation flitting back and forth between the operator in front of you and a second operator flying thru the air at a speed of 80 to 100 miles an hour.

One day a captive propaganda balloon broke from its moorings over the Sixty-ninth Regiment Armory and shot into the clouds, spilling leaflets, its anchorage dang-



Below:—Photo of One of Uncle Sam's New Coastal Airships, Showing the Main Cabin and Engine of the "C-7". One of These Modern Dirigibles Was Exhibited at the New York Aëro Show and Attracted Much Attention. The "Ship" Exhibited Had Done Seventeen Months' Patrol Service Along the Atlantic Coast; the Dirigible Was Filled With the Wonderful New Balloon Gas—Hellum—Which Is Non-Inflammable.

Top View:—New British Super-Zeppelin. This Photograph, Publication of Which Is Now Permitted, Shows the Construction of the Monster British Airships. The Picture Gives an Excellent Idea of the Construction and Shows the Separate Gasbags (or Ballonets) Which Are, However, Covered Over When In Flight. Lower Right View:—The Aft Engine House, Showing Reversible Propeller System for Lifting. —Photos by Central News Photo Service, N. Y.

and a powerful Caproni tri-plane. A captured German 'plane of the Albatross type was also exhibited. There were also shown a number of gas type, or lighter-than-air aircraft, such as solo balloons, blimps, a naval dirigible which had seen seventeen months' service on coast patrol work, etc. The "gas bags" were filled with the new balloon gas—Helium. The individual exhibits included many interesting auxiliary appurtenances in the flying world, such as rapid-fire photographic cameras, aircraft machine guns, measuring instruments for indicating the velocity of the 'plane thru the air, et cetera, and a host of other new and highly novel devices.

Radio-telephony was demonstrated by the Army Radio Corps of the Air Division in a very popular and interesting way. During the course of the exposition, various types of aircraft flew over the city, equipt with wireless telephone and telegraph installations, so that communication from either looked like, or how it worked, and many of them had a twisted notion that it had something to do with *telegraphy* somehow or other. However, Uncle Sam's radio experts, as soon as they got the sets up and working, soon showed the visitors how the wireless telephone worked. The roof operator, who is stationed at that point so that he could readily observe the approach of aircraft, would start calling the airplane or dirigible as soon as it came to view, somewhat in this fashion: "Hello airplane! Hello airplane! Hello airplane!" After a few moments' pause, and when the operator had manipulated the tuning of the apparatus to the right point and gotten his Audion detector and amplifiers adjusted to the proper strength, the voice of the pilot on the airplane, hovering in the air several hundred feet above the aëro show, could be heard calling, thru a large Audion amplifier—"Hello land station! I get you all right now, land station!" It was really very ling. Up to approximately 3,000 feet it sailed, where it exploded in a burst of brown smoke, falling upon a roof in the neighborhood of Fifth Avenue. Came the wireless comment from an airplane aloft:

"Did you see that? It burst about a thousand feet under us—ought to make good stuff for the reporters. By the way, are any down there?"

"Yes," broke in a newspaper man standing near the land wireless set, "and will you spell your observer's name for the reporters?"

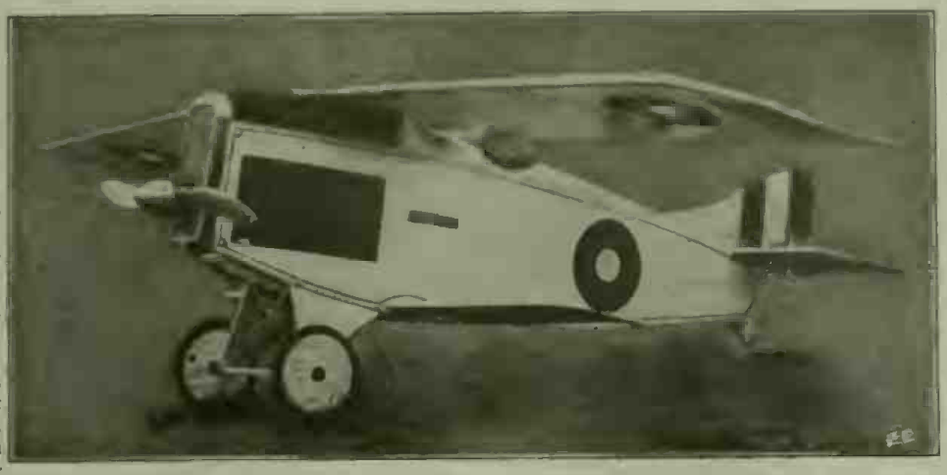
"Yes—it's Sergeant S-a-u-v-e-g-e-a-u. He had a date to come to New York this afternoon, and altho he's come he can't fill his date very well, unless he comes down and lands on the crankshaft. Anything else?"

"No, thanks," said the reporter as he hung up on the first *interview* by wireless telephony yet recorded.

The radio apparatus exhibited, including that in the exhibit of the United States

www.americanradiohistory.com

Navy, was that of the vacuum bulb or Audion type. The range of the wireless telephone airplane apparatus for transmitting and receiving speech signals varies, of course, with the size of the transmitting set, the length of the aerials used on the airplane and several other factors. It is interesting to note at this point that only recently Secretary of the Navy Daniels carried on a wireless telephone conversation on March 11th with an airplane flying over the Potomac River at a distance of 150 miles. In this two-way wireless telephone conversation with the Secretary of the Navy, who was located at Washington, he used his ordinary desk telephone, which was connected up to the wireless transmitting set in another building. A recent report states that radio-telegraphic communication from earth to 'plane has been carried on over a distance of 200 miles.



The Fastest Airplane Exhibited At the Aëro Show In New York—The "Christmas Bullet" —Rated Speed 200 Miles Per Hour. Test Showed 185 M.P.H. To Be Used as "Taxiplane" to Deliver Dispatches to Vessels One Day Out At Sea.

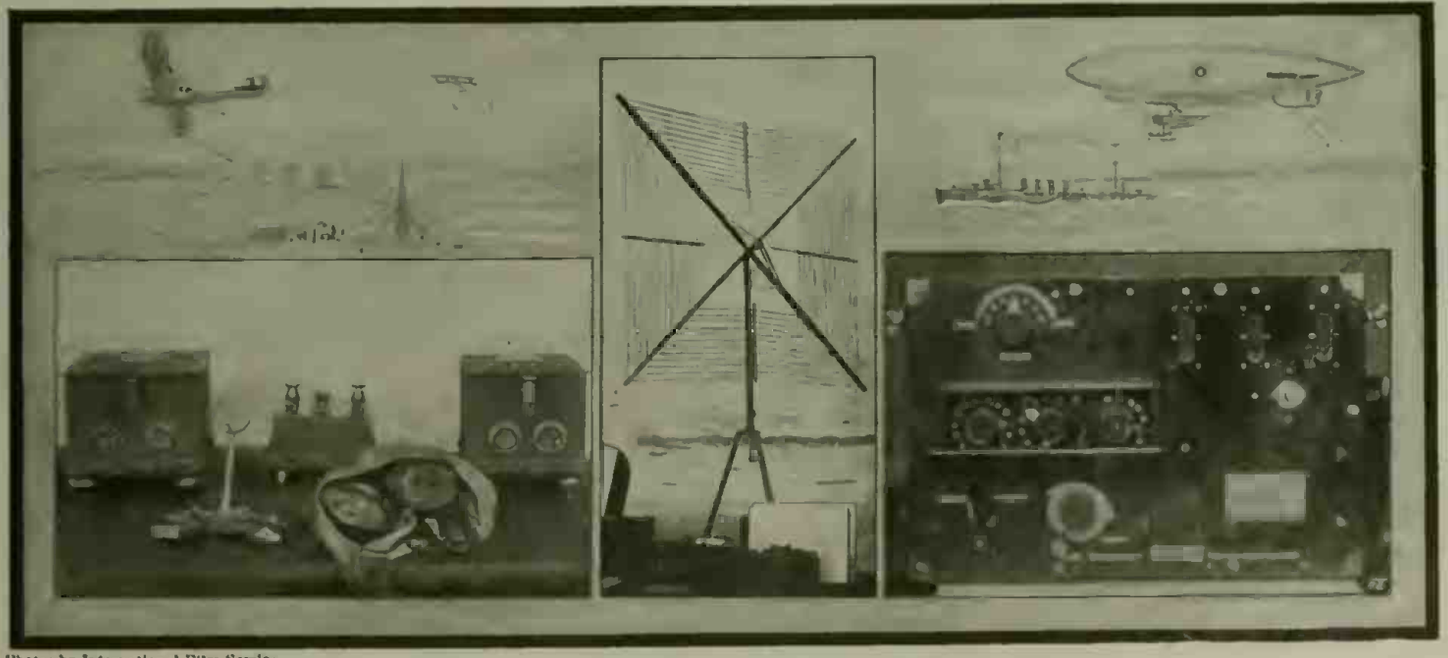
The form of antenna used on aircraft during the war has been invariably that employing a quick-acting reel, on which the phosfor bronze stranded antenna cable was wound upon or released from, according to the desires of the pilot. However, in the newer aërial systems as applied to the airplane, not one, but two aërials are utilized, and no reels are employed. Each wire is about 100 feet long, with a two-pound lead weight at the end, and flies out from either extreme of the wings. These wires, contrary to popular conception, are said not to interfere with the maneuvering of the plane at all. One of the officers at the radio exhibit explained that the 'planes can rise and land with these wires outstretched without any trouble. One of the wires forms the aërial, while the other forms a counterpoise ground capacity. The tuning and detecting apparatus are connected between them in the cockpit.

In looking over the wireless equipment on the various 'planes, one was struck by the wide-spread adoption of the wind-driven wireless dynamo, and even the gigantic foreign bombing planes, including the Handley-Page, were fitted with a wind-driven radio generator. This small dynamo is usually mounted just to one side of the fuselage or cockpit, and is rigidly secured to the wing. As the airplane speeds thru the air, the propeller on the small dynamo is rapidly spun, and the necessary current thus produced for operating the radio telephone or telegraph instruments. Whenever an airplane or dirigible was in radio telephonic communication with the station at the show, the most frequent question heard among the audience was: "Why is it that the terrific noise of the airplane engine is not heard above the comparatively weak voice of the pilot?" The explanation is simple when you know how it is done. The explanation for the non-transmission of the airplane engine exhaust noises is as follows: Many weary weeks were spent in special research on this particular problem by experts of the concerns who developed the radio telephone during the war, under great pressure, but thanks to their keen perception of the principles involved in successfully telephoning by radio from a moving vehicle in the air, in proximity to a terrific noise such as produced by the airplane, these engineers had the forethought to finally devise a special sound detecting instrument or microphone, which is strapt to the aviator's breast, and in the front of which there is a metal plate containing three small holes about the size of a needle. The voice waves of the airplane operator impinge directly against this plate, and readily pass thru the small openings in it, thus vibrating the diafram of the microphone, while the violent swirling noises set up by the airplane engine pass by it without affecting the diafram thus protected.

Here are some of the outstanding electrical and other features which appealed to the visitor of the aero show, in looking over the airplanes of all designs, both large and small. On one of the 'planes one found *red* and *green* signal lights, which were placed respectively on the extreme outer ends of the lower wing. Another novelty was the electric searchlight of small size, mounted over the cockpit so as to be rapidly manipulated by the pilot or his assistant, for the purpose of making landings at night or helping to locate the enemy in a night attack. Many interesting exhibits were on hand of the various magneto ignition systems. A beautiful model was shown of a spark phase-angle indicator, which roused great interest among the spectators, as the sparks staggered around the edge of a rapidly revolving two-foot black disc, which was covered over with sheet glass. Of course, there were electric lights in the aviators' quarters, or cockpit, besides many other electrical and allied features of great interest, such as signaling systems between the pilot and the observer, provision for supplying current to the electrically-heated aviator's clothes, which the aviators always wear on long distance trips, or in night flying when it is particularly cold.

Other exhibits included luminous radium dial measuring instruments and gages, electro-pneumatic and other forms of aerial photographic apparatus, some of which operated at very high speed, as can be read-

(*Continued on page* 60)



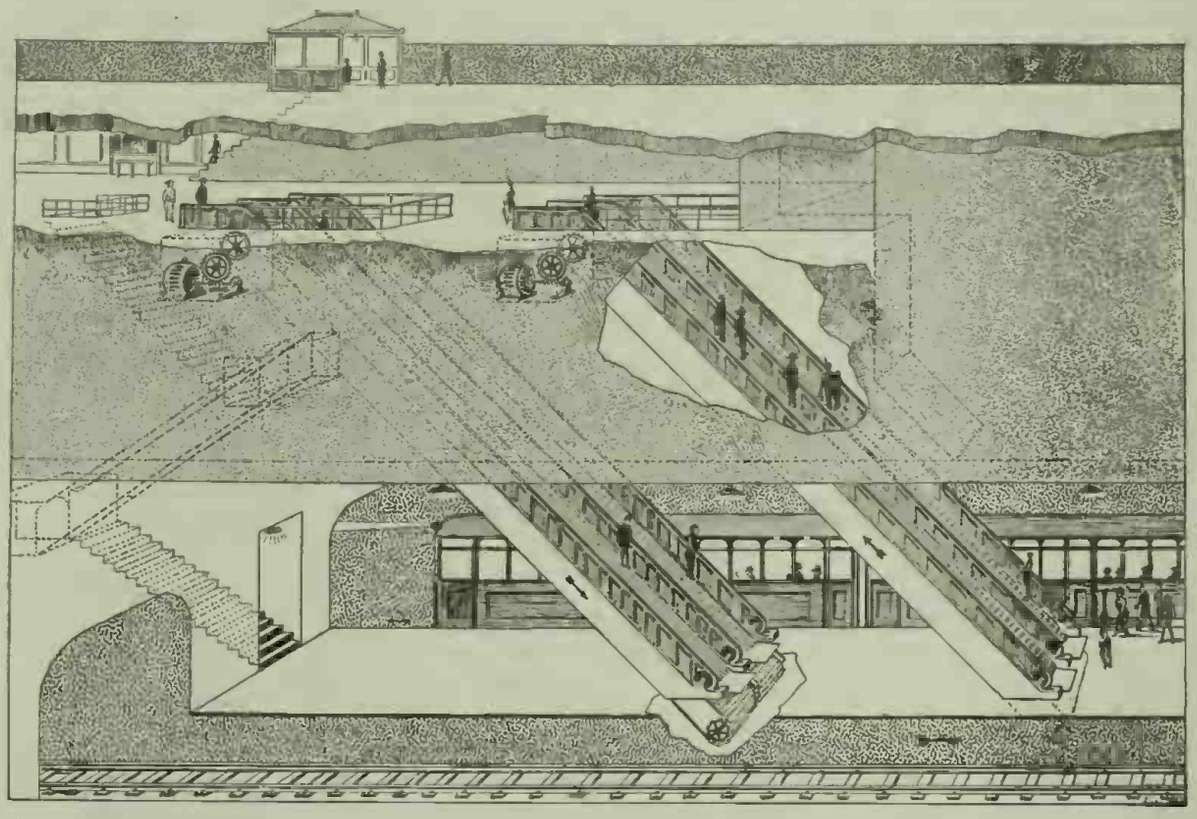
Photos by International Film Service

Airplane Radio at the "Aëro Show." Left:—A Short Range Wireless Telephone Set, Transmitting and Receiving, Used on Airplanes. Center:—A Radio Direction Finder, Used for Locating Direction of Transmitting Stations. Right:—The Airplane "Land Station" Wireless Telephone Set, Transmitting and Receiving. One of the Many Exhibitions of the Special Feature at the Aëro Show Held In New York City. The Management of the Show Arranged for Demonstrations and Exhibitions of the Many Developments of Aërial Communication Recently Adopted by the U. S. Government.

www.americanradiohistory.com

Monster Escalator for New York Subway

THE New York subway system has incorporated in its various ramifications some of the most novel engineering features possest by any similar transportation system in the world. Moving platforms have been suggested and tried in various New York transportation systems, and moving stairways or escalators are not unknown to the metropolis' subway and elevated railroad traveling public by any means. But one of the most interesting and highest lift escalators is now being built at the Park Place and Broadway station of the 7th Avenue Subway, New York City. The accompanying illustration shows a sectional view of this subway innovation, which promises to make this station one of the highest speed stations of its kind in the world.



An Innovation in Escalators is to be Tried Out at the Park Place Station of the Seventh Avenue Subway in New York City. Four Escalators Will be Available, Any Or All of Which May be Operated Either Up Or Down, Depending Upon the Direction of Traffic, Which Is Mostly Eastward in the Morning and Westward at Night.

The four escalators to be finally installed will be *reversible*, and several ways of operating these electric motor-driven moving stairways will be available. In the morning when this downtown station of the great metropolis is flooded with office-bound passengers, then if necessary all four of the escalators may run *upward* to carry the traffic to the street. After about 10 o'clock in the morning when the traffic thins down, until it is about half uptown and half downtown, then two parallel escalators can be upward and the other two downward. If the traffic is quite light, it will be up to the station master to cut out two of the escalators and block them off, running one of the remaining pair upward and the other downward. As the crowd slowly changes and becomes a strong uptown-bound traffic, toward the latter part of the afternoon, then all of the escalators will be run *downward*.

The reason for installing the escalators at this station was because of the fact that the 7th Avenue Subway, which dives under the Interboro Subway, running under Broadway at this point, has to pass under the latter Subway, and as it is located about three levels underground, this renders present climbing to the street up existing stairways a very tedious and laborious exertion, which is almost as bad as climbing the steps of the Washington Monument. Of course, the present staircases will remain in place, as under the condition where north-bound traffic might necessitate operating all of the escalators downward, then passengers arriving on southbound trains would have to gain access up these stairways to the street. It would probably be more expedient to operate three of the escalators downward and one upwards, a problem which the traffic engineers will have to determine by careful check over a considerable period of time, after the escalators have been in operation for a while.

Lightning of All Kinds

Lightning photos are more or less common, and a great number of them have been publisht in the various issues of this Journal from time to time, but one of the most astonishing lightning pictures ever recorded by the camera, is that shown in the accompanying view, which incorporates every form of lightning, such as bead, forked, chain and ribbon, so-called heat or *flash*, and ball lightning. This picture is extremely interesting to all photographers, who have attempted to obtain good photos of lightning discharges. It is quite a trick to photograph lightning in just the way you would like to have it appear on a finished picture.

In some cases, and as is the usual practise, excellent lightning pictures are obtained by waiting for a dark period just after a flash, and then opening the camera shutter, which has previously been set for a time exposure. As soon as the next flash of lightning occurs, the shutter is at once closed, and the plate then developed. This sounds simple, but as Shakespeare said, "There is many a slip twixt the cup and the lip," and one humorous instance comes to mind of an ambitious lightning photographer, who sud-

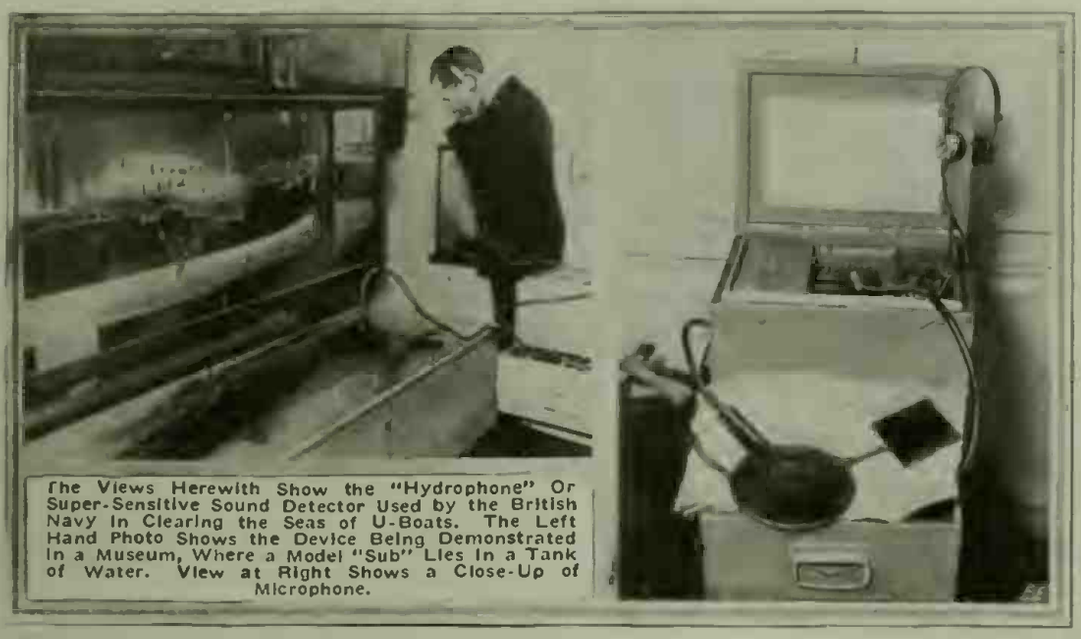
(*Continued on page* 56)



In this Remarkable Photo Lightning of Many Kinds—Chain, Bead, Forked and Ribbon Varieties—Are Shown. A Photo Hard to Beat.

www.americanradiohistory.com

British Submarine Detector



The Views Herewith Show the "Hydrophone" Or Super-Sensitive Sound Detector Used by the British Navy In Clearing the Seas of U-Boats. The Left Hand Photo Shows the Device Being Demonstrated In a Museum, Where a Model "Sub" Lies In a Tank of Water. View at Right Shows a Close-Up of Microphone.

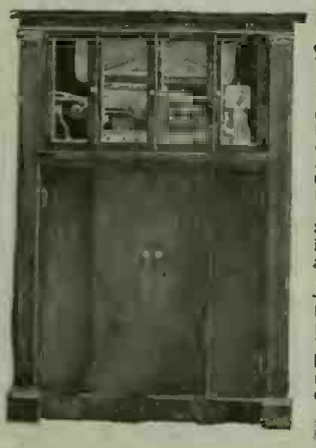
This invention was used extensively and successfully by the British Navy during the war. Wires lead to various stations on the ship, at which listeners are posted. By this means a steady watch is kept and the approach of every undersea craft is heralded. One of the photos shows a model submarine in an experimental tank, showing the hydrophone in the tank, while the man with the receivers listens to the sounds from the propeller which warn of the approaching submarine.

Practically all of the British ships were equipt with the device, and it is acknowledged that many ships were saved by means of the instrument, which is somewhat like a dictagraph, i.e., a super-sensitive telephone transmitter connected with a low resistance telephone receiver. The sound detecting microphone is placed in a submerged part of the hull.

Electric Violin-Virtuoso a Marvel

One of the most wonderful musical instruments ever perfected is the electrically played violin-virtuoso shown herewith. Musicians said it could never be done—but it has been accomplisht at last, with a range of action almost, if not, indeed, actually, miraculous.

The control of both speed and pressure of the bows of the self playing violin is said to be perfect. Regardless of how fast or slow the tempo the proper ratio of pressure is consistently maintained. This is accomplished by means of a small electric motor possessing a speed of from 200 to 6,000 (and any intermediate rate) revolutions per minute, and so constructed that the amount of pressure applied to the bows is automatically and accurately regulated by the speed. Thus even the softest notes are clear and sweet, while the loud are rich and sonorous. Furthermore, one by one, there has been added to the Violano-Virtuoso various devices for producing not only the staccato, but the arpeggio, portamento, pizzicato, shake, trill and all other musical variants peculiar to violin playing.



The Electrically Played Violin Is Truly a Wonder of Modern Science—It Was Long Predicted That Such a Device Could Not Be Built. But It Has—and Sixty Magnetically Operated Fingers Do the Work—and Play Better Than Most Human Violinists. Four Magnets Operate the Bows.

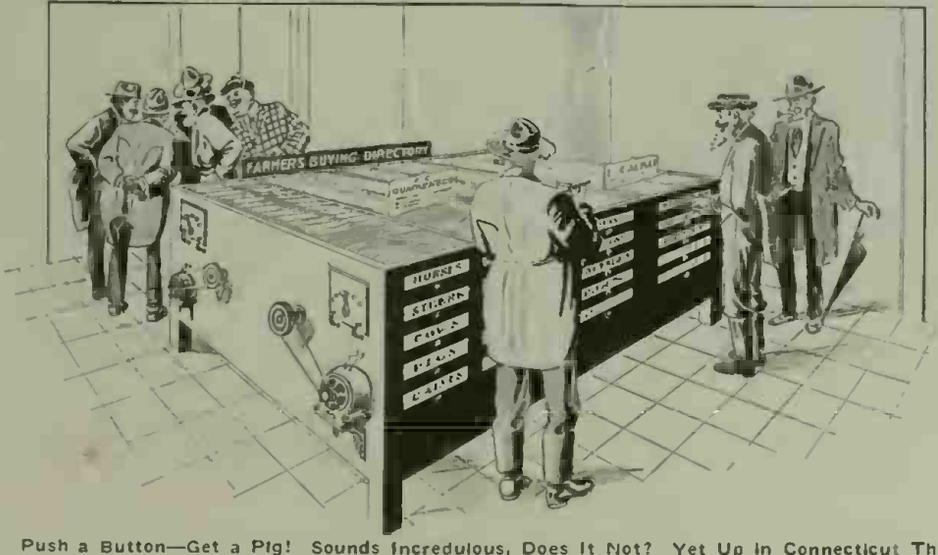
Sixty "fingers" perform the action. As the contact cylinder carrying the paper (fed by a secondary cylinder) revolves, and the perforations in the music roll pass given points, contact is made with one or more of the brushes and an electric current flows to finger magnets resting over the finger board. Each of these magnets attracts an armature connected with a finger operating rod acting upon the violin strings. The same current also acts simultaneously on the bow action magnets. Another magnet produces the "staccato" while the tremolo

(*Continued on page* 56)

Push a Button--Get a Pig

The Federal Agricultural Agent up in Litchfield, Conn., being frequently called upon to help farmers find things they needed and having no definite means of knowing where they were to be had except for gossip heard on his rounds, conceived the idea of an agricultural survey. Now, if you want to locate a supply of seed corn or oats, a grain binder, a pure-bred bull, or some young pigs, in any community in five counties in that State, all you have to do is to walk into the office of the State Librarian at Hartford, run a series of cards thru an electric sorting machine, and, Presto! you have the information.

It may sound a little like the story of Aladdin's lamp, but it is only big business applied to farm affairs under war stress. The Council of Defense took up this plan and offered to back the farm bureaus to the limit in every county in the State. Five of the eight counties began surveys early in March, 1918. Forty questions, under the headings of area, crops harvested in 1917, crops planted to be harvested in 1918, live stock on hand, machinery on hand, and employes, were included in the survey, and a corps of volunteer farmer census enumerators got busy. When the survey was completed the farm bureaus had a stack of cards containing minute information as to the resources and needs of every farm. An electric sorting machine was installed in the State Library, and any fact disclosed by the survey can be made available by throwing on an electric switch. The survey has been invaluable by helping Connecticut to mobilize her agricultural forces for peace needs.



Push a Button—Get a Pig! Sounds Incredulous, Does It Not? Yet Up In Connecticut They Have Such an Electric System In Operation. You Don't Exactly Get the Pig Or Cow by Pushing the Button, But You Do Obtain Data as to Where You Can Buy Them.

www.americanradiohistory.com

Putting It Over on Fritz

By K. K. SAMMERIN

Tricks and Odd Slants of Warfare that Puzzled the Hun

THE immediate ancestor of the "Mills" hand grenade was the "jam tin." This was an awkward and unreliable species of bomb, shaped like a canned soup receptable, with a six- or eight-inch projecting fuse intended to burn four seconds. Sometimes it fulfilled expectations exactly, but more often the fuse was temperamental. It went off before the time was up, or sputtered long enough, after dropping in the German trench, to allow one of the enemy to pick it up and toss it back. Because, early in the fall of 1915 when this crude weapon flourished, bombs of any kind were so scarce that the soldiers often made their own, few opportunities for dosing the enemy with his own pills were overlooked.

The last day upon which Fritz monkeyed with "fizzers" from the Allied trenches with any degree of self-confidence was November 12th, 1915. That occasion taught him that even a "dud" jam tin has its lively moments.

For several weeks preceding the date mentioned a French ordnance engineer had been experimenting with what he termed "instantaneous fuse." This was made up, wound in waxed thread, just like the ordinary fuse used in jam tins. The essential and important difference between the two varieties lay in the fact that while straight fuse fizzed off at the rate of *one and one-half inches a second*, the instantaneous variety burned *twenty-six feet a second!*

Without giving the fact much publicity, several thousand jam tins identical in appearance with the stock variety were made up. In every way but one these were the same; the six-inch fuse was instantaneous, and was made with the end charred a trifle, to look as if the bomb had been lighted and had gone "dud" after being thrown.

Over a sixty-kilometer front in the Verdun sector the bombers were assembled and coached in the use of this new weapon. Simultaneously at seven in the evening "parties" started out for the German wire. Stopping here, each of the four hundred bombers participating delivered himself of four regular "jam tin" grenades and four of the "imitations" before scurrying back.

Fritz noted one striking feature of the engagement. Many of the Allied missiles landed "dud"; this probably was due to the extraordinary *inefficiency* of the French ordnance department, concerning which the German privates had been told so much. All along the line German defenders picked up the imitation duds and lighted their fuses, intending to bomb the bombers with French ammunition.

The havoc that resulted was appalling! Each grenade, of course, exploded the instant it was lighted. Because a raid was in progress, anyway, each individual accident received no attention at the moment. If Fritz saw Heiney go up in smoke while handling a French bomb, he thought simply that Heiney had been too careless—tough luck for Heiney, but *he* would never get caught that way. A second later another trick bomb would send him to join his Hun Comrade.

For several minutes after the bombers reached their sheltered trench the explosions continued across No Man's Land. It was estimated at the time that a full thousand of the grenades exploded in the hands of German soldiers before anyone found out the secret. Since the average bomb exploding in the confined lane of a trench will kill three and wound six soldiers, it is fairly safe to assume that this simple trick cost the Germans at least *five thousand men in killed and wounded!* From that day forward it was official practise in the German lines to let French bombs severely alone.

Another point at which Allied wits bested German scheming was at forecasting retreats by the enemy. To civilians, well-posted with data on the occasional exploits of airplane observers, this does not sound sensational in the least, but doubtless to the Huns themselves the manner in which the Allied forces knew of the last retreat in the Soissons-Reims sector in time to take full advantage of it seemed little less than miraculous. No matter what airmen may say about the photographs they took, or the observations made by telescope from a 'plane, this latter scheme could only tell of a retreat actually under way—too late for much action by the Allies. On the other hand, the method described here not only would tell for certain, two weeks in advance of the first troop or supply train movement, *but would mark off the exact line to be abandoned, and tell the depth to which the Germans intended to relinquish their hold!*

This was done simply by listening in on the unintelligible gibberish of German trench wireless with Allied instruments. Ordinarily, of course, three-fourths of the signaling done in the front trenches is done by means of telephone, orders being sent thru one central station by wire to all parts of the sector.

Towards the end of the war, however, the Germans began to run out of wire and telephone instruments. They could not replace them because of a lack of the materials. Therefore they began to plan on saving every instrument and foot of wire when a retreat was to be made. They took out the stations gradually, and as they removed them they set up trench wireless instead. The Allies, after finding out this plan, simply watched the appearance of wireless sets where 'phone stations had been; when the wireless began to predominate it was certain that ten days or two weeks would

(*Continued on page 77*)



He Thought He Detected Something That Sounded Just a Little Like a Message! He Wound the Phonograph and Turned Its Speed Indicator Down So That the Record Revolved Only a Few Times a Minute. Then He Applied the Needle Again. Aha! There Was Something There!

www.americanradiohistory.com

Cold Light

By ROGERS D. RUSK, M. A.

COLD light is one of the wonders of the modern age. Light without heat seems like a contradiction, nevertheless it is a scientific fact. Since the discovery of the electrical

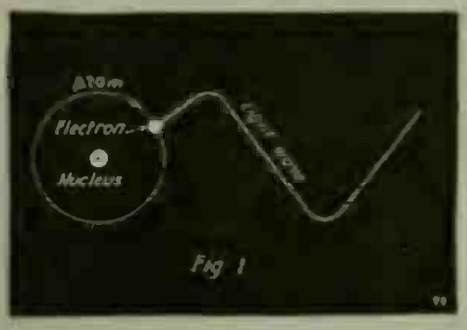


Diagram Illustrating the Old Theory of Light Produced by Electricity. In This Explanation the Electron is Considered as Continuously Producing Light Waves by its Rotation. The Newer Theory of Light and Heat Waves is Shown at Fig. 2.

nature of light, the possibility of transforming electricity directly into light, without the production of heat, has been a tempting goal. For centuries, scientists dreamed of solving the mystery of the *firefly* and the *Aurora Borealis*, but dreamed in vain. They saw light without heat produced in Nature, but could not produce it themselves.

Today the discovery that light may be produced without heat, by means of electrical ionization, seems to be the key to the situation, and we can only wonder where it may lead us. At the present time over 96 per cent of all the energy used in the fifty million incandescent lamps in the United States, instead of being turned into light, *is wasted in the form of heat!* Moreover the astonishing production of light without heat by ionization has given us a new view of the relation between light and electricity and the great problem of the origin of light.

It used to be thought that light could only be produced by incandescence, that is, thru heating of a solid body to white heat. Strange as it may seem, the candle and the kerosene lamp are really incandescent lights. The light they give off is due to white-hot particles of carbon liberated in the combustion process. Even the light from an arc lamp is mainly due to the crater in the positive carbon being heated to incandescence.

The fact that heat is not the only factor which effects the production of light can be easily seen in two ways. First, salts of sodium, potassium and lithium may be thrown in the same flame at exactly the same temperature, but the first gives off a bright yellow light, the second a violet, and the third a deep red. Second, light is produced by an electric spark in a partial vacuum, such as a Geissler tube, *with little or no heat at all.* In both of these cases the light *must* be produced by the breaking up of the molecules, of the solid or gas, into electrically charged particles, or ions, in a manner to be explained later.

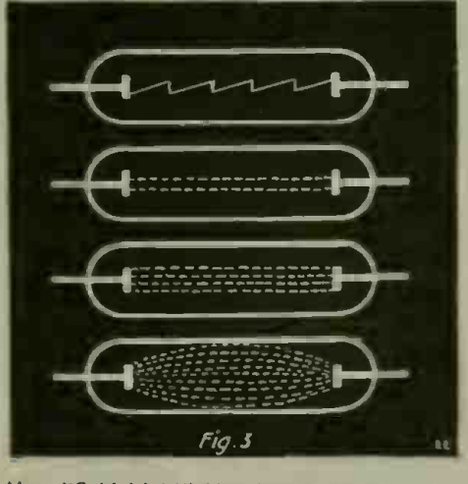
The idea of using cold light for illuminating purposes seems to have first occurred to Nikola Tesla. Very early in his career he suggested that the effects produced in Geissler tubes might be utilized in that way. Not until recent years, however, did his suggestion bear fruit in the shape of the now famous Moore *vacuum tube* light, invented by McFarland Moore, which produces a fine soft light from a glass tube thirty to forty feet long, filled with carbon dioxid. The heat which this light produces is almost negligible.

Cold light is a term used to indicate luminous radiation *without* heat radiation, and that means maximum efficiency, i.e., a colder and a colder source. The old fashioned kerosene lamp wastes 36.4 calories of heat per second for every candle-power of light produced. The gas mantle wastes 11, and the tungsten lamp but from 1. to 2. calories.

Considering electric lights only, the heat loss in tungsten lamps has been reduced by the introduction of gases such as nitrogen into the bulb, but arc lights have made a greater development. The invention of the enclosed arc reduced the heat loss without reducing the illumination. Then the invention of the flaming arc increased the illumination without increasing the temperature of the arc. The latter is the most interesting development because part of the light from the flaming arc is *cold light*, from the chemicals in the flame which are ionized by the electric current. The cold light from these ions plus the light from the incandescent carbons makes the flaming arc nearly *three hundred per cent* more efficient than the ordinary incandescent lamp.

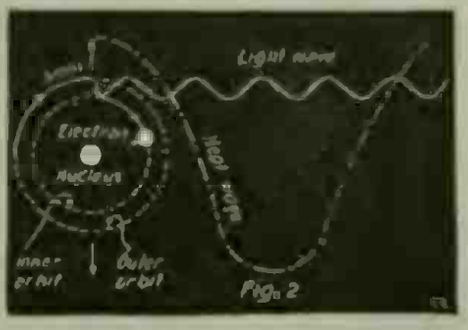
The first flaming arc appeared in 1900, known as the Bremer arc, and using carbons impregnated with several chemical salts. Later Steinmetz and Whitney used the rare metals titanium and chromium in their arcs and produced a still more efficient light. About the same time the *mercury vapor* light was invented, which gave a brilliant bluish white light from the mercury ions in the arc. Later still is the discovery by two scientists, Franck and Hertz, that an electric current of only 4 volts, when past thru *cold iodin vapor*, produces a faint light of definite color. When the voltage is raised to twelve, another color is obtained. This is *true cold light*, produced directly from the molecules as they are ionized by the current. How this is possible, and how light and heat may be produced independently of each other, will now be shown.

What the actual source of a light wave is has been one of the mysteries of science since the beginning of history. The discovery by Maxwell, Hertz and others that light is an electro-magnetic vibration, caused scientists to look for the electric charges which produce these waves. When the electron was discovered it was thought that the solution had been found, but there



How "Cold Light" May be Obtained by Exhausting an Ordinary Glass Tube. When Air is Pumped Out of a Tube in Which There is an Electric Spark Discharge, a Stage is Reached Where the Whole Tube is Filled with a Soft Luminous glow—Cold Light.

was still one great drawback. Scientists said that as the electron revolved about its axis in the molecule it produced light waves just like a paddle wheel in a body of water. But as all molecules of all substances con-



The New Theory of Light and Heat Waves, Which Says that Light is Produced Intermittently. Here Light is Produced by the Electron Jumping from One Orbit to Another, as the Circular Orbital Paths Indicate.

tain electrons which are constantly in motion, then all substances should give off light all the time. This was ridiculous, as everything in the world and the whole universe would be of a dazzling brightness like the sun.

The discoveries of today are changing this idea completely. One of the world's greatest physicists, Planck, says electrons cannot give off light waves continuously, but emit definite quantities at intervals. This theory he calls the *quanta theory*, and another physicist, Bohr, says the time the light is given off is when the motion of the electron is suddenly changed from its normal continuous motion, by its jumping from one atom to another, or from one orbit to another about the same atom. This is a very simple theory, but it is often the simplest theory which best explains the facts. When trillions of trillions of electrons are doing this at the same time, the light is to all purposes continuous. These theories have received added confirmation from work done recently by Prof. Millikan of Chicago University, who gained fame by his original measurements of the electron itself.

The principle of the new theory can be easily explained by an illustration. If a ball is whirled in a circle on the end of a string, the pull on the string is steady and continuous as long as the ball whirls with the same speed. However, if the ball is suddenly stopt or hit by something which makes it change its course, a jerk or a wave will be felt in the string. Now an electron does the same thing, only the jerk or wave is sent out in all directions by the electro-magnetic field about the electron. This jerk or wave is the little quantity which Planck calls a "quanta". The familiar way in which an electron is pictured as continuously producing light waves, by its rotation, is shown in Fig. 1, but this is wrong according to the above theory. What really must happen is shown in Fig. 2, where the two circles represent different orbits and the full line represents the path of the electron jumping from one orbit to another and at the same time emitting a quantity of radiation or *light*. The way in which electricity or some other agency causes this disturbance of the electron is not fully understood.

The most remarkable thing about it all is that heat and light waves may be produced independently. A heat wave is produced by the vibration of the whole molecule or atom as shown by the big arrows and dotted wave line in Fig. 2. And under

(*Continued on page 73*)

www.americanradiohistory.com

Popular Astronomy

Astronomical Distances

By ISABEL M. LEWIS
of the U. S. Naval Observatory

THE immensity and grandeur of the scale upon which the visible universe is fashioned lies almost beyond human comprehension. To visualize the vast extent of our own solar system which is but a single unit in the system of the stars we may have recourse to earthly standards of measurements, such as the mile. But when we desire to express in terms of units that can be grasped by our imagination, the distances of the stars that lie far, far beyond, we find that all ordinary standards of measurement become utterly inadequate for our purpose. For the measurement of celestial distances *within* the solar system the unit employed is either the familiar mile or kilometer or the "astronomical unit," which is the mean distance from the earth to the sun (ninety-two million nine hundred thousand miles in round numbers).

The unit of measurement employed for distances *beyond* the solar system is either the *light year* or more recently the *parsec* which appears to be rapidly replacing the light year among astronomers. A "light year" is the distance that light, with its finite but almost unimaginable velocity of one hundred and eighty-six thousand miles *per second, travels in a year.* It is equal in round numbers to sixty-three thousand times the distance from the earth to the sun or approximately six thousand billions of miles. The parsec is equal to three and twenty-six hundredths (3.26) light years, and it is approximately two hundred thousand times the distance from the earth to the sun. It is "the distance of a star with the *parallax* of a second," a fact which its name conveys to us. In other words, at the distance of one parsec the distance from the earth to the sun, "the astronomical unit," would subtend an angle equal to one second of arc. This angle is spoken of as the parallax of the star. The larger the parallax; that is, the larger the angle that the astronomical unit or radius of the earth's orbit subtends, viewed from the star, the nearer the star is to us. The fact that there is no known star within one parsec, or three and twenty-six hundredths light years, of the sun shows the immensity of the scale of the universe of stars.

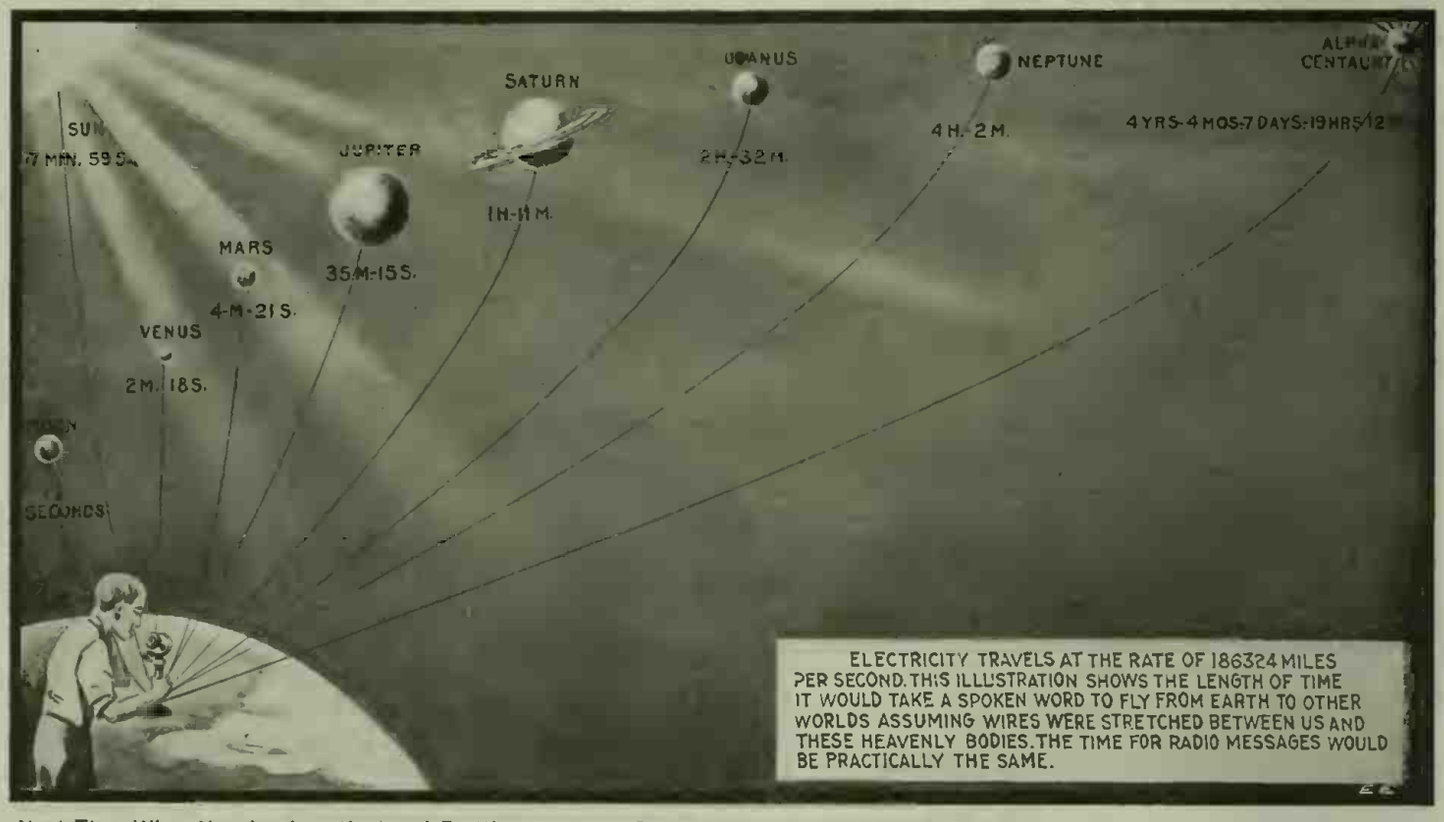
Before considering the distances of the stars and the extent of the sidereal system of which our sun and his satellites form a part, let us undertake to express the distance of the sun, moon and planets from the earth and the extent of the solar system in terms with which we are familiar.

The nearest to the earth of all celestial bodies is its satellite, the moon. So near is the moon that if we should make on some great plain a model of the solar system in which the astronomical unit, the distance from earth to sun, would be four hundred feet, the distance between earth and moon would be only one foot. On the same scale the most distant planet Neptune would be two and one-quarter miles away. In round numbers the moon is distant from us sixty times the distance from the earth's center to its surface or two hundred and forty thousand miles and thru our great telescopes we see it as it would appear at a distance of one hundred miles.

Granted that it were possible to escape the earth's gravitational bonds and to travel by our swiftest means of conveyance, the airplane, thru interplanetary space, let us consider how long it would take us to reach the moon, sun and planets if our speed were unslackened at two hundred miles an hour. An airplane traveling at this rate would circumnavigate the earth in a little over five days and would reach the moon in seven weeks. A trip to the sun, however, would require fifty-three years.

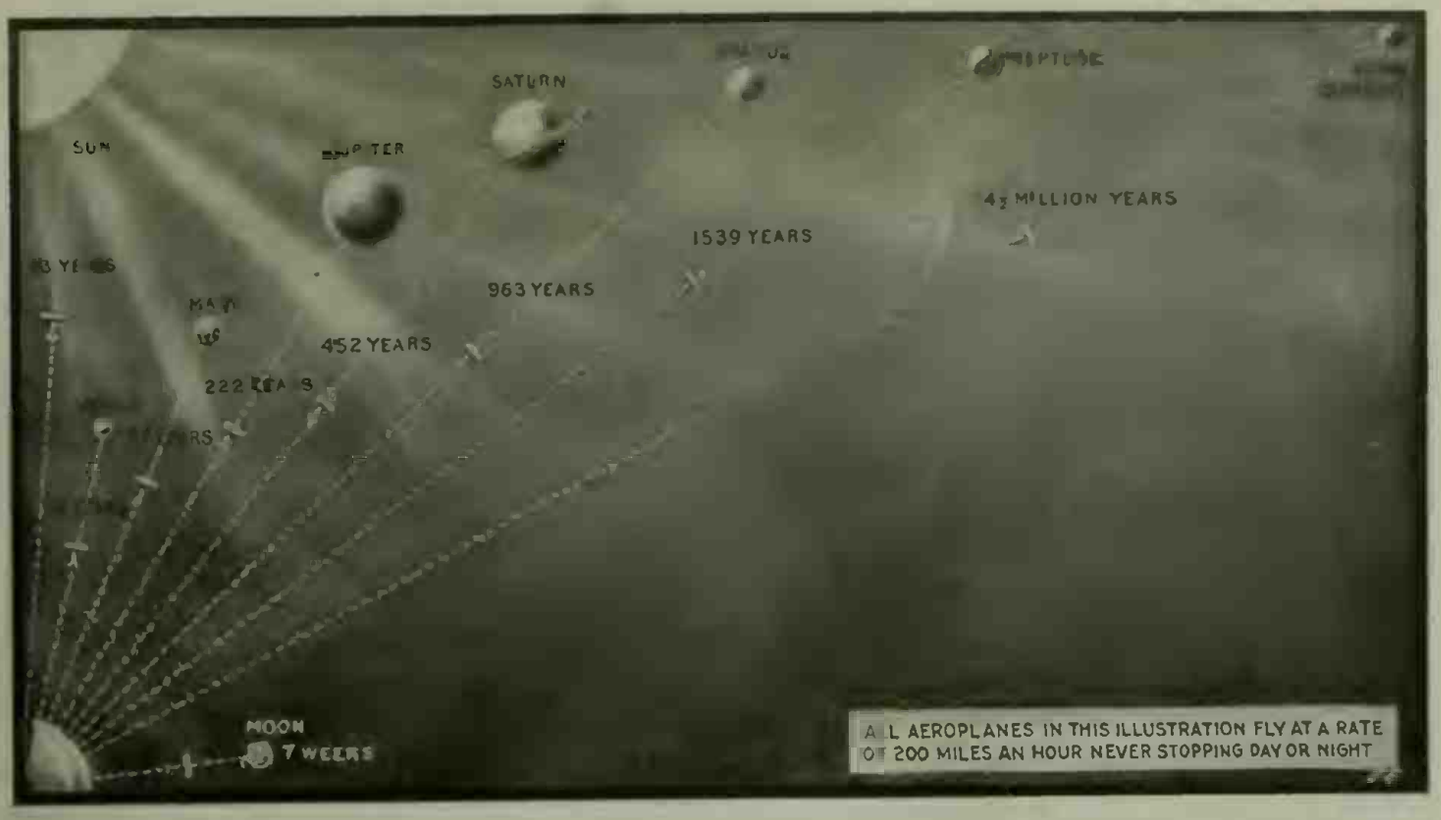
After traveling for fourteen and a fraction years we would pass the orbit of Venus and eighteen years later the orbit of Mercury. If we preferred to travel outward from the earth in the direction of Mars and the outer planets instead of toward the sun, more than twenty-seven years would elapse before the orbit of Mars would be crost. An airplane journey to Jupiter would be a matter of more than two hundred years, to Saturn four hundred and fifty years, to Uranus nearly one thousand years and to Neptune about one thousand five hundred years. To cross the solar system on the diameter of Neptune's orbit would be a journey of more than three thousand years. The sun's attraction reaches far beyond Neptune's orbit, however. There are comets belonging to the solar system compelled by the sun's attraction to accompany him on his travels thru space that return periodically to the immediate vicinity of the sun from regions far beyond the orbit of Neptune and there is also the possibility that one or more undiscovered planets may travel around the sun in orbits exterior to Neptune's orbit.

Measured in terms of familiar units, such as are employed for the measurement of distances on our own planet, the extent of the solar system is tremendously great. Seen from Neptune, the sun presents no appreciable disk. It is in this sense starlike to the Neptunians, but seen from Neptune the stars appear no more brilliant and



Next Time When You Are Impatient and Fretting Because "Central" Keeps You Waiting Ten Seconds for a Connection, Imagine That Your Best Girl Is on Neptune. You say "Hello" and It Takes Exactly 4 Hours and 2 Minutes for "Hello" to Get Up to Neptune, and Then You Have to Wait 4 Hours More to Give Your Sweetheart a Chance to Say "Hello" in Return. While If She Were on Alpha Centauri, It Would Take Your Voice Over Four Years to Get to Her and an Equal Time for Her Voice to Get Back, Altho You Know That Electricity Travels at the Rate of 186,324 Miles a Second.

www.americanradiohistory.com



The Fastest Vehicle Known to Man is the Airplane. Supposing There Was Air Instead of a Vacuum Between the Earth and the Other Heavenly Bodies, It Would Take an Airplane a Very Considerable Time to Reach These Bodies. Even to the Moon, the Nearest of All Heavenly Bodies, Only 236,000 Miles Distant, Seven Weeks Would Be Consumed in Reaching It By Airplane. To Reach Neptune, It Would Take 1359 Years. Such Are the Immense Distances of the Universe.

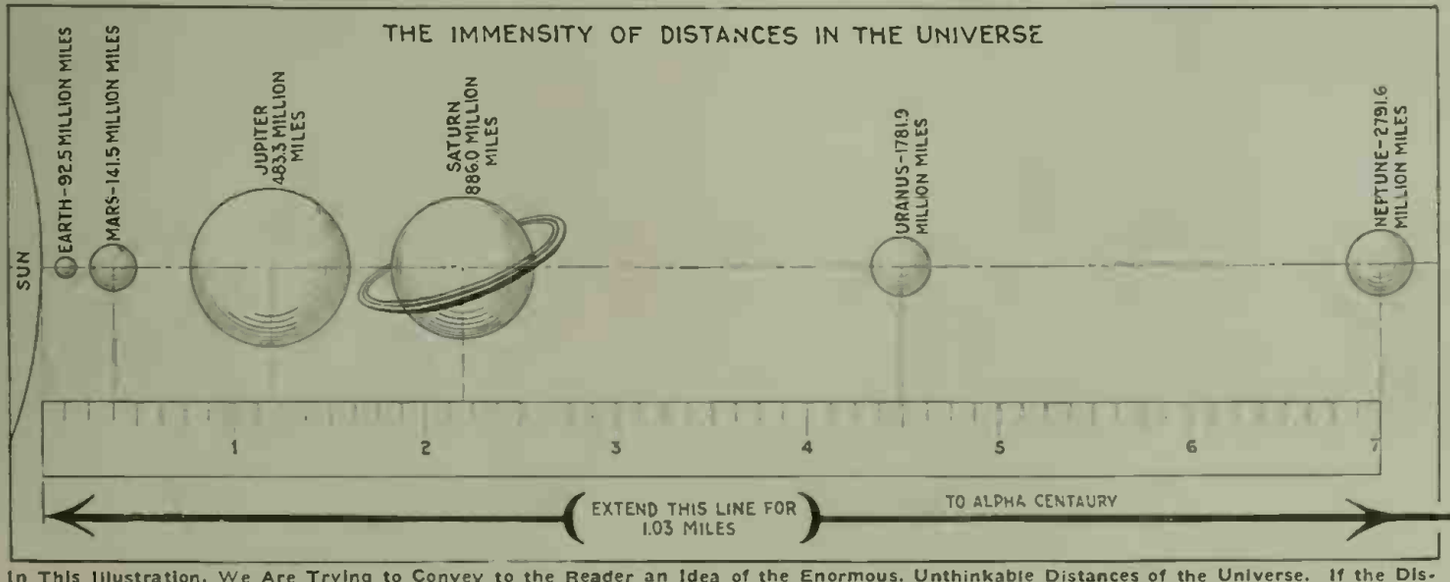
therefore no nearer than they do to us.

To Neptune the sun, tho star-like in form, supplies a very appreciable quantity of light and heat (one nine hundredth of the amount the earth receives) while the amount of light and heat that Neptune receives from the nearest stars is entirely inappreciable. When our airplane reaches Neptune after a journey of one thousand five hundred years, it is, as it were, just clearing the ground for its flight to the stars. To cover the intervening space to the nearest star, traveled by light in four and a third years, an airplane would require *fourteen and a half million years*. In that time the solar system itself would be in some far distant part of the universe, for it is speeding onward thru space at the rate of twelve miles a second or about four astronomical units a year.

Changing now our unit of measurement that we may express interstellar distances in comprehensible numbers, we prepare to travel from the earth to the stars with the velocity of light.

At this speed, one hundred and eighty-six thousand miles per second, we circumnavigate our globe in one-seventh of a second, reach the moon in one and a fourth seconds and the sun in eight minutes. In a little over four hours we pass the orbit of Neptune and are started on our journey to the stars penetrating further and further into interstellar space. For a year we travel and reach not a single star tho we are speeding ever onward with the velocity of light. We have now covered the distance of one light year which means the waves of light from the sun we have left behind must travel for a year before they reach us. We continue our journey and find ourselves next at a distance of one parsec from the sun. We have traveled a distance of approximately three and a quarter light years, and were it possible to see the earth as well as the sun at this distance, the two would appear to be but one second of arc apart, a distance that requires the most careful adjustment and manipulation of the telescope to measure accurately. We are still one light year distant from Alpha Centauri, the nearest of the bright stars. A few of the stars may now appear somewhat brighter than they appear to us on earth, but the majority of the stars appear just as we see them here on earth and the forms of the constellations remain practically unchanged in appearance, for we are only beginning our journey thru the sidereal universe and our position in the universe has only shifted in a slight degree. If we should continue our journey to the immediate vicinity of Alpha Centauri, we would find that it is not like our own sun, a single star, but is a binary star consisting of two suns in revolution around their common center of gravity. The distance of this binary system from the solar system has been meas-

(*Continued on page* 54)



In This Illustration, We Are Trying to Convey to the Reader an Idea of the Enormous, Unthinkable Distances of the Universe. If the Distance from the Sun to Neptune, Which in Reality Is 2,791 Million Miles, is Represented By Seven Inches On This Scale, Then the Distance from the Sun to the Nearest Star, Alpha Centauri, Would Be Slightly Over One Mile. Note How Near the Earth Is to the Sun, Altho 92 Million Miles Away from It. In Order to Show the Earth Without It Touching the Sun, It Was Necessary In This Drawing to Make the Earth Smaller Than Mars. In Reality Mars Is Smaller Than the Earth. The Other Planets Are Shown in Their Correct Proportions.

www.americanradiohistory.com

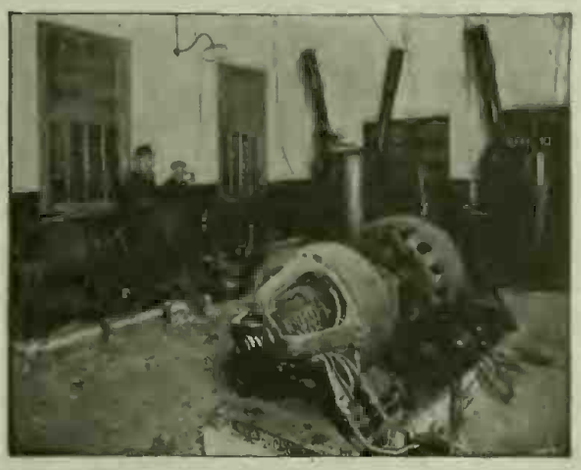
Reclaiming Metal Dust From Flue Gases

IN refineries of different types there is always a possibility of some valuable by-products, waste, etc., being lost by gases ascending the flue. This is particularly true in the metal treating field. Here it has been found possible to save solid and liquid particles from the flue gases by an electrical process. This consists in passing the gases thru tubes in which are suspended insulated chains charged with high voltage direct current. In passing thru the tube the particles carried by the gases become electrified and are projected against the walls to the tubes. These tubes are grounded and thus the particles drop into hoppers below. Mechanical rectifiers convert the low voltage alternating current into direct current.

An interesting application of this process was recently made in a copper refinery. In this particular installation there is another noteworthy fact and that is the size of the generating and transforming unit used.

The treater tubes containing the high tension electrodes and thru which the flu gases pass are arranged in six groups. The electrodes are suspended at the top from a rack which provides ample insulation, and are connected with the high tension direct-current line at the bottom. The gases from the furnaces pass thru pipes 13 feet in diameter, a "Y" with valves being provided so that the gases can be made to go either thru the treater or directly to the stack as desired. See figure herewith.

It is stated that over 90 per cent of the flue dust can be removed and that the value of the copper, zinc and other metals recovered will within a short time pay for the treating equipment.



This Power Plant Delivers 100,000 Volts and .5 Ampere, Direct Current, for Precipitating the Solid Particles in Flue Gases, Such as in the Metal Refining Field, Thus Saving as Much as 90 Per Cent of the Flue Dust.

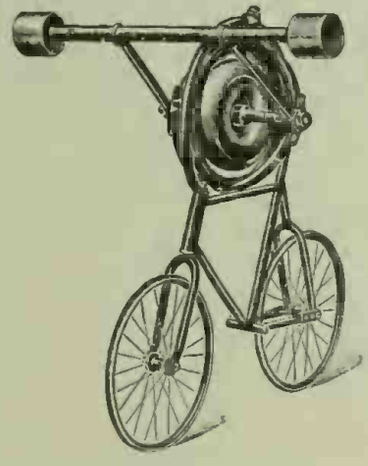


Interior of High Tension, Direct Current, Electrode Chamber Inside of Flue Tube Measuring 13 Feet in Diameter. The Electrodes Are Suspended Chains Which Carry the Charge When in Use.

The transformers are of 40 kva. capacity, 200 volts low tension and 100,000 volts high tension. To the motor-generator shafts are coupled the commutating rectifiers for transforming the high-tension alternating current into direct current.

A Gyrostatic Bicycle

The accompanying illustration shows a novel gyrostatic bicycle model built by a London scientific instrument maker, and this machine will maintain its equilibrium for a considerable period of time. Many of us most probably have seen the street fakir shouting loud and longly about the wonderful possibilities of the toy gyroscope,



The Gyrostatic Bicycle Is Used Extensively in School Laboratories to Demonstrate the Wonderful Stabilizing Power of the Gyroscope.

and the apparatus here shown duplicates the many startling maneuvers that the little twenty-five-cent toy gyro performs. When a gyroscope balance wheel is spun rapidly, and providing the rim of the wheel is sufficiently heavy to give it a good momentum, it will be found very difficult to shift the bicycle, or other device on which the spinning gyro is mounted. To demonstrate the principle of the gyroscope—which is based upon the fact that a spinning or rotating mass tends to preserve its plane of rotation—all one has to do is to jack up the rear wheel of a bicycle, and by turning the pedals, cause this wheel to spin rapidly. Now hold the bicycle off the ground a short distance, and endeavor to turn the complete bicycle sidewise. You will experience a surprisingly strong counter-turning effect, which tends to keep the bicycle in its upright plane as long as the wheel spins at a fair rate of speed. Many of these gyros are electrically driven; also it is well to keep in mind the fact that even an ordinary bicycle exerts some gyrostatic effort, and this has much to do with the success of the rider in maintaing his upright position while spinning along on two wheels mounted in tandem, that is, one behind the other. You have prohably noticed, if you have ever ridden a bicycle that the faster you go, the easier it is to maintain your balance. The increasing gyrostatic effect as the rotational speed of the wheels increased was the reason.

A HARD DRINKER OF SOFT DRINKS.

This little girl is a soft drink demonstrator and she sits in show windows all day long pouring drink after drink of some delicious beverage into the glass and raising it to her lips and draining it with the greatest ease.

She seems to like the beverage, for after each drink she nods her head a couple of times with a happy smile which seems to say, "My, that was good"; then she pours down another one.

The figure is made life size of papier maché and mounted on a tabourette, which contains the electric motor and speed reducing mechanism. The cams and levers which operate the arms and head are thoroly concealed inside the body.



Drink Hearty, Little Girl. It's Only Some of Willie Bryan's Famous Grape Juice. An Electric Motor Solves the Mystery of This Silent and Ever-Drinking Demonstrator.

www.americanradiohistory.com

Try These On Your Auto

ELECTRIC CIGAR LIGHTER FOR THE AUTO

At last—a perfect electric cigar lighter. It should prove a boon to motorists. It is handy and convenient—always within reach. The burner tip is made of heavy wire and will last indefinitely. Burner tip is protected by a cap not shown in cut. This neat and efficient cigar lighter is equipt with 5½ foot cord, which automatically rewinds. The lighter is easily attached to the battery in the car and costs practically nothing to operate.



Ever Try to Light a Cigar While Driving an Auto? This Electric Cigar Lighter Does the Trick Better Than Matches and Does Not "Blow Out".

NEW MAGNETO IMPULSE STARTER.

One of the many reasons why the magneto is so firmly established as the supreme ignition system is the fact that it does not depend upon any other unit or units for its electrical output and distribution of current.

The magneto transforms mechanical energy into electrical energy. The moment the shaft of a magneto-equipt engine revolves, the magneto begins to generate electrical energy for ignition; and, following requirements, the higher the rate at which it is driven the more intense are the sparks.

To facilitate *starting* when necessary, the magneto here shown can be supplied, with an impulse starter, which automatically "speeds up" the magneto armature at the exact moment of firing the *initial* gas charge or charges, thus providing at even low speeds the full electrical capacity of the magneto.

In a word, the impulse starter or coupling is a mechanical device for the purpose of obtaining positive and efficient starting, without the aid of batteries or a battery system of ignition.

The impulse starter is located between the magneto drive and the armature; when the engine is cranked or barred over, the armature is held stationary, while energy is being stored up by the compression of a series of springs. At a predetermined moment the springs are released and the armature is given a partial revolution at high speed. In this way, intense sparks are provided, and the engine given its starting impulse.

As soon as the engine commences its regular operation, or attains a speed of about 120 r.p.m., the impulse starter is automatically disengaged, the "starter" transmitting the driving energy to the magneto as a flexible coupling.

The control of the "starter" is by means of a lever mounted on a shaft projecting from the front of the housing. The lever is so constructed that it can either be operated by hand or thru the medium of a control connection.

The impulse starter is not an attachment, but is provided only as a part of this new magneto.



By Storing Up Energy In a Special Spring Coupling Device, It Becomes Possible to Spin This Magneto at Starting, and Provide a Hot Spark.

HEADLIGHT DIMMER

An Ohio electric concern is offering the public a device known as a headlight dimmer for use on Ford cars to dim the headlights when driving at night. This dimmer, it is claimed by the maker, can be attached to any Ford car by simply clamping it over the steering post and connecting the wires to the lighting circuit. The wires are easily connected, and when in use it is said that the dimmer will not affect the ignition or lighting system in a detrimental way. The control is made possible by means of a push and pull switch and a barrel type resistance. It is pointed out that it makes possible the use of a brighter light than can be secured thru the use of dimming lenses, yet at the same times makes it convenient to dim the lights according to requirements of traffic laws.



Here Is a Simple Electric Headlight Dimmer, Something Every Car Requires by Law. It Answers to the Call of Fords.

EFFECTIVE AUTO SIGNAL.

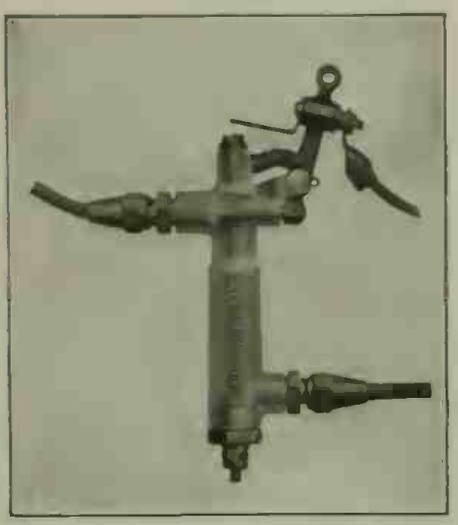
In this new electric auto signal there is only one *signal box*, which is placed on the left rear fender (or body or panel in the case of commercial vehicles and trucks). This shows both from the front and rear, and is visible day and night. The left rear fender is the logical place for the signal, as it is seen by all cars following from the rear, or cars approaching from the front, as well as by the traffic policeman, who is always to the left of cars approaching him.



A Logical Design In Electric Auto Signals, Which Can Be Seen from Front or Rear. It Is Controlled from the Driver's Seat by Means of a 3-Way Switch.

The signal is controlled for *left*, *right*, or *stop* by a plainly marked, single handle, three-way switch attached to the steering column immediately below the steering wheel, or in a place most accessible to the person driving. It is easily attached, and there are no moving parts to get out of order. A tell-tale buzzer indicates that the signal is functioning. A very slight amount of current from the lighting system of the car or dry cells is consumed. The signal is easily installed on the car by any mechanic.

ELECTRICALLY HEATED PRIMER FOR QUICK STARTING OF AUTOS.



This Electrically Heated Primer Will Save Much Useless Cussing and Start Your Auto Engine In a Jiffy. The Fuel Is Heated, Mixed With Air and Vaporized. Then Sucked Into the Engine. A Simple and Positive Device.

The autoist usually thinks of a primer as a means of pumping fuel into the cylinders quickly. The master primer here shown is not a pump in any sense of the word. The fuel is first heated boiling hot, vaporized by heat and mixed with air. Then drawn into the cylinders by suction of the motor. The suction draws only the quantity needed. Liquid gasoline will not explode. It must be vaporized. It must have air mixed with it to make it explosive.

Liquid fuel in large quantities carbonizes the engine. With the throttle of the carburetor closed, the master primer acts as an auxiliary carburetor—supplies the motor with what it needs in any kind of weather—heated vapor. The heating coil draws 20 amperes, about the same as the horn. Without it you may turn a balky engine over a hundred times.

To operate the primer all one need do is just pull a button on the dash. The same operation as choking the carburetor. Pulling the button makes electrical contact and opens the outlet valve of the primer. When car starts let go of button; the contact is broken and valve shuts off automatically.

NEW MAGNETIZER FOR REMAGNETIZING FORD MAGNETOS.

The Ford engine will display a great deal more "pep" if the magnets on the magneto are kept charged. We all know these magnets will lose their magnetism, which naturally reduces the energy displayed by the engine. The magnetizer is constructed in such a way that these magnets can be charged without taking the engine apart. All that is necessary is to take off the transmission cover. The magnets can then be charged, requiring only three or four seconds to each magnet. This is done by connecting the magnetizer to a well charged 6 or 12-volt battery or a sufficient number of dry cells in series.



Ford Owners Will Hail With Delight This New Magneto Magnetizer.

www.americanradiohistory.com



RADIO DEPARTMENT

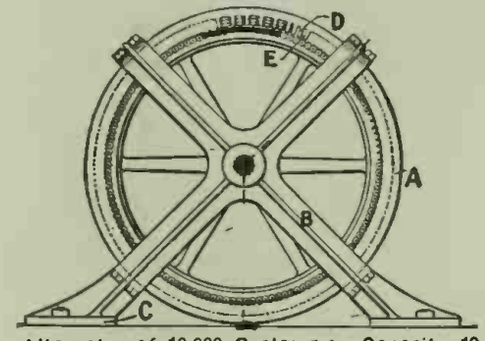


The True Wireless

By NIKOLA TESLA

Written Exclusively for The Electrical Experimenter

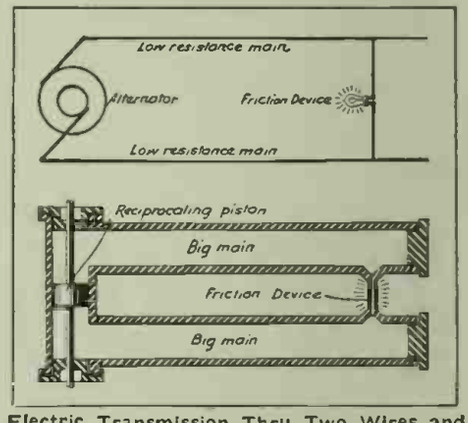
EVER since the announcement of Maxwell's electro-magnetic theory scientific investigators all the world over had been bent on its experimental verification. They were convinced that it would be done and lived in an atmosphere of eager expectancy, unusually favorable to the reception of any evidence to this end. No wonder then that the publication of Dr. Heinrich Hertz's results caused a thrill as had scarcely ever been experienced before. At that time I was in the midst of pressing work in connection with the commercial introduction of my system of power transmission, but, nevertheless, caught the fire of enthusiasm and fairly burned with desire to behold the miracle with my own eyes. Accordingly, as soon as I had freed myself of these imperative duties and resumed research work in my laboratory on Grand Street, New York, I began, parallel with high frequency alternators, the construction of several forms of apparatus with the object of exploring the field opened up by Dr. Hertz. Recognizing the limitations of the devices he had employed, I concentrated my attention on the production of a powerful induction coil but made no notable progress until a happy inspiration led me to the invention of the oscillation transformer. In the latter part of 1891 I was already so far advanced in the development of this new principle that I had at my disposal means vastly superior to those of the German physicist. All my previous efforts with Rhumkorf coils had left me unconvinced, and in order to settle my doubts I went over the whole ground once more, very carefully, with these improved appliances. Similar phenomena were noted, greatly magnified in intensity, but they were susceptible of a different and more plausible explanation. I considered this so important that in 1892 I went to Bonn, Germany, to confer with Dr. Hertz in regard to my observations. He seemed disappointed to such a degree that I regretted my trip and parted from him sorrowfully. During the succeeding years I made numerous experiments with the same object, but the results were uniformly negative. In 1900, however, after I had evolved a wireless transmitter which enabled me to obtain electro-magnetic activities of many millions of horse-power, I made a last desperate attempt to prove that the disturbances emanating from the oscillator were ether vibrations akin to those of light, but met again with utter failure. For more than eighteen years I have been reading treatises, reports of scientific transactions, and articles on Hertz-wave telegraphy, to keep myself informed, but they have always imprest me like works of fiction.



Alternator of 10,000 Cycles p.s., Capacity 10 K.W., Which Was Employed by Tesla in His First Demonstrations of High Frequency Phenomena Before the American Institute of Electrical Engineers at Columbia College, May 20, 1891. Fig. 1.

The history of science shows that theories are perishable. With every new truth that is revealed we get a better understanding of Nature and our conceptions and views are modified. Dr. Hertz did not discover a new principle. He merely gave material support to a hypothesis which had been long ago formulated. It was a perfectly well-established fact that a circuit, traversed by a periodic current, emitted some kind of space waves, but we were in ignorance as to their character. He apparently gave an experimental proof that they were transversal vibrations in the ether. Most people look upon this as his great accomplishment. To my mind it seems that his immortal merit was not so much in this as in the focusing of the investigators' attention on the processes taking place in the ambient medium. The Hertz-wave theory, by its fascinating hold on the imagination, has stifled creative effort in the wireless art and retarded it for twenty-five years. But, on the other hand, it is impossible to over-estimate the beneficial effects of the powerful stimulus it has given in many directions.

As regards signaling without wires, the application of these radiations for the purpose was quite obvious. When Dr. Hertz was asked whether such a system would be of practical value, he did not think so, and he was correct in his forecast. The best that might have been expected was a method of communication similar to the heliographic and subject to the same or even greater limitations.



Electric Transmission Thru Two Wires and Hydraulic Analog. Fig. 3.

In the spring of 1891 I gave my demonstrations with a high frequency machine before the American Institute of Electrical Engineers at Columbia College, which laid the foundation to a new and far more promising departure. Altho the laws of electrical resonance were well known at that time and my lamented friend, Dr. John Hopkinson, had even indicated their specific application to an alternator in the Proceedings of the Institute of Electrical Engineers, London, Nov. 13, 1889, nothing had been done towards the practical use of this knowledge and it is probable that those experiments of mine were the first public exhibition with resonant circuits, more particularly of high frequency. While the spontaneous success of my lecture was due to spectacular features, its chief import was in showing that all kinds of devices could be operated thru a single wire without return. This was the initial step in the evolution of my wireless system. The idea presented itself to me that it might be possible, under ob-

IN this remarkable and complete story of his discovery of the "True Wireless" and the principles upon which transmission and reception, even in the present day systems, are based, Dr. Nikola Tesla shows us that he is indeed the "Father of the Wireless." To him the Hertz wave theory is a delusion; it looks sound from certain angles, but the facts tend to prove that it is hollow and empty. He convinces us that the real Hertz waves are blotted out after they have traveled but a short distance from the sender. It follows, therefore, that the measured antenna current is no indication of the effect, because only a small part of it is effective at a distance. The limited activity of pure Hertz wave transmission and reception is here clearly explained, besides showing definitely that in spite of themselves, the radio engineers of today are employing the original Tesla tuned oscillatory system. He shows by examples with different forms of aërials that the signals picked up by the instruments must actually be induced by earth currents—not etheric space waves. Tesla also disproves the "Heaviside layer" theory from his personal observations and tests.

EDITOR.

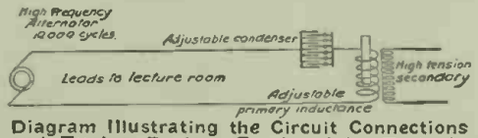
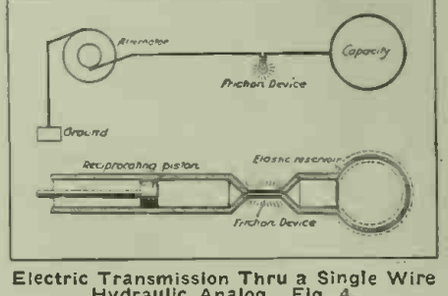
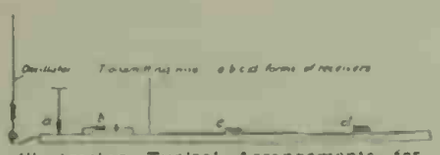


Diagram Illustrating the Circuit Connections and Tuning Devices Employed by Tesla in His Experimental Demonstrations Before the American Institute of Electrical Engineers With the High Frequency Alternator Shown in Fig. 1. Fig. 2.



Electric Transmission Thru a Single Wire Hydraulic Analog. Fig. 4.

www.americanradiohistory.com



Illustrating Typical Arrangements for Collecting Energy in a System of Transmission Thru a Single Wire. Fig. 5.

servance of proper conditions of resonance, to transmit electric energy thru the earth, thus dispensing with all artificial conductors. Anyone who might wish to examine impartially the merit of that early suggestion must not view it in the light of present day science. I only need to say that as late as 1893, when I had prepared an elaborate chapter on my wireless system, dwelling on its various instrumentalities and future prospects, Mr. Joseph Wetzler and other friends of mine emphatically protested against its publication on the ground that such idle and far-fetched speculations would injure me in the opinion of conservative business men. So it came that only a small part of what I had intended to say was embodied in my address of that year before the Franklin Institute and National Electric Light Association under the chapter "On Electrical

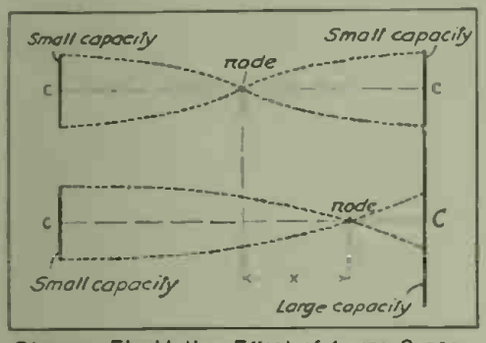
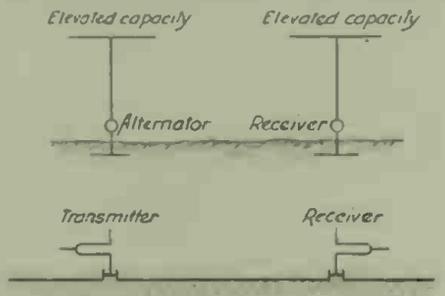


Diagram Elucidating Effect of Large Capacity on One End. Fig. 6.

Resonance." This little salvage from the wreck has earned me the title of "Father of the Wireless" from many well-disposed fellow workers, rather than the invention of scores of appliances which have brought wireless transmission within the reach of every young amateur and which, in a time not distant, will lead to undertakings overshadowing in magnitude and importance all past achievements of the engineer.

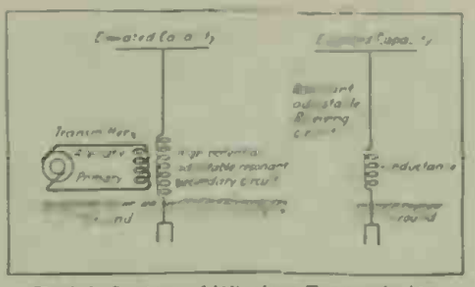
The popular impression is that my wireless work was begun in 1893, but as a matter of fact I spent the two preceding years in investigations, employing forms of apparatus, some of which were almost like those of today. It was clear to me from the very start that the successful consummation could only be brought about by a number of radical improvements. Suitable high frequency generators and electrical oscillators had first to be produced. The energy of these had to be transformed in effective transmitters and collected at a distance in proper receivers. Such a system would be manifestly circumscribed in its usefulness if all extraneous interference were not prevented and exclusiveness secured. In time, however, I recognized that devices of this kind, to be most effective and efficient, should be designed with due regard to the physical properties of this planet and the electrical conditions obtaining on the same. I will briefly touch upon the salient advances as they were made in the gradual development of the system.



Transmission of Electrical Energy Thru the Earth as Illustrated in Tesla's Lectures Before the Franklin Institute and Electric Light Association in February and March, 1893, and Mechanical Analog of the Same. Fig. 7.

The high frequency alternator employed in my first demonstrations is illustrated in Fig. 1. It comprised a field ring, with 384 pole projections and a disc armature with coils wound in one single layer which were connected in various ways according to requirements. It was an excellent machine for experimental purposes, furnishing sinusoidal currents of from 10,000 to 20,000 cycles per second. The output was comparatively large, due to the fact that as much as 30 amperes per square millimeter could be past thru the coils without injury.

The diagram in Fig. 2 shows the circuit arrangements as used in my lecture. Resonant conditions were maintained by means

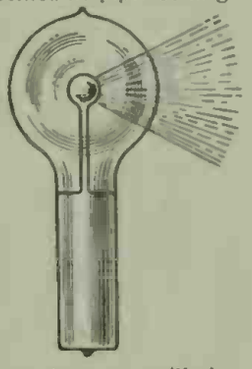


Tesla's System of Wireless Transmission Thru the Earth as Actually Exposed in His Lectures Before the Franklin Institute and Electric Light Association in February and March, 1893. Fig. 8.

of a condenser subdivided into small sections, the finer adjustments being effected by a movable iron core within an inductance coil. Loosely linked with the latter was a high tension secondary which was tuned to the primary.

The operation of devices thru a single wire without return was puzzling at first because of its novelty, but can be readily explained by suitable analogs. For this purpose reference is made to Figs. 3 and 4.

In the former the low resistance electric conductors are represented by pipes of large



The Forerunner of the Audion—the Most Sensitive Wireless Detector Known, as Described by Tesla in His Lecture Before the Institution of Electrical Engineers, London, February, 1892. Fig. 9.

section, the alternator by an oscillating piston and the filament of an incandescent lamp by a minute channel connecting the pipes. It will be clear from a glance at the diagram that very slight excursions of the piston would cause the fluid to rush with high velocity thru the small channel and that virtually all the energy of movement would be transformed into heat by friction, similarly to that of the electric current in the lamp filament.

The second diagram will now be self-explanatory. Corresponding to the terminal capacity of the electric system an elastic reservoir is employed which dispenses with the necessity of a return pipe. As the piston oscillates the bag expands and contracts, and the fluid is made to surge thru the restricted passage with great speed, this

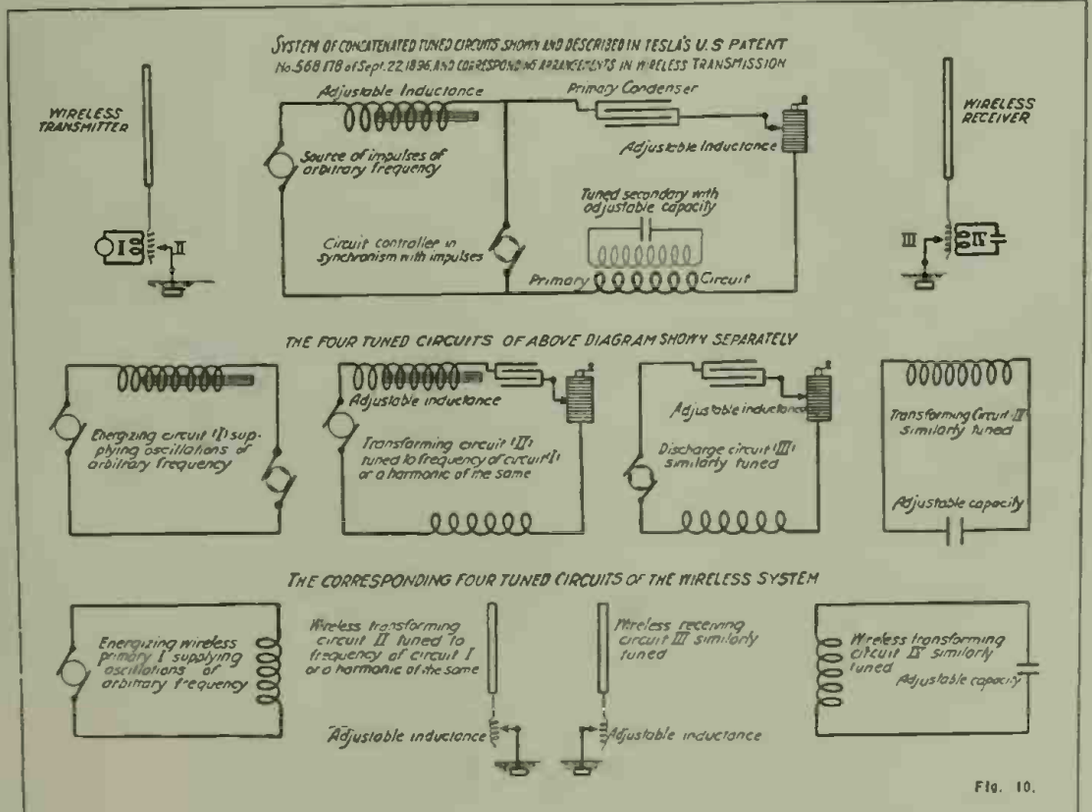


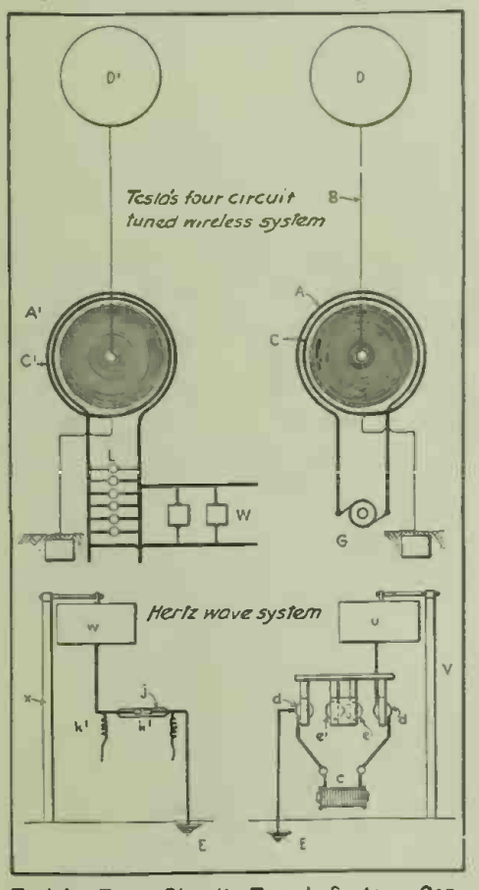
Fig. 10.

Tesla's System of Concatenated Tuned Circuits Shown and Described in U. S. Patent No. 568,178 of September 22, 1896, and Corresponding Arrangements in Wireless Transmission.

www.americanradiohistory.com

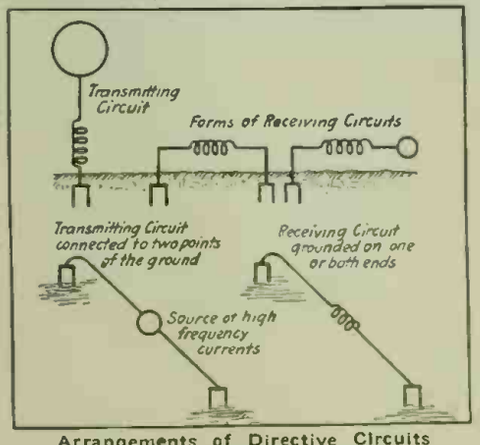
resulting in the generation of heat as in the incandescent lamp. Theoretically considered, the efficiency of conversion of energy should be the same in both cases.

Granted, then, that an economic system of power transmission thru a single wire is



Tesla's Four Circuit Tuned System Contrasted With the Contemporaneous Hertz-wave System. Fig. 11.

practicable, the question arises how to collect the energy in the receivers. With this object attention is called to Fig. 5, in which a conductor is shown excited by an oscillator joined to it at one end. Evidently, as the periodic impulses pass thru the wire, differences of potential will be created along the same as well as at right angles to it in the surrounding medium and either of these may be usefully applied. Thus at *a*, a circuit comprising an inductance and capacity is resonantly excited in the transverse, and at *b*, in the longitudinal sense. At *c*, energy is collected in a circuit parallel to the conductor but not in contact with it, and again at *d*, in a circuit which is partly sunk into the conductor and may be, or not, electrically connected to the same. It is important to keep these typical dispositions in mind, for however the distant ac-



Arrangements of Directive Circuits Described in Tesla's U. S. Patent No. 613,809 of November 8, 1898, on "Method of and Apparatus for Controlling Mechanism of Moving Vessels or Vehicles." Fig. 12.

tions of the oscillator might be modified thru the immense extent of the globe the principles involved are the same.

Consider now the effect of such a conductor of vast dimensions on a circuit exciting it. The upper diagram of Fig. 6 illustrates a familiar oscillating system comprising a straight rod of self-inductance $2L$ with small terminal capacities cc and a node in the center. In the lower diagram of the figure a large capacity C is attached to the rod at one end with the result of shifting the node to the right, thru a distance corresponding to self-inductance X. As both parts of the system on either side of the node vibrate at the same rate, we have evidently, $(L + X)\ c = (L - X)\ C$ from which $X = L\,\frac{C - c}{C + c}$. When the capacity C becomes commensurate to that of the earth, X approximates L, in other words, the node is close to the ground connection. *The exact determination of its position is very important in the calculation of certain terrestrial electrical and geodetic data* and I have devised special means with this purpose in view.

My original plan of transmitting energy without wires is shown in the upper diagram of Fig. 7, while the lower one illustrates its mechanical analog, first publisht in my article in the *Century Magazine* of June, 1900. An alternator, preferably of high tension, has one of its terminals connected to the ground and the other to an elevated capacity and impresses its oscillations upon the earth. At a distant point a receiving circuit, likewise connected to ground and to an elevated capacity, collects some of the energy and actuates a suitable device. I suggested a multiplication of such units in order to intensify the effects, an idea which may yet prove valuable. In the analog two tuning forks are provided, one at the sending and the other at the receiving station, each having attached to its lower prong a piston fitting in a cylinder. The two cylinders communicate with a large elastic reservoir filled with an incom-

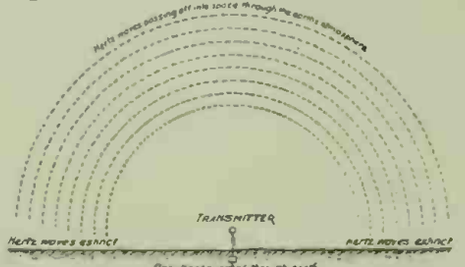


Diagram Exposing the Fallacy of the Gliding Wave Theory as Propounded in Wireless Text Books. Fig. 13.

pressible fluid. The vibrations transmitted to either of the tuning forks excite them by resonance and, thru electrical contacts or otherwise, bring about the desired result. This, I may say, was not a mere mechanical illustration, but a simple representation of my apparatus for submarine signaling, perfected by me in 1892, but not appreciated at that time, altho more efficient than the instruments now in use.

The electric diagram in Fig. 7, which was reproduced from my lecture, was meant only for the exposition of the principle. The arrangement, as I described it in detail, is shown in Fig. 8. In this case an alternator energizes the primary of a transformer, the high tension secondary of which is connected to the ground and an elevated capacity and tuned to the imprest oscillations. The receiving circuit consists of an inductance connected to the ground and to an elevated terminal without break and is resonantly responsive to the transmitted oscillations. A specific form of receiving device was not mentioned, but I had in mind to transform the received currents and thus make their volume and tension suitable for any purpose. This, in substance, is the system of today and I am not aware of a single authenticated instance of successful transmission at considerable distance by different instrumentalities. It might, perhaps, not be clear to

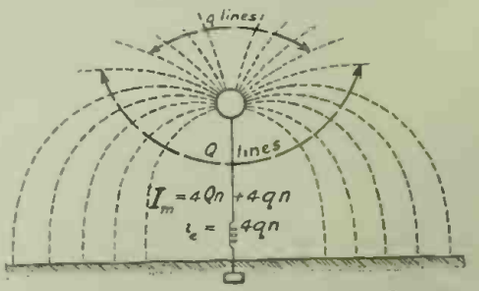


Fig. 14. Diagram Explaining the Relation Between the Effective and the Measured Current in the Antenna.

those who have perused my first description of these improvements that, besides making known new and efficient types of apparatus, I gave to the world a wireless system of potentialities far beyond anything before conceived. I made explicit

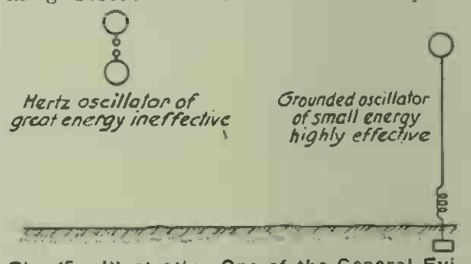


Fig. 15. Illustrating One of the General Evidences Against the Space Wave Transmission.

and repeated statements that I contemplated transmission, absolutely unlimited as to terrestrial distance and amount of energy. But, altho I have overcome all obstacles which seemed in the beginning unsurmountable and found elegant solutions of all the problems which confronted me, yet, even at this very day, the majority of experts are still blind to the possibilities which are within easy attainment.

My confidence that a signal could be easily flashed around the globe was strengthened thru the discovery of the "rotating brush," a wonderful phenomenon which I have fully described in my address before the Institution of Electrical Engineers, London, in 1892, and which is illustrated in Fig. 9. This is undoubtedly the most delicate wireless detector known, but for a long time it was hard to produce and to maintain in the sensitive state. These difficulties do not exist now and I am looking to valuable applications of this device, particularly in connection with the high-speed photographic method, which I suggested, in wireless, as well as in wire, transmission.

Possibly the most important advances during the following three or four years were my system of concatenated tuned circuits

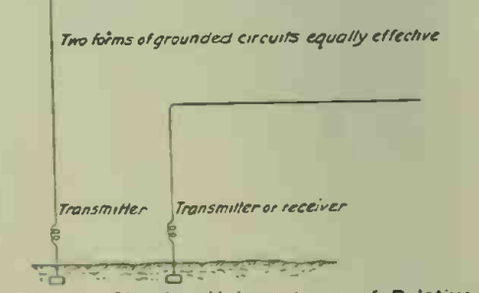


Fig. 16. Showing Unimportance of Relative Position of Transmitting and Receiving Antennae in Disproval of the Hertz-wave Theory.

and methods of regulation, now universally adopted. The intimate bearing of these inventions on the development of the wireless art will appear from Fig. 10, which illus-

(*Continued on page* 61)

www.americanradiohistory.com

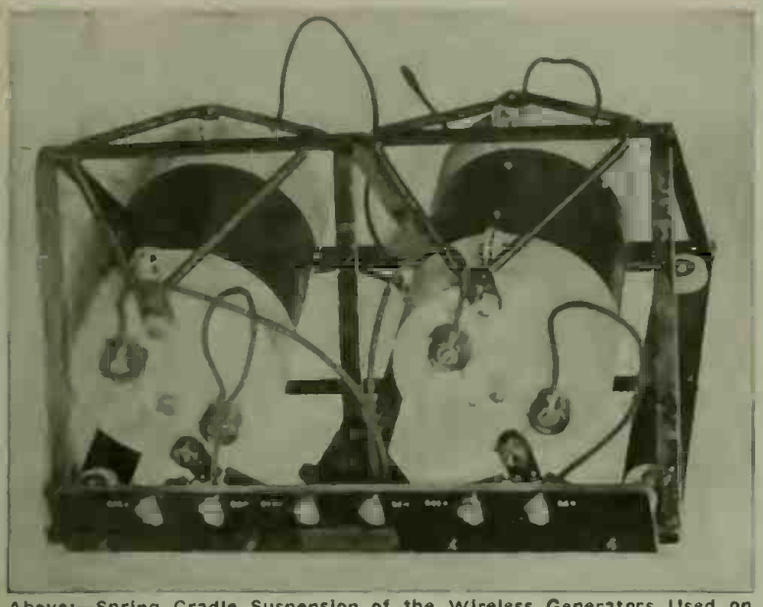
Novel Generators

IMAGINE yourself wearing a set of head receivers and a telephone transmitter and listening to a voice saying, *"I am right over R 7 and your shells are all bursting 'short.' Increase range 50 yards."* That was the experience of American radio operators during the latter part of the war, for radio telephone sets were developed that enabled men on the ground to talk with airplanes flying over the enemy lines and aim the guns according to their directions.

An essential feature of the radio telephone set is a small generator to deliver direct current at from 275 to 350 volts. For airplane use, these generators also delivered current at 25 volts. One is mounted on the landing gear of each 'plane, so that the air "back-wash" of the propeller drives a small two-blade wooden fan on the generator shaft. Thus the generator runs whenever the 'plane is in motion, and also while it is on the ground with the engine running. Constant voltage with variable speed is secured by an ingenious arrangement of differential fields controlled by a two-element vacuum tube mounted in the *stream-line* housing of the generator.

At stations on the ground or on shipboard, power is taken from storage batteries, and here a small dynamotor, driven by 10-volt current, gives the required high voltage. In the field one of these sets was originally mounted on a light metal frame carrying a voltmeter, fuses and terminals. Quite recently an aluminum carrying-case was developed which was watertight when closed. All the switches, fuses, etc., are mounted inside.

A submarine chaser often lies motionless, waiting for a U-boat to stick its nose above the surface. So sensitive are the listening devices on the submarines that even the slight hum of one of these dynamotors, transmitted to the chaser hull, would betray its position. Hence the dynamotors furnished to the Navy are mounted in a cradle of coil springs as here illustrated. *Photos courtesy Westinghouse E. & M. Co.*



Above:—Spring Cradle Suspension of the Wireless Generators Used on U. S. Naval Submarine Chasers and Destroyers, to Eliminate the Transmission of the Humming Sound Produced by Their Operation, to the Steel Hull of the Vessel and Its Subsequent Interception by a Lurking U-boat. The Sub-sea Sound Detector Used by the German Submarines Was so Sensitive That This Precaution Was Necessary.



Ground Officers of the U. S. Army Talking to Airplanes In Flight by Means of Wireless Telephone. The Range of Such Communication Has Recently Been Increased to 150 Miles by Official Test.

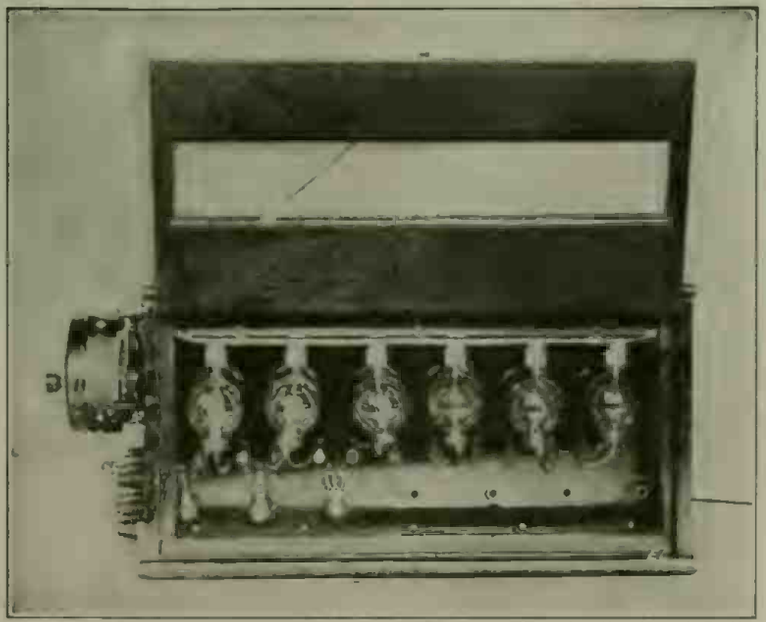


At Right:—Lower Right-hand View Shows the Wind-driven Airplane Radio Generator Developed During the War. Its Speed, of Course, Varies with the Velocity of the 'Plane and How Its Voltage Is Maintained Constant with Variable Speed Is One of the Interesting Problems That Radio Engineers Had to Solve Before Anything Else Could Be Done.

Boosts Signals 1,000,000 Times

The six-step audion amplifier set here shown represents the latest development in amplifiers, and its intensifying qualities are enormously in excess of any similar apparatus produced heretofore. Under ordinary conditions, this set will *amplify* 1,000,000 *times*, so it is especially well adapted for use in connection with the reception of the very weak signals set up by the small portable transmitters used in modern warfare. As a matter of fact, the set has been designed strictly with an eye towards military field work, and similar purposes, and has already proved its efficiency along such lines. An entirely new departure in design is seen in the fact that only one "A" battery, and one "B" battery are employed. In addition, these batteries are practically free of adjustment, which greatly enhances the value of this set, and is a unique feature in amplifier construction.

In connection with the above apparatus, it may be mentioned that the success of the French armies was in part due to the wonderful results achieved with such amplifiers on the various battle-fronts. Amplifiers using as many as nine steps were employed with marked success in trench communication, aerial communication, and similar work.



The Most Powerful Vacuum Tube Amplifier Now Standardized and Built. It Is a Six-stage Amplifier and Possesses an Amplifying Power of 1,000,000 Times. It Solved Many Knotty Problems During the War.

In the lower left-hand corner of the panel is mounted a simple two-way switch, by means of which the first bulb can be made either a detector for radio signals or the first-step amplifier for audio-frequency currents. When used as a detector, the connections from the tuner are made to the upper pair of external binding posts. When used as an amplifier, the connections from the detector (or the two-ground terminals, in case one is receiving conduction or induction currents thru the earth) are made to the lower pair of external binding posts. To the other pair of binding posts is connected the six-volt storage battery.

The telephone cord terminates in a plug, which can be plugged into the third, fourth, fifth or sixth jack cord to the degree of amplification which is desired.

www.americanradiohistory.com

U. S. Adopts Multiplex Radio

THE recent announcement that the Government had decided to adopt the multiplex system of radio telegraphy and telephony, makes possible some entirely new methods of communication.

The multiplex radio system is a complex one. The multiplex system of ordinary telegraphy permits the sending and receiving of eight different messages on one wire at the same time. Thus it may be seen what a great advantage it holds over the old method of Morse telegraphy.

Radio messages are sent by the same method. The trans-Atlantic Radio Room in the Navy Department illustrated herewith is completely equipt with a multiplex radio outfit. By this new system Secretary Daniels is able to keep in communication with several vessels out at sea at the same time. Likewise, President Wilson, on his voyage to France, was able to keep in immediate communication with Washington.



A Recent Photo Taken of the U. S. Navy Department's Trans-Atlantic Radio Operating Room. Multiplex Radio Signaling Is Now Carried on in Both Directions across the Ocean.

This photograph is the first to be released showing the trans-Atlantic Radio Operating Room of the Navy Department.

This is the receiving room of the radio station in the Navy Department. Four receiving machines constitute, with the four perforating machines, one complete unit of multiplex radio-telegraphy. As a result, four messages may be sent and four received over one antenna at the same time.

RADIO LINKS 3,000 MILES BETWEEN OMSK AND LYONS.

Omsk, in which are centered the hopes for the rebuilding of a new Russia, after months of isolation, is now actively in wireless communication with the outside world. Hourly reports, containing a complete news service, are received in Omsk direct from the French wireless station at Lyons, France. Outgoing communication will be inaugurated soon.

From Omsk to Lyons is 3,000 miles on a direct air line over Bolshevik Russia and Central Europe. Omsk is about midway between the Atlantic and Pacific oceans.

AN OMISSION.

We wish to state that credit for the photographs accompanying the article entitled "The City of Splendid Night" by Amos Stote, publisht in the January, 1919, issue, should have been given to the New York Edison Co.

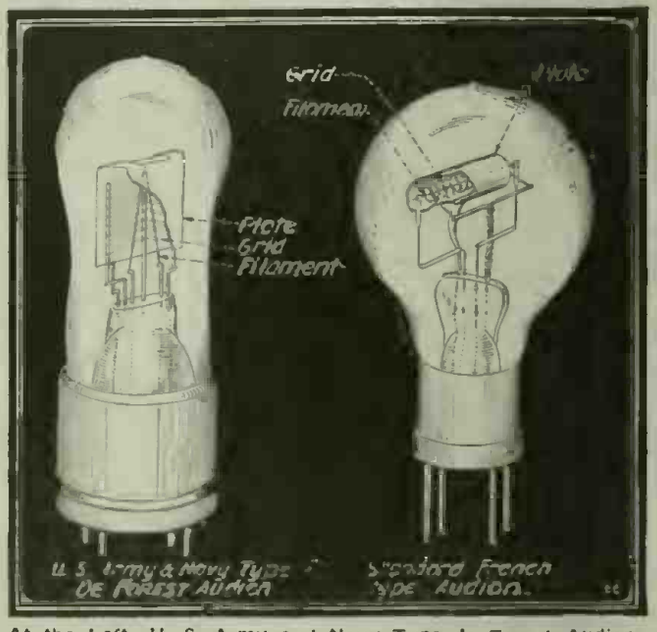
New French and American Audions

UNDOUBTEDLY the radio amateur and experimenter has often wondered what form of audion or vacuum detector and amplifier was being used both by the American and European armies. Thru the courtesy of Dr. Lee de Forest, we are enabled to show herewith the standard form of three-electrode audion in use by the French Army signal corps, as well as by the French Navy, and also the standard form of three-electrode audion in use by the United States Army Signal Corps.

As we have heard but very little concerning the French and other European wireless apparatus for several years, owing to the war conditions existing, we find considerable interest in the French type of vacuum bulb detector and amplifier, and so we will consider it first.

As the illustration shows it comprises a spherical form of glass bulb, which is eventually pumped out to a very high degree of vacuum. One thing decidedly noticeable about both the French and American tubes, is the simplified and highly improved form of base which incorporates four contact pins, which form a juncture with four sockets in the bayonet-joint receptacle supporting the audion. Two of the contact pins lead to the incandescent filament, while the other two connect to the grid and the plate respectively. It is thus but a moment's work to snap a bulb out of its socket and replace it with another one.

The French audion is unique in its general design, as will be noted from the accompanying illustration, the filament being in the form of a fine straight wire passing thru the center of the grid, which takes the form of a helical coil of non-oxidizing wire. Outside of the helical grid, we find the wing or plate element, which is made in the form of a small cylinder or tube. Each of the three distinct elements comprising the audion are spaced about 3/32 inch apart. It is stated on good authority that during the war the French Government manufactured five thousand of these audion bulbs every day, or almost two million of them in a year. This rate of audion production was carried on during the last two years of the war. The French bulb here shown is particularly interesting as being efficient and suitable in all three functions,—detector, amplifier and oscillator.



At the Left—U. S. Army and Navy Type de Forest Audion. At Right—the Famous French Type of Three Electrode Audion, Five Thousand of Which Were Manufactured Every Day during the Last Year of the War. It Serves as Detector, Amplifier and Oscillator.

The Standard United States Army type of three-electrode audion here shown comprises filament, grid and plate, rigidly secured in place in the manner indicated. Particular attention has been given in this design to the manner of supporting the inverted "V" type filament as well as the grid and plate elements, so that as a matter of fact these rugged bulbs can be handled without any particular pains, and none of the electrode elements can move as they could in the older types. A still better construction is involved in a modified and improved form of audion being developed for the United States Signal Corps by Dr. de Forest. It will be seen how the plate member is bent into the shape of an inverted "U" and rigidly secured by two wire members securely molded or fused into the glass stem. The fine wire grid is securely mounted in place inside of the plate member on two upright wire legs as shown, and the top of the filament is anchored and supported by a third wire secured in the glass stem. There is still a slight chance for a little movement between the electrode elements in this detector, and in the improved form aforementioned and which is now being developed and perfected, the filament, grid and plate are still further strengthened, so that no matter how much the bulb is jarred or shaken, no variation whatsoever can occur in the spacing between any two of the three electrodes.

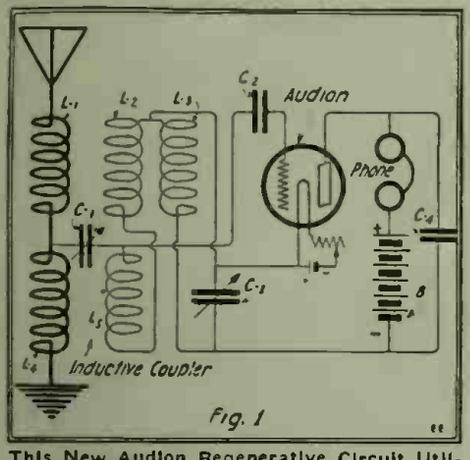
www.americanradiohistory.com

New Regenerative Vacuum Tube Circuits

By SAMUEL D. COHEN

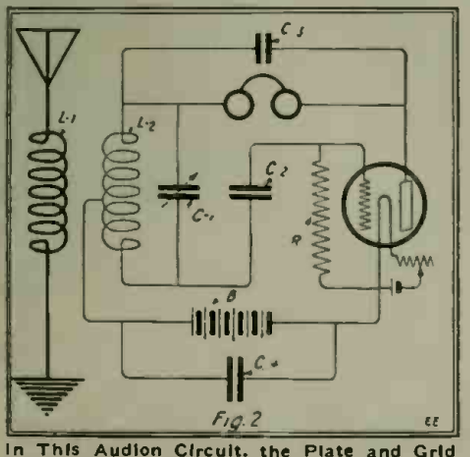
DURING the war the vacuum tube has gone into very extensive use in radio communication and other allied electrical fields. The regenerative circuits used until now have been found satisfactory. However, certain improvements were discovered and it is the privilege of the writer to give the results of some of these improvements that were made on regenerative vacuum tube circuits for the reception of long distance stations using long wave lengths.

One of the schemes tried by the writer was to couple the grid to the plate of the vacuum tube directly in the antenna system of the oscillating circuit, in order that heterodyne method of reception might be accomplished with maximum efficiency. For this work it was essential to construct a coupled magnetic system in order to accomplish the desired effects and the accompanying photograph shows a special type of inductive coupler utilized thruout these experiments. It will be noted from the

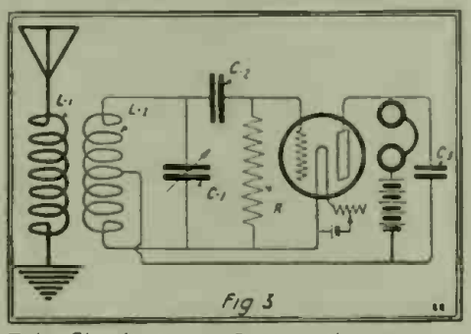


This New Audion Regenerative Circuit Utilizes a Five Coil Loose Coupler, Which Is Described In Detail by the Author. By This Arrangement the Grid and Plate Circuits Are Coupled Magnetically. There Are Two Secondary Coils Which Form a Variometer.

photograph that the primary winding consists of two distinct coils *wound on the same tube* and in the same direction. The third coil which is swung on a pivoted arm as indicated moves into the magnetic field of one of these coils. The secondary of the coupler also consists of two coils, moving one inside of the other, thus comprising



In This Audion Circuit, the Plate and Grid Are Coupled Magnetically Thru Coil L_2, and the Central Tap Should Be Accurately Taken Off.



This Circuit for a Regenerative Vacuum Tube Is Similar to That Given In Fig. 2, and Needs no Special Comment.

a variometer. The coupling of both of these coils can be changed at will, both within the main primary and outside of the primary. This was essential in order to eliminate the use of switches for the control of the inductance of the coils.

The coils were built with great care, in order to eliminate the undesirable oscillations produced within the coil circuits, due to the inherent distributed capacity of the coils.

A circuit giving remarkable results in amplifying received signals is that shown in Fig. 1. The main inductance L_1 is the main primary connected in series with the small coil wound on the same tube L_4, which is thereafter connected to the ground as indicated. L_2 and L_3, which comprises the secondary of the coupler are connected in a variometer manner as indicated. The joint point of these coils is connected to the filament terminal of the vacuum tube. The end of the coil is linked to the battery B, of the plate, while coil L_2 is connected

ROGERS UNDERGROUND ANTENNA

Since the publication of the Rogers underground antenna in our March issue we have been flooded with letters from amateurs all over the country who desire to have further information on this wonderful radio development. The standard question asked by most of these correspondents is, how large is the antenna, how to connect it, etc. In a few words, we might say that a satisfactory method is to use about 100 to 300 feet of ordinary standard automobile rubber cable, burying same in a 3-foot earth trench. The cable is then covered up entirely. One end is insulated, the other end goes to the instruments *taking the place of the former aeriol.*

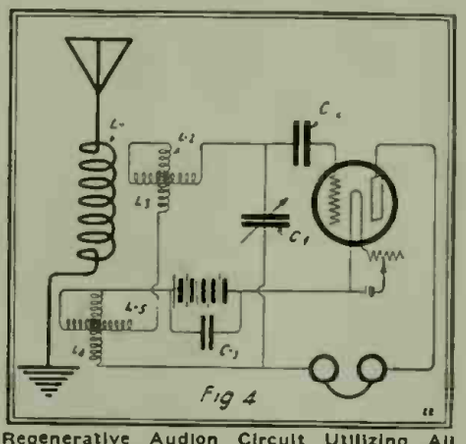
In our next issue we shall have a comprehensive article specially prepared for amateurs on the Rogers Underground System.—*Editor.*

to the tertiary coil L_5, which coil is the one mounted on the moving arm as indicated on the right of the photograph. Coils L_5 and L_4 are coupled magnetically and electrostatically thru the condenser C_1. It will thus be seen from the diagram that the plate and grid are coupled thru the inductance L_3 and which said inductance is coupled to the antenna system L_1. A critical adjustment is necessary between L_4 and L_5, and between L_2 and L_3, to give maximum radio frequency amplification in the circuit. Condenser C_3 has a magnitude of the order of two microfarads and is used in general to permit the high frequency current to readily pass to the plate.

Another circuit is shown in Fig. 2, which gave excellent results. In this circuit, the plate and grid are coupled magnetically thru coil L_2. In this particular case, it is very essential to note that the filament coil line should be tapt off exactly at the center of coil L_2 in order to give best results. This is done in order to equalize the potentials between the grid and plate circuits. Coil L_2 can be made as a variometer as will be shown later. Condenser C_1 is a regular oscillatory secondary tuning condenser. The resistance R is a grid leak-resistance and its magnitude depends upon the operating characteristics of the tube.

A similar circuit to that of Fig. 2 is shown in Fig. 3, and needs no comment.

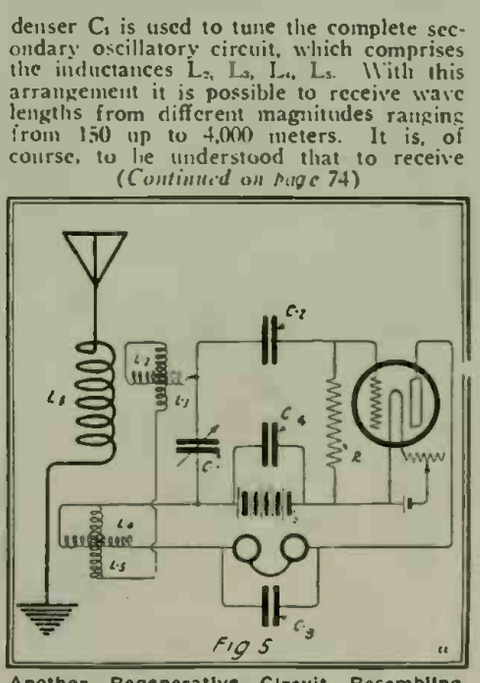
In Fig. 4 is shown another circuit for accomplishing the necessary results for regenerative effects for better efficiency. It will be noted that the inductances L_2 and L_3 comprise a variometer secondary coupled to the primary L_1. The inductance L_1 is coupled magnetically to the antenna inductance L_1 and to inductance L_5, which comprises another variometer of both L_4 and L_5, coupled magnetically to the plate and wing circuit of the vacuum tube. Con-



Regenerative Audion Circuit Utilizing All Five Coils on the Loose Coupler. Variable Condenser C_1 Is Used to Tune the Complete Secondary Oscillatory Circuit in the Manner Indicated.

denser C_1 is used to tune the complete secondary oscillatory circuit, which comprises the inductances L_2, L_3, L_4, L_5. With this arrangement it is possible to receive wave lengths from different magnitudes ranging from 150 up to 4,000 meters. It is, of course, to be understood that to receive

(*Continued on page 74*)



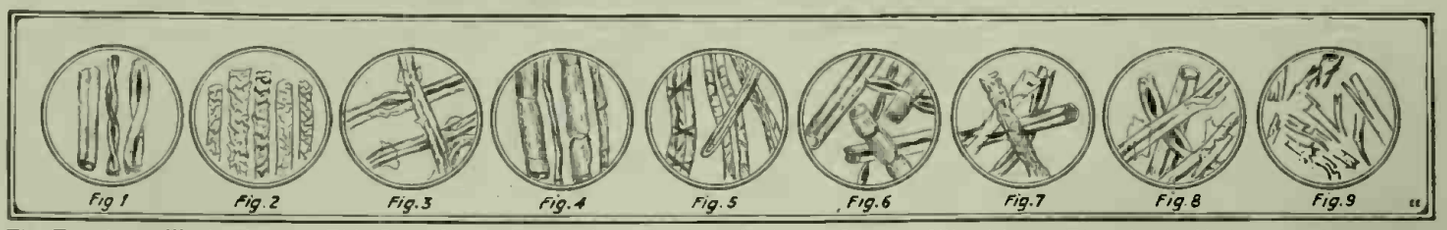
Another Regenerative Circuit Resembling Fig. 4. Here the Radio Frequency Bridging Condensers C_3 and C_4 Are Used to Permit Radio Frequency Currents to Pass Freely to the Plate.

www.americanradiohistory.com

Practical Chemical Experiments

Testing of Wool, Cotton and Linen

By ALBERT W. WILSDON



The Two Long Illustrations on This Page Show How Various Textiles Such as Cotton, Silk, Linen, Etc., Look Under the Microscope. Microscopic Examination of Such Textiles Is Considered One of the Best Methods of Determining Just What a Certain Fabric Is Composed of. Microscopic Drawings of the Various Fabrics Shown In the Illustration Above are:—1—Cotton, 2—Wool, Various Kinds, 3—Silk, 4—Linen, 5—Hemp, 6—Cotton and Linen Mixed, 7—Cotton and Wool, 8—Cotton and Silk, 9—Shoddy, Made from New, Fine, Blue Worsted Clips.

IN order that the layman may be more familiar with methods of making quick and accurate tests of varied textiles, this article is written, and not with an object of a complete treatise on "Textile Testing," which work in its entirety may be written in several volumes.

A person buying a piece of material, let



Fig. 19. The Burning Test Applied to Various Cloth Materials to Determine Their Composition, Particularly the Presence of Wool. Vegetable Fibers May Be Readily Distinguished from Animal Fibers By Burning, Animal Fibers Such as Silk and Wool Giving Off the Smell of Burnt Horn. They Do Not Fire Like Vegetable Fibers, But Cease to Burn When Removed from the Flame. Vegetable Fibers Give Off a Slight Odor of Burnt Wood When Ignited, and They Burn Away Very Rapidly With a Flash, leaving No Hard Cinder, But a White or Gray Ash Only.

us say for a suit, does not want to feel that he is being imposed upon by having inferior substitutes sold him when he believes it is all wool. He must, therefore, have immediately available some means of testing.

Textiles may be separated into two main divisions, as we may call them. VEGETABLE FIBERS, under which heading appear *Cotton*, *Flax*, *Hemp*, etc., and ANIMAL FIBERS, as *Wool* and *Silk*.

COTTON appears under the microscope as a wide band, generally twisted, as shown in Fig. 1. Chemically, cotton fiber, separated from all impurities, may be looked upon as pure Cellulose, similar in composition to the Cellulose in starch. Ordinary raw cotton is not pure Cellulose, containing as it does, various impurities such as wax, oil, coloring matter, water and about 1 per cent. of mineral matter.

The appearance of various kinds of WOOL under the microscope is shown in Fig. 2. Wool differs very considerably in chemical composition from Cotton and Flax. It consists of horny-matter (*Keratin*), Carbon, Hydrogen, Oxygen, Nitrogen and Sulfur. This composition is strikingly noticed when wool is burnt, accounting for the peculiar and disagreeable smell of *burning horn* which is given off. Boiling Caustic Soda or Potash solutions dissolve Wool, and if Acetic Acid in excess is added to the solution obtained Hydrogen Sulfid is given off.

SILK, under the microscope, exhibits no definite structure, but consists of cylindrical or flattened, sometimes helical, compact threads, having the appearance of a smooth cylinder without any contents. Fig. 3 depicts Silk as seen under the microscope. Chemically, Silk is composed of silk gelatine, silk fiber, with fat, coloring matter and mineral substances.

FLAX-LINEN fibers consist of chemically pure Cellulose, and are of regular thickness. The cells are built up in a regular manner, cylindrical in shape, having *nodes* arranged at regular intervals as shown in Fig. 4.

In HEMP the cells are very irregular in form, and do not possess *nodes* as in the former case. The cell walls are not of such constant thickness as Flax, and the ends of the fibers are blunt, having thick walls, frequently branching laterally.

SHODDY is old woolen or worsted materials, torn to pieces by a machine having spiked rollers, which reduces them to fibers. They are then cleaned, and the fiber spun with a certain proportion of new wool.

Broadly, shoddy fibers are of two kinds, namely—those obtained by mechanical disintegration alone from the clippings, and second, those fibers that are obtained from rags that have been carbonized. It thus becomes necessary to consider first the result of a purely mechanical operation, and in the latter case, combined chemical and mechanical operations. Naturally, we con-



Fig. 20. This Shows Apparatus Arranged for the Accurate Testing of Cotton and Wool Content of Cloth, and One That Is Used By Practically All Commercial Cloth Testers. One Glass Contains a Solution of Caustic Potash, or Caustic Soda, Into Which Is Immersed a Sample of the Wool to Be Tested: A Precipitat Indicates the Relative Amount of Cotton and Other Substances Present. Likewise When Cotton Is Immersed in an Acid, a Precipitat Will Show the Relative Amount of Adulterants. See Also Fig. 7.

sider whether the chemical operation of carbonizing has in any way altered the fibers so that they might differ microscopically from those treated only mechanically.

Pure wool, when first sheared from the sheep, shows that the fibers are terminated at one end with a slightly rounded point, while the other end shows a more or less

(*Continued on page 79*)



Microscopic Appearance of Various Fabrics Under Microscope, Continued. 10—Shoddy, Made from New, Fine, Black Worsted Clips, 11—Shoddy, Made from Carbonized Brown Serge, 12—Shoddy, Made from Brown Serge That Has Been Carbonized and Subsequently Stript, 13—Fibers Made from Blue Serge That Had Been First Carbonized, Then Stript, and Afterward Dyed Green, 14—Shoddy, from the Same Batch as That Shown In Fig. 12, Except That It Has Been Dyed a Full Red, 15—Originally a Brown Serge That Had Been Carbonized, Then Stript, Afterward Dyed a Deep Orange, and Finally Garneted, 16—Shoddy, Made from Brown Serge Which Had Been Carbonized, Stript and Dyed Olive Shade, 17—Shoddy, Made from Various Knit Goods of Different Colors, 18—Shoddy, Made from Serges That Were Carbonized, Stript and Dyed a Deep Maroon.

www.americanradiohistory.com

Experiments in Radio-Activity

By IVAN CRAWFORD

PART III.

IN the last article ionization by a-rays was discust. The radiations of radium also possess the property of affecting photographic plates. This action of radio-active substances is essentially an ionizing property and the effect produced is



Arrangement of Plate and Uranium Salt in Taking Radiographs.

proportional to the ionizing power of the substance.

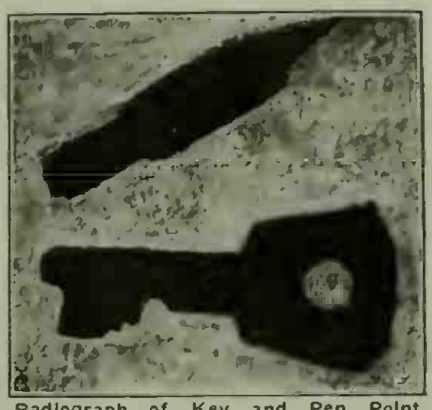
Both the a and b particles ionize the air thru which they pass; however, the a-particles do this to a larger extent. In fact the total number of ions per sec., due to the complete absorption of a-rays from one gram of radium, is 2.56×10^{10}, while the beta rays from the same amount of radium produce only 9×10^{4}. It will be seen from this that the a-rays would affect the plate to a much greater degree than the b-rays. This is only true when there is no obstruction between the substance and the plate. When a solid is interposed the effect is accomplished almost entirely by the b-rays on account of their greater penetrating power.

Geitel, and afterwards Becquerel and Mme. Curie showed that the b-rays were subject to magnetic deflection. The experiments conducted by Kaufmann and Becquerel have shown that the b-particles consist of negatively charged particles projected with an exceedingly high speed, indeed almost approaching that of light. These experiments also proved their mass was equal to that of the cathode particle in vacuum tube phenomena. Really, however, the b-particles are electrons ejected from radio-active substances at a considerably higher speed than that observed for the cathode particle.

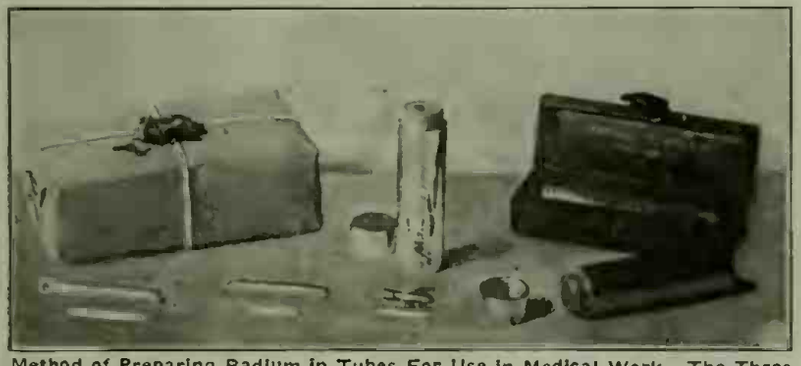
To show the effect of b-rays on photographic plates a very simple device suffices. The following experiment may be easily carried out. An ordinary photographic plate is wrapt in black paper; a few metal objects, such as coins, keys, etc., are then placed upon it and covered with a piece of radio-active ore. Any uranium or thorium salt may be used instead. The exposure should last several days. The action is much slower than X-rays and the results much less clearly defined. A plate with uranium salts on it is shown in Fig. 1. This lack of definition makes this method ill-adapted for practical radio-graphy. The salts of uranium and thorium have been found to give off the beta particles which affect the photographic plate. An interesting experiment is to take an incandescent gas mantle which contains thorium, and spread it evenly over a photographic plate. After a long exposure the plate will be seen to be affected.

Niewenglowski has shown that phosphorescent calcium sulfid after being exposed to sun-light, assumes the power of emitting beta particles. These particles are extremely penetrating, and are capable of affecting photographic plates even thru comparatively thick sheets of intervening metal. This property, however, differs from ordinary radio-activity. The sunlight seems to cause a disintegration of the calcium atom, causing an emission of beta rays.

Much better radiographs may be obtained if the ionizing agent is the active portion from a spinthariscope. This is a wonderful little instrument and should be in the hands of every experimenter of radio-activity. Considering the great variety of experiments which may be performed with it, and the comparatively small sum for which it may be procured from several leading houses, the experimenter, if at all possible, should possess himself of one. It is, while being an extremely interesting and instructive apparatus, a very simple one. In its common form it somewhat resembles the eyepiece of a microscope. The distal lens is removed, and in its place is put a metal plate upon which a thin layer of phosphorescent zinc sulfid is glued. Just above this screen and with its end about over the middle of it, a small watch hand is secured. To the extremity of this a small quantity of radium salt is fastened. In some spinthariscopes the arm which supports the active substance is removable, allowing it to be utilized in the making of radiographs. Those, however, which are fitted with stationary arms or those in which the active substance is placed directly on the screen, may be employed by removing the lens portion and using the case alone. When using a spinthariscope for making radiographs the exposure need only last about two days. This is because of the much greater activity of the substances used in the construction of these instruments. If figures such as letters be cut from heavy lead foil or some metal sheet and interposed between the spinthariscope element and the plate, their shadow will be clearly discernible. Many interesting photographs may be made in this manner. The author has found that it is impractical to attempt the construction of such an instrument as they are more cheaply bought. Of course there are many variations of the experiments just described which will not be given here as they will doubtless suggest themselves to the reader's mind.



Radiograph of Key and Pen Point Taken with Radium Ore. Exposure Three Days.



Method of Preparing Radium in Tubes For Use in Medical Work. The Three Small White Tubes Contain Radium Sulfate and Have Respectively 2,550 and 100 Milligrams of Radium Element Content. Beside them Are the Silver and Platinum Screens Used, Back of Which Is the Brass Carrying Tube, Together with a Package Ready for Shipment.



A Small Silica Capsule, Shown in Natural Size, Containing 1.764 Milligrams of Anhydrous Radium Barium Bromid, Having a Radium Element Content of 740 Milligrams. At the Present Market Price of $120 Per Milligram, This Radium Shown in the Dish Has a Cash Value of $88,800.

Before closing this article it has been thought fitting, however, to describe several experiments with this remarkable little instrument—the spinthariscope. If the experimenter will take the spinthariscope into a dark room he will be able to see wonderful flashes of light resembling shooting stars. It is best for the observer to remain for several minutes in the dark before attempting his observations, so to allow the eyes to become accustomed to the darkness. Upon further observation a pulsating nebula of light surrounded by flashing meteors will be seen. This is caused by the fluorescence due to the ions from the disintegrating atom striking the zinc and sulfid screen. The spinthariscope clearly shows the constant shower of particles given off by radio-active substances without any sensible depreciation in their weight or power.

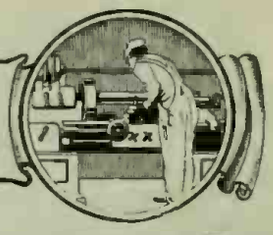
The spinthariscope may be used in another very interesting and instructive experiment. The earlier experimenters with

(*Continued on page* 68)

www.americanradiohistory.com



THE CONSTRUCTOR



The "Noiseless" Phonograph

By THOMAS REED

I WISH you knew Gladys Doolittle. No I don't, either. I've got no grudge against you. The Doolittles live in the next wing of my hotel, and as their parlor windows face mine I know all about the family, except who they are. "Gladys Doolittle," is only *one* name I call her—among others, yes, many others!

Gladys entertains a young man quite frequently. It isn't the same young man—I wish it was. She's "looking 'em over," and the specimens come on in a remarkably even procession, one at a time, some way she has it fixt. No fights, or jostling in the ante room; never any novelty like that.

Her entertainment is a stock sketch, always the same. From 8 to 9, the visitor engages in conversation with "Pa" Doolittle about what they've both read in the newspaper, while Gladys butts in occasionally with remarks on the sock she's trying to knit. Thus "Pa" samples him, and at the same time the victim makes up his mind whether he likes this better than the hall bedroom on the whole. About 9, he tries to pet the dog—one of these micro-dogs it is—and it bites him; the cake hound has to have his sample, too, I suppose. At 9:15, "Pa" retires. He's a nervous wreck or something, and needs the sleep; if he forgets he needs it, Gladys reminds him. Then, new scene: she turns off all the bulbs except the pink reading-lamp, chases the knitting off the davenport, and trails over and opens up the phonograph. The "vamping" is about to begin.

So far the performance has been confined to the home, but from this on it invades the neighborhood, and atrocities come hard and fast. Gladys uses "haunting" melodies in her vamping business, and as the vampees are always different, one haunter is all she needs at a time. When she first came it was "Memories," but that wore out on her, and ever since then it's been "Poor Butterfly." Does it haunt? Well, look: when Gladys laps her lily finger and gives that record the initial twirl, and old "But" soars out into the community with his ragtime triplets fluttering around him, we know too well it'll be an hour before the trusty insect will be allowed to fold his painted pinions and beat it back to the envelope. Does it haunt? Woof!

I'm slowly getting crazy from it. Perhaps you've noticed signs of it in my writings. What's that, somebody says—"What d'ye mean *slowly?*" Well, all right, you know the cause of it, anyway. I have an idea I could sue Gladys or her father or somebody and get damages—if the jury should decide I was less valuable crazy than the way I was before. If anybody wants to buy my claim, I'll make an attractice price on it, for cash "or what have you?"

I suppose it isn't really Glad's fault that the instrument she's using in her "laboratory" operates on the neighbors as well. Phonographs are loud! all of 'em. The manufacturers took pains to make 'em so, out of an absolute misconception. They got the idea very early that several or more people would like to hear 'em at once. Why, even now, when they ought to know better, they publish those pictures showing the whole family sitting spellbound, mother dropping her sewing and Johnny his Meccano or volume of Browning, and all that.

The facts are just the other way. Johnny delights in the jangled jazz that nobody can follow but himself, that makes the baby cry and the others want to. If Little Sister starts the well-worn maxixe, and falls to dreaming of the slim-waisted lounge-lizard she's seen in the movies, mother fidgets and glances at her offspring with apprehension; and when Big Sister puts on the $7.00 "operatic," father picks up his paper and stealthily makes for the kitchen. And so it goes. The Home has been endangered by these instruments ever since the "Pup first heard His Master's Voice," and you know it.

It's a "Noiseless Phonograph" that's needed, and as usual I have to invent it—nobody else will waste the time. Sometimes I get almost discouraged raking around after the big inventors and clearing up the poisonous by-products they leave. Everything falls on Patsy Bolivar. However, here's your new phonograph, not only *inaudible* except to the persons who want to hear it, but one that you can make yourself with hardly any trouble. With this and the prohibition law in operation, I feel as tho the Home might straighten out and survive for several years.

This machine has become possible, in a practical sense, only lately, thru the invention of the Skinderviken transmitter-button, a complete transmitter in itself; and right here I sure won't object if Mr. Skinder makes one simoleon on his part of the rinktum, because he advertises in our "Mag." like a regular fellow, and will sell you a single button if you want it.

Fig. 1 shows the general layout. For the whirling table, take one of these round shallow tin pans they use for baking Washington-pie sections — or strata, I guess you'd call 'em. The Five and Ten 'll have 'em. Take some pains to fix it true on the spindle.

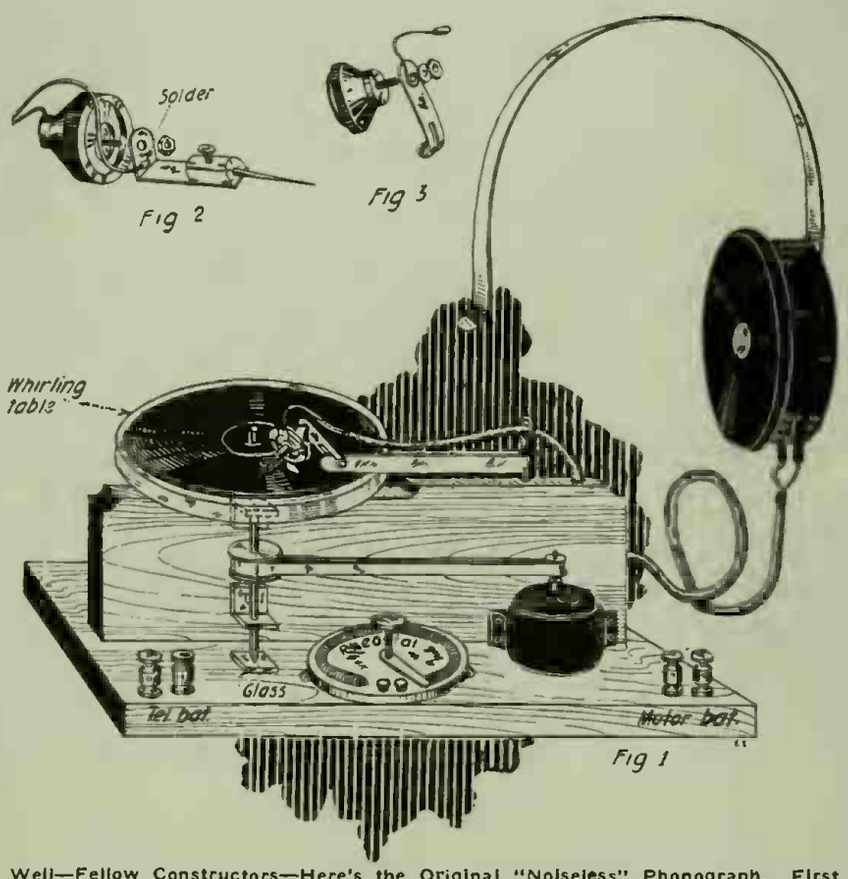
The spindle runs in holes thru two brass elbows. At the lower end, to reduce friction, point it off and have it bear on a piece of glass.

As the transmitter-button is so much lighter than the ordinary reproducer, the pressure of the needle on the record will be negligible, so you won't need a governor. Your battery motor will run it evenly enough, and the speed is regulated by your rheostat.

Fig. 2 shows the method of attaching the needle to the front stem of the button.

Fig. 3 shows the short arm for perpendicular play and method of attachment to the back stud of the button.

Of course it's understood you can connect up as many receivers as there are folks who want to listen. But say—if any fellow starts to laugh at you or me for our "silent phonograph," just remove the gentle little receivers altogether and hitch on a couple of audion amplifiers from your old wireless set, then sick "Poor Butterfly" on that critic, magnified up till he'll think the pretty creature is a night-flying airplane with a ton of bombs on its chest. Oh! Boy!



Well—Fellow Constructors—Here's the Original "Noiseless" Phonograph. First You'll Need One of Those Transmitter Buttons That's All the Rage Now-a-Days. You Stick a Needle Holder On Said Button, Rig Up a Pie Tin Turn-Table, Hook Up a Battery and 'Phone to the Button, and Let 'Er Go!

www.americanradiohistory.com

Automatic Bell-Ringing Attachment

By T. A. NEELIN

THE present diagram illustrates a simple home-made attachment for an ordinary eight-day clock, for the purpose of automatically ringing a bell or working a relay at certain fixt times. It was primarily designed for use in a small



The Clock Fitted with Automatic Electric Bell-Ringing Switch. This Arrangement Has Given Entire Satisfaction in a High School for Some time, and Provides 18 Rings Between 9 A. M. and 4 P. M.

high school where it was not thought desirable to purchase an expensive clock especially designed for that purpose. The clock in question has given entire satisfaction and rings at intervals of about 35 minutes with intermissions of three minutes between periods, making some 18 rings between 9:27 a. m. and 4 o'clock p. m. An attachment constructed according to the enclosed diagram should cause the bell to ring at the following times: 8:55, 9, 9:55, 10, 10:55, 11, 11:55 and 12 noon; 1:25, 1:30, 2:25, 2:30, 3:25, 3:30 and 4 p. m. The accompanying photograph shows the clock as it is in use at the present time.

CONSTRUCTION

A wooden disc bounded by the inner and outer circles c^1 and c^2 was cut from whitewood and finished to about 3/8 of an inch in thickness. A copper strip of the form c^3 was then cut and attached to the wood by means of a screw at s^1 and a coating of shellac to hold it in place in the other parts. A narrow slit s^2 just wide enough for insulation purposes, separates the ends of this strip. The screw s^1 serves to connect the bare end of an insulated copper wire c^4 to the copper strip c^3. This wire connects to one pole of the battery B as shown. Copper plates of the form c^{11} c^5 c^6 c^7 c^8 c^9 c^{10} were next cut and in c^6, c^8, c^9, c^{11} holes just large enough to admit a 3/8 inch screw were bored. Corresponding holes were bored in the wood disc. The copper plates were then laid down in shellac and insulated from each other by narrow spaces as shown; c^6 and c^9 were connected by a wire attached by means of the screws s^6 and s^7, and passing behind the wood disc; c^8 and c^{11} were similarly connected. The dial was then removed from the clock and the disc inserted in its place. The hands were next prepared.

To the outer extremity of the hour hand was attached a little brush made of fine strands of copper wire obtained from a piece of "lamp cord" and bound tightly about the hand. The hand was then adjusted in place so as to press the brush evenly on the surface it past over. A small brass wheel w^1, say 5/16 of an inch in diameter rotates freely and smoothly on the pin which fixes it to a piece of wood as shown. Into the other end of this piece of wood the outer end of the minute hand was inserted. The object of the wood was to insulate the minute hand from the wheel. The minute hand was then curved upward in the middle to allow the whole to freely pass over the hour hand while at the same time the curved minute hand acts as a spring to hold the wheel firmly against the copper parts beneath. The minute hand was then put in place; c^{12} is an insulated copper bell wire attached from the rear to the metal works of the clock, and continuing to the bell, or relay if a number of bells are to be worked at the same time, and thence to the battery B.

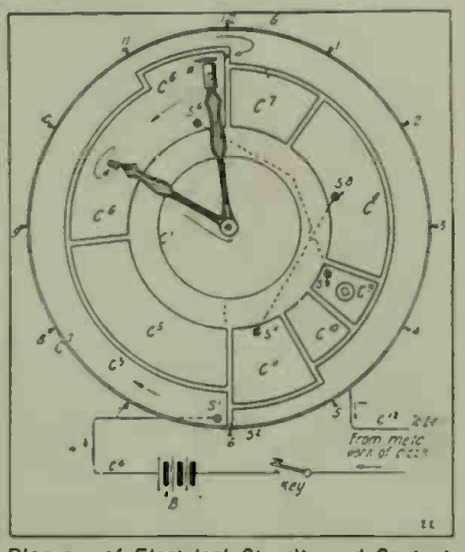
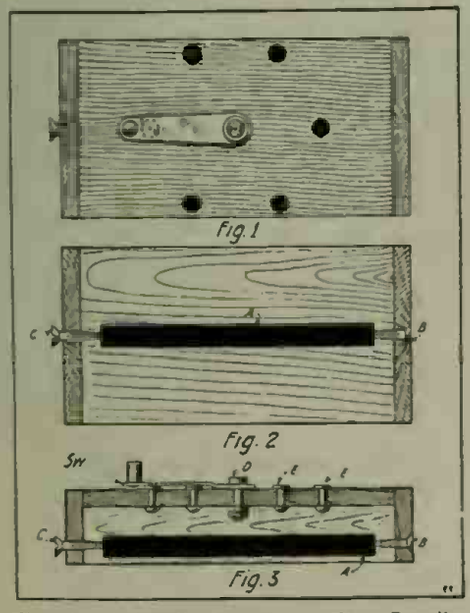


Diagram of Electrical Circuits and Contacts Fitted to Hands of Clock for Ringing One or More Bells at Different Hours.

ACTION

From the battery B the current may be thought of as travelling thru the wire c^4 to the copper plate c^3. As soon as the wheel w^1 bridges the gap at G the current can then pass to c^6, thence thru the brush and hour hand, the works of the clock, thru the wire c^{12} completing the circuit and thus ringing the bell or working the relay. In a few seconds the circuit is broken again at "G" by the minute hand moving on, and the bell stops ringing. The wires shown by the dotted lines are necessary to get the current from the hour hand to the proper plates so that the bell may ring at the times indicated.

A "Lead Pencil" Rheostat



The Lead-Pencil Rheostat. The Pencils, Without Rubber Erasers, Are Supported Between Wood Screws, as Shown. Proper Wire Connections Being Made Between the Switch-Points and Screws.

The accompanying drawing shows a lead pencil rheostat. The idea is new and very simple at the same time. The lead pencils used are in no way spoiled and can be taken out of the frame and used as if new.

Fig. 2. A, is a pencil (a drawing pencil) which has the lead exposed at both ends. B is a screw which is flush with the wood, F, and makes connections with a wire not shown. C is another screw longer than B. D, E, E are the parts of a switch.

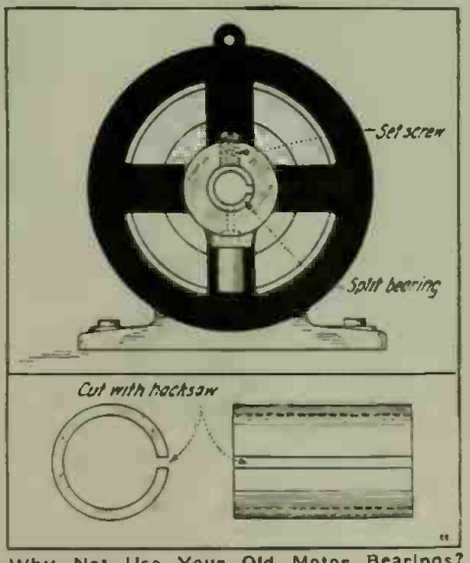
Fig. 3. It shows the switch side of rheostat. The pencil, A, is set between screws B and C. Screw C is screwed down until the both screws make good connections with the exposed lead in the ends of pencil. Connect wires with the screws, connect the wires in the right place on the switch. The number of pencils used and their length will determine the size of the rheostat. It is best to use good drawing pencils as their resistance is higher.

Contributed by JONAS GULLBERG.

USE YOUR OLD MOTOR BEARINGS.

The accompanying sketch illustrates how the bearings of small motors can be easily used when badly worn. Remove bearing from motor and cut with hacksaw as shown in sketch, drill and tap bracket for set-screw and replace bearing; tighten set-screw until motor runs without vibrating.

Contributed by HENRY L. BEIMEL.



Why Not Use Your Old Motor Bearings? Cut a Slot in the Lining and Close It Up With a Set Screw.

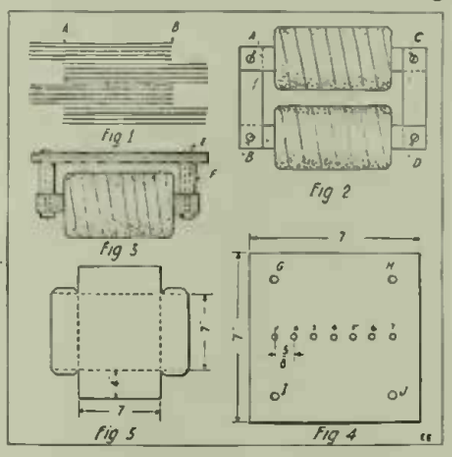
www.americanradiohistory.com

A HEAVY DUTY 110 VOLT, 60 CYCLE STEP-DOWN TRANSFORMER.

BY RAY SEITZ

With this article I intend to fill the want of the experimenter for a good and efficient transformer.

The first step is to make the core. From a piece of black sheet iron cut enough



A 250-Watt Step-Down Transformer for Use in the Laboratory, in Cautery Work, and General Experimental Work.

strips 5" long 1½" wide to make a pile 3" high and 3¼" long and 1½" wide to make a pile 3" high. Now build four cores like those shown in Fig. 1, two from the the larger size and two from the small size strips. When you have done this clamp tightly in a vise and wrap well with three layers of good friction tape. On the long legs wind three layers No. 12 D. C. C. copper magnet wire, 30 turns to the layer, taking a tap off at each layer. The two legs will require 2¼ pounds of wire. Now wrap two layers of good friction tape over this and begin winding the primary which consists of 6 layers No. 22 S. C. C. magnet wire, 80 turns per layer, using a layer of paper between each layer of wire. This winding, the primary, will require 1½ pounds of No. 22 S. C. C. magnet wire. After you have both of the legs wound wrap again with two layers of friction tape and paint the whole heavily with shellac and bake in an oven for three hours. Now put the four legs together and drill a hole in each corner to pass a ¼" bolt A*B*C*D—Fig. 2.

After the holes are drilled, the next thing to do is to solder the taps on with short pieces of No. 12 R. C. wire and brought to their proper binding posts. No. 1 comes from the beginning of secondary winding, No. 2 from first tap, No. 3 from second tap. No. 4 from end of winding on first leg, (end of winding on first leg and beginning of winding on second leg are joined together, and tap 4 also comes from this joint). No. 5 from first tap on second leg. No. 6 from second tap on second leg, No. 7 from end of winding on second leg.

When connecting the ends of the windings together care should be taken to see that they will help each other along and not "buck" each other. By applying the hand-rule for electro-magnets you can easily figure which ends have to go together. The primary sections are connected up in series with each other, applying the hand rule as in the case of the secondary and the two remaining ends are spliced to a piece of black extension cord for connecting up to the supply. The hole, 8, in Fig. 4, is for this piece of extension cord to go thru, having first bushed it out with a piece of fiber tube from a 30 amp. cartridge fuse.

The top is made from a piece of ½" red birch, cut to the dimensions in Fig. 4. The holes marked 1-2-3-4-5-6-7 are for the binding posts and 8 for the connecting cord. The other holes are for fastening the transformer to top. When fastening transformer to top, four pieces ¼" gas pipe 1½" long, will separate the core at the right distance from the top.

Fig. 5 gives the dimensions and shows how to cut the sheet for making a box to fit the transformer. It is made from 24 gage sheet iron, having the corners riveted together.

Short-circuits and heavy overloads will not harm this transformer, if not left on for too long a time. This transformer, if built the way described, will work perfectly and is absolutely noiseless at low load and at full load produces a slight hum. It consumes about five watts at no load and draws about 250 watts at full load. The secondary has six steps of three volts each, three volts between each terminal. This transformer is designed to operate on the standard current of 110 volts 60 cycles. The writer has built several of these transformers and they work to perfection under many different conditions.

A NEW WRINKLE IN ROLLER BEARINGS.

Most machine bearings are made of the ring-oiling type, that is, the bearing is supplied with a reservoir for oil, into which dip one or more rings that run upon the shaft, and thus supply the journal continually with oil. During the operation of the machine there is a continuous flow of oil thru the bearing, which not only keeps the shaft well lubricated, but tends to wash away any particles of metal that may be worn from the rubbing surfaces.

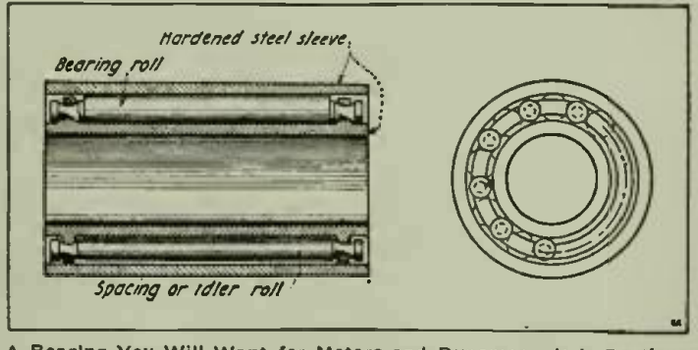
In a dynamo, it is important that the oil from the bearings should not follow the shaft and run out on the armature. The oil itself is not so injurious, altho it tends to destroy the insulating varnishes, but it causes an undesirable accumulation of dust that may greatly impair the insulation.

The accompanying diagram shows a new type of roller bearing, so designed as to run without the use of any lubricants. It is as simple as it is efficient.

This bearing consists of an outer hardened-steel casing and an inner hardened-steel sleeve. Between these are placed two sets of rollers of two different sizes, the smaller serving as the spacing or idler rollers and the larger being the essential bearing rollers. The relative position of these rollers is shown in the sectional sketch. The idler rollers are so designed to run on what may be called a *track*, and are held loosely in place by two retaining rings.

The bearing is suitable for all kinds of work. When used in connection with line shafting, the outer sleeve fits into a shell, held in place in the hanger in the usual manner.

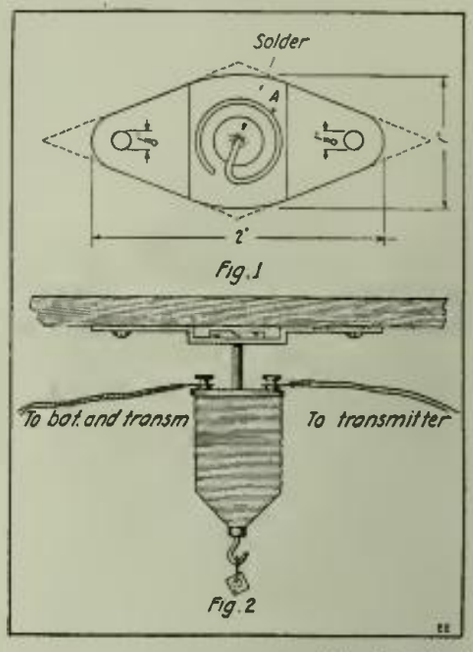
Contributed by
PETER J. M. CLUTE, B.Sc.



A Bearing You Will Want for Motors and Dynamos. It is Particularly Strong and Runs Without Oil or Other Lubricants.

THE "TALKING TABLE."

If the apparatus here described is fastened to the under-side of a dinner table it will set the table in vibration so that any



An Entertaining Wrinkle for the Electrical "Bug" to Try Out—the Talking Table. The Magnet Connects Up with a Microphone and Battery.

number of persons putting their ears flat upon the table, will hear a person talking over the 'phone, if it is connected up as shown in the accompanying sketch.

A small piece of sheet brass is cut as shown in Fig. 1. A piece of soft iron wire, such as that used for cores of induction coils and about 6 inches long, is bent at one end as indicated at (A) Fig. 1 and put thru a hole in the center of the brass plate; the other end is bent into the form of a small hook. Next cut off about 2 inches of a cheap lead pencil and soak it in water till the lead will come out easily, then glue the pieces of pencil to the wire just above the hook. Take a piece of cigar-box wood and cut a piece about 1⅜ inches in the center so it will fit over the leadless pencil on the wire, and 2 holes to receive the two binding posts, Fig. 2. Glue the disc over the pencil on the wire near the upper end. The binding posts are then placed thru the other two holes. The pencil is now wound with No. 24 B. & S. silk or cotton covered wire, the end of the wire being fastened to the two posts. A small weight, weighing about two or three ounces, is hung on the hook. The apparatus is then screwed to the under side of the table and connected up to a microphone and battery.

Contributed by
WADE ROBINSON.

CLEANING PAINT BRUSHES.

For cleaning hard paint brushes make a hot solution of lye water; stand the brush so that just the bristles are in the solution.

For making old corks new. Boil in hot water for one-half hour.

Contributed by AN EXPERIMENTER.

A new thermostatic metal which is remarkably sensitive to heat has been invented. The metal may be used in connection with an electric thermostat to control heating systems and to give the alarm in case of fire.

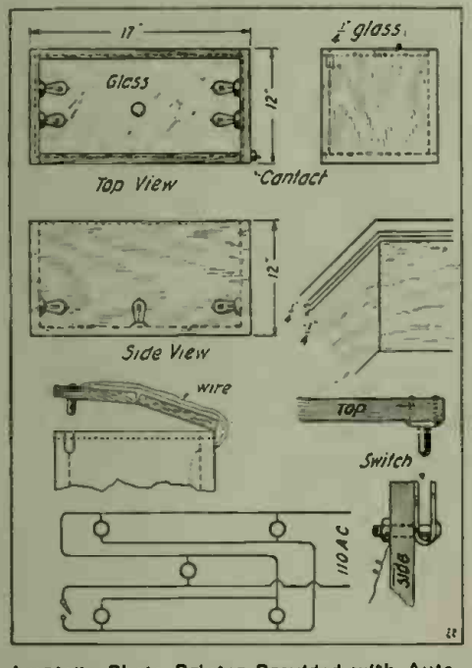
www.americanradiohistory.com

A PHOTOGRAPHIC PRINTING BOX.

The inconvenience of the printing frame is entirely done away with in this electric printing box. In regard to time the saving is enormous. The necessary material required follows: 1 piece wood 1"/12"/17" (base); 2 pieces wood 1"/12"/15" (sides); 2 pieces wood 1"/12"/12" (ends); 2 pieces wood 1"/6"/17" (top-hinged in the middle); 1 piece glass (plate) 15½"/10½"; 4 tungsten lamps; 1 ruby lamp; 5 sockets, and 1 lamp cord with plug.

The box is assembled as shown in the figure. The sockets are screwed 2" up from the bottom on the ends and are 5" apart. One socket is put in the middle for the ruby lamp. The next step is to wire the sockets according to the diagram, leaving enough wire to go over the top for the automatic switch which now will be taken up. The object of this switch is to turn on the four white lights when the lid is down. It consists of an L-shaped piece of spring brass or phosphor bronze that is screwed to the cover and fits into a V-shaped piece of metal when the cover is down tight. A piece of wire about 2' long runs over the top to the L-shaped switch. The other side can be wired up from the inside of the box.

The remaining step is to put on the glass plate. The glass should be as heavy as possible; plate glass is the best. There is often quite a heavy strain on the plate from printing and consequently a light glass is liable to crack. The top of the box is now rabbited out ¼" deep and ¼" wide from the inside all around, so that the glass will fit in flush with the top. The top is hinged in two places in the middle opening, and two more places on the end to give no play at all to the cover. It is well to cover the inside of the top with a piece of cotton flannel the size of the glass plate. This insures that the negative will be in firm contact with the printing paper.



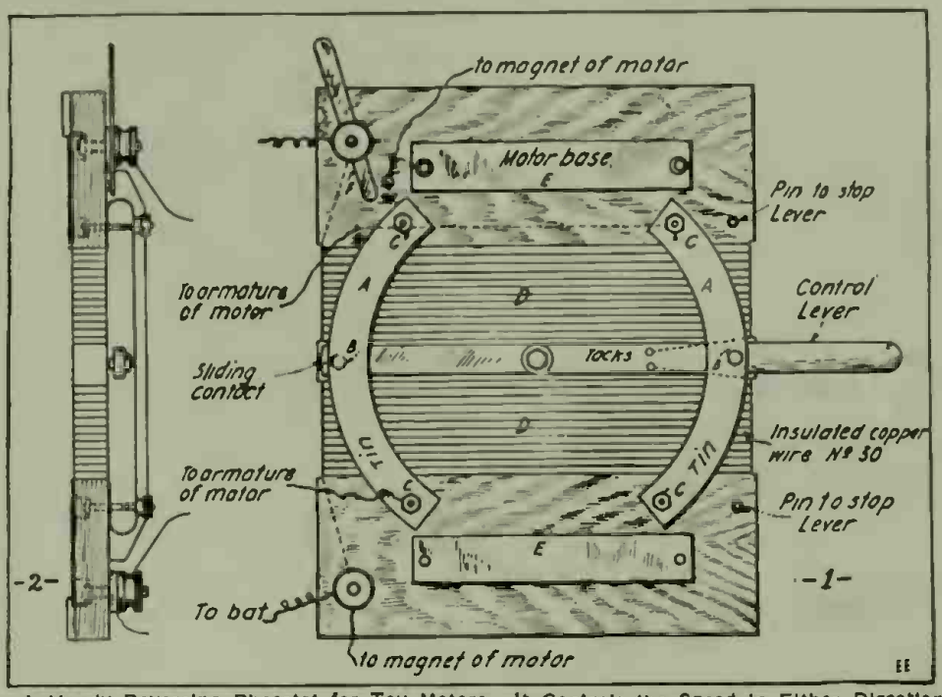
Amateur Photo Printer Provided with Automatic Switch for Opening and Closing the Light Circuit When the Lid Is Operated.

It is seen from the wiring diagram that the ruby lamp is kept burning all the time. This is to allow for printing masks to be adjusted, the negative to be arranged, etc. This printing box is capable of turning out prints at a rapid speed, doing away with the clumsy printing frame. It is very simple in construction and will repay anyone who constructs it.

Contributed by
MALCOLM MACURDA.

Reversing Rheostat for Small Motors

This rheostat is built under the motor on a wood base 6 x 8 x ½ inches. On each side of the base, 2¼ inches from the ends, cut two grooves ⅜ inch deep and 1 inch wide, leaving a space of ½ inch between. Take about thirty-five feet of No. 28 insulated copper wire, fasten one end to a binding post under the base as shown in Fig. 1, and wind it around the base closely and evenly, gluing it near the place where the sliding contact, B, is to work. The final end of the wire is tacked to the lower side of the base. Wind the other side in like manner. The lever is a thin piece of wood ½ inch wide, carrying two short binding posts, B B, which serve as sliding contact points, connecting the arc, A A, and the coil, D, off of which the insulation has been scraped in the path of the slider, B. The nearer the glue is to this path the better.



A Handy Reversing Rheostat for Toy Motors. It Controls the Speed in Either Direction and Can Be Actuated from a Distance by a String Attached to the Handle.

Contributed by OSCAR ROSE.

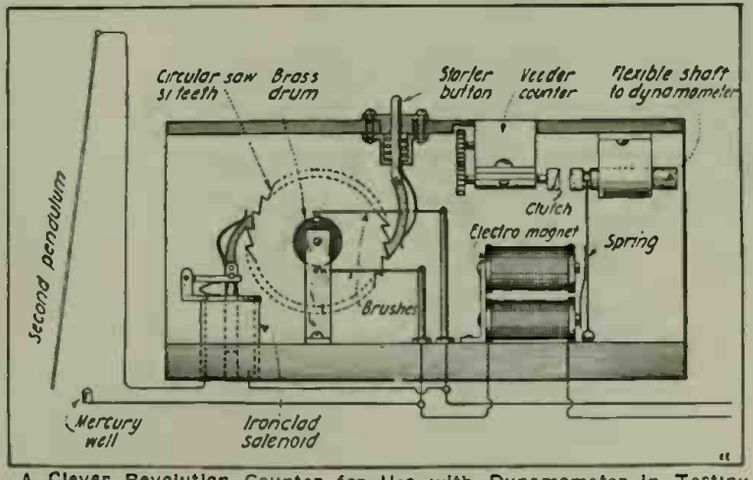
Revolution Counter for Dynamometer

Electric tachometers have not proven a success where accuracy is demanded such as in dynamometer testing work and therefore several revolution counting apparata have made their appearance on the market. These latter usually take the form of solenoid operated clutches operating in turn revolution counters. When the fuel-weighing apparatus makes contact, the clutch is engaged and a stop watch started. When the weighed quantity of fuel is used up the scale breaks contact, the counter is stopt and the stop watch stops. Thus an accurate method of determining *pounds of fuel per brake horse-power hour* is secured.

A "seconds pendulum" is a pretty handy piece of apparatus to have in any laboratory. I built such a pendulum so that at every swing the lower end of the pendulum would brush thru a mercury cup fastened on a suitable adjustable support. The requisites are one solenoid with laminated soft iron core, one old electric bell magnet, a circular saw, a few small gears and a little work.

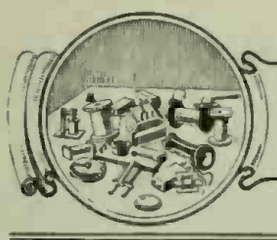
The small brass drum attached to the saw has a piece of insulation in the path of one of the brushes whose length is sufficient to cover the circular distance of all teeth over thirty, so that there will be thirty movements of the saw or a time

(Continued on page 73)



A Clever Revolution Counter for Use with Dynamometer in Testing Work.

www.americanradiohistory.com



HOW-TO-MAKE-IT



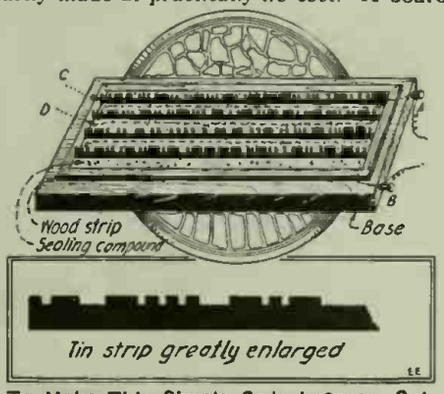
This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 is awarded; for the second best idea a $2.00 prize, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

FIRST PRIZE, $3.00

A MANUAL TYPE CODE LEARNER.

I give below drawing of a "code teacher" which I am contributing to the "How to Make It" Department.

This code teaching instrument can be easily made at practically no cost. A board



To Make This Simple Code Learner, Cut Out the Dot and Dash Characters On Strips of Tin and Embed Them In Sealing Compound. The Buzzer Circuit Is Made and Broken Over These Projections.

(any size to suit the maker) has slits cut into it lengthwise with a knife or saw, as indicated. Tin or brass strips are procured, with a length equal to that of the board. The dots and dashes are cut out along the edges of the strips, as in the drawing. They are put in the slots, then connect all together with a wire. Then take some wood about ¼-inch square and put it around the edge on the top. Melt some sealing compound and pour it in the box just made by putting the wood strip around the board, to within ⅛-inch from the top of the tin. Then cut out a piece of tin to make the "pen;" connect it up to a buzzer or telegraph sounder and slide the "pen" across the tops of the tin strips, which makes the dots and dashes at any speed desired.

Contributed by LOUIS C. KING.

IMPROVED MORTAR AND PESTLE.

When a mortar and pestle are used for grinding chemicals dust often gets into the eyes, or small particles are driven out of the mortar and are lost, particularly in the case of hard crystals requiring a consider-



Make This Simple Cover for Your Mortar and Pestle and Keep Out the Dirt.

able force to break them. A simple but very efficient safeguard consists in making a cover for the mortar from a circle of cardboard, with a central hole just large enough to admit the pestle as sketch shows.

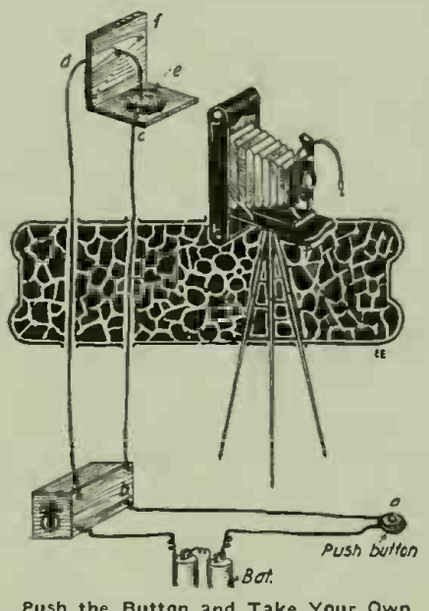
Contributed by H. J. GRAY.

SECOND PRIZE, $2.00

TAKING YOUR OWN "MUG" IN GROUP FLASHLIGHTS.

When taking group photos by flashlight it is often desired that everyone be in the picture, but as someone must hold the flash-pan and set it off at the proper moment, this is often impossible. I have a plan, which is explained below, which allows everyone to be in the photo.

In the diagram *a* is push-button held by photographer; *b* is spark coil, the wires from *a* being connected to the primary side of the coil, with set of dry cells in circuit; *c* is one wire, from secondary side of coil, which is taken thru hole in bottom of holder and soldered to *e*; *d* is other wire from secondary side of coil which is taken thru hole in back of holder *f* and turned down until there is a gap of about one-fourth inch between it and *e*; the covering should be removed from *d* for about one inch from end; *e* is baking powder can cover which should be securely fastened to holder *f* as shown; *f* is holder made of two pieces of



Push the Button and Take Your Own "Mug" with This Unique Electric Flashlight Scheme.

wood about six inches wide fastened together at right angles and covered on the inside with sheet asbestos, which acts as reflector and protects wood. Holder can be placed on either side of camera, but must be *back of camera.*

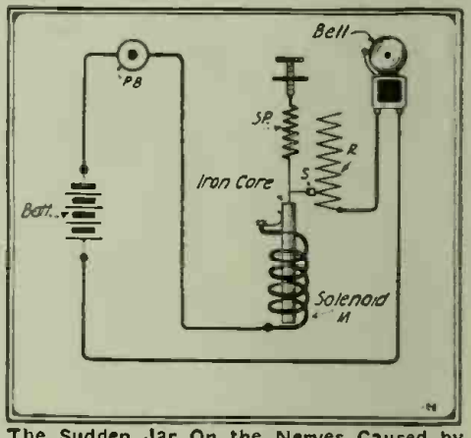
How It Works.—The operator puts the proper amount of flash powder in the baking powder can cover, in and around the point of wire *d*. He then arranges his group, using the camera finder for this purpose, leaving, however, a place for himself. The light in the room should be turned low, leaving only enough to see by. The camera shutter is now opened, the photographer takes his place in the group, and at the proper moment pushes the button. The spark between wire *d* and baking powder can cover sets off the powder, after which the photographer closes the shutter, and the picture has been taken.

Contributed by GLEN M. ROYSTON.

THIRD PRIZE, $1.00

A PROPOSED "BELL SOFTENER."

When some one comes to the door and rings the bell, its sudden sound scares



The Sudden Jar On the Nerves Caused by Ringing the Ordinary Bell Can be Obviated by Inserting a Solenoid-Controlled Rheostat In Series with the Bell and Battery.

everyone. With this device it starts softly and gets louder gradually. The apparatus used is the same as generally employed for this purpose with the exception of the softener, which is a large cylinder wound with resistance (R), which is entirely in circuit at the start, but is varied by the slider S. When the key PB is released, the slider is pulled back to the original position (having been pulled down by the magnet M) by the spring SP.

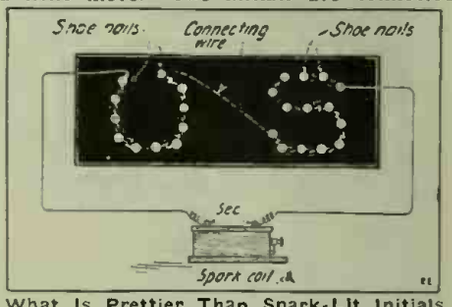
CAUTION: Do not have the slider too far from the magnet; make the cylinder short but large in diameter. Do not use too much resistance; allow enough current to pass so that the magnet will work.

Contributed by
ERNEST INNES and ETHBERT REED.

SPARK-LIT INITIALS

I here give a description of spark-lit initials formed from old shoe nails, driven into a block of wood so as to form letters.

A piece of wood ¾" x 1½" x 3" is used for the base, initials one inch high are drawn on the base and the shoe nails are driven into the initials about 1/32" apart, or a little more. The initials are connected



What Is Prettier Than Spark-Lit Initials Such as These, Which Can be Lit Up by Even a Small Spark Coil.

together as shown and wires are connected from the secondary terminals of a spark coil to the letters. When the coil is excited, sparks jump from nail to nail, lighting up the initials in a very pretty way in the dark.

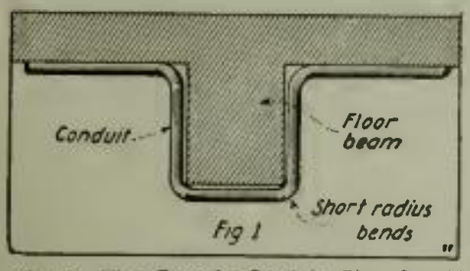
Contributed by
DE FOREST G. STICKNEY.

www.americanradiohistory.com

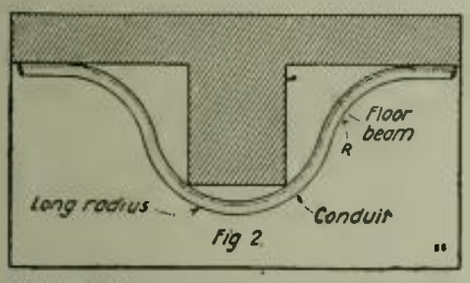
METHOD OF FORMING A SHORT-RADIUS BEND IN CONDUIT.

By George W. Shirley

To make a short radius bend in conduit for a location such as that indicated in Fig. 1, the method to be described can be used. Where turns of the usual radius are



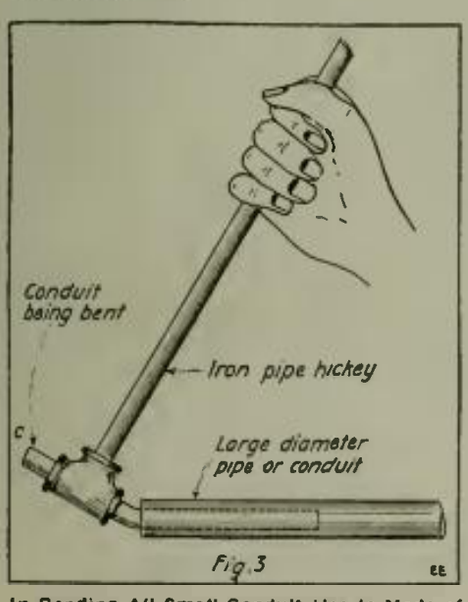
Above: The Electric Conduit Pipe Should Always Be Neatly Bent and Fitted In Place Like This. The Bends Must Be Even Curves, Not Kinked Bends.



Above Is Illustrated How Not to Bend Electric Conduit. Such Pipe Bends Soon Loosen, and Besides Present a Very Unworkmanlike Appearance. How to Bend Conduit Right Is Explained Herein.

made, the conduits do not lie close to the surfaces and present the undesirable appearance delineated in Fig. 2. But with this method, bends of the approximate form diagrammed in Fig. 1 can be so made that the inner face of the conduit will lie not more than 1¼ inches from the faces of the beam. A sleeve, *P*, of a larger diameter than the conduit, *C*, being bent, is slipt over the end of the conduit (Fig. 3) and then the short-radius turn can be formed with a hickey, *H*.

The electrician uses what is known as a *hickey* for bending all small pipe curves. The hickey is nothing more or less than a substantial pipe *tee* fitted with a handle of pipe as shown in Fig. 3. The handle is threaded, of course, so as to screw into the fitting firmly.



In Bending All Small Conduit Use Is Made of What Electricians Call a "Hickey." This Is Made of a Short Length of Pipe Threaded Into a Heavy "Tee."

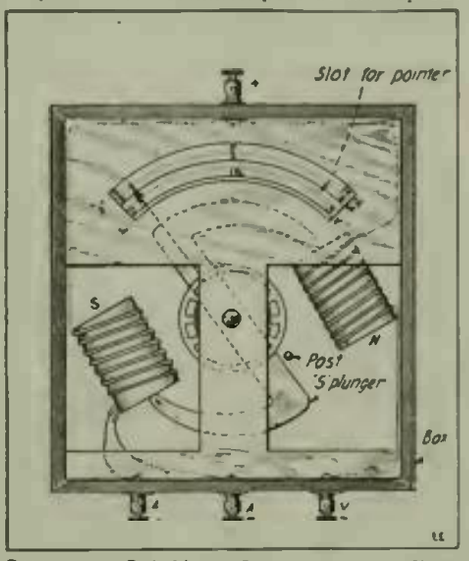
A Low-Reading Volt-Ammeter

Remove the balance wheel, bearings, and hair-spring from an old alarm clock. Using composition wall-board or thin wood, make a box 3x3½ inches and ⅞ in. deep. For ease in adjusting, the front should be cut away as shown, and the front should be easily removable. In the center, both back and front, bore a small hole to receive the bearing screws, which are cup-shaped in the ends. The balance wheel should spin freely when in place.

On a thin sheet of soft iron, taken perhaps from an empty tomato can, draw a circle with a radius of one and one-sixteenth inches. Inside this circle cut an armature like the letter S, as shown in the drawing. Punch a small hole in the center of this "tin" letter S, and slip on the balance-wheel shaft and fasten to it. Push the hair-spring on the shaft above the wheel. The free end of the hair-spring is secured to a small post. The spring must of course be adjusted to the proper tension. A thin pointer made of No. 32 wire is made fast to the balance wheel, letting the end project up thru the slot cut at the top of the instrument. A bit of colored paper should be glued to the end of the pointer.

Around a stick of wood half inch thick and ⅝ wide, wrap a couple of thicknesses of cardboard, gluing carefully. On this form wind one layer of No. 20 four feet. Fasten this with shellac. Over this coil wind 5 turns of heavier wire, say No. 14. For the voltmeter coil 40 feet of No. 32 may be used. This makes 200 turns and has a resistance of nearly 7 ohms. A dry cell giving 1.5 volts will send over 1/5 ampere thru this coil. 200 x .2 amp. gives 40 amp. turns, or 40 feet x .2 amp. equals 8 amp. feet. .2 amp. at 1.5 v gives .3 watt. When the ammeter coil having 20 turns or 4 feet is carrying 2 amperes it too will have 40 amp. turns or 8 amp. feet, and will exert the same magnetic pull as the voltmeter coil at 1.5 volts.

If we wish to measure a little higher voltage we may use 140 feet of No. 36 copper wire, having a resistance of 50 ohms. Now at 4.5 volts the energy absorbed will be nearly .3 watt. One watt should pull the armature or plunger the full distance into the coil. A square of paper covers the opening in the front and a glass fitted into slots excludes the dust. Each coil may be joined to a common post at the top but



Procure an Old Alarm Clock. You Are Then Ready to Start Building This "Triple Scale" Volt-Ammeter, a Most Useful and Desirable Measuring Instrument for the Experimental Laboratory.

to a separate post at the bottom. Instrument will work in either horizontal or vertical position. Calibration should be done last. If no standard instruments are at hand, each dry cell in series adds 1.5 volts. For the ammeter scales, two cells in series will send 6 amperes thru 48 feet No. 20; one cell will give 3 amperes thru the same wire, and 1 ampere thru 9 feet of No. 32. My "battery tester" has been used often during the past year. Tester may be used for a moment on much stronger currents than examples given.

Contributed by H. H. DAVIS.

Converting Small Motor Into a Dynamo

If your motor is not already mounted on a base, it would be well to do so for this experiment. On this base mount two binding posts BB.

Then disconnect the wires which come from the field coil and connect them to two dry cells, as shown in the sketch. Connect two short wires from the brushes to the binding posts BB, the wires being indicated by AA. A switch may be put between the field coil and batteries if desired.

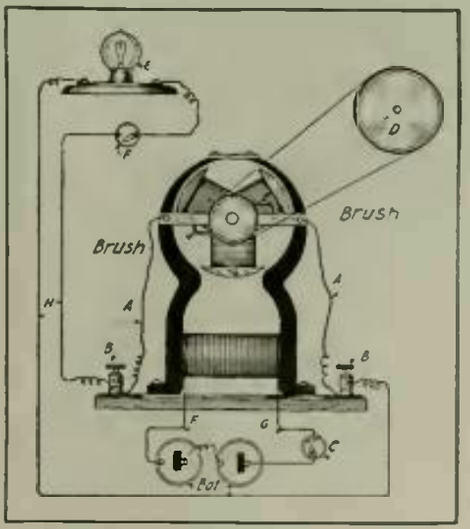
Now belt the motor to any large wheel, D, such as a fly-wheel of a sewing machine. A water motor serves the purpose very well.

When the armature is revolved at a high rate of speed, current will be generated, which will pass thru the wires HH, connected to a small electric bulb, storage battery or to another toy motor.

In my case the motor was very small, only three inches high, designed to run on two batteries, and when converted into a dynamo it gave sufficient current to burn out a two and seven-tenths (2.7) volt bulb, which I had taken from a flash-light.

It must be borne in mind, however, that the voltage of a dynamo is controlled by the size and number of wires with which it is wound and the speed at which the armature is rotated, as well as the strength of the field magnet.

Contributed by E. L. DURGEN.



To Demonstrate the Principle of the Dynamo the Experimenter Will Find It Extremely Interesting to Drive a Small Toy Motor with a Steam Engine, a Water Motor, or Another Motor, and Exciting the Field by a Few Dry Cells. A Small Lamp Can be Lighted.

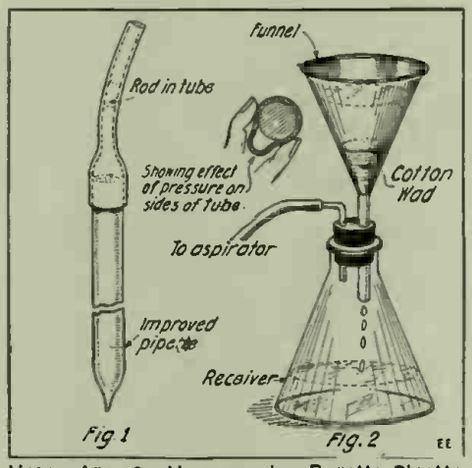
www.americanradiohistory.com



PRACTICAL CHEMICAL LABORATORY DEVICES.

By Thomas W. Benjamin.

THERE are many instruments and operations in chemistry that can be so improved as to make them handier or to shorten the time required for a given

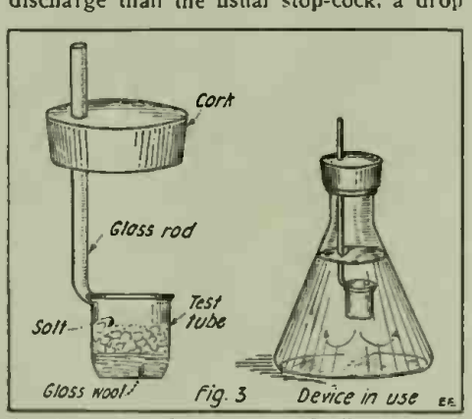


Here Are a Home-made Burette-Pipette and a Vacuum-Filter of Simple and Ingenious Construction Welcome in Every Laboratory.

process. Many of these are in everyday use in large laboratories but the experimenter hears but little of them.

A form of burette, or more properly a pipette, having several advantages is shown in Fig 1. Instead of the usual form with the stop-cock at the bottom, a plain graduated tube is fitted at the top with a 6-inch length of rubber tubing. The valve in this case is made by sliding a short length of glass rod into the rubber tube, locating the same midway of its length. The tube is normally kept closed by this rod but a slight pressure on one side of the rubber will cause the tube to buckle out and form a channel thru which liquids or air can flow.

The device can be filled either by sucking the fluid up into the tube with the mouth or by immersing it into the fluid with the valve open and removing after the valve is closed. This valve will give a finer regulation of the discharge than the usual stop-cock, a drop



An Automatic Saturator Is Easily Made as Shown in Above Diagram and May Come In Handy.

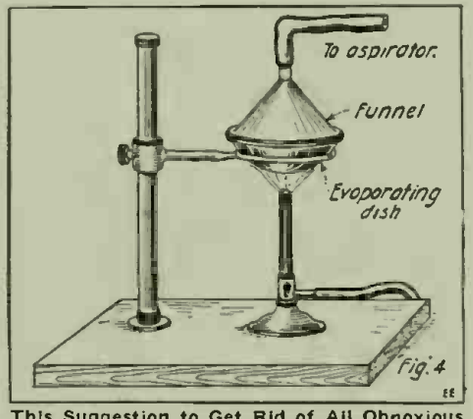
at a time or a steady stream being readily attainable.

VACUUM FILTER: When filtering thick fluids the process may be speeded up by the use of a vacuum filtering device. To create the vacuum, use can be made of the glass aspirators which are procurable at a very reasonable price. To use this for filtering, the receiver is fitted with a cork having two holes. One, large enough to take the spout of the funnel, the other having a short glass tube inserted. See Fig. 2.

A wad of absorbent cotton is placed in the bottom of the funnel and reaching a short distance up the sides. This is to support the filter paper and prevent it breaking under air pressure. The bent glass tube is connected to the aspirator and when the water flow is started a slight vacuum will exist in the receiver. Any liquid poured into the funnel will be filtered at a rapid rate due to the air pressure forcing it thru.

SATURATED SOLUTION APPARATUS: Saturated solutions of salts can be more quickly made by supporting the salt near the surface of the liquid. The idea being that as the salt dissolves the fluid gets heavier and sinks to the bottom, being replaced by other fluid. This circulation is automatic and continues till the saturation point is reached.

A little device, easily made of glass, that can be used with all chemicals is shown in Fig. 3. The body is made by cutting a two inch length from a large test tube and bending in the edges at the cut by heating till soft in a Bunsen flame. A wad of glass



This Suggestion to Get Rid of All Obnoxious Fumes in the Small Laboratory Is Certainly Meritorious and Shows What a Little Ingenuity Will Attain.

wool is placed in the tube, being held in place by the turned-in edge. The glass rod used to support the device is fastened in place by heating the rod and tube where they are to be joined until soft and then pressing them together. A cork fitted over the rod will support the device inside a bottle.

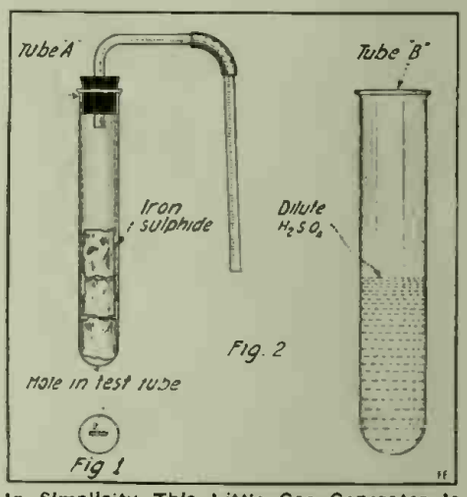
In use the tube is filled with the salt to be dissolved and placed in the bottle containing the solvent at such a height that the top of the tube is just below the surface. Additional salts may be added from time to time as found necessary.

The aspirator mentioned in connection with filtering can be used with advantage when drying or evaporating. In this case the evaporating dish is covered by a funnel the spout of which is connected to the suction tube of the aspirator; see Fig. 4. The vacuum created will draw off all fumes and vapors at a rapid rate. Should the vapor be required for further experiment a condenser can be connected in the line between the funnel and the aspirator to condense the vapor.

A SIMPLE GAS GENERATOR.

Frequently small quantities of gas are desired in the chemical laboratory, and no convenient and simple method of generation can be found. The apparatus described is very simple, yet it serves the purpose admirably.

First, procure two test tubes, one having

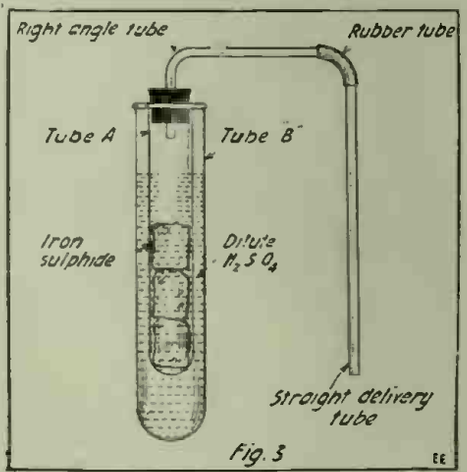


In Simplicity This Little Gas Generator Is Undoubtedly Unrivalled. Two Test-Tubes, a Cork, Some Rubber and Glass Tubing—That's All!

dimensions approximately 5/8" x 7" long, the other approximately 7/8" x 10" long. In the bottom of the smaller test tube file a small hole with a triangular file (Fig. 1), into this test tube fit a one-hole rubber stopper. Fit stopper, with a right angle, connecting tube, and straight delivery tube, as in Fig. 2, and insert in smaller test tube. The smaller tube A, is inserted in the tube B, the flare of tube A prevents it from slipping thru to the bottom of tube B.

In operating: If H_2S is to be generated, a stick of FeS, iron sulfid is placed in tube A, and the cork inserted. Dilute sulfuric acid is put into tube B, filling it about two-thirds full. When tube A is inserted into tube B, a large volume of gas is produced.

If hydrogen is wanted, small clippings of iron or iron filings are put into tube A.



The Gas Generator Ready Assembled for Business. Get the Gas-Mask, Archimedes!

and lowered into the dilute acid in B. Removing tube A stops the generation of gas.

(Continued on page 87)

www.americanradiohistory.com



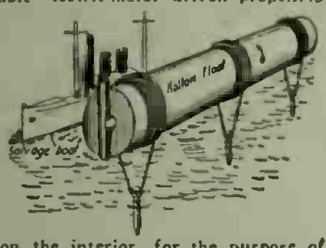
LATEST PATENTS



Electric Device for Raising Sunken Ships.

(1,288,108, issued to Vladimir V. Messer.)

In this novel scheme for raising sunken ships, a number of large floating members or tanks are utilized, which are provided with suitable electric-motor driven propellers

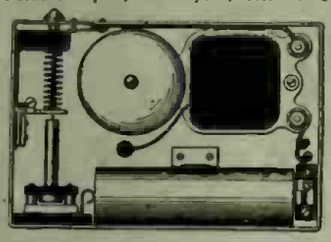


on the interior, for the purpose of causing the float to rotate in the water either in one direction or the other, about its axis. By means of flexible insulated conductors leading from the salvage boat to the float, the motors may be properly controlled, and current supplied to them for their operation. The dependent cables at the bottom of the float are made fast to the sunken vessel, by divers or by other means. These cables can be let out or reeled up by causing the float to rotate, and the cables wound up or reeled off from differentially grooved drums rigidly mounted on the exterior of the float.

Safety-Chest for Valuables.

(No. 1,291,051, issued to James L. McQuarrie.)

By means of an ingenious safety chest, a continuous alarm is sounded in the event of any unauthorized disturbance of the chest. The alarm mechanism is entirely enclosed in a small separate compartment, which may be readily removed, when the chest is open, for repair, etc. The

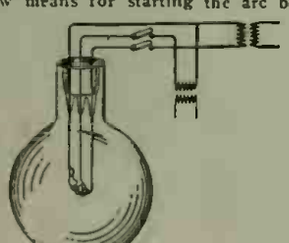


alarm is actuated by a gravity operated pendulum member, which is freely movable in response to any disturbance of the chest, once it has been set and the chest locked. Also magnetic means are provided for holding the gravity operated pendulum when it is thus moved by agitation of the chest, so as to keep the alarm bell circuit closed continuously.

Incandescent Arc-Lamp.

(No. 1,290,930, issued to Philip K. Devers, Jr.)

In this interesting form of incandescent arc lamp, the arc is operated between two electrodes of tungsten or other suitable material, in a gaseous medium of considerable pressure. The inventor provides a new means for starting the arc be-

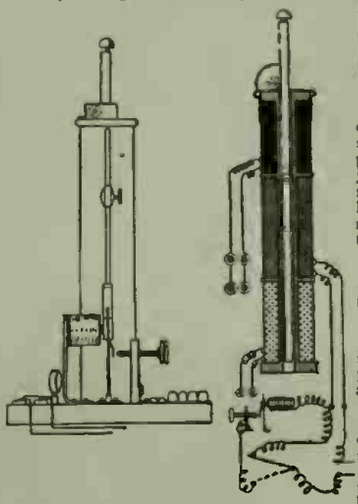


tween the electrodes at low potential, while the electrodes are below a temperature at which the electron emission occurs. Surrounding the gap between the electrodes, there is provided a spiral heating coil, and the arc-supporting current is impressed across the electrodes at the same time that the heating coil is switched into circuit.

Medical Coil Apparatus.

(No. 1,290,628, issued to Louis Mayor.)

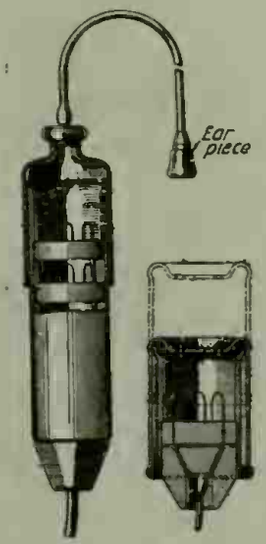
Can be operated from commercial A. C. lighting circuits. There are three windings on the apparatus, one primary and two secondaries. One secondary is connected with sponge or other electrodes for applying the current, while the lower secondary coil provides a low voltage current for operating a small lamp for endo-



scopic work, etc. The soft iron core passing thru the coils is adjustable as to position, by means of a control knob fitted with rack and pinion attachment.

Adjustable Thermic Telephone.

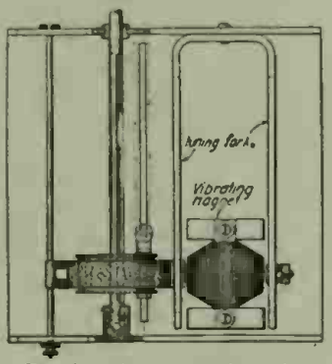
(No. 1,290,114 issued to Picter de Lange and Robert Aeronut Baron van Lynden.)



An improved form of thermic telephone adapted for certain purposes, or wherever it becomes an object to accurately regulate the intensity of the sound reproduction by varying the volume of the sound chamber. In this particular arrangement the sounding chamber is arranged in two parts, so that one may be slid over the other, thus either lengthening or shortening the chamber.

Constant Amplitude Vibration Motor.

(No. 1,290,264, issued to Leslie R. McDonald.)



This ingenious motor is made up of a rotary member mounted on a square shaft, which is actuated or propelled about its axis by an adjustable belt member, which is alternately and regularly pulled taut and loosened, by virtue of its attachment to an electrical tuning fork in the manner here illustrated.

A Vacuum Tube Peak Voltmeter.

(No. 1,287,161, issued to Richard H. Wilson.)

An improved method for measuring the peak voltage between two points of an electrical net-work, and a further object of which is to measure a direct or alternating voltage without the necessity of constant calibration of the measuring instrument. These results are accomplisht by connecting the input circuit of the thermionic valve between the net-work terminals, across which the voltage is to be measured, and allowing the resulting uni-directional pulsating cur-

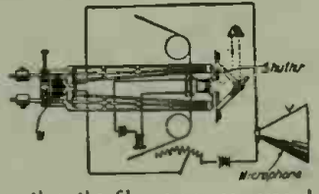


rent in the output circuit to pass thru a resistance or impedance.

Sound Recorder and Reproducer.

(No. 1,290,711, issued to Manuel Calderon.)

In "recording" the sounds on a photographic film by creating variations and graduations in light to dark, the sound waves are picked up by a microphone, or a battery of microphones. These microphones, thru a battery and rheostat, are caused to actuate an electromagnet, M. This magnet operates on two armatures attached to the pivoted levers shown, to the longer ends of which there are attached light beam shutters, which may enter the beam of light in the manner apparent. The variations as aforementioned in the light and dark graduations are photographed on the film, and correspond to the voice waves. In "reproducing" the voice, the film is past before the beam of light, and the variations in light value pass-

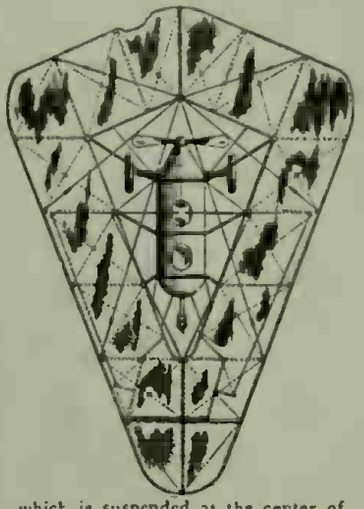


ing thru the film, cause corresponding variations in a battery and telephone receiver circuit, by virtue of their action on a selenium cell placed behind the film.

A Non-Capsizing Airplane.

(No. 1,284,373, issued to Platon Lazarides.)

The design of this airplane may be of the biplane type. The inventor provides a triangular form of wing, both of which are similar in shape and area, the center of the wings being open, so that the aviator can see upward as well as sideways and downward. One of the principal objects of the inventor is to provide a flying machine such that if the engine should stop in mid-air, it would then become possible for the airplane to settle to the surface of the earth in much the same way as a parachute does. This is accomplisht by carefully balancing the entire plane, and the ear or body

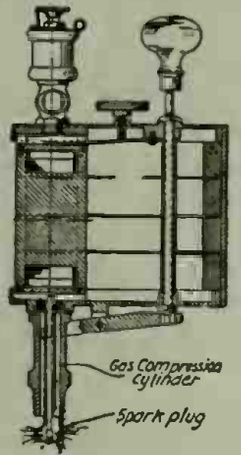


which is suspended at the center of the wings.

Spark Plug and Generator Combined.

(No. 1,290,190 issued to Albert B. Herrick.)

This interesting patent covers a very ingenious gasoline engine spark plug and generator combined, which is operated by the compression of the engine. In other words, this device includes an electro-magnetic generator similar in principle to a magneto which is adapted to be automatically operated by the com-

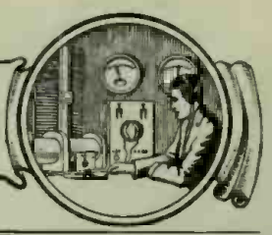


pression of the gases in the cylinder of an internal combustion engine. In the form shown, the generator constitutes but one coil wound on a soft iron core. This is surrounded by a series of strong steel magnets. At the base of the generator there is a threaded terminal which fits into the spark plug orifice of the gasoline engine, so that the compression can operate therein to push against the piston member.

www.americanradiohistory.com



WITH the AMATEURS



Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light-toned ones. We pay $3.00 each month for the best photos. Address the Editor, "With the Amateurs" Dept.

"Amateur Electrical Laboratory" Contest

THIS MONTH'S $3.00 PRIZE WINNER—N. NUSHAWG

HEREWITH are three views of my "Chemical Laboratory." I think it will be needless for me to give a description of the contents of my laboratory as I had the view so photographed as to cover that part. A brief outline or history of my laboratory I think would not be out of place. The "Lab." as you see it in the accompanying views is an accumulation of five years of experimental work. My first laboratory consisted of an old wash-stand, of which a part can be seen directly behind "yours truly" in the view in which I am standing. Year by year I added to the aforesaid wash-stand, as my finances would permit, until today I have what I consider a model "Amateur Chemical Laboratory."

My laboratory is not only a place which affords me much amusement but is also my "Study Hall" and my "College of Chemistry" combined in one. I maintain a schedule of study which embraces two hours each evening, including the study of chemistry, electricity, biology and other studies interesting to those contemplating a life of science.

Two articles which I would like to call to your attention, noticeable in the general view of my laboratory, are first: the electric furnace constructed from the description found in the April, 1918, issue of the ELECTRICAL EXPERIMENTER. This furnace will be found on the ledge below my apparatus shelf in the right hand side of the picture. The other article is the hydrogen sulfid generator, which will be observed beside my specimen cage just beneath the window (to the left). I am sending a separate description of this apparatus to the Editor, hoping he will see fit to publish the same in "your magazine"; so keep an eye peeled for it.

This laboratory is located in the cellar of my home and is twenty-two feet in length and fourteen feet in width. It is constructed of plaster board and has a four inch air cushion around it on three sides, so as to protect it against any dampness from the cellar. It is heated by a furnace pipe that you will notice running thru the laboratory. It is fitted with electric lights for general illumination and a gas lamp for use in the printing of photos. I have gas and running water at hand. A hood is also among the apparatus; this serves in eliminating all obnoxious odors.

I have been taking the ELECTRICAL EXPERIMENTER since the August issue of 1915, and have each copy since that time. I find it to be the best magazine in its field and have highly recommended it to my friends, gaining the "E. E." quite a few friends by so doing. I have found the "Experimental Chemistry" course by Albert W. Wilsdon very interesting, having followed and studied each lesson since the first.—N. Nushawg, 534 Arbor Ave., Dayton, Ohio.



www.americanradiohistory.com

Science in Slang

3. The Specks in Space

By EMERSON EASTERLING



T was one of those clear bright summer nights when the moon and stars stood out against the black background of the sky, casting a silvery light upon the faint landscape. We were motoring along a highway, and as the sky loomed out as the cynosure of the time, our conversation drifted to astronomy, being of the scientific trend, and our company being more or less scientifically inclined. Pointing to the moon, Stokes made the remark, "Old girl, since Adam quit rubbing his eyes and became aware that he was a sentient being your reflections have permeated space and we have become familiar with your lunar highness. Lovers have sworn their LOVE by you, and coyotes have howled under your rays. But not until the spectroscope shows up and dissects the moon beam, laying its vibratory secrets bare before us, we were not so sure after all but that you were green cheese, as the story book affirmed.

"The old time Chinks were the first guys to finger around and get on to the ways of the welkin—in fact they looked right thru the welkin and got wise to such things as eclipses and other primary stuff of the great all-around. It was reported that two old timers named Hi and Ho who profest to be 'there' on the astronomical dope failed to inform their boss, the Emperor of Cathay, of the eclipse that came around unannounced, and it is further stated that according to the regulations of the country, the men were forced to suffer the amputation of their heads.

"Next in order came the Chaldeans, who claimed to be wised up on the aerial phenomena, and who were able to predict eclipses and so forth. They blew their horn and left some records that are real amusing and historically instructing, but they started the ball so that we hear from such guys as Thales, Anaximander, Pythagoras, Anaxagoras and Eudoxus, Hipparchus, Meton and a few choice more astronomers and not from other lines—of course we have heard from some of the birds in other lines, but as a whole they were star gazers and dreamers.

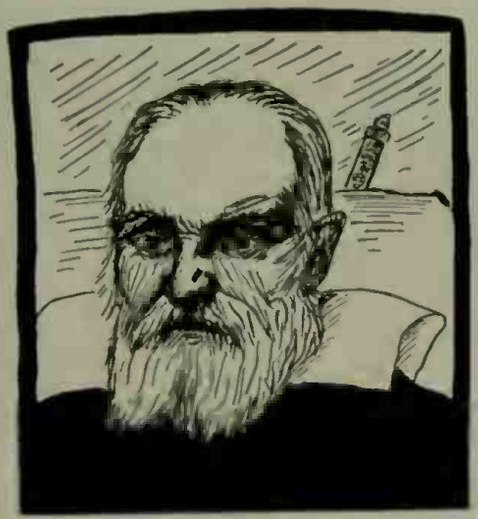
"Then we read of the endeavors of the Egyptians, from the school at Alexandria, and of Ptolemy and his ideas. You know he was the duck that was guilty for the Epicyclic System, which has it down in such a manner that the believer is led to accept the statement concerning the revolution of the planets around a center that is itself doing the merry-go-round stunt. From his standpoint he was right—the only trouble with him was that he overlooked, while gazing so far into the heavens, that our little elongated spheroid was one of the ethereal company in motion with the rest. But the old boy unhitched the old plugs with which Apollo had pulled the old glare around and run the brow wrinkles in other directions when he let loose with his treatise 'Almagest'. All this was way back in B. C. about 200.

"On astronomy, and more so on astrology, the Gypsies were 'there', but to the Greeks we owe the coining of the word 'ASTRONOMY', from the word *νόμος*, or nomos, which means LAW; and *αυγρου*, or astron, which means star or + we get the same which means Star-Law. From the Greeks spring Thales, the man who stands out in the first discoveries of the electrical phenomena, and who was so good at the heavenly twinklers that he was termed the Father of Astronomy. It was him and not Chrissy Columbus that told the World in general that the globe that we now know as the 8,000 mile in diameter ball of dirt and water (which is not necessarily mud) was round instead of a flat chunk upon the shoulders of Atlas. It was he who determined when the equinoxes and the solstices were due to arrive, and he knew beforehand when the famous eclipse of the Sun was to occur—the one that caused the Lydians and the Medes to throw up the sponge in their famous battle, you've read of the incident in history. Then the sundial was invented by a Greek, Anaximander.

"Getting back to the history of the thing we see a poor guy gazing up thru a dilapidated old farmhouse roof—where there was no roof—and thinking. Well, he thought so hard that we now still read of the Copernican theory of the universe. He stuck our planet in with the rest of the whirling globes and fireworks. He got a hunch from Pythagoras.

"Brahe then came along and modified the theory of Copernicus and cut out the 'cycles and epicycles' stuff, and as he was not housed up in a farmhouse he built a magnificent observatory. Then came the apt pupil of Brahe's, Kepler, who compounded a pile of laws and stamped his cognomen on history,

"After a while Galileo grew up from the skipping rope and marbles age and invented the telescope and pendulum. Looking thru the glass instrument he found that Jupiter had a moon—not the kind that showed up when some of his marbles collided with too much force, tho. After he slipt us a handful of physics and astronomy and the like we become aware that from the dressing room of Life there steps out a Sir Isaac Newton, who saw the apple fall and told us all about gravitation. Of all the 'Big Bugs' in astronomy, as well as mathematics, we lift our hat a little higher to Ike."



Galileo, the Bird Who Defied the World by Telling It that It Turned Around Instead of Standing Still, as Was Thought.

"I once read of the Arabians as being up on the Astronomical dope," I ventured.

"Yes, they were," Stokes replied. "A duck by the name of Ulugh Beg, who was not an ugly beggar but an astronomer, catalogued a bunch of stars. They took to that and astrology, like the Egyptians and Moors.

"Then Laplace topt off Newton's 'Principia' with his *Mécanique Céleste*.

"Naturally, the first thing to be considered is the Sun. The savages recognized it as the means of life on our planet (of course they knew of no other) and worshipt it as their God, in the same manner as we do the $, only they openly acknowledged it. In plant life we are aware of an attraction by it. Only the blind cannot see the effect it has upon everything in general. Now, with a lot of the experiments behind us, we have it figured out that we are 93,000,000 miles from Old Sol, and that the hot old



Ike Newton, the Gink Who Invented Gravitation by Means of the Cider-Fruit.

boy is composed of much the same material as our Earth, and we also have it doped out that the temperature up at the Sun arrives at the twelve thousand mark, F. It has a 'photosphere' where we have our hydrosphere and a 'Chromosphere' where we have our atmosphere. The mathematical wonders have it down in their note books as follows for the weights of the Earth and Sun, respectively: 6,000,000,000,000,000,000,000 and 2,000,000,000,000,000,000,000,000 *tons*. To reduce that down to ounces would take Steinmetz at least a second—you know him. Then the candle-power looks like this on paper: 1,575,000,000,000,000,000,000,000,000,000."

"How would you say that if you did not have your pencil along" asked Bender.

"Well, the first, replied Stokes, looking down at his paper, "is six sextillion. The

(*Continued on page* 69)

www.americanradiohistory.com



THE ORACLE

The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addrest to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

REWINDING TELEPHONE MAGNETO.

(993) Walter F. Hawley, Buffalo, N. Y., writes us:

Q. 1. How can he rewind a 3 bar telephone magneto to produce 10 volts?

A. 1. This question cannot be answered exactly, excepting on one condition, and that is that you would need a magnetomometer at hand with which to measure precisely the strength of the magnetic flux in maxwells per square inch of pole-face area.

We can suggest from our experience in this line, however, that the armature be wound full with No. 17 to 18 B. & S. gage S. C. C. or enameled magnet wire. This would be suitable for a potential of 8 to 10 volts. Of course, the voltage can always be increased by raising the speed, but naturally there is a limit to this, as the machine will not safely stand too high a speed.

A. C. SOLENOID.

(994) Stanley Dohrzynski, Cuyahoga Falls, Ohio, asks the Oracle:

Q. 1. For data on winding a small A. C. solenoid about 3 inches in diameter and 3½ inches long, with a ⅝ inch iron core.

A. 1. Unless such an A. C. electromagnet is very carefully designed, which would require elaborate calculations, and also unless it is carefully and very exactly built according to these specifications as computed, then the current taken will vary considerably from that calculated. Also in the case of the solenoid, with a movable core, the current will vary from a very high value when the core is just entering the coil, down to a certain minimum value, when the core is pushed all the way into the coil.

The only thing we can suggest in your case would be to experiment with several sizes of wire. For the size of solenoid you have in mind, you might try winding it full with No. 18 D. C. C. magnet wire. The weight which such a solenoid could lift with the core all the way in the coil would probably be in the neighborhood of one-half pound. The iron core must be laminated, not a solid piece.

1 K. W. WIRELESS TRANSFORMER DATA.

(995) J. R. Johnson, McConnelsville, Ohio, writes this department:

Q. 1. Please give data for winding a 1 K. W. radio step-up transformer.

A. 1. We are pleased to give you herewith data on 1 K. W. close core step-up transformer.

The laminated sheet iron core should measure 15 inches long and 8¼ inches wide, and have a cross-section of 2 × 2 inches, or 4 square inches. The primary winding which should have taps taken off from each layer should comprise 344 turns of No. 10 B. & S. gage D. C. C. magnet wire. The secondary should comprise about 12 pounds of No. 32 D. C. C. magnet wire, thoroly impregnated with paraffin and beeswax while being wound into pies. There should be 24 pies or coils, each ¼ inch thick. This secondary winding should give 14,176 volts with 300 turns in the primary; 21,265 volts on 200 turns in the primary, and 42,530 volts with 100 turns in the primary in use. Of course, when the normal number of primary turns are reduced in order to raise the secondary voltage, a suitable iron core choke coil or impedance must be used in series with the primary winding in order to control the current, so that the transformer will not over-heat and burn out the windings.

The "June" Number of the Electrical Experimenter

Electrifying Our Battleships—The electrically driven U.S. battleship "New Mexico," by Charles M. Ripley, of the General Electric Co.

Problems of Telephotography—Written by an authority on the subject—Leroy J. Leishman.

"My Inventions"—No. 5, by Dr. Nikola Tesla, himself.

In the Wonderland of "Tin Can Toys"—by George Holmes.

Photographing Nauen's Radio Signals in America—A Startling Scientific Achievement.

Close-Ups of the Newest Scientific Movies—The Rôle of Electricity and Science in Photoplays.

How American Electricians Solved the "Submarine Detector" Problem.—Illustrated.

A New "Pocket Wireless" That Actually Works—with photos of the Apparatus in Use.

Rogers Underground Wireless for the Amateur—by H. Winfield Secor. Don't miss this article—It answers all the "Radiobug's" questions.

Improved Capillary Battery—by Thomas Reed.

The New Kolster Direct-Reading Wave Meter and Decremeter.

Choke Coils—How to Design and Build Them, by Prof. F. E. Austin.

Experimental Mechanics.—Lesson 12. Twist Drill Practise, by Samuel D. Cohen.

The Audion—How to build and exhaust them, with Graphs for different tubes, by C. Murray.

2 K. W. STEP-DOWN PIPE THAWING TRANSFORMER.

(996) Joel H. M., Carney Point, N. J., inquires:

Q. 1. Can you supply data on a 110 volt, 60 cycle, A. C. step-down transformer for pipe thawing, the secondary giving about 12 volts.

A. 1. We give herewith data on the construction of a 2 K. W. transformer suitable for operation on 110 volt, 60 cycle, A. C. The secondary is suited to develop a current of about 13 volts and 150 amperes.

The primary winding of this transformer consists of 13½ pounds or 244 turns of No. 8 B. & S. D. C. C. magnet wire, or 2 No. 11 D. C. C. wires can be wound side by side and connected in parallel. The laminated sheet iron core, on one leg of which the primary is wound, should measure 17½ inches long by 8¾ inches wide, and have a cross-section of 2¼ × 2¼ inches.

The secondary winding for this transformer should comprise 31 turns of No. 0 B. & S. gage D. C. C. magnet wire, and will develop a current of about 13 volts and 150 amperes. If this is too difficult to wind on, 2 No. 3 wires may be used or 4 No. 6 wires, connecting these wires in parallel.

REWINDING DYNAMO.

(997) A. C. McLellan, La Porte, Ind.:

Q. 1. I want to know what size wire the armature or field or both will have to be wound with to get 40 volts and as much amperage as possible from a dynamo as follows:

Field is 6 pole, now wound with No. 20 D. C. wire, 1¼ pound to the pole. The armature has 28 slots, wound with 28 coils, parallel lap winding, and has 2 brushes at an angle of 60 degrees from each other. Each coil is wound with 20 turns of No. 20 D. C. wire. Commutator has 28 bars, diameter is 4¾ inches, length 3 inches, and at a speed of 2,000 R.P.M. it now generates 105 volts and 9 amperes. The dynamo is shunt wound, and when wired for 40 volts I want it shunt also. It seems to pull very hard now without any load on it at all.

A. 1. We would advise as follows concerning the rewinding of your 105 volt, 9 ampere dynamo:

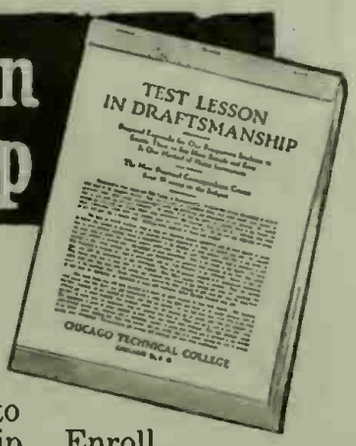
For 40 volts the field should be rewound with the same amount of wire, or 1¼ pounds per pole of No. 15 B. & S. gage D. C. C. magnet wire. The armature should be rewound with the same number of coils and in the same fashion or style of winding as previously used, but each coil should be composed of 7 turns of No. 15 B. & S. gage D. C. C. magnet wire.

You mention that the dynamo armature seems to turn very hard without any load on it at the present time. This most likely is not due to any electrical reasons, but merely mechanical ones. We would suggest that the bearings be carefully inspected; also on some small dynamos fitted with a number of brushes, the brush friction is made too great, and they should be readjusted so as to have just sufficient spring tension against the commutator to eliminate any undue sparking. In some cases,

(*Continued on page* 50)

www.americanradiohistory.com

FREE Test Lesson In Draftsmanship



Send for this free lesson which explains the Chicago "Tech" method of teaching Draftsmanship by mail. Positions at big salaries are now waiting for competent men. Even draftsmen of limited training and experience are snapped up and paid good salaries. If you are dissatisfied with your opportunities, learn Draftsmanship. Chicago "Tech" will train you in the most practical way in the shortest time. Mail the coupon today and let us tell you about the Chicago "Tech" method. The free lesson will show you how well equipped you are to follow Draftsmanship. Enroll in the course only if you decide that you can take it up to advantage. No cost, no obligation on you to make this investigation. Send the coupon.

$25 to $100 a Week

Draftsmen always command good salaries. And now when American industries are to be called upon to meet vast foreign and increased domestic demands, the opportunities are greater than ever. This is the time for you to prepare for a better position—a higher salary.

Come to the College or

Learn At Home

Hold you present position while training. Our experts will instruct you by mail. Only your spare time is required. You are directly under practical draftsmen and engineers. You are taught exactly the work required in the drafting rooms of big concerns. No time put in on unnecessary studies. This means thorough instruction and early graduation.

Easy Payments

The fees for Chicago "Tech" Courses are very moderate—and you can pay on easy terms. And also, you obtain in a few months what it would take several years to acquire by ordinary methods. You can get an early start. You are soon ready to take a paying position and to quickly get back the cost of your course. Then keep on earning more.

FREE Instruments

Every student of the Chicago "Tech" mail course in Draftsmanship receives this set of instruments, or a cash credit in case he already has a set. These instruments are of the same make and sizes as are used by high salaried experts in drafting rooms of factories, shops, railroads, etc. You use them while learning—then take them right into your practical work.



Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Splendid opportunities open now. Send coupon and get all the facts.

Learn All This in Spare Time

Principles of the Automobile. Every point made clear about the basic principles of propulsion—steam, gas and electric cars. Power transmission systems in pleasure and commercial cars, etc., etc.

Gasoline Engines. All about the different types. A complete course in gas engine construction, operation and repair.

Power Plants and Transmissions. Application of power by 4-6-8-12 cylinder engines. Types of clutches, gears, drives, axles, etc.

Carburetors and Fuel Supply Systems. All methods demonstrated. Fuel values. How to test. Gasoline and air mixtures. Regulation, care and management, etc., etc , etc.

Lubrication and Cooling All about oils and how to test them. Splash and circulating systems. Operation in different cars explained. Diagrams and tables. Cooling systems completely illustrated, etc.

Batteries. Electrical principles explained. Instructive diagrams of wiring and connections. Coils, condensers, vibrators, etc., etc.

Magneto Ignition. Principles and practical operation of various types and systems with diagrams. Generation of current. Field, armature, high and low tension, all explained. Complete in every point.

Starting and Lighting Systems. All modern methods. Starters—spark, mechanical, air, acetylene, electric, battery—shown in detail with diagrams and full explanations. Charging. Motor and generator adjustments, etc., etc.

Know How to Find and Fix Troubles

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men, and men who know how to inspect cars. This course makes you proficient. Prepares you to take a job as an expert. Not enough competent men now available.

WRITE Send the coupon and get catalog and all information about the Course, the small fee and the easy terms. All this sent on request. Mail coupon now.

Send the Coupon—Now

The sooner you are prepared the sooner you will be holding a job that pays a large salary and opens the way to advancement. Many executives, general managers and superintendents began as draftsmen.

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send you the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything.

The coupon will bring the Teet Lesson, free. Also information about the profession of Draftsmanship and detailed facts about Chicago "Tech" methods, the fees, terms, etc. Mark with X the branch you are interested in—or if in doubt about which course to take, write a letter stating facts about yourself and asking our advice which will be freely given. Mail either the coupon or letter today.

CHICAGO TECHNICAL COLLEGE,
545 Chicago "Tech" Building, Chicago

Without obligation to me, please send me your FREE Test Lesson and other interesting literature covering the subject indicated below.
Mark X opposite work in which you are especially interested.

☐ Architectural Drafting	☐ Plan-Reading—Building
☐ Machine Drafting	☐ Plan-Reading—Shop Men
☐ Electrical Drafting	☐ Estimating
☐ Structoral Drafting	☐ Surveying
☐ Sheet Metal Drafting	☐ Map Drafting
☐ Builders' Course	☐ Autos and Gas Engines

Name.....

Address.....

City.....State.....

College or Home Study? State which.....

Chicago Technical College 545 Chicago "Tech" Bldg. Chicago, Ill.

www.americanradiohistory.com

Thousands of Wonderful Opportunities in the Electrical Field

The Trained Man Is Needed Everywhere

By L. L. COOKE,
Chief Engineer, Chicago Engineering Works

BUSINESS conditions throughout America and even the world today are such that there are now truly wonderful opportunities for trained men in the electrical field. The electrical business has grown so fast and electricity is being continually applied to so many new uses that the demand for trained electrical men is growing faster than the supply.

Even on the farm electricity is now becoming common and thousands of farm lighting and power plants have already been installed. This shows how broadly electricity is applied today, and suggests something of the very great demand for hundreds of thousands more of trained electricians.

"Where will we get the men," is the question heard on every side. Electrical Manufacturers are spending thousands of dollars a week advertising merely for help. Look at the "Help Wanted" columns of any newspaper and see for yourself the demand for trained men. The salaries paid to young men with a thorough knowledge of electricity are unbelievable. The size of the pay envelopes going into the pockets of electrical workers every week reflects the scarcity of men to fill these responsible positions. So, not only is the electrical field greatly vacant now due to the absence of electrical men enlisted in the war services of our government, but it will be more greatly vacant when war's results are counted, and the need for men to fill the industrial places of our soldiers and sailor boys will swell the demand.

Moreover, the reconstruction and readjusting periods to follow in the war's wake are going to increase the employment of electrical workers beyond even the natural immense requirements. Electricity is yet to do its biggest services to the world after the war. Tho unlimited are its boundaries now, electricity and men who know its functionary phases and operations will have even wider scope and opportunity for years after peace is declared.

The most vital question for the young man of today to answer is not "Shall I enter the electrical profession?" but "What is the quickest, easiest and surest way to become a trained electrical man?" Time was when it took from three to four years to turn out an accomplished electrician who could be entrusted with any job that came along. Only a few years ago it used to cost thousands of dollars to make an accomplished electrician, which amount was made up in expensive tuition, board, etc., as well as money lost in non-production while the student was learning. Hundreds of thousands of dollars were lost in this manner because the student, seldom, if ever, is a producer while studying. This means a tremendous loss to the nation, as a minute's reflection will readily show.

Correspondence instruction has changed all this. By this method the student wastes no time on unnecessary branches. He gets exactly the training he will use in practical work and throughout his entire course he has the direct personal instruction of specialists in the branch he has selected.

Further, he can do his studying at home, in his spare time. He does not have to give up his regular job until he has qualified as a Certificated Electrician and is ready to enter his new profession. Think of the thousands of dollars this one great feature of correspondence instruction has saved this country in the past year alone.

I urge every young man with ambition and pluck to grasp the opportunity that present conditions offer the electrically trained man. Don't hesitate because of age or experience. Young men, boys and old men are needed and must fill the gaps to keep business going. Do your part. Prepare yourself for a real position by specializing in some branch of electricity. All you need is a few months' practical, snappy instruction from a competent engineer and you will be ready to go after some real money. But do it now. Our boys are returning filled with ambition, strong and healthy after two years' out-door living. How can you hope to compete throughout the reconstruction period without the special knowledge and advantages training will give you?

The Chicago Engineering Works are ready to help you. A specially designed course has been prepared that will fit you in the shortest possible time to take up the extremely interesting and profitable work as a Certificated Electrician. The course is the result of many years' teaching of young men in this vast field. It is intensely practical. It is highly condensed, simplified, up-to-date and complete. You can make a splendid success in this study, and the school will guarantee, under bond, to return every cent paid for tuition, if you are not entirely satisfied when you receive your Electrician's Certificate granted you as a graduate of the school. We teach contracting and electrical drafting along with the course and hundreds of our graduates are now successful contractors.

You can take the entire course in your spare time. No interference with your regular duties. We understand just what you must know and have devised a really wonderful way of instruction by mail. We have trained thousands of men and will train you to your complete satisfaction or the course will not cost you one cent.

Remember, that you will not be under the slightest expenses except the tuition price. A splendid Electrical Outfit is given free to every student and much of the training is done by actual work with this outfit. You have no car-fare or living expenses as you would have if you studied at a trade-school. You don't have to buy your outfit, or pay for the maintenance of expensive school equipment as you would elsewhere. The electrical outfit which we give every student includes Electrical Tools, Instruments, Materials, etc., and is given absolutely free.

The price of the course, you can pay in small installments if you want to—in other words, you can pay as you go along. These payments you can take out of your salary which you receive from your regular employment, it not being necessary to give this up until you are fitted and ready to take a good position as a real electrician.

One excellent feature of the assistance the Chicago Engineering Works is giving young men to help them succeed is the free employment service. The standing of the school is so high and the quality of students so well known that many firms rely entirely upon our graduates to fill vacancies in their staffs. We are continually receiving requests from employers to send them trained Electrical men. We assist our students to good positions and keep in touch with them for years, helping and advising them in every way possible.

I cannot urge all young men too strongly to get into the field of electricity. I know the vast opportunities for bright men and the opportunities have never been better than they are now and will be for the next ten years. The industry needs you and will give you a good chance to make a success of your life. Write us and let us tell you all about what we can do for you.

We have just prepared a new book on Electricity and its Opportunities and I want to send you this wonderful book—FREE. Write me personally telling me just what you are doing and what you would like to do. I'll gladly answer your letter myself and give you the benefits of my many years' experience in this field. But whatever you do, don't neglect the golden opportunity now offered live men. Address L. L. Cooke, 443 Cass St., Chicago, Ill.—Adv.

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

BE A CERTIFICATED ELECTRICIAN



A Real Position Like This—For You

The country needs thousands of trained, Certificated Electricians to fill good positions—and at big pay. It's all a matter of knowing how, and I will teach you by up-to-date, modern instruction. You can learn at home, without interfering with your regular work, by my highly successful method of *Home Instruction* in *Practical Electricity*.

Prepare NOW and be ready in a few months to earn your $46 to $100 A WEEK

Send for this Book

My book, "HOW TO BECOME AN EXPERT ELECTRICIAN," has started thousands of young men on the way to splendid success. A new edition of this has just been printed. I want every young man interested in Electricity to have a copy, and will send you one, ABSOLUTELY FREE and PREPAID. Write me today.

How I Train My Students

As Chief Engineer of the Chicago Engineering Works I know exactly the kind of training a man needs to enable him to get and hold good positions, and to earn big pay. I have trained hundreds of men who are holding splendid electrical jobs.

I give each of my students personal attention and a complete and thorough training. I give him a SPLENDID ELECTRICAL OUTFIT FREE, and much of the training is done by actual work. When my students graduate and receive their Certificate, they are ready for a real position. But *still more*, at any time you wish you can come to our splendidly equipped Electrical Shops for special training. No other school can give you this.

A Real Opportunity for YOU

Wishing is never going to make your dreams come true. You've got to *study*—to *learn*. A man is worth possibly $2 or $3 a day from his neck down—and no more; but there is *no limit* to what he can be worth from his neck up.

A *trained mind* is what gets the big pay. It is this training that you need, and I can train you in a few months. Are you ambitious to make a real success—then send me the coupon—today.

Electrical Outfit FREE

To every student who answers this ad I am giving a Splendid Electrical Outfit of standard size Electrical Tools, Instruments, Materials, etc., *absolutely free*. Furthermore, to every Electrical Student I give a truly *valuable* surprise that I cannot explain here.

Free Employment Service

I am continually receiving requests from employers to send them trained Electrical men. I assist my students to secure good positions. I keep in touch with them for years, helping and advising them in every possible way.

Write Now—Don't Delay

Delay never got you anything. Action is what counts. Get started—and get started now. Write me send me the coupon right NOW.

L. L. COOKE, *Chief Engineer*

CHICAGO ENGINEERING WORKS

441 Cass Street Dept. 25 Chicago, Ill.

YOU CAN DO IT

USE THIS "FREE OUTFIT" COUPON

CHIEF ENG. COOKE, Dept. 25, 441 Cass St., Chicago, Ill.

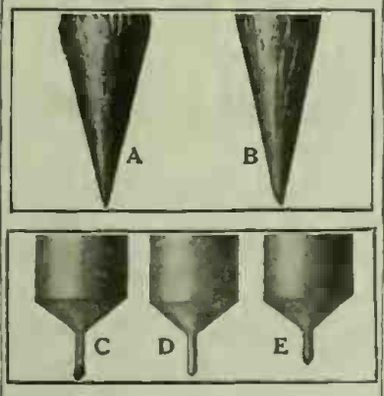
Sir: Send at once—fully prepaid and entirely free—complete particulars of your great offer for this month.

Name.....

Address.....

City..... State.....

www.americanradiohistory.com



Study these microphotographs!

A—New ordinary steel needle.
B—Ordinary steel needle after playing *one* record. *Note the worn point!*
C—New Sonora Semi-Permanent Silvered Needle. Note that the parallel sides (which are *not* tapered) always fit record groove perfectly.
D—Sonora Needle after playing *one* record. No perceptible wear.
E—Sonora Needle after playing over *fifty* records. Needle has worn down, but is in perfect playing condition.

Preserve Your Phonograph Records

THE INSTRUMENT OF QUALITY
Sonora
CLEAR AS A BELL

Semi-Permanent Silvered
NEEDLES
Replace steel needles!

They play 50 to 100 times and are used on ALL MAKES of steel needle records. Unequalled for convenience, economy, improvement of mellowness of tone and the increasing of life of the records.

Loud—Medium—Soft
30c per card of 5. In Canada 40c

FREE! Sample Sonora Needle will be sent FREE on request. Write for it

Sonora Phonograph Sales Company, Inc.
GEORGE E. BRIGHTSON, President
279 Broadway, *Dept. G.*, New York
Toronto: Ryrie Building

CAUTION! Beware of similarly constructed needles of inferior quality



Don't Grope for Words

We are all trying to SELL something—it may be brains, or automobiles, or soap—but words are the universal medium of exchange. LEARN TO USE THEM CORRECTLY—PROFITABLY. Get a command of English! Spend a few minutes daily with Grenville Kleiser's Mail Course in Practical English and Mental Efficiency. It will surely teach you how to

Use Good English—*and Win*

Enlarge your Stock of Words—Use the Right Word in the Right Place—Write Compelling Business Correspondence, Stories, Advertisements, Speeches—Become an Engaging Conversationalist—Enter Good Society, etc.

Ask for free particulars *today*.
We send them by mail. No agent will call.

FUNK & WAGNALLS COMPANY, Dept. 267, NEW YORK, N. Y.

Rider Agents Wanted

Everywhere to ride and exhibit the new Ranger "Motorbike" completely equipped with electric light and horn, carrier, stand, tool tank, coaster-brake, mud guards and anti-skid tires. Choice of 44 other styles, colors and sizes in the famous "Ranger" line of bicycles.

DELIVERED FREE on approval and 30 DAYS TRIAL. Send for big free catalog and particulars of our *Factory-direct-to-Rider* marvelous offers and terms.

TIRES Lamps, Horns, Wheels, Sundries, and parts for all bicycles—at half usual prices.

SEND NO MONEY but tell us exactly what you need. Do not buy until you get our prices, terms and the big FREE catalog.

MEAD CYCLE COMPANY Dept. D107 CHICAGO

THE ORACLE

(*Continued from page* 46)

also, the armature may rub against the field poles, and this can be easily ascertained by removing the armature and noting if there are any shiny spots on the field poles or armature core.

ELECTRIC ARC TEMPERATURE

(998) James G. Peck, Elmira, N. Y., says:

Q. 1. What is the temperature of the electric arc produced between two ½ inch carbons?

A. 1. In regard to data for building an arc light from two ½ inch diameter carbons to give you a temperature of 3,500 degrees Centigrade, any arc, large or small, gives about the same temperature roughly speaking; the large arcs using larger carbons simply giving a greater quantity of heat, but not a higher temperature. The electric arc will give you the greatest temperature of any ordinary source of heat known. The average arc, using ½ inch carbons, either cored or solid, consumes about 5 amperes, on 110 volts, and the candle power is about 1200.

Appended are some interesting high temperature sources of heat:

Bunsen burner	1,870 deg. C.
Oxy-coal gas flame	2,000
Oxy-hydrogen flame	2,800
Oxy-acetylene flame	3,500
Electric arc (furnace)	3,500

RADIO LOOSE COUPLER DESIGN

(999) Alvin Harrison, Albert Lea, Minn., asks:

Q. 1. Several questions on designing loose couplers for wireless receiving circuits.

A. 1. In standard practice it is usual to provide both primary and secondary coils with loading inductances, these inductances being either a separate part of the circuit, or else combined with the coupler windings themselves, preferably the latter.

The primary as well as the secondary circuits are, in the most efficient design of coupler, made so as to form a continuous coil capable of being tuned to the highest wave length which it is desired to receive. Any other form of loading inductance which is separate from the windings of the coupler only form a source of loss, for it requires a certain amount of energy (I^2R) to excite this separate loading inductance, and, as it does not form a part of the main coupler winding, and is not useful in producing a part of the common electromagnetic field which transfers the energy from the primary to the secondary circuit, as you will see, in any event then it must be a source of *unrecoverable loss.*

We would refer you to a very good article on "Building a 20,000-meter Undamped Receiving Set," by William Burnett, Jr., page 258, August, 1917, issue; also

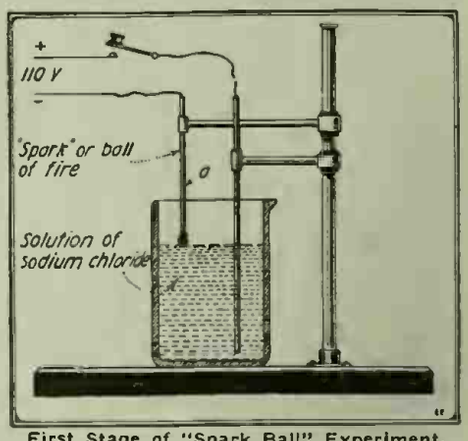
"The Design of Large Radio Receiving Transformers," by Chas. S. Ballantine, Radio Engineer, page 732, February, 1917, issue.

"The Calculation and Measurement of Inductance," by H. Winfield Secor and Samuel Cohen, parts 1, 2 and 3, which appeared in the March, April and September, 1917, issues.

PECULIAR SPARK BALLS.

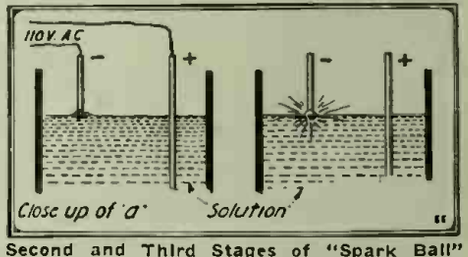
(1000) R. J. O., San Antonio, Texas, writes:

Q. 1. I am a reader of the ELECTRICAL EXPERIMENTER and desire some information regarding an experiment performed in my "Lab" some time ago which I am at a loss to know "the why and wherefore" of. Thus: I made a solution of Sodium Chlorid and water, in a small beaker. (See sketch.) Using a current of 110 volts and a small telegraph key to open and close the circuit, I connected it as shown in the "hook up." I proceeded as in sending a telegraph message and found that a rapid movement of the key produced a stream of what appeared to be sparks between the neg. (—) pole about 1/32 of an inch above the solution. The so-called "sparks" will continue to appear as long as the copper wire lasts. (It melts rapidly). My question is "What are those sparks?" If not sparks, what is it?



First Stage of "Spark Ball" Experiment.

A. 1. The experiment which you describe is nothing new and is well known to those who have experimented with electrolytic interrupters a good deal. This experiment can be performed not alone with sodium chlorid, but with almost every acid. Providing the current is strong enough, a ball of fire will appear at the end of one wire which touches the surface for the following reason: As soon as the point touches the liquid which has a more or less high resistance, the solution at this point immediately starts to boil. At the same time hydrogen gas is evolved, and the electric current setting fire to it explodes this minute quantity of gas, thereby giving rise to a small explosion. This phenomenon occurs in very rapid succession, and the explosions take place several thousand times per second. Mr. H. Gernsback some years ago obtained quite large "fire balls" of this sort by using a fine carbon pencil as one electrode.



Second and Third Stages of "Spark Ball" Experiment. The Theory of Its Action Is Very Interesting.

200 WATT TRANSFORMER DATA.

(1001) James Dicks, Delhi, La., inquires:

Q. 1. Please give me data on 200 watt step-up wireless transformer for operation on 110 volts, 60 cycles.

A. 1. The laminated sheet iron core for this transformer should measure, for a 200 watt transformer, 10½ inches long by 6½ inches wide and 1 x 1 inch in cross-section. The primary winding, placed on one of the long legs, should comprise 660 turns No. 15 B. & S. gage D. C. C. magnet wire. Before winding on the primary coil, the iron core leg should be insulated with four layers of oiled linen or Empire cloth.

The secondary winding should comprise 17 pies or sections, each ¼ inch thick, with paraffin paper discs between them when assembled. The size of the secondary wire should be No. 34 B. & S. gage D. C. C. and 3.7 pounds of secondary wire are required. There should be about 35,000 turns in the secondary, and the secondary voltage with

(*Continued on page* 52)

www.americanradiohistory.com



How Would You Train 50,000 Employees?

Western Union's Big Problem Think of an army of 50,000 men and women, differing greatly in ability, adaptability and previous training — remember that all of them were self-supporting wage-earners, who could not afford to let anything interfere with their regular occupations — consider that it was their employer's desire to make intensive training practical for all, without lessening their present efficiency—and you have some idea of the complex employe-training problem that confronted the WESTERN UNION when it undertook to make it possible for any of its 50,000 employes to acquire a higher degree of efficiency in their work.

How it was Solved As WESTERN UNION found that there were no courses covering completely and thoroughly the highly specialized telegraph business, it had special texts written by its own experts, who thus became the personal instructors of its employes. After careful inquiry, the Company decided that the correspondence instruction method would give all employes an equal opportunity, while its flexibility would meet any individual needs and circumstances. And finally WESTERN UNION arranged to loan the price of the Course to deserving employes who might be unable to meet even the moderate fee asked for training.

The actual conduct of courses and instruction was entrusted to the American School of Correspondence, Chicago, whose Educational Charter and 22 years' successful experience eminently fitted it to carry out WESTERN UNION'S plans to make special training possible to any of its 50,000 employes.

Don't Dodge Promotion

Whatever occupation you would prefer to follow you can't dodge the fact that you're dodging promotion — dodging the job ahead, with its guarantee of better pay — so long as you refuse to train yourself thoroughly for the work you want to do. The man or woman with training is bound to succeed—for trained workers are the scarcest commodity in industry. A glance at the "Help Wanted" columns of your daily paper — *a question put to your boss* — will quickly prove this. The American School can properly develop your natural ability —make you a thoroughly skilled worker. A small part of your spare time—some of the hours you now waste—invested in systematic study will soon fit you for the position, and pay, you want.

Make This Test

We will train you on a make-good basis—allow you to test out the practical value of any Course by covering the first ten textbooks without risking one cent. This means that if you're not satisfied with your progress — if you find you're not getting money-earning training from the course — we'll refund every cent you've paid us. Full satisfaction or your money back is the only basis on which we accept students. If the fairness of this offer appeals to you—as it has to thousands—check and mail the Coupon for Free Bulletin. You assume no obligation.

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. W7445 CHICAGO, U. S. A.

TRAINING-THE KEY TO SUCCESS

Please send me booklet and tell me how I can fit myself for the position marked X: ASC

.....Western Union Courses	.....Steam Engineer
.....Telephone Engineer	.....Lawyer
.....Draftsman and Designer	.....Business Manager
..... Automobile Engineer	.....Cert. Public Accountant
.....Automobile Repairman	.....Accountant and Auditor
.....Airplane Mechanic	.....Bookkeeper
..... High School Graduate	.....Stenographer
..... Fire Insurance Expert	..... Gen'l Education Course
.....Sanitary Engineer	.....Com. School Branches
.....Heating and Ventilating Engineer	.....Electrical Engineer
	.....Electric Light and Power Superintendent
.....Master Plumber	.....Hydroelectric Engineer
.....Civil Engineer	.....Wireless Operator
.....Structural Engineer	.....Architect
.....Mechanical Engineer	.....Building Contractor
.....Shop Superintendent	

Name .....

Address .....

www.americanradiohistory.com



Tires at Wholesale

Save 1/3 Your Tire Cost

	Tires	Tubes	"Armor"
30 x 3	$13.60	$2.90	$3.00
30 x 3½	17.00	3.45	3.60
32 x 3½	19.65	3.60	3.60

Other sizes quoted on request.

Order these 5,000 mile Beacon "Rib-Skid" Tires, Red Tubes and "Inside Armor" at above prices on money-back approval, or write at once for full description and our plan of selling First Grade, Fully Guaranteed Tires, etc., direct-to-you at wholesale prices. Give size of tires and name of car. Address

MODERN TIRE CO., 659 7th Street, RACINE, WIS

Pocket Tool Chest

Strong Knife *Wire Pliers*
Leather Punch *Hoof Hook*
Sheeding Awl *Wire Cutter*
Screw Driver *Screw Bit*
Alligator Wrench

9 Tools in 1

Each a strong, practical tool. As easily carried as a 3-blade knife, and has no more parts. Length, 4 in. Pliers and wire cutters are drop-forged tool steel — cut barbed fence wire as easily as 8-inch pliers. Blade is tempered cutlers' steel. Each tool works independently. Once used, always carried by Electricians, Railway Man, Motorists, Mechanics, Horsemen, Sportsmen.

Flican Wunderknife

Sent postpaid in U. S. for $1.75 (add 5c if insured). Highest quality construction, fully guaranteed.

Elican Specialty Co. 874 Merchants Bank Bldg. Indianapolis, Ind

BIG PROFITS for YOU in HB BATTERY CHARGING

Start now to build big battery business. Opportunities best this season—more old cars driven—new Fords with storage batteries. HB users are easily clearing

$100 to $200 Extra Profit Every Month

Some even more. Get in the game! This HB 7-Battery Charger recharges 1 to 7 auto batteries at once. Current cost 12c to 15c per battery. Motorist pays 75c to $1.50. Figure your profits. No electrical or mechanical experience required to operate. No expensive renewals or adjustments.

$25 Puts This Money-Maker in Your Garage on Money-Back Guarantee

Balance in 9 monthly payments of $20 each. Earnings easily pay for machine. Pin your $25 initial payment check to this ad and send today for trial order. You run no risk under HB Absolute Money-Back Guarantee. Don't delay. Get busy! Get those profits!

HOBART BROS. CO., Box5E, Troy, O.
Successful manufacturers since 1893

POPULARITY FOLLOWS THE

UKULELE

If you play quaint, dreamy Hawaiian music or latest songs on the Ukulele you will be wanted everywhere. We teach by mail 20 simple lessons; give you free a genuine Hawaiian Ukulele, music, everything—no extras. Ask us to send the story of Hawaiian music. You will love it. No obligation—absolutely free.

The Hawaiian Institute of Music
1400 Broadway, Suite 1106, New York

BUILD A $100 PHONOGRAPH

CATALOG FREE!

Assemble your own Phonograph Do it yourself easily. Have the finest machine. Astounding saving. We give you the phonograph secrets. Complete instructions 10 cents.

ELECTRO MECHANICAL PARTS CO.
160 N. Wells St. CHICAGO

LANGUAGES QUICKLY LEARNED ON ALL PHONOGRAPHS

"Like learning a tune—and as easy." Our Disc Records repeat the correct accent and pronunciation until you know it. Family and friends enjoy language study by the

LANGUAGE-PHONE METHOD
And Rosenthal's Practical Linguistry

War has created unlimited opportunities for those who know languages. Prepare now to better your position or increase your business. Used and recommended by educators in leading colleges. Write for booklet and Free Trial Offer.

SPANISH, FRENCH ITALIAN, E TC.

THE LANGUAGE PHONE METHOD
931 Putnam Building. 2 W. 45th St., N. Y.

The Seneca MOTOR CAR

Built for the Owner **$990.00**

Simple, sturdy construction. Low cost of up-keep and operation. Cantilever springs in rear. Comfortable E-Z riding

4 cyl. - 27 H. P. 108 in. wheel base

Dealers Wanted Immediate deliveries. Fifth successful year. Increased output. Liberal newspaper advertising in dealers' territory. Wonderful opportunities. Write or Wire NOW.

THE SENECA MOTORCAR CO., 45 Seneca Factory, FOSTORIA, OHIO

THE ORACLE

(*Continued from page* 50)

all primary turns in use is 5,890. The secondary voltage is increased in proportion as the number of primary turns in circuit at any time are decreased. The secondary leg of the core should be well insulated with 10 layers of oiled linen before placing the pies in place.

NEUTRAL POINT OF D. C. DYNAMO AND A. C. MOTOR SPEED CHANGES.

(1002) R. G. LeTourneau, Stockton, Cal., asks the Oracle:

Q. 1. Several questions concerning the shifting of the neutral point on a D. C. generator and speed changes of induction motors.

A. 1. The neutral point on the commutator of the D. C. generator changes at least slightly with changes in speed of the armature as you mention, unless the machine has one of the following precautions taken in its design: The machine might have a very powerful field, which would cause a very even and rigid distribution of the flux at the pole tips; the machine might be provided with *interpoles*, such as provided on any one of the leading machines on the market at the present time, which tends to preserve an even distribution of the field flux, and thus to preserve a practically fixt neutral point, thus obviating the necessity for shifting the brushes, even on overloads of 50 per cent. Or again the machine might be provided with variable air gaps between the field pole tips and the armature, such as in the Stow design, where all of the field poles are geared together by means of worms and gear rods to a common handwheel on the top of the machine, which enables the field poles to be advanced toward or receded from the armature and the air-gap flux distribution varied.

You are correct in assuming that several different speeds can be obtained from an A. C. motor by changing the groupings of the field poles, i.e., by changing the number of poles, such as by causing the field to produce 4 poles, 6 poles, 8 poles, and so on. This system is adopted in some of the leading A. C. motors now on the market. You will find data on this subject by referring to books on A. C. machinery.

A. C. TEST FOR "SHORTED" ARMATURE COILS.

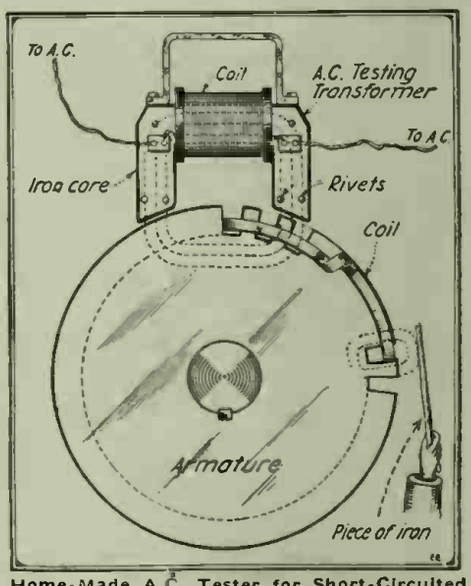
(1003) Earl E. Teater, Wheeling, West Va., writes the Oracle:

Q. 1. For data on a simple A. C. testing scheme for short-circuited armature coils.

A. 1. Herewith we describe an A. C. testing device for determining whether armature coils are short-circuited or not and which is used in repair shop work. The small transformer has a single winding on it, which is excited with alternating current suitably controlled by connecting it in series with a lamp bank or choke coil, etc. Using this transformer primary, as it may be called, and holding it in contact with the armature, in successive positions, as the armature is turned from coil to coil, there is set up thru the armature core a magnetic flux, which induces a current in the armature windings. If one of the coils happens to be short-circuited, as becomes apparent, this current will heat up the coil. Also by turning the armature a complete revolution and holding a small piece of iron against it, the coils being tested for short-circuits will be easily located, as the piece of iron held near the coil will vibrate, due to the resultant magnetic field set up by this coil and the current passing thru it. The transformer device should not be put in position nor removed while current is flowing thru the magnetizing coil of course.

To make this testing transformer, a laminated sheet iron core of the shape indicated in the diagram is built up, and it may be riveted at several points. It should have a width equal to the approximate length of the armature, and also a pole-face curvature as nearly like that of the armature core as possible. The winding on this transformer may, for a small size device to be used in testing out small magneto or auto lighting dynamo armatures, be composed of about 75 turns of No. 14 B. & S. insulated magnet wire.

A very satisfactory and simple test for short-circuited as well as open-circuited armature coils can be carried out by connecting a buzzer across the brushes, and thus testing from bar to bar with a 75 ohm telephone receiver. If a coil is short-circuited or partially short-circuited, then no sound or a weak sound will be heard in the telephone receiver. It has been found that this test will give better and more accurate

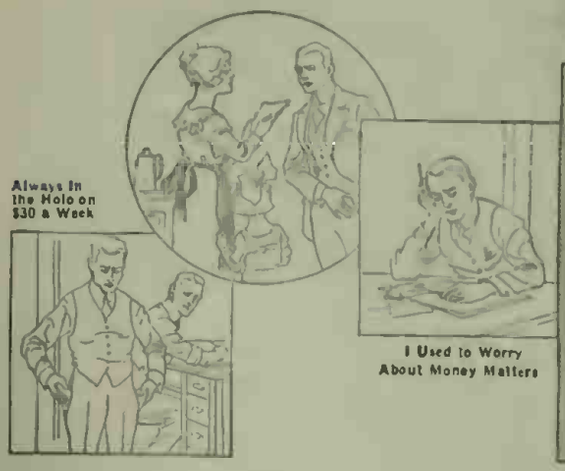


Home-Made A.C. Tester for Short-Circuited Armature Coils. The Materials Required to Build It Are Available About Any Shop. Its Action Is Simple, Yet Positive.

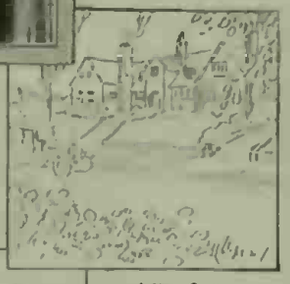
results in a minimum of time, than is the case where the Wheatstone bridge is used. Open-circuited coils will manifest their presence when the proper bars are bridged by a very loud noise in the receiver. It is common practice in many shops to use this test in connection with the 110 volt, 60 cycle A. C. lighting current, the necessary current being past thru the armature in series with a 110 volt lamp.

If you have a good voltmeter on hand or posibly an ammeter without the shunt on it, you can also make tests quickly for open or short-circuited coils or grounds by the bar-to-bar test, passing direct current thru the brush points on the commutator. For this work the armature is usually mounted in a testing cradle, comprising a wooden frame and one upright which carries a pair of adjustable copper or other brushes which will transmit the testing current to diametrically opposite points on the commutator, for the two-pole armature, or four points ninety degrees apart for a four-pole armature. In any case where the telephone receiver and A. C. or buzzer method are used, or the voltmeter method, the criterion of the tests for a perfect armature is to obtain a similar or very closely similar degree of sound in the receiver for each coil, or an equivalent similarity in the voltmeter readings for every coil on the armature. If any appreciable difference is noted in the meter readings or in the telephone, then the connections of the commutator, and also the leads of the coils should be carefully examined. Sometimes a high reading will result from a poorly soldered lead connection to the commutator bar, which on a superficial examination may appear to be a first-class soldering job.

www.americanradiohistory.com







"At Dawn the Answer Flashed on Me!"

How a young man jumped from $30 a week to $50,000 a year. His remarkable success he attributes to the way he uses his will. "What I've done, I believe anyone can do," he says.



THERE are only a few $50,000 jobs—yet of all the men in the country it is difficult to find enough to fill the few big jobs available. There are plenty of men for the $25-a-week positions—but the thousand-dollar-a-week openings "go begging." How this young man trained himself for earnings of $50,000 a year is one of the most interesting chapters in the annals of even present-day fortune making. This is the story told me, almost word for word, by the young man *who did it*.

"Three short years ago I was $5,000 'in the hole'—and earning $30 a week. I had a wife and two children to support, and I used to worry myself sick about the future.

"Today—it seems like a dream—all my troubles are over. I am worth $200,000—enough to keep me and my family in comfort for the rest of our lives. I own two automobiles. My children go to private schools. I have just purchased, for cash, a $25,000 home. I go hunting, fishing, motoring, traveling, whenever I care to.

"LET me say in all sincerity that what I have done I believe any one can do. I am only an average man—not 'brilliant'—have never gone to college—my education is limited. I know at least a hundred men who know more than I, who are better educated and better informed—and their earnings probably average less than $50 weekly while my income is over $1,000 weekly. I mention this to show that earning capacity is not governed by the extent of a man's education—to encourage those who have not had the advantage of a comprehensive education.

"What, then, is the secret of my success? Let me tell you how it came about.

"One day, about three years ago, something happened that woke me up to what was wrong with me. It was necessary for me to make a decision on a matter which was of little consequence. I knew in my heart what was the right thing to do, but something held me back. I said one thing, then another; I decided one way, then another. I couldn't for the life of me make the decision I knew was right.

"I lay awake most of that night thinking about the matter—not because it was of any great importance in itself, but because I was beginning to discover *what was wrong with me*. Along towards dawn the answer flashed on me and I resolved to make an experiment. I decided to cultivate my will power, believing that if I did this I would not hesitate about making decisions—that when I had an idea I would have sufficient confidence in myself to 'put it over'—that I would not be afraid of myself or of things or of others. I felt that if I could smash my ideas across I would soon make my presence felt. I knew that heretofore I had always begged for success—had always stood, hat in hand, depending on others to give me the things I desired. In short, I was controlled by the will of others. Henceforth, I determined to have a strong will of my own—*to demand and command what I wanted.*

"WITH this new purpose in mind, I applied myself to finding out something more about will power, and in my investigation I encountered the works of Professor Frank Channing Haddock. To my amazement and delight, I discovered that this eminent scientist, whose name ranks with James, Bergson and Royce, had completed the most thorough and constructive study of will power ever made. I was astonished to read his statement, 'The will is just as susceptible of development as the muscles of the body!' My question was answered! Eagerly I read further—how Dr. Haddock had devoted twenty years to this study—how he had so completely mastered it that he was actually able to set down the very exercises by which anyone could develop the will, making it a bigger, stronger force each day, simply through an easy, progressive course of training.

"It is almost needless to say that I at once began to practice the exercises formulated by Dr. Haddock, and I need not recount the extraordinary results that I obtained almost from the first day. You already know the success that my developed power of will has made for me.

"People sometimes worry because they cannot *remember* or because they cannot *concentrate*. The truth is, will power will enable them to do *both*. The man who can use his will can not only concentrate and remember, but can *make use* of these two faculties. And I want to leave this one word with you—no knowledge, no plan, no idea is worth a penny unless it is used—and it cannot be used unless some one's power of will does it!"

PROF. Haddock's rules and exercises in will training have been placed in book form, and I have been authorized by the publishers to say that any reader who cares to examine his startling book on will power may do so without sending any money in advance. In other words, if after a week's reading you do not feel that "Power of Will" is worth $3, the sum asked, return it and you will owe nothing.

When you receive your copy for examination I suggest that you first read the articles on: The law of great thinking; How to develop analytical power; How to guard against errors in thought; How to drive from the mind unwholesome thoughts; How to develop fearlessness; How to use the mind in sickness; How to acquire a dominating personality.

It is interesting to note that among the 225,000 owners who have read, used and praised "Power of Will" are such prominent men as Judge Ben B. Lindsey; Supreme Court Justice Parker; Wu Ting Fang, ex-U. S. Chinese Ambassador; Gov. McKelvie of Nebraska; Assistant Postmaster-General Britt; General Manager Christeson, of Wells Fargo Express Co.; E. St. Elmo Lewis; Senator Arthur Capper, of Kansas, and thousands of others.

As a first step in will training, I would suggest immediate action in this matter before you. It is not even necessary to write a letter. Use the blank form below, if you prefer, addressing it to the Pelton Publishing Company, 30-J Wilcox Block, Meriden, Conn., and the book will come by return mail. This one act may mean the turning point of your life as it has meant to me and to so many others.

Pelton Publishing Company,
30-J Wilcox Block, Meriden, Conn.

I will examine a copy of "Power of Will" at your risk. I agree to remit $3 or remail the book in 5 days.

Name .....

Address .....

.....

www.americanradiohistory.com



Men Wanted for Airplane INDUSTRY

Wonderful opportunities—great scope for advancement—and big pay—await you in the airplane industry. This does not mean actual flying, but in any and all of the various branches of the industry. It is the coming profession—the future means of transportation. U. S. Mail is already being carried by airplanes. Factories are springing up everywhere and trained men are in big demand.

Openings in Many Branches You can get into this profession while it is still in its infancy as a mechanic, engineer, repairman, instructor, inspector, builder, contractor, salesman or professional aviator. The minute you understand the science and mechanics of aviation you can step into a high-salaried position.



We Guarantee Our Training

We absolutely and unreservedly guarantee that our Home Training Course will enable you to qualify for a good position as soon as you graduate. The Course itself has been written by noted aeronautical engineers, and covers the entire fundamentals of practical aeronautics. Every lesson is written and illustrated so clearly that you cannot fail to understand it. **But see for yourself.** Take ten lessons. Then if you are not satisfied you are not out one cent. We guarantee satisfaction.

Prepare Now for a Big Future

Only by specialized instruction can you expect to succeed in aviation or in any line of business. Training alone will fit you for a big job—and NOW is the time to begin. Check and mail the coupon for Big Free Bulletin and Money-Back Guarantee.

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. F 7445 CHICAGO, U. S. A.

TRAINING THE KEY TO SUCCESS

Please send Free Bulletin and explain how I can qualify for the position checked. ASC

....High School Graduate	....Lawyer
....Electrical Engineer	....Business Manager
....Elec. Light & Power Supt.	....Certified Pub. Accountant
....Hydroelectric Engineer	....Accountant and Auditor
....Telephone Engineer	....Bookkeeper
....Telegraph Engineer	....Stenographer
....Wireless Operator	....Fire Insurance Expert
....Architect	....Sanitary Engineer
....Building Contractor	....Master Plumber
....Civil Engineer	....Heating & Vent. Engineer
....Structural Engineer	....Automobile Engineer
....Mechanical Engineer	....Automobile Repairman
....Shop Superintendent	....Airplane Mechanic
....Steam Engineer	....General Education Course
....Draftsman and Designer	....Common School Branches

Name .....

Address .....

Let Me train YOU in AVIATION



My advice to you is to start right now to take my

HOME COURSE IN AVIATION

and prepare to fill one of the big jobs later. Wonderful opportunities. Trained men in big demand. Prepare now for big future. Lessons are easy to understand. Write TODAY for my FREE BOOK, "The Science of Aviation," and I will send it and write you a personal letter that will interest you. Address:

Capt. G. F. Campbell, formerly Third Ace of the Royal Flying Corps.

CAPT. GEO. F. CAMPBELL, Chief Instructor, National Aero Institute, 538 S. Dearborn St., Dept. 7445, Chicago

"SEXUAL DISASTERS"

is something different. Actual cases from pen of a physician. Warns you against hundreds of sex evils in very plain language. More interesting than fiction. Sent immediately, postpaid, for $2.00. MONONGAHELA NOVELTY CO., Box A-565, MONONGAHELA, PA.

Popular Astronomy

Astronomical Distances

(*Continued from page* 25)

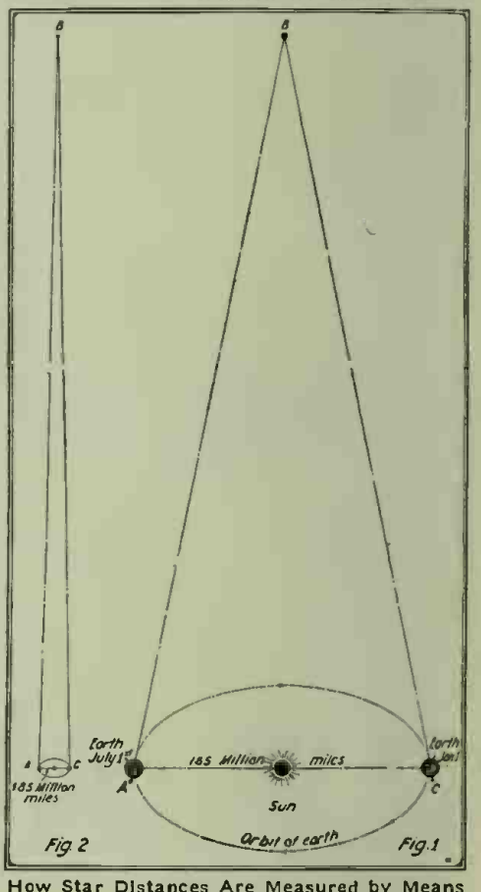
ured with considerable accuracy and is known to be four and a third light years. Tho there may be a few faint stars or non-luminous stars nearer to us than Alpha Centauri, and there is, in fact, one inconspicuous star known to be slightly nearer, the distinction of being the nearest of the brighter stars has long been held by Alpha Centauri. As our own sun continues his journey thru the universe the two stars (our sun is a star just like Alpha Centauri) will finally draw away from each other after many ages have past and some other sun of space will be our nearest star. The distances that separate the stars from each other probably average as great as the distance from the sun to Alpha Centauri. Within a sphere whose center is at the earth and whose radius is five parsecs, or about sixteen light years, there are only about twenty known stars. There is therefore small chance of collision among bodies that are so small in proportion to the tremendous intervals of space that separate them from each other. There is ample room for the individual stars to pursue their journeys thru space without interfering with each other's motion so long as they are as widely scattered as they appear to be in this portion of the universe. That our own sun has continued its journey thru the universe for some hundreds of millions of years without any catastrophe such as would result from closely approaching or colliding with another sun of space shows on how grand a scale our sidereal system is fashioned.

Stars that are ten, fifty or even one hundred light years from the earth are our near neighbors in space. They are the stars that show a slight displacement in the heavens or measurable parallax viewed from opposite sides of the earth's orbit. There are probably a thousand stars among the hundreds of millions of stars within reach of the greatest telescopes whose distances have been determined in light years by direct measurement of their displacement in the heavens resulting from the change of position of the earth in its orbit. The most distant of the stars are apparently immovable in the heavens showing neither the effect of the sun's motion or their own motion thru space. Methods for ascertaining the distances of many far remote stars and star-clusters have been devised, however, and some comparatively recent investigations have yielded determinations of the distances of these objects indicating that the diameter of the system of stars to which our sun belongs approximates to at least three hundred thousand light years. It is difficult to grasp the full significance of this fact. It means that hundreds of millions of the suns of space throng the visible universe at distances from us and from each other running into hundreds, thousands and even hundreds of thousands of light years. The light waves from some tiny object that we can just barely glimpse in one of our great reflectors may have started on their journey thru space over one hundred thousand years ago when men of the Old Stone Age inhabited our planet earth!

Astronomers have found as a result of their investigations that the sidereal system to which our solar system belongs is in the form of a flattened spheroid with its longest axis in the plane of the Milky Way. We have shown in a preceding article on the Milky Way how all the various units of our system, stars, nebulae and star clusters are distributed with reference to this plane, including our own sun. The extent of this star system composed of hundreds of millions of individual suns in addition to nebulae and clusters is, as we have said, at least three hundred thousand light years along its longest axis, while globular star clusters distributed above and below its central plane have been found to be at distances from it ranging from ten thousand to two hundred thousand light years. This entire organized system is our sidereal universe. Space beyond is unexplored. The globular star clusters are the most distant celestial objects so far discovered. The spiral nebulae may be entirely within the limits of this system or future determinations of the distances of the fainter spirals may extend the limits set by the globular clusters to include spirals found to be still more distant.

We can conceive the possibility that our sidereal universe, vast as it is known to be, may be but a unit in some still greater organization and that other similar systems lie beyond the reach of existing telescopes at unimaginable distances of a higher order.

The mind of man is overwhelmed by the thought of sidereal systems as vast as our own lying far beyond our ken. Whether or not such external systems do exist and are with our own sidereal system units in some still vaster creation we cannot know.



How Star Distances Are Measured by Means of Parallax.

We have attempted to grasp feebly the vast expanses of time and space that are to be found within our own sidereal system, but the finite mind of man cannot grasp the wonders of a creation in which our entire sidereal system may hold a position as subordinate as does our own planet in the sidereal universe to which our sun belongs.

The distances of stars are almost inconceivable to the human mind. They are computed by what is known as the parallax. In order to make this plain to the non-technical reader, Fig. 1 shows the method used. When the astronomer wishes to measure the distance of a distant star, he takes an exact observation of the star on January 1st when the earth is in position C. Then on July 1st he again observes the same star with very accurate instruments. Then he will have an angle A, B, C. The

(*Continued on page* 56)

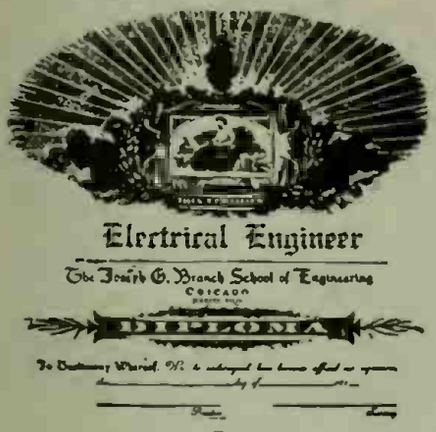
www.americanradiohistory.com

BE THE MAN WHO KNOWS! -and Earn Big Pay

By our method of teaching, in your *Spare time at Home*

You Can Soon Be A Trained Man

Electrical, Steam, or *Marine Engineer,* or a Graduate in any of our numerous other *Practical Business Courses*



Your Diploma

Business Today Demands Trained Men—

you know that. Your success in life depends upon how well you prepare for it. It's a question of knowing your subject! Big business is looking, hunting, advertising—for big, trained men to accept good positions at big pay; such men are scarce; but there are always too many of the other kind. Which class are you going to be in

You want to study with a Real School. The high standing of the Jos. G. Branch School of Engineering may be indicated by the fact that

We Trained Over 1000 Men for Government Marine Service

No matter what line of training you need, you will probably find exactly what you want in the list of our courses below. Each course is practical and complete, yet everything is written, illustrated and explained so clearly that anyone who can read can understand it. Everything is made clear. You do not become involved in difficult technical matter which is of no value and discourages the student, but you go right straight through from the start to the finish—and then you've got it! You can't fail if you will simply do your part, and follow our instruction.

THE COURSE YOU WANT IS HERE

Complete, Practical Correspondence Courses in

Electrical Engineering	Marine Engineering	Practical Mathematics
Stationary Engineering	Drafting	Ingenieria Electrica (Spanish Course)
Power Plant Engineering	Drawing & Designing	Mechanical Refrigeration
Power Plant Accounting	Practical Chemistry	

VALUABLE BOOKS FREE

We have published a Library of Valuable Business Books covering each of the above courses, and we are furnishing a set free to each enrolled student who answers this ad. These are all standard books, each by an authority on the subject. The books above may be worth many times the cost of the course. Here is the Library that goes with the Electrical course:

Practical Electricity — The Electric Motor
Alternation Currents Simplified
Electric Wiring — Practical Mathematics

Send in the Coupon now for full particulars about the course you are interested in.

The Jos. G. Branch School of Engineering
Dept. 15, 542 S. Dearborn St. Chicago, Ill.

Cut Out and Mail—NOW

USE THIS COUPON

Jos. G. Branch School of Engineering
Dept. 15, 542 S. Dearborn St., Chicago

You may send me, free full information about your special offer on course checked below:

Electrical Engineering	Marine Engineering	Practical Mathematics
Stationary Engineering	Drafting	Ingenieria Electrica (Spanish Course)
Power Plant Engineering	Drawing & Designing	Mechanical Refrigeration
Power Plant Accounting	Practical Chemistry	

Name .....
Address .....
City ..... State .....
Present Occupation .....

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com



"Saved $100.00 On My Diamond"

The $85 diamond you send compares favorably to a ring recently bought at $185 (a saving of $100).—Name on request.

This firm nearly 3/4 century old, rated over $1,000,000. Ordered by mail, lends money on high grade jewelry. Amazing bargains in unpaid loan diamonds. Free examination.

Why Pay Full Prices

Prove for yourself that it's unnecessary. Send your name for wonderful Illste free. Every jewel accurately described in detail. Radically different from catalogs. See these prices before you buy.

Send for Latest List

Diamond Loans Must sell unpaid loans. Hundreds of diamonds for under market prices. Free examination. Amazing bargains proved by customers' letters. Write today.

Jos. DeRoy & Sons, 8050 DeRoy Bldg.
Only Opposite P.O. Pittsburgh, Pa.
References: Dun's or Bradstreet's; Marine National Bank; Union Trust Co., Pittsburgh.

BOYS! BOYS! JOIN The JUNIOR YANKS



Be the first to organize a company in your town. A real boys' organization—no grown-up leaders. Secure an officer's commission for yourself. Get four to six boys to join you.

The only boys' organization teaching military signals, wig-wagging, wireless telegraphy, machine gun and rifle drill, how to dig trenches, make tree entanglements, dug-outs, listening posts, how to advance and retreat, do scout and guard duty; all the things a real soldier knows.

Write today and we will tell you how to become a "Junior Yank" and officer, receive the official Junior Yank Trench cap and collar ornaments, and a complete military outfit without one cent of cost.

Send ten cents (stamps or coin) for the official magazine in colors, "The Junior Yank" and a copy of the manual of drill and rifle practice. Have all your boy friends write at the same time. Address

Junior Yanks, 202 W. Ohio St., Chicago, Ill.

USE HB BALL BEARING ELECTRIC MOTORS

HB Electrical Motors Save Power—Get Ball Bearing equipped HB Motors, as they save you a substantial sum each month on your power bills. Absolutely they are trouble-proof, economical, amply designed, just right for your requirements—one-half to 15 h.p., they substantially lower your power costs. Easy to install and operate. Require practically no attention.



$20.00 gives you an HB Ball Bearing motor. The balance on easy terms. Suits your requirements. Let our engineering department advise you. Send in your problems. State kind of machinery you wish to run and type of current available. Can also furnish Battery Charging Outfits, Lighting Generators, etc. Pin this ad to your letterhead and mail for further information today.

HOBART BROTHERS COMPANY
Box 5E Troy, Ohio
Successful Manufacturers Since 1893

Earn $35 to $100 WEEKLY



ALL OR SPARE TIME

You can make $35.00 to $100.00 a week. I want hustlers, money-makers, to work with me, to advertise, sell and appoint agents. Biggest thing in years. City conveniences without plumbing. Used in any room. Sells on sight. Demonstrating tub furnished. Folds small, self-emptying, non-leakable. Guaranteed 10 years.

AGENTS MAKE SALES EASILY

Two sales daily means $60.00 a week. Leggett, Ohio, "Worked two hours, took two orders, profit $10.00." Hayhurst, Nebr., "Took 11 orders in 4½ days—profit $55.00, ordered 12 more tubs." Manning, Iowa, "Sold 10 tubs in one day—profit $50.00." DeHut, Nebr., "Sold 12 tubs in three days—profit $60.00." And hundreds of others making big money. 70 per cent of homes have no bath tubs. Experience and capital unnecessary. Credit given to the right man. Get full particulars and "special plan" all free.

H. S. Robinson, Pres., THE ROBINSON CABINET MFG. CO.
4979 Factories Building TOLEDO, OHIO

ELECTRICAL training again open to civilians. Over 3000 men trained for electrical industries in experience of more than a quarter of a century. For men of ambition and limited time. Condensed course in Electrical

ENGINEERING enables graduates to secure good positions and promotions. Theoretical and Practical Electricity, Mathematics, Steam and Gas Engines, Mechanical Drawing. Students construct dynamos, install wiring and test

IN ONE YEAR



electrical machinery. Course with diploma, complete.

Thoroughly equipped fireproof dormitories, dining hall, laboratories, shops.

Write for catalog. 27th year opens October 1, 1919.

BLISS ELECTRICAL SCHOOL
260 Takoma Avenue, Washington, D. C.

Be an Artist

Comics, Cartoons Commercial, Newspaper and Magazine Illustrating. Pastel, Crayon portraits, Poster and Fashions. Earn Big Money. Taught by Mail or Local Classes. Write for illustrated booklet, terms and list of successful pupils

ASSOCIATED ART STUDIOS. 13A Flatiron Bldg., N. Y.

ASTRONOMICAL DISTANCES.

(*Continued from page 54*)

distance from A to C being roughly 185,000,000 miles, and the angle being known, it is easy to figure the distance from B to A by means of trigonometry. But if the star B is at an immense distance such as is shown in Fig. 2, the angle A, B, C becomes very small. As some of the stars are billions upon billions of miles removed from the earth, it will be readily seen that there will come a point when the angle A, B, C ceases to exist. In other words, the distance A to C, altho 200,000,000 miles, will practically vanish—as it is so little—and the angle becomes so sharp that A, B, C is practically nothing but a straight line. As a matter of fact most of the stars which we see are so far removed from the earth that they have no appreciable parallax, and it is therefore impossible to know how many billion miles such a star is removed from the earth. As a matter of fact only a comparatively few stars exist that show an appreciable parallax, even with the extraordinary degree of perfection attained in measuring instruments. Such is the inconceivable magnitude of interstellar distances.

Distances from the sun to the planets and to the nearest star in terms of the astronomical unit (distance from earth to sun) and in millions of miles.

Table I.

	In Astronomical Units	In Million Miles
Mercury	0.39	36.0
Venus	0.72	67.2
Earth	1.00	92.9
Mars	1.52	141.5
Jupiter	5.20	483.3
Saturn	9.54	886.0
Uranus	19.19	1,781.9
Neptune	30.07	2,791.6
Alpha Centauri (nearest star)	273,000.00	26,000,000.0
Value of light year	63,000.00	6,000,000.0
Parsec	206,265.00	20,000,000.0

Table II.

Time required to travel from the earth to sun, moon, planets and nearest star by airplane, (at the rate of 200 miles per hour), and with velocity of light, (at rate of 186,324 miles per second).

To	By airplane	With velocity of light
Moon	7 weeks	1¼ seconds
Sun	52.99 years	7 min. 59 sec.
Venus	14.37 years	2 min. 18 sec.
Mercury	32.46 years	5 min. 6 sec.
Mars	27.72 years	4 min. 21 sec.
Jupiter	222.68 years	35 min. 15 sec.
Saturn	452.37 years	1 hour 11 min.
Uranus	963.38 years	2 hours 32 min.
Neptune	1,539.30 years	4 hours 2 min.
Alpha Centauri (nearest star)	14½ million years	4.35 years

Note: The above results were obtained by using the *mean* distances of the planets from the sun and the nearest approach of the planets to each other.

RELIEVING THE CAR CRUSH.

(*Continued from page 15*)

lide! The westerner wants to get off and the easterner wants to get on, naturally.

Now an old axiom says that one mass can't take the place of another mass without displacing that first mass. But tho we have learned in our physics class that water is not compressible, Subway passengers are compressible to the NTH degree.

Then after a homeric battle in which both sides display a titanic amount of muscular effort the "westerner" is finally ejected forcibly from the car and a half dozen "easterners," with the "gentle" help of the subway gladiator, are packed into the train, which proceeds on its way until the next station, where the same little game of forcible subtraction and addition is enacted all over again.

The cure? There are three doors on each New York subway car: Two on each end and one (about the same size as the front and end door combined) in the center. If the outgoing passengers could use, say, the end doors only and the incoming travelers the middle doors only, and if this rule would be strictly enforced, don't you think that this would help to make the Subway a better place to travel in?

And, besides, Kipling *would* be right. "East and West, they never shall meet!" Anyway, not so rudely!

ELECTRIC VIOLIN-VIRTUOSO A MARVEL.

(*Continued from page 21*)

is obtained by means of a third magnet which vibrates the tail piece thru the medium of the shaker bar.

To produce the wonderful orchestral effects achieved by the Violano-Virtuoso, as the instrument is called, it is necessary to use not one but *four* bows—one for each string.

These bows consist of numerous conical discs of specially prepared flexible celluloid, the edge of each disc acting as the hair of a bow. And it is possible for these revolving bows *to play simultaneously on all of the four strings.* These 4 bows are operated by bow magnets and are mounted on a bow shaft extending over the bridge. This, in connection with the fact that the instrument has sixty fingers against the *four* available to the human violinist, is the reason why this instrument can, with facility, render the most difficult concertos, etc.—the master-pieces of the world's musical literature—some of which it is manifestly impossible for any save the greatest human virtuosi to achieve.

The bows are automatically rosined. Suspended above the strings is the *rosin box* from which the strings automatically obtain the proper supply of rosin. This box is controlled by a governor and according as the speed of the motor raises or lowers—the greater the bow speed and the closer the box comes to the bows, which by their revolutions against the surface of its rosin, automatically obtain a greater or less supply as required.

Our illustration shows the electrically operated violin, as well as its accompanying player piano. Both instruments playing together, thus give rise to a very creditable musical performance.

ALL KINDS OF LIGHTNING.

(*Continued from page 20*)

denly took it into his head that he was going to take some superlative lightning photos on a certain summer day. In this particular instance, the thunder storm had not been behaving very nicely, according to the photographer's notions, but he thought he would take a chance any way. We might mention before going further, that the thunder storm did not come up in the usual way, and proceed to discharge veritable forked "Bolts of Thor," but satisfied itself with merely hanging around in the offing, and giving a perfect imitation of the best flash, or so-called "heat" lightning, you ever saw. What happened was this. The photographer waited until several of these flashes had occurred and the rain had begun to fall, when he thought the lightning discharges would sharpen up enough to photograph most beautifully. However, he miscalculated the extent and the frequency of the flash lightning, which in this particular case hung on for a long time, and accompanied each flash of forked lightning, which was rather slight in quantity, with the total result that after six 8x10 negatives had been exposed, and then rushed expectantly into the dark room and developed, they showed,—what do you suppose? Well, sir, those six plates turned out to be six of the finest snap-shots of the surrounding landscape and buildings that you ever laid eyes on. By actual comparison you could not tell them from a sunny mid-day snap-shot of the surrounding country taken with the same camera.

Thus the motto would seem to be, that to obtain good lightning photos, one should take advantage of a very dark overhanging storm which gives the greatest contrast of course, for the lightning flashes to appear against. At night would seem to be a most opportune time to photograph lightning discharges, but many excellent pictures have been obtained in the day time as well, under suitable conditions as just outlined.

www.americanradiohistory.com

ELECTRICITY



Taught By a Practical Man
and in Your Home!

I am teaching electricity and electrical drafting to many men, young and old, and trust you will become sufficiently interested after reading this advertisement, that you will send for my catalog which tells what I am endeavoring to do and also places before you the simple way in which the instruction work is handled. The catalog is written in a very plain manner, much in the same style as my lessons are written, and tells you exactly what you get and what the course can do for you. My catalog, as well as my advertisements, is written in a very careful, conservative manner so there is no possibility of you expecting something you will not get.

The Purpose of the Course of Study

I have been designing courses in electrical instruction and teaching electricity, off and on during the past 17 years, and during that time I have had an unusual opportunity to make a special study of the teaching business, from the standpoint of a practical man. This course of my own is designed with a view of reaching those who do not have a lot of time and money to devote to study work, and to give them as thorough a knowledge as possible of electricity, in the shortest possible time. The instruction is given like you were working on various jobs, giving the explanation necessary for the understanding of the theory covered by the subject under discussion. There are many conditions which seldom occur in the every day run of electrical experience, and these conditions I lay particular stress on. This part of the instruction makes the course particularly attractive and valuable to those already engaged in active electrical work.

It Is Up To You

The instruction work is laid out and given in a way easily understood. It is not a cut and dried book plan, but the lessons are prepared especially for the purpose for which they are used and additional instruction is given to the individual student, with a view of meeting his particular needs. I have the information to give and I believe the ability to impart it to others, a fact which is in a way proven by other institutions which have made use of my services in the design and perfecting of instruction courses. To understand this work, IT IS UP TO YOU to stick with me and I will surely stick with you till you understand any part of the work you have gone over.

Practical Men Take My Course and Recommend it to Others

Sixty percent of my students are actively engaged in electrical work and find the instruction I give well suited to their needs. Several of these men have had their fellow workers take the course also and they are taking the instruction together making a class-room proposition of it and the results are in every way satisfactory to all concerned. One of these classes was started by a Chief Electrician, one of my students in Glen White, W. Va., who now has practically all the men under him taking my course. I believe the fact that these men who understand electrical work approve of my course to this extent is one of the strongest endorsements I could get.

What Electrical Men Say Of My Course

In my catalog are letters from men I have taught, some being men I have taught when connected with other institutions years ago, and they are printed with a view of showing you that I have a clear, simple way of getting the information to one so it can be understood. I am printing here extracts from letters received recently from a few of my present students, from which you will note that they are in every way satisfied with the course and the method of handling the instruction.

This letter is from Stanley Dobson, of Moncton, New Brunswick. "I wish to say that I am well pleased with your method of teaching and I trust I will please you as well by my application to the lessons.

"Feeling that in your electrical course you offer a most practical system of training for anyone in the electrical work, I would refer you to a young man here in Moncton from whom you might secure an enrollment in your school. His name is Mr. Walter Stratton.

"I thought I would mention him to you as I have already recommended your school very highly."

This letter is from John Anderson, Farrell, Pennsylvania. "I am writing this so that you may know me better and know I am in earnest in taking this course. I am a foreman in this plant and all I have learned is through practice and that is the reason I want to learn more. The other day the Assistant Chief at this plant said to me that he had taken a course some time ago and I asked him about your course and he advised me to write to you. This man worked under me sometime ago and now I am working under him and I do not want it to happen again."

This letter is from Max Engleman, New York City. "Your first installment on the electrical course received and I went to work and liked the method of your instructions very well. You will find the answers to the examination questions attached to this letter. I am occupied as a waiter and would be only too glad to move into a real trade. Hoping to succeed and thanking you for your help, I am, yours very sincerely, Max Engleman."

This letter is from the same man two months later. "In the book review of the Electrical Experimenter, I saw a discription of the Burgess Blue Book, which I would like to possess and wish you would mail me a copy. I have given up my position as waiter and am now employed as electrician in the Ritz Carlton Hotel and so far like the work very much. With best regards, I am Yours very truly, Max Engleman."

Another letter from Mr. Engleman about a week later. "Your lessons together with your Blue Book received and I thank you very much, and I think it is like everything else that is connected with your name, really 'A No. 1.' My work in the hotel consists of work on motors, dumb waiters and elevators and from time to time I do repair work on small apparatus. Yours sincerely, Max Engleman."

The following is from J. L. Knight, Chief electrician of the coal mines at Glen White, West Virginia, who is taking my course together with a number of men who work under him. "I am just in receipt of your valued letter and am more than pleased with the suggestions and information therein and you can rest assured that I shall do all that is possible for the school and the boys and at the same time learn much myself. Speaking of the lessons, I have never seen anything as interesting as they are, and, as soon as I get a new lesson I get right after it and don't stop until I think I have mastered the subject. Our assistant general manager looked over our lessons last night and he did not hesitate in saying that the lessons were the best that he had ever seen. He is a college man with a number of years' experience in the engineering business and knows a good thing when he sees it and I feel sure that he will write you regarding your work within the next days. We received the returns on the last lessons and all of us are more than pleased with the work that you are giving. I never saw a more enthusiastic bunch of men than they are over the lessons and everyone is buckled down to work and is going to try and make good. For myself, I wish to say that I took a course some years ago in electric railways and lighting and that I have gotten more out of your lessons thus far, and I know that if I live until I complete this course, with the knowledge that I will get out of it connected with the 14 years of practical experience, I shall be able to hold any kind of a position. Your school has a good write-up in the County paper this week and I have seen that due credit was given Mr. Yorke Burgess. I will send you a copy of this as soon as it is out. All of the boys are better pleased every day with the lessons and there is nothing but compliments for the Burgess Electrical School in this little town of Glen White."

Fifty Fifty

I work absolutely on a 50-50 basis with my students. You pay me the comparatively low price I ask, and I give you the instruction and other help as is stated in my catalog. No student is permitted to pay cash for his entire course on starting, the course being paid for in small monthly payments as you go along. Students have the privilege of discontinuing the work if they should find that it was not just what they were after, and their payments stop at the same time. This is my way of doing business and I would not want your money when I was not giving you the instruction.

Apparatus, Instruments, Material, Etc.

Certain electrical apparatus, instruments, material, charts, drafting implements, etc., as detailed in the catalog, are included in the course and are a part of the regular instruction for which there is no extra charge as it is covered by the regular monthly payments.

FILL OUT COUPON FOR ONE OF MY CATALOGS WHICH GIVES FULL INFORMATION

BURGESS ELECTRICAL SCHOOL
745 E. 42nd St., Chicago, Ill.

YORKE BURGESS,
BURGESS ELECTRICAL SCHOOL,
745 East 42nd Street, Chicago, Illinois.

Gentlemen:—

Send me catalog describing your course in Electricity and Drafting.

NAME.....

ADDRESS.....

CITY.....

STATE.....

www.americanradiohistory.com



"The Joy of Father and Boy."

"ELECTRO"

Chemical Laboratory

We present herewith to our friends our new **E. I. Co. Chemical Laboratory** which contains real chemicals and apparata to perform real chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a **Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.**

It contains the following 44 chemicals:

Alum $Al_2(SO_4)_3$, $(NH_4)_2SO_4$
Antimony (powdered) (Sb)
Ammonium Aqua (NH_3+H_2O)
Ammonium Carbonate $(NH_4)_2\ CO_3$
Ammonium Chloride (NH_4Cl)
Ammonium Sulphate $(NH_4)_2\ SO_4$
Barium Chloride $(BaCl_2)$
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride $(CaCl_2)$
Calcium Oxide (CaO)
Calcium Sulphate $(CaSO_42H_2O)$
Charcoal (Carbon) (C)
Chloride of Zinc $(ZnCl_2)$
Copper Sulphate $(CuSO_4)$
Ferrous Sulphate $(FeSO_4)$
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5(OH)_3$
Hydrochloric Acid (HCl)
Iodine (I)
Iron Chloride $(FeCl_2)$
Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
Magnesium Carbonate $(MgCO_3)$
Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
Nickel Chloride $(NiCl_2)$
Oxalic Acid $(H_2C_2O_4)$
Sodium Bicarbonate $(NaHCO_3)$
Sodium Borate $(NaBO_2)$
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate $(NaNO_3)$
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride $(SnCl_2)$
Sulphate of Nickel $(NiSO_4)$
Sulphate of Zinc $(ZnSO_4)$
Sulphuric Acid (H_2SO_4)
Tin (Granulated) (Sn)
Zinc (Metal) (Zn)
Zinc Carbonate $(ZnCO_3)$

The following apparata are furnished:

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube
Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure
Glass Tubing
One book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

DESCRIPTION OF THE OUTFIT:

The outfit consists of forty-four (44) Chemicals all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) enough to make dozens of experiments with each. See list of Chemicals herewith.

The apparata furnished are all of the best obtainable make and of standard laboratory size and shape. A list of the 17 pieces of apparata furnished with this outfit is printed also herewith.

The Instruction book is a real Chemistry Course for the Beginner. Some of the Contents are: **Division of Matter:** This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. **Chemical Nomenclature.** This explains in simple language the derivation of the chemical names of the Elements and their compounds. There is a chapter on **Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms,** etc.

A good part of the book is devoted to Weights and Measures. The Metric System, the English system and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights, Volume, Capacity and Length; Per Cent solutions; Conversion of Measure expressed in parts; Poisons and their antidotes; Technical and common name of chemical substances; Formulas for Cleaning various substances, etc., etc.

Among the 100 Experiments are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to Make Chlorine Gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

The price is still $5.00

Shipping Weight 10 lbs.

(Can be shipped by Express only.) Send your order today to:

TRADE MARK **THE ELECTRO IMPORTING CO., Mfrs.** TRADE MARK
231 FULTON STREET NEW YORK CITY

See our full page Ad, on page 88 for Free Cyclopedia

www.americanradiohistory.com

Will Man Freeze the Earth to Death?

(*Continued from page 8*)

Rising prices and increasing scarcity surely will drive us to other fuels. Alcohol has been cited as a probability, mainly because it can be produced anywhere crops are grown. The truth of this matter is that if the fuel requirements of the world were to be supplied by the world's crops there would be no crops left to feed the world's inhabitants.

The final summation simply is that when coal and oil both give out we will have an era of substitutes beside which the war bread of the past year will be heavenly. We will scratch around, burn up all our forests, dig our peat bogs to the bottom, and do what we can to find other substances to supply the deficiency. All the substitutes will be costly, both from point of view of actual price and in point of efficiency. Those who cannot afford to use them will simply have to move toward the equator or freeze to death.

Radium is the one direct answer to the problem raised by this situation. True, it exists only in minute quantities in the earth's crust. True, under our present system of extraction it costs prohibitively. Still, it is the only logical answer.

Why? While radium is present only in proportions of from one to three grains per ton in the outer thirty miles of the earth's crust—excluding the oceans, of course, in which there is only a trace—there is sufficient of it in the upper two miles of crust to supply all possible power wants of man. The fact that it now costs us over a half-million dollars a pound to extract it is no argument. The scientific brains of the world never has been focust on the problem of securing radium. Only the inventive skill of a small number of people has been concerned with the processes of mining and extracting any kind of precious metal. With only a few dozen laboratories in the world knowing anything whatever about radium, the cost of securing the metal has been *cut in half in the last four years.* In the event that radium showed itself to be the only salvation for men outside of the equatorial zone, would not this cost be slaughtered? Would not radium be extracted by the ton instead of by the milligram? When it is considered that by the extraction of all the radium in a belt of land, ten miles wide by three miles deep, extending around the earth sufficient of the metal would be secured to run civilization just as it stands until eternity, without further outlay for power of any kind, does this seem impossible? It would be an undertaking for centuries, undoubtedly, but what of it? There would be little or no depreciation in the metal secured year by year, and every tiny particle mined and extracted would do away with the necessity for just so much other fuel. In case the project were started under Government or other competent supervision, the probability would be strong that the descending price curve of radium would cross the rising cost curve of other fuels in the course of from fifty to one hundred years.

The only alternative to this desperate plan that seems to be offered to our descendants is the piping of steam and hot air from the earth's interior. On a small scale this has been done already in Italy, but scientists have pointed out that serious disturbances, earthquakes, cracking of the crust and other disasters involving huge losses of human life would be certain to follow the experiment of trying this on a large scale. The trouble mainly would be caused by the sudden cooling of certain portions while the other parts remained in a molten state. The great catastrophe of a tremendous crack appearing in the middle of the Pacific Ocean, with the resultant clouds of live steam and poison gas covering the earth and killing all animal and vegetable life, would be the great debacle most to be dreaded. Taking all into consideration, radium seems like the best and safest possibility.

One strange possibility which has an equally queer parallel in the case of radium extraction on a large scale is the quick doom which would face the earth if men piped all their heat from the earth's interior. Providing millions of these vents for power uses on all continents would cool the iron center of the earth speedily.

Under the present scheme of things, Professor Maurier estimates that the earth will cool to the temperature of the moon (—110 degrees Centigrade) in twenty-eight million years. Human life as we know it will have been extinct, in all probability, for twelve or thirteen million years of this term, unless man finds some material in which to clothe himself thru which body heat cannot pass, and grows his crops in huge heat-insulated greenhouses.

If the vents were opened, however, the heat of the earth's center would flood the atmosphere, even if used as economically as possible. It would rise to the outer edges of our air, coming into contact with the bleak (absolute zero) temperatures of the void, and cooling. Instead of the gradual change extending over millions of years, man would be confronted by a situation to which he probably could not adapt himself. The end of the world would come in ten thousand, yes, perhaps in five thousand years.

Even if the radium power system were inaugurated, something similar might take place, tho by no means as suddenly. Radium apparently was placed in the earth's crust for one particular purpose. That was to keep the earth from cooling off quickly.

We have seen that twenty pounds of radium would equal nine tons of anthracite in a year's time. The amount of radium in the thirty-mile crust of the earth, according to Professor Henri Becquerel of the French Academy, *is sufficient almost to equalize the daily loss of heat thru the atmosphere!* That means that if there were a little more radium in the earth this planet never would cool off at all! Also it means that if the earth were of the same consistency all the way thru, and not mostly molten iron or steel, the amount of radium being of the same proportion as at the surface, the globe would get hotter constantly. In the course of a few decades or centuries it would burst into flames and burn to a cinder.

The big point for us to grasp, however, lies in the fact that we are living now on earth solely because the crust contains radium. If this had not been the case the earth would have become cold and dead eons ago. If man, for any reason, becomes so grasping or in such dire necessity that he extracts all of the radium from the crust, he simply will be limiting his chances of a long stay very definitely.

This, however, is a remote possibility. The radium is scattered thru the whole crust to an average depth of *thirty miles.* Below this there is a highly heated tho solid zone in which there probably is a certain amount of radium. This zone extends *eighty miles* in depth, and below it is molten iron, the *core* of the earth. Man will have his hands full extracting the radium from the upper two or three miles of the crust. Since this will give him all he ever can need, unless the demands of future civilization grow much faster than any of our estimates figure, he would not touch the greater portion.



EARN $35 TO $100 PER WEEK

As a Mechanical Draftsman

Thousands of Men Wanted

You can learn Mechanical Drawing at home in your spare time through our practical Home Study Course and qualify for Big Pay. We have placed hundreds of our students in good paying positions. Government departments and private concerns are continually calling upon us for our graduates.

Become a Chief Draftsman

and get to the very top in this well-established and rapidly growing profession. The training given by the Columbia School of Drafting will give you just the knowledge you need to make good as a Chief Draftsman. No previous training is necessary. You can begin our course now and make rapid progress from the start under the Personal Instruction of the President of the School, Mr. Claflin, by mail. His carefully prepared lessons and personal letters of advice make each step easy and interesting.

Draftsmen Now Getting $35 to $100 a Week

with big chances for better pay as the demand grows. All big engineering, construction and manufacturing projects must first go through the drafting room before the workmen can commence. All such enterprises depend upon large numbers of draftsmen. Salaries are advancing steadily.

Drawing Outfit Free with Our Course

As soon as you enroll you will be sent our drawing outfit for your own use throughout the course. This entire outfit will be yours to keep. You are not obliged to return it after completing the course.

Not Only a Correspondence School

The Columbia School of Drafting is probably the largest residence school in the country specializing in the training of professional Draftsmen. Our Home Study Courses are an extension of the same instruction as given locally.

Illustrated Catalog FREE

Simply fill in the coupon below, return it to us and we will send you free a copy of our illustrated catalog which tells all about our practical Home Study Course and how you may secure our instructions at once on easy terms so as to quickly qualify for one of the big positions open.

Send This Coupon Today.

COLUMBIA SCHOOL OF DRAFTING
Dept. 982, 14th and T Sts., Washington, D. C.

Without obligation to me, please send me your Illustrated Catalog and tell how I may secure your practical training in Drafting and your help in securing a position as Draftsman.

Name .....

Address .....

City ..... State .....

www.americanradiohistory.com

"The National Authority on Electric Wiring for Twenty-Five Years"

All You Need to Know About Wiring

is in the Latest Edition of

"Standard Wiring"



THIS year's edition, completely revised to date, is the only accurate book on electric light and power wiring and construction published.

The National Electrical Code, with all its new rules, is explained and illustrated. 52 of the latest and simplest tables which show, at a glance, just what size of wire is needed for any kind and size of lighting or motor installation, for any voltage, current and drop desired for any system. Direct Current, Alternating Current, single, two or three-phase. The latest Code Rules on grounding required on all work.

How to install and operate generators, motors and every kind of wiring device with diagrams of connections. Special chapters on illumination, House Wiring, Electrical Units and their Equivalents. The latest lamp data. Proper symbols to use to indicate outlets, etc., etc.

It Will Make You an Expert Wireman

Leather Cover - Pocket Size - 375 Pages - Price $1.50

Sent to any address, postpaid, on receipt of price

H. C. Cushing, Jr., 10 West 40th St., New York

FREE TO THE RUPTURED

DON'T WEAR A TRUSS

FREE TRIAL



Inner surface made self-adhesive purposely to prevent slipping and to keep constantly applied the absorbent-astringent medication called PLAPAO. Close the hernial opening as nature intended so the Rupture CAN'T come down.

Do Away With Steel and Rubber Bands That Chafe and Pinch

You know by your own experience that the truss is a mere makeshift—a false prop against a collapsing wall—and that it is undermining your health. Why, then, continue to wear it? STUART'S PLAPAO-PADS are entirely different—being medicine applicators made self-adhesive purposely to prevent slipping and to hold the distended muscles securely in place. No straps, buckles or springs attached. No "digging in" or grinding pressure. Soft as Velvet—Flexible—Easy to Apply—Inexpensive. Continuous day and night treatment at home. No delay from work. Hundreds of people, old and young, have gone before an officer qualified to acknowledge oaths, and swore that the PLAPAO-PADS cured their Ruptures—some of them most aggravated cases—and of long standing.

Send Today For FREE PLAPAO--No Charge for it--Now or Ever

Simply write your name and address below. Send this advertisement for absolutely FREE TRIAL PLAPAO and 48-page Book on Rupture. No charge for it—now or ever. Nothing to be returned. "Be wise today 'tis madness to defer." Address, PLAPAO CO., Block 844, St. Louis, Mo.

Name..... Address.....

GREEN AUTOMATIC MACHINE



ADD TO YOUR INCOME

WITH LITTLE EFFORT $5 to $10 A DAY MADE EASY WITH

New Improved Green Automatic Machine

Sharpens, Hones and Strops all kinds of safety razor blades, in one operation, from four to six blades per minute. For both Quality and Quantity, this machine is in a class by itself. There is nothing like it on the market. Let us send you our free booklet explaining everything including the "AMERICAN" Key Cutter—cuts square, angular or round slots.

AMERICAN SHARPENING MACHINE CO. (Inc.), Dept E E, 184 W. Washington St., CHICAGO

"AMERICAN" Key Cutter



New York Aëro Show

(*Continued from page* 19)

ily imagined for the visitor was shown a complete composite photographic map of the city of Washington, D.C., which was taken from an airplane in a trip lasting but two hours and fourteen minutes. Hundreds of photos are taken by the rapid-fire cameras, and after developing and printing these have to be evenly matched and assembled. Large photographs taken about New York along the river, showing the ferry boats, etc., were taken during the afternoons of the different days, and the plates would be rushed to the aëro show, there developed and finished and prints made by the Army's photographic experts, the mounted photographs being on exhibit at the show in from one hour to an hour and one-half after they had been taken by the aviator flying above the city.

The machine gun exhibit attracted much attention, particularly the means used for synchronizing two machine guns on the battle-planes, so that they both fired dead ahead and thru the revolving propeller, the bullets passing accurately thru the spaces between the blades every time these spaces came in line with the machine gun barrels. The Packard Automobile Company, makers of the well-known Packard motor car, exhibited a new pleasure and battle-plane fitted with the Packard 12-cylinder aircraft engine, which somewhat resembles the Liberty motor. The Liberty motor, which was on exhibit, attracted considerable attention, and the number of these motors built by each of the large automobile concerns during the war were shown. There was a large sea-plane on exhibit which had flown to the show.

Speed enthusiasts in the flying world had their attention riveted on what was purported to be the fastest airplane in the world, the "Christmas Bullet," a small model of which was exhibited at the Aero Show. It was very well built, and the most remarkable feature of the design of the "Bullet" is that there are no struts between the planes, and also there are no guy wires, as in the usual types of monoplanes. The wings are supported by the cantilever principle, and besides they are *flexible*. The "Christmas Bullet" bi-plane is guaranteed to make 200 miles an hour, and it attained a speed of over 185 miles per hour on a recent trial flight, when equipt with a six-cylinder 185 H.P. Liberty motor. It is claimed by its builders to be the safest and fastest airplane in the world. Not only this, but its lifting capacity compared to its size is greater than that of any other 'plane, it is stated. As will be evident, this ingenious design of 'plane is constructed on the principle of true bird flight, which therefore makes it self-balancing and serviceable in any kind of weather. The wing surface is 170 square feet, and the total weight is 2,100 pounds, which includes fuel for three hours.

This airplane is intended to play the rôle of the first "taxi-plane" ever used in steamship service, and is to be operated at the port of New York by one of the leading steamship companies for overtaking a ship a day out at sea with sacks of belated mail, dispatches, etc.

Among the interesting airplane engines exhibited at the Show was the well-known "Dusenberg." This Company exhibited a powerful new model 12-cylinder aircraft engine, in which each set of six cylinders operated a separate crank shaft of its own. The power from the individual crank shafts was then transmitted to the propeller shaft by means of two gears, one on each side of the main driving gear secured to the propeller shaft.

www.americanradiohistory.com

The True Wireless

By Nikola Tesla

(Continued from page 30)

trates an arrangement described in my U. S. Patent No. 568178 of September 22, 1896, and corresponding dispositions of wireless apparatus. The captions of the individual diagrams are thought sufficiently explicit to dispense with further comment. I will merely remark that in this early record, in addition to indicating how any number of resonant circuits may be linked and regulated, I have shown the advantage of the proper timing of primary impulses and use of harmonics. In a farcical wireless suit in London, some engineers, reckless of their reputation, have claimed that my circuits were not at all attuned; in fact they asserted that I had looked upon resonance as a sort of wild and untamable beast!

It will be of interest to compare my system as first described in a Belgian patent of 1897 with the Hertz-wave system of that period. The significant differences between them will be observed at a glance. The first enables us to transmit economically energy to any distance and is of inestimable value; the latter is capable of a radius of only a few miles and is worthless. In the first there are no spark-gaps and the actions are enormously magnified by resonance. In both transmitter and receiver the currents are transformed and rendered more effective and suitable for the operation of any desired device. Properly constructed, my system is safe against static and other interference and the amount of energy which may be transmitted is *billions of times greater* than with the Hertzian which has none of these virtues, has never been used successfully and of which no trace can be found at present.

A well-advertised expert gave out a statement in 1899 that my apparatus did not work and that it would take 200 years before a message would be flashed across the Atlantic and he even accepted stolidly my congratulations on a supposed great feat. But subsequent examination of the records showed that my devices were secretly used all the time and ever since I learned of this I have treated these Borgia-Medici methods with the contempt in which they are held by all fair-minded men. The wholesale appropriation of my inventions was, however, not always without a diverting side. As an example to the point I may mention my oscillation transformer operating with an air gap. This was in turn replaced by a carbon arc, quenched gap, an atmosphere of hydrogen, argon or helium, by a mechanical break with oppositely rotating members, a mercury interrupter or some kind of a vacuum bulb and by such *tours de force* as many new "systems" have been produced. I refer to this of course, without the slightest ill-feeling, let us advance by all means. But I cannot help thinking how much better it would have been if the ingenious men, who have originated these "systems," had invented something of their own instead of depending on me altogether.

Before 1900 two most valuable improvements were made. One of these was my individualized system with transmitters emitting a wave-complex and receivers comprising separate tuned elements cooperatively associated. The underlying principle can be explained in a few words. Suppose that there are n simple vibrations suitable for use in wireless transmission, the probability that any one tune will be struck by an extraneous disturbance is $\frac{1}{n}$. There will then remain $n-1$ vibrations and the chance that one of these will be excited is $\frac{1}{n-1}$, hence the probability that two tunes would

WANTED!

OFFICE MEN
Auditors, Accountants, Office Managers, Credit Men, Cashiers, Bookkeepers and Cost Clerks—$1,200 to $7,500.

FACTORY MEN
Electrical and Mechanical Engineers, Factory Managers, Superintendents, Foremen, Designers, Draftsmen—$1,500 to $12,000.

CONSTRUCTION MEN
Civil and Structural Engineers, Transitmen, Construction Superintendents and Foremen, Estimators, Designers and Draftsmen—$1,200 to $10,000.

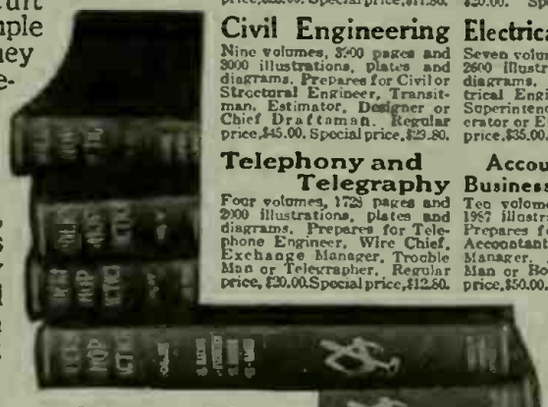
TRADES—Machinists and Toolmakers, Auto Repairers, Electricians, Stationary Engineers, Firemen, Plumbers, Carpenters, etc.—$1,200 to $2,000.

All these positions were advertised in a single issue of a Chicago newspaper

Which Job Can You Fill?

Which one of them could *you* fill? If you haven't the knowledge necessary to break into the *big-pay class*, decide to *get that knowledge NOW!* Any of the books listed below will quickly fit you for a well-paid job—at home—in your spare time.

These books were written by experts in plain, everyday language. They are free from puzzling technical terms. Numerous illustrations, diagrams and tables make difficult points as simple as A-B-C. They are handsomely bound in half or full leather (except Law and Practice, which is bound in law buckram) and stamped in gold. Fill out the coupon.



Carpentry and Contracting
Five volumes, 2138 pages and more than 400 illustrations. Prepares for Contractor, Building Superintendent and Carpenter Foreman. Regular price, $25.00. Special price, $17.80.

Fire Prevention and Insurance
Four volumes, 1500 pages and 600 illustrations, diagrams, forms, etc. Prepares for Counterman, Rate Clerk, Inspector or Agent. Regular price, $20.00. Special price, $15.80.

Civil Engineering
Nine volumes, 3500 pages and 3000 illustrations, plates and diagrams. Prepares for Civil or Structural Engineer, Transitman, Estimator, Designer or Chief Draftsman. Regular price, $45.00. Special price, $29.80.

Electrical Engineering
Seven volumes 3000 pages and 2600 illustrations, plates and diagrams. Prepares for Electrical Engineer, Power Plant Superintendent, Substation Operator or Electrician. Regular price, $35.00. Special price, $19.80.

Telephony and Telegraphy
Four volumes, 1728 pages and 2000 illustrations, plates and diagrams. Prepares for Telephone Engineer, Wire Chief, Exchange Manager, Trouble Man or Telegrapher. Regular price, $20.00. Special price, $12.80.

Accountancy and Business Management
Ten volumes, 3680 pages and 1987 illustrations, forms, etc. Prepares for Certified Public Accountant, Auditor, Office Manager, Accountant, Credit Man or Bookkeeper. Regular price, $50.00. Special price, $24.80.

Automobile Engineering
Five volumes, 2400 pages and 2000 illustrations. Prepares for Garage Foreman, Automobile Mechanic or Chauffeur. Invaluable to car owners. Regular price, $25.00. Special price, $17.80.

Steam and Gas Engineering
Seven volumes, 3300 pages and 2500 illustrations, plates, diagrams, etc. Prepares for Stationary, Marine or Locomotive Engineer or Fireman. Regular price, $35.00. Special price, $21.80.

Machine Shop Practice
Six volumes, 2200 pages and 2500 illustrations. Prepares for Machine Shop Superintendent or Foreman, Foundryman, Pattern Maker, Tool Designer or Tool Maker. Regular price, $30.00. Special price, $19.80.

Law and Practice
(with Reading Course in 25 bound pamphlets). Thirteen volumes, 6000 pages and 24 illustrations. Prepares for all Bar Examinations. A wonderful aid to business men. Regular price, $72.00. Special price, $39.80.

Sanitary, Heating and Ventilating Engin'ring
Four volumes, 1454 pages and more than 1400 illustrations, etc. Prepares for Sanitary Engineer, Heating and Ventilating Engineer, Master Plumber or Plumber. Regular price, $20.00. Special price, $13.80.

Practical Accounting
Four volumes, 1840 pages and 800 illustrations, plates and diagrams. C. P. A. questions and practical problems. Prepares for Accountant, Bookkeeper or Cost Clerk. Regular price, $20.00. Special price, $12.80.

One Week Free Trial

We'll gladly send you any set for seven days' examination. Don't send us a penny; just pay the small shipping charge when the books arrive. Examine them carefully—use them at your work for an entire week. At the end of that time, if you feel they aren't worth far more than we ask, return them *at our expense*. If you keep them, pay the bargain price on the easy terms explained below.

American Technical Society
Dept. X3385 Chicago, U. S. A.

50c A WEEK

Yes, if you decide to keep the set you have selected, send $2 within seven days and then $2 a month (*50c a week*) until the present low price has been paid. Have you ever heard of a more generous offer? Remember, you take no chances whatever—we send the books for examination and you are not obliged to keep them if you do not care to buy. Mail the coupon *now*—before you turn the page.

American Technical Society, Dept. X3385, Chicago, Ill.

Please send me set of ..... for 7 days' examination, shipping charges collect. I will examine the books thoroughly and, if satisfied, will send $2 within 7 days and $2 each month until I have paid the special price of ..... If I decide not to keep the books, I will return them by express at your expense. Title not to pass to me until the set is fully paid for.

Name .....

Address .....

Reference .....

Learn Watchwork, Jewelrywork and Engraving A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL Department, Bradley Institute, Peoria, Ill., for our latest catalog.

WRITE THE WORDS FOR A SONG

We write music, guarantee publisher's acceptance. Submit poems on patriotism, love or any subject.
CHESTER MUSIC COMPANY
918 S. Michigan Ave., Room 313 Chicago, Illinois

www.americanradiohistory.com



The Ellis "Music Master" Reproducer

Will make your Talking Machine "The Soul of the Living Artist"

NO ordinary sound-box can reproduce a composition as originally played or sung by the artist. The true tone coloring is lacking—the beautiful overtones completely lost. And if not perfectly adjusted the ordinary reproducer vibrates, causing a harsh and shrill tone so commonly associated with mechanical music.

But with the Ellis "Music Master" Reproducer all this is changed. Every shade of expression that originally went into the record is faithfully and accurately reproduced. By its special, improved features and construction all harsh discordant sounds are eliminated and the music flows out in a clear, round tone exactly as if the artist himself were in your home, playing or singing at his very best.

You must hear the "Music-Master" to apppreciate its great merit

It took 10 years of hard study and constant experimenting to develop this one reproducer that faithfully brings to life all there is in the record.

Words cannot convey to you an adequate idea of how much this wonderful device will do to improve the playing of records. You must see it—hear it—compare the effect with any and all other reproducers you know of; then you will understand why every music-lover owner of a phonograph who hears the "Music-Master" Reproducer wants to own one.

For all machines—Plays all Records

No matter what style, size or make of talking machine you have if it uses disc records you can use the Ellis "Music-Master" and enjoy the *real* music. Easily put on, it prolongs the life of the records, because it is much lighter in weight than other reproducers. And the price is so low that you cannot afford to be without it—it will double the worth of your instrument.

Write today for full details

Thousands of satisfied users attest to the *real* value of my reproducer. I want to send you some of their letters and tell you more about my "Music-Master". Fill in and mail the coupon below for full particulars. Ask for Circular E.

Patentee and Manufacturer

J. H. ELLIS P. O. Box 882 **MILWAUKEE, WIS.**

Mail this Coupon Now!

J. H. ELLIS, P. O. Box 882, Milwaukee, Wis.

Please send me full information about the Ellis "Music-Master" Reproducer.

Name .....

Address .....

City ..... State .....

be struck at the same time is $\frac{1}{n(n-1)}$. Similarly, for a combination of three the chance will be $\frac{1}{n(n-1)(n-2)}$ and so on. It will be readily seen that in this manner any desired degree of safety against the statics or other kind of disturbance can be attained provided the receiving apparatus is so designed that its operation is possible only thru the joint action of all the tuned elements. This was a difficult problem which I have successfully solved so that now *any desired number of simultaneous messages is practicable in the transmission thru the earth as well as thru artificial conductors.*

The other invention, of still greater importance, is a peculiar oscillator enabling the transmission of energy without wires in any quantity that may ever be required for industrial use, to any distance, and with very high economy. It was the outcome of years of systematic study and investigation and wonders will be achieved by its means.

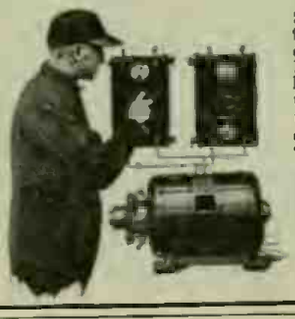
The prevailing misconception of the mechanism involved in the wireless transmission has been responsible for various unwarranted announcements which have misled the public and worked harm. By keeping steadily in mind that the transmission thru the earth is in every respect identical to that thru a straight wire, one will gain a clear understanding of the phenomena and will be able to judge correctly the merits of a new scheme. Without wishing to detract from the value of any plan that has been put forward I may say that they are devoid of novelty. So for instance in Fig. 12 arrangements of transmitting and receiving circuits are illustrated, which I have described in my U. S. Patent No. 613809 of November 8, 1898 on a Method of and Apparatus for Controlling Mechanism of Moving Vessels or Vehicles, and which have been recently dished up as original discoveries. In other patents and technical publications I have suggested conductors in the ground as one of the obvious modifications indicated in Fig. 5.

For the same reason the statics are still the bane of the wireless. There is about as much virtue in the remedies recently proposed as in hair restorers. *A small and compact apparatus has been produced which does away entirely with this trouble,* at least in plants suitably remodelled.

Nothing is more important in the present phase of development of the wireless art than to dispose of the dominating erroneous ideas. With this object I shall advance a few arguments based on my own observations *which prove that Hertz waves have little to do with the results obtained even at small distances.*

In Fig. 13 a transmitter is shown radiating space waves of considerable frequency. It is generally believed that these waves pass along the earth's surface and thus affect the receivers. I can hardly think of anything more improbable than this "gliding wave" theory and the conception of the "guided wireless" which are contrary to all laws of action and reaction. Why should these disturbances cling to a conductor where they are counteracted by induced currents, when they can propagate in all other directions unimpeded? The fact is that the radiations of the transmitter passing along the earth's surface are soon extinguished, the height of the inactive zone indicated in the diagram being some function of the wave length, the bulk of the waves traversing freely the atmosphere. Terrestrial phenomena which I have noted conclusively show that there is no *Heaviside layer,* or if it exists, it is of no effect. It certainly would be unfortunate if the human race were thus imprisoned and forever without power to reach out into the depths of space.

Make Big Profits in Battery Charging



$150 to $250 Clear Profit Each Month recharging auto storage batteries. The HB 16-Battery Charger recharges 1 to 16 6-volt batteries or their equivalent at once with current cost of 12c to 15c per battery. Motorist pays 75c to $1.50. Figure your profits! This season means bigger battery business than ever—more old cars driven—new Fords to have storage batteries. Get busy now! Don't delay! Start after those profits!

$57 Puts This Money-Maker in Your Garage on Money-Back Guarantee

Balance in 10 monthly payments of $23. each. Earnings pay for machine. No electrical knowledge necessary to operate. Uses 2 or 3 phase city current. Furnished complete with 2 charging panels capable of charging 1 to 8 batteries each. No adjustments or expensive renewals. Big, permanent profits. Sold on HB Absolute Money Back Guarantee. Order Now—you run no risk. Pin your check to this ad and mail today for trial order. Do it NOW!

Hobart Brothers Company, Box 5E, Troy, Ohio.
Successful Manufacturers Since 1893.

www.americanradiohistory.com

The actions at a distance cannot be proportionate to the height of the antenna and the current in the same. I shall endeavor to make this clear by reference to diagram in Fig. 14. The elevated terminal charged to a high potential induces an equal and opposite charge in the earth and there are thus Q lines giving an average current $I = 4Qn$ which circulates locally and is useless except that it adds to the momentum. A relatively small number of lines q however, go off to great distance and to these corresponds a mean current of $i = 4qn$ to *which is due the action at a distance.* The total average current in the antenna is thus $I_m = 4Qn + 4qn$ and its intensity is no criterion for the performance. The electric efficiency of the antenna is $\frac{q}{Q+q}$ and this is often a very small fraction.

Dr. L. W. Austin and Mr. J. L. Hogan have made quantitative measurements which are valuable, but far from supporting the Hertz wave theory they are evidences in disproval of the same, as will be easily perceived by taking the above facts into consideration. Dr. Austin's researches are especially useful and instructive and I regret that I cannot agree with him on this subject. I do not think that if his receiver was affected by Hertz waves he could ever establish such relations as he has found, but he would be likely to reach these results if the Hertz waves were in a large part eliminated. At great distance the space waves and the current waves are of equal energy, the former being merely an accompanying manifestation of the latter in accordance with the fundamental teachings of Maxwell.

It occurs to me here to ask the question—why have the Hertz waves been reduced from the original frequencies to those I have advocated for my system, when in so doing the activity of the transmitting apparatus has been reduced a billion fold? I can invite any expert to perform an experiment such as is illustrated in Fig. 15, which shows the classical Hertz oscillator and my grounded transmitting circuit. It is a fact which I have demonstrated that, altho we may have in the Hertz oscillator an activity thousands of times greater, the effect on the receiver is not to be compared to that of the grounded circuit. This shows that *in the transmission from an airplane we are merely working thru a condenser,* the capacity of which is a function of a logarithmic ratio between the length of the conductor and the distance from the ground. The receiver is affected in exactly the same manner as from an ordinary transmitter, the only difference being that there is a certain modification of the action which can be predetermined from the electrical constants. It is not at all difficult to maintain communication between an airplane and a station on the ground, on the contrary, the feat is very easy.

To mention another experiment in support of my view, I may refer to Fig. 16 in which two grounded circuits are shown excited by oscillations of the Hertzian order. It will be found that the antennas can be put out of parallelism without noticeable change in the action on the receiver, this proving that it is due to currents propagated thru the ground and not to space waves.

Particularly significant are the results obtained in cases illustrated in Figures 17 and 18. In the former an obstacle is shown in the path of the waves but unless the receiver is within the effective *electrostatic* influence of the mountain range, the signals are not appreciably weakened by the presence of the latter, because the currents pass under it and excite the circuit in the same way as if it were attached to an energized wire. If, as in Fig. 18, a second range happens to be beyond the receiver, it could only strengthen the Hertz wave effect by reflection, but as a matter of fact it detracts

(Continued on page 87)



Learn Public Speaking

10 LESSONS FREE

Write — quick — for particulars of this extraordinary offer; an opportunity you will never forget if you take advantage of it. Ten lessons in effective public speaking absolutely FREE to those who act promptly, to introduce our course in localities where it is not already known.

We teach you by mail to become a powerful and convincing speaker—to influence and dominate the decisions of one man or an audience of a thousand. We have trained hundreds and helped them to increase their earnings and their popularity. Learn, in your spare time at home, how to overcome "stage fright" and conquer fear of others; how to enlarge your vocabulary; how to develop self-confidence and the qualities of leadership; how to RULE others by the power of your speech alone; how to train your memory. Our

WHAT THE COURSE TEACHES YOU.

How to talk before your club or lodge;
How to address board meetings;
How to propose and respond to toasts;
How to make a political speech;
How to tell entertaining stories;
How to make after-dinner speeches;
How to converse interestingly;
How to write better letters;
How to sell more goods;
How to train your memory;
How to enlarge your vocabulary;
How to develop self-confidence;
How to acquire a winning personality;
How to strengthen your will power and ambition;
How to become a clear, accurate thinker;
How to develop your power of concentration;
How to be the master of any situation.

New Easy Method

perfected and taught only by Prof. R. E. Pattison Kline, former Dean of the Public Speaking Department of the Columbia College of Expression, can be learned in 15 minutes a day. Prof. Kline is one of the foremost authorities in the country on public speaking and mental development. Do not let this chance escape you.

Offer Limited

Send This Free Coupon Now

This Special Offer of TEN LESSONS FREE is made strictly for advertising purposes and will be withdrawn without notice. Write now, before it expires, and receive full particulars with enrollment blank by return mail. No obligations of any kind. Just tear off and mail this free coupon—or a postal will do.

FREE LESSONS COUPON

North American Institute,
7445 Manhattan Bldg., Chicago

I am interested in your course in Effective Public Speaking and your offer of ten lessons free. Please send full particulars. It is understood that this request places me under no obligation of any kind.

.....

.....

www.americanradiohistory.com

Pour Red, White and Blue from a Glass of Water



You can mystify your friends with puzzling chemical tricks; write secret letters with invisible ink; make your own magic writing paper, and your own blue ink or ink powder. Write with water and have it turn blue. You can pour seemingly plain water into three glasses and have it turn red in one, white in another and blue in the third. Send twenty-five cents in stamps and get your outfit by mail, postpaid. If you send right away, we will enter your name to receive a copy of "The Chemcraft Chemist." It's an interesting magazine for boys. "Chemcraft" Junior Regular "CHEMCRAFT" Outfits at $1.50, $3.00 and $5.00. 25c.
THE PORTER CHEMICAL CO., Arcade Building Hagerstown, Md. Post'd

Build Your Own PHONOGRAPH,
It's Easy With Our Help
SAVE OVER HALF



A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fine profit building phonographs for your friends.
Write Today for Our Free Blue Print Offer. Agents wanted for our ready built Choraleons.
Choraleon Phonograph Co.
705 Monger Bldg., Elkhart, Ind.



ZIP-ZIP Patented Sept. 3rd, 1918
The Greatest 50 Ct. Article on the Market. Shipped right from the factory the same day we receive your order. The Prong is made of beautiful metal; never break or wear out; scientifically made and best workmanship. The rubbers are elastic and lasting, with plenty of pep and force. Zip-Zip, complete, only 50c pre-paid. Be sure the name Zip-Zip and our address appear on the article you buy. Order from us or any Sporting Goods Store in your city. Send Stamps, Coin or Money Order.
AUTOMATIC RUBBER CO. COLUMBIA, S. C.



$50 for ONE DRAWING PAID
Illustrators—Cartoonists—Commercial Artists make big money. Learn NOW at home in spare time by our new instruction method. Handsome booklet free explains everything. Write for it today. Get our Special Free Outfit offer.
Washington School of Art, Inc. 1407 H St., N.W. Washington, D.C.



NATIONAL DENTAL TRADE SCHOOL
506 S. Wabash Ave., Chicago, Ill.
LEARN MECHANICAL DENTISTRY—DEMAND UNLIMITED
A paying Professional trade: You will be a trained dental mechanic and receive our diploma when competent. Students given advantage of thoroughly up to date laboratory, and services of graduate Dental Surgeons on practical cases. No effort spared to place graduates advantageously. No age limit. Day or Evening. Individual instruction. No educational requirements. No book or home study. Easy terms. Highest references. Especially attractive proposition to those who write at once for catalog H.



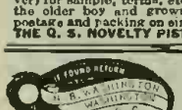
You Can *RENT* This Phongraph
On our new plan! $10 puts this Young's Superior Phonograph in your home on 30 Days' Trial! Plays all makes of disc records. Cabinet size, 47 ins. high. *Rental applies on purchase.* $125 Value for $62.50. Write for details of greatest phonograph bargain ever offered. Offer Limited. Write Today.
YOUNG'S SUPERIOR PHONOGRAPH
62 W. Madison St. Dept. U. Chicago, Ill.



GO INTO MOVING PICTURE BUSINESS
Small Capital Starts You
Our Catalog FREE. Shows you how to earn $25.00 to $50.00 per day
on our easy payment plan. Begin now and get your share. We sell everything. Write today.
Atlas Moving Picture Co.
Dept. 49 538 S. Dearborn St., Chicago

You can be quickly cured, if you
STAMMER
Send 10 cents coin or stamps for 70-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering for 20 years.
Benjamin N. Bogue, 754 Bogue Building, Indianapolis

A WONDERFUL NEW INVENTION The Q. S. Target
Pistol shoots shot 100 feet, wooden arrows 20 to 30 feet, with surprising power and accuracy. Boys go wild over it. Grown people find it most interesting. Send 10c. (silver) for sample, terms, etc. Our Q. S. Special, 25c., for the older boy and grown people. Send 3c. extra for postage and packing on single order. (Agents wanted.)
THE Q. S. NOVELTY PISTOL CO., Delanson, N. Y.



EARN MONEY
Stamping Names on Key Tags. Either sex. Spare time. Some make $50
Send 25c for Tag with your name on and instructions. Returned if required. Exp. Key Tag Co., Cohoes, N. Y.

My Inventions

(Continued from page 17)

lamp there. It was the exact spot which I had originally chosen.

So it went day after day with variations, but I was determined to achieve at whatever cost and in the end my efforts were rewarded. By the spring of 1884 all the differences were adjusted, the plant formally accepted, and I returned to Paris with pleasing anticipations. One of the administrators had promised me a liberal compensation in case I succeeded, as well as a fair consideration of the improvements I had made in their dynamos and I hoped to realize a substantial sum. There were three administrators whom I shall designate as A, B and C for convenience. When I called on A *he* told me that B had the say. This gentleman thought that only C could decide and the latter was quite sure that A alone had the power to act. After several laps of this *circulus vicious*, it dawned upon me that my reward was a castle in Spain. The utter failure of my attempts to raise capital for development was another disappointment and when Mr. Batchellor prest me to go to America with a view of redesigning the Edison machines, I determined to try my fortunes in the Land of Golden Promise. But the chance was nearly mist. I liquefied my modest assets, secured accommodations and found myself at the railroad station as the train was pulling out. At that moment I discovered that my money and tickets were gone. What to do was the question. Hercules had plenty of time to deliberate but I had to decide while running alongside the train with opposite feelings surging in my brain like condenser oscillations. Resolve, helped by dexterity, won out in the nick of time and upon passing thru the usual experiences, as trivial as unpleasant, I managed to embark for New York with the remnants of my belongings, some poems and articles I had written, and a package of calculations relating to solutions of an unsolvable integral and to my flying machine. During the voyage I sat most of the time at the stern of the ship watching for an opportunity to save somebody from a watery grave, without the slightest thought of danger. Later when I had absorbed some of the practical American sense I shivered at the recollection and marvelled at my former folly.

Tesla in America

I wish that I could put in words my first impressions of this country. In the Arabian Tales I read how genii transported people into a land of dreams to live thru delightful adventures. My case was just the reverse. The genii had carried me from a world of dreams into one of realities. What I had left was beautiful, artistic and fascinating in every way; what I saw here was machined, rough and unattractive. A burly policeman was twirling his stick which looked to me as big as a log. I approached him politely with the request to direct me. "Six blocks down, then to the left," he said, with murder in his eyes. "Is this America?" I asked myself in painful surprise. "It is a century behind Europe in civilization." When I went abroad in 1889—five years having elapsed since my arrival here—I became convinced that *it was more than one hundred years AHEAD of Europe* and nothing has happened to this day to change my opinion.

Tesla Meets Edison

The meeting with Edison was a memorable event in my life. I was amazed at this wonderful man who, without early advantages and scientific training, had accomplished so much. I had studied a dozen languages, delved in literature and art, and had spent my best years in libraries reading all sorts of stuff that fell into my hands, from Newton's *"Principia"* to the novels of Paul de Kock, and felt that most of my life had been squandered. But it did not take long before I recognized that it was the best thing I could have done. Within a few weeks I had won Edison's confidence and it came about in this way.

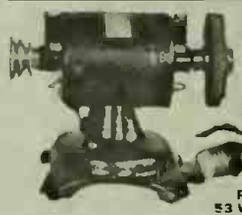
The S. S. *Oregon*, the fastest passenger steamer at that time, had both of its lighting machines disabled and its sailing was delayed. As the superstructure had been built after their installation it was impossible to remove them from the hold. The predicament was a serious one and Edison was much annoyed. In the evening I took the necessary instruments with me and went aboard the vessel where I stayed for the night. The dynamos were in bad condition, having several short-circuits and breaks, but with the assistance of the crew I succeeded in putting them in good shape. At five o'clock in the morning, when passing along Fifth Avenue on my way to the shop, I met Edison with Batchellor and a few others as they were returning home to retire. "Here is our Parisian running around at night," he said. When I told him that I was coming from the *Oregon* and had repaired both machines, he looked at me in silence and walked away without another word. But when he had gone some distance I heard him remark: "Batchellor, this is a d—n good man," and from that time on I had full freedom in directing the work. For nearly a year my regular hours were from 10.30 A. M. until 5 o'clock the next

MY NEW BOOK
"Muscular Development"
will tell you how to get a wonderful muscular development like mine, perfect health, abundance of vitality and great strength as I have.



EARLE E. LIEDERMAN
Why not look as healthy and be as strong as I am?

The results of my system are shown on my own person and that is recommendation enough. To give every one the opportunity to profit by what I have learned, I will mail my book, for a limited time only, on receipt of
10c Stamps or Coin
This wonderful book will help you. It is profusely illustrated and contains pictures of many of the world's strongest men whom I have trained. Send for it to-day. Right now, while it is on your mind.
EARLE LIEDERMAN, Dept. 208, 203 Broadway, N. Y.



Mechanics' Utility MOTOR GRINDER
A Time-Saver and Money-Maker for Shop, Factory, Garage or Home
Attach to any electric light socket and you have a power unit which will do grinding of all descriptions as well as drive small machinery. Can be furnished with chuck and buff for buffing.
Type B—Complete with 4 in. by one-half in. Emery Wheel, $15.50. Order today.
RACINE UNIVERSAL MOTOR CO.
53 W. Jackson Blvd. Chicago, Ill.

FRENCH WIRELESS



FROG made of steel with large clicker inside, used to learn telegraphy. GREAT FUN. SEND YOUR FRIENDS WIRELESS MESSAGES. SENT complete with code, and to make a big bundle we will send a Ford Joke book. Parlor games, etc., all for 10c. **10c**
Dept. 72, American Toy Co., Lowell, Mass., U.S.A.

INDEX TO ELECTRICAL EXPERIMENTER
FOR VOLUME 1, 2, 3, 4, 5
Price **15c.** Postpaid
EXPERIMENTER PUBLISHING CO.
Book Dept. 231 Fulton St., N.Y.

www.americanradiohistory.com

morning without a day's exception. Edison said to me: "I have had many hard-working assistants but you take the cake." During this period I designed twenty-four different types of standard machines with short cores and of uniform pattern which replaced the old ones. The Manager had promised me fifty thousand dollars on the completion of this task but it turned out to be a practical joke. This gave me a painful shock and I resigned my position.

Immediately thereafter some people approached me with the proposal of forming an arc light company under my name, to which I agreed. Here finally was an opportunity to develop the motor, but when I broached the subject to my new associates they said: "No, we want the arc lamp. We don't care for this alternating current of yours." In 1886 my system of arc lighting was perfected and adopted for factory and municipal lighting, and I was free, but with no other possession than a beautifully engraved certificate of stock of hypothetical value. Then followed a period of struggle in the new medium for which I was not fitted, but the reward came in the end and in April, 1887, the Tesla Electric Company was organized, providing a laboratory and facilities. The motors I built there were exactly as I had imagined them. I made no attempt to improve the design, but merely reproduced the pictures as they appeared to my vision and the operation was always as I expected.

In the early part of 1888 an arrangement was made with the Westinghouse Company for the manufacture of the motors on a large scale. But great difficulties had still to be overcome. My system was based on the use of low frequency currents and the Westinghouse experts had adopted 133 cycles with the object of securing advantages in the transformation. They did not want to depart from their standard forms of apparatus and my efforts had to be concentrated upon adapting the motor to these conditions. Another necessity was to produce a motor capable of running efficiently at this frequency on two wires which was not easy of accomplishment.

At the close of 1889, however, my services in Pittsburg being no longer essential, I returned to New York and resumed experimental work in a laboratory on Grand Street, where I began immediately the design of high frequency machines. The problems of construction in this unexplored field were novel and quite peculiar and I encountered many difficulties. I rejected the inductor type, fearing that it might not yield perfect sine waves which were so important to resonant action. Had it not been for this I could have saved myself a great deal of labor. Another discouraging feature of the high frequency alternator seemed to be the inconstancy of speed which threatened to impose serious limitations to its use. I had already noted in my demonstrations before the American Institution of Electrical Engineers that several times the tune was lost, necessitating readjustment, and did not yet foresee, what I discovered long afterwards, a means of operating a machine of this kind at a speed constant to such a degree as not to vary more than a small fraction of one revolution between the extremes of load.

The Invention of the Tesla Coil

From many other considerations it appeared desirable to invent a simpler device for the production of electric oscillations. In 1856 Lord Kelvin had exposed the theory of the condenser discharge, but no practical application of that important knowledge was made. I saw the possibilities and undertook the development of induction apparatus on this principle. My progress was so rapid as to enable me to exhibit at my lecture in 1891 a coil giving sparks of *five inches*. On that occasion I frankly told the

(*Continued on page* 89)

Don't Commit A Crime Against The Woman You Love



LIONEL STRONGFORT

"Dr. Sargent of Harvard, declared that Strongfort is unquestionably the finest specimen of physical development ever seen."

NO AMOUNT of love will ever atone for the crime you will commit, if you make some pure, trusting young girl your wife when you are UNFIT to assume the duties and responsibilities of a husband and a father. Her whole future life, her body and soul, will be in YOUR keeping; no one will be able to help her if YOU prove faithless to her trust in you. *Don't put the matter aside*, you can't get away from it; you can't make any girl happy, if you are weak, impotent, sickly; grouchy with dyspepsia or biliousness, poisoned by constipation, or suffering from any other debilitating ailment. Stop and think, right now, for HER sake, if not for your own. What CAN her marriage to you bring her, but lifelong regret and sorrow, if you are only an apology for a man, with your muscles flabby, your blood like water and your brain woozy as a result of your condition.

She Thinks You Are a Man

She trusts, admires and loves what she THINKS you are—a real MAN, mentally, morally and physically, whom she can *respect* as well as love. She believes you to be a man who can look any other man in the eye and hold your own with him; who is able to protect her under any circumstances; who can make his way in the world and give her the comforts she has a right to expect from her husband; and finally who will ultimately make her the mother of healthy, happy children, a blessing to you both. Think of the kind of children you will make her the mother of if you are one of the great UNFIT! Think of the weak, ailing, rickety, defective boys and girls such men bring into the world—pitiable little creatures, with no chance in life, living reproaches to the father who begot them. Don't close your eyes to these things. They are *facts;* facts thoroughly understood by every breeder of dogs, cattle and horses; facts recognized by the legislators of several states, who would make it a LEGAL, as well as a MORAL, crime to marry when unfit.

Make Yourself 100 Per Cent Fit

Put your past behind you. What if you have led a gay life and sowed a big crop of wild oats? Start NOW to root them out. What if you have burned the candle at both ends, and feel now like a human wreck, with your strength of body and mind dissipated and your vitality ebbing away? All the more reason why you should begin *now, TODAY*, to stop that steady loss, build up your strength again, regain your lost vitality and make a manly, red-blooded man of yourself. It's the ONLY thing to do—the only way to have any more happiness in life—the only way to keep from slipping down into the scrap heap of the hopelessly down-and-out—*and you can do it, if you go about it the right way.*

Strongfort Will Show You How

No matter what your work or business or occupation, you can build yourself up in my way without interfering with it in the least. I'll help you strengthen your heart, lungs, stomach and every other vital organ; I'll help you free yourself from dyspepsia, biliousness, constipation, catarrh or other chronic ailments; I'll help you steady your nerves and clear your brain and send the rich, red blood of life and vital energy coursing through your arteries again, so that you will be THE man your wife believes and expects you to be. I haven't any patented dope or bottled physic to sell you. I haven't any iron-bound, muscle-fatiguing, tiresome routine of exercises or straitlaced, ascetic living to recommend. I am a Builder Up of Men, and I build them up in Nature's way—the way that was successful in making me the strongest man in the world; the way that is succeeding with my pupils, thousands of them, in every country of the civilized world.

Don't Be Discouraged

Never mind how low down you have fallen; I don't care a rap what your present condition is or what brought you to it—*I know I can improve you* 100 per cent in a few short months. I am doing it every day for men who had given up all hope; bringing back their health and strength; making them respected members of society again; filling them with life, and ambition, pep and ginger, and enabling them to make a success in the world. I can do for you what I have done and am doing for others, and I WILL DO IT, if you will mark NOW, on the coupon below the trouble or troubles that are affecting you, or the points you are most interested in, and MAIL IT TO ME TODAY. My free book, "Promotion and Conservation of Health, Strength and Mental Energy," will show you the quick, easy, sensible, *manly* way out of your difficulties; the way that has brought renewed hope and confidence and joy of living to thousands of other men; it will show you how to make yourself FIT to live; FIT to marry; or, if you are married already, it will help you become the father of healthy, happy, laughing children who will be a joy to you and your wife as long as you live. YOU WANT THAT BOOK.

Do Your Part Now

Do YOUR part, and I'll do MINE—I guarantee it. Fill out and send me the coupon, with three 2c stamps for postage and packing on the free book, "Promotion and Conservation of Health, Strength and Mental Energy," and I'll send you with it, without charge, helpful, *personal* information on the conditions that are troubling you. DON'T DELAY—here's the coupon—Do your part NOW

LIONEL STRONGFORT

Health and Strength Specialist

883 Strongfort Institute Newark, N. J.

FREE CONSULTATION COUPON

Mr. Lionel Strongfort, Newark N. J.—Please send me your book, "PROMOTION AND CONSERVATION OF HEALTH, STRENGTH AND MENTAL ENERGY," for postage of which I enclose three 2-cent stamps. I have marked (X) before the subject in which I am interested.

..Colds	Flat Feet	. Heartweakness
..Catarrh	..Stomach Disorders	. Poor Circulation
..Asthma	.. Constipation	. Skin Disorders
..Obesity	.. Biliousness	. Despondency
..Headache	.. Torpid Liver	..Round Shoulders
..Thinness	.. Indigestion	..Lung Troubles
..Rupture	..Nervousness	. Increased Height
..Lumbago	. Poor Memory	..Stoop Shoulders
. Neuritis	..Rheumatism	..Muscular Development
..Neuralgia	..Youthful Errors	(S89)
. Flat Chest	..Vital Losses	
..Deformity (describe)	. Impotency	
..Insomnia	..Gastritis	
..Short Wind		

Name .....

Age .....Occupation .....

Street .....

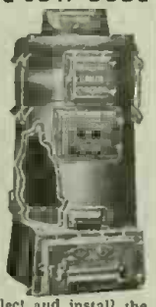
City .....State .....

www.americanradiohistory.com



DO Your Own PLUMBING AND HEATING at low cost

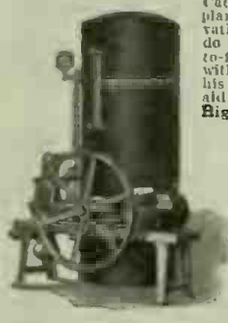
Send for our big instructive 256 page well-bound Handy-Man Book Catalog. Every Home Owner, Contractor, Electrician, Farmer, Factory Manager, etc., needs it. Shows over 10,000 Fixtures and Supplies in plumbing and heating at wholesale. Shows how to save skilled labor, hard work and unnecessary material by



OUR NEW

Cut-to-fit-Method

This wonderful book helps you select and install the proper Plumbing, Water Supply System, Hot Air, Water or Steam Plant. Besides being our Wholesale Catalog it has many practical plans, diagrams, sketches, elevations, etc., showing how to do the work this newer, cut-to-fit way. Any handy man with a few tools can easily do his own installing with the aid of this



Big Handy-Man Book

We have spared no effort and have gone to a great expense to compile this valuable book. With economy still a national necessity, it would be unpatriotic to send this extensive book broadcast to non-interested parties. Therefore, we request a temporary deposit for each copy of 25c which we refund on first order, or we send our Bargain Bulletin Free. Address Today

HARDIN-LAVIN COMPANY
40 Years At
4510-20 Cottage Grove Ave., Chicago
$500,000 plants behind our guarantee



THIS is Richard A. Oldham. He earned $2200.00 in four months with a Haywood Tire Repairing outfit. For 20 years he was telegraph operator on the Illinois Central Railway. He is now 58 years old. He answered my advertisement—quit his job—bought a plant and opened a business. He just wrote me "I have made more in eight months than 2½ years as operator." There are now 500 stations where tire repairing is neglected.

I Must Have 500 Men

To Fill These Positions

I have a Big interesting Book to send you. It tells all about tires—gives inside figures and profit. Send for it! What Oldham and others are doing You can do. $2500.00 to $4,000.00 per year is conservative. Like Mr. Oldham—One machine will start you. Then open a shop. You can see business all around you. Put out a Haywood Sign and business will come to you. Now get started. Send for the Big Book and start making money.

M. HAYWOOD, Pres.
Haywood Tire & Equipment Co.
1209 Capitol Ave. Indianapolis, Ind.

Learn to **PAINT SIGNS and SHOW CARDS**



I teach you personally, by mail, in a short time. Oldest and largest School. Big field, work interesting. You can

EARN $18 TO $45 A WEEK

Fittner, Minn., wrote, "Did job after first lesson, got $10, profit $7.06." Crawford, B. C. says: "Earned $200.00 while taking course." Get literature, samples, guarantee; all FREE.

DETROIT SCHOOL OF LETTERING
Established 1899. 685 D. S. of L. Bldg., DETROIT, MICH.

FUTURE RAPID TRANSIT

(*Continued from page 7*)

an airplane and provided with planes or wings. This provision of planes on either side of the car renders it possible to modify their angle of incidence, to relieve the supporting rail of a larger part of the weight of the vehicle.

The aërial monoflier, as our artist has here depicted, may be propelled by means of one or more propellers placed either at one end of the car or at both ends, and in any case these could be electrically driven, the current necessary for operating the electric motors being taken thru appropriate contact shoes or brushes, resting in contact with insulated conducting rails fixt to the frame-work upon which the monorail is supported. The end view of the monoflier shows clearly the arrangement of the two third rails, one on either side of the monorail, constructed so that they may also serve to insure the maintenance of the car in the proper vertical position, by preventing any lateral displacement thereof. For the purpose of maintaining the car in the proper vertical position by virtue of the third rails just mentioned, there are provided two series of wheels inside the car, as the end view indicates, one set on either side of the monorail structure. From one end of the car to the other, the slot, as it might be called, slightly expands so that the car can negotiate curved sections of rails, which it could not do if the slot running thru the car from front to rear were made perfectly straight. The car is provided with electric lights and the usual protective features, such as electric braking means, electric fans in warm weather, signal lights, etc. The motorman, whose cab is placed in the forward part of the car, has full control of the electric propeller motors, and he can also change the angle of the planes, on either side of the monoflier, so as to cause it to practically float in the air when it is under full headway, the monorail passing thru its center merely acting as a guide rail along which it flies. Electric heaters could be used in the cold weather, and for heating coffee and cooking light meals, etc., in the buffet lunch on board, electric stoves would be available.

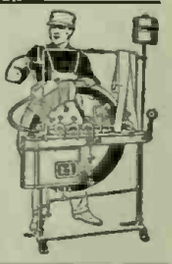
In general the monoflier is ovoid in form, thus following the latest practise in the design of dirigible airships, so that it will encounter the minimum of resistance from the air during its displacement. Such a craft should be easily able to attain a speed of 175 to 200 miles an hour and higher, as when it has attained its highest velocity and the planes are properly elevated, the craft will be practically *floating in the air*, without encountering any retarding friction from engagement with the monorail, excepting when passing around curves. Even here the friction which would normally be encountered might be reduced considerably if not entirely obviated by the provision of a proper air rudder at the rear of the car. When the car had reached the end of its run, owing to its peculiar ovoid shape, etc., it would have to be reversed in position before starting back, or else sent back to its destination by a parallel monorail system, which would undoubtedly be the usual practise, much in the manner shown in the accompanying view. Undoubtedly in the years to come, when such highly congested localities as New York City have become more and more built up with towering office structures, with a daily working population of say 12,000,000 to 15,000,000 people, and the subways and street elevated lines have become crowded to the limit of endurance, then it seems that such a system as this should serve a very useful purpose indeed.

If such a system as here illustrated were properly constructed and designed, it would not only serve as a fine piece of industrial engineering, but it would also give

AN EASY WAY TO MAKE MONEY Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business. One man says "I made $60.00 the first day." Others average $200 to $500 a month. Very little capital needed. Jobs plentiful. Every motorist a possible customer. No experience needed. We teach you.

SHALER Tire Repair Outfit

Improved Wrapped Treed Method
Used by Tire Manufacturers



Does as good work as the big high priced vulcanizing outfits. A boy can use it. It's the only vulcanizer that has Automatic Heat Control, and can't undercure or overcure a tire. Requires no watching or regulating.

FREE Book

"How to Open a Tire Repair Shop." It tells how to make big money. Don't delay. Write quick.

C. A. SHALER CO.
2204 Fourth St. Waupun, Wisconsin

THE MIDGET SLIDE RULE



has many exclusive features. It will handle three factors at one setting and has a Log-Log Scale. Polyphase or Inverted Scale. Addition and Subtraction Scale. Square Root Scale and Binary Scale. It will add and subtract fractions and give decimal equivalents, multiply and divide fractions and mixed numbers. It will also give the Logarithms of Numbers and the Sines, Tangents, Cosines and Cotangents of all angles. An instruction book, "The Slide Rule Manual," 16 pages, 12 illustrations, is sent with each rule. Length of Logarithmic Scale, 12 inches. Diameter of rule, 4 inches. Body of rule made of 24 Ga. steel, transparent celluloid indicators. Graduations printed in black on a white coating, figures large and easily read. Price, sent postage paid with instructions, $1.00. Send for free descriptive circulars. Your money back if you are not satisfied.
GILSON SLIDE RULE CO., Niles, Mich.



Says the Master Mechanic. The Greb Automatic Grip Puller is a One-Man Puller—Quick-acting, strong and simple in the extreme. May be locked in any desired position. A combination of two or three arms. Heavy Duty Size capacity 1" to 18"—Junior size capacity 1" to 7". Two sets of jaws furnished with each size.

Ten Days' Trial If your dealer or jobber does not have them we will send you one. Try it ten days. If not satisfactory, return to us and we will refund your money. We also make the GREB RIM TWOL.
THE GREB CO., 230 State Street, BOSTON

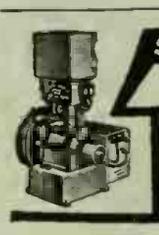


Swing 4 in., 11 in. between centers, 17 in. total length. Shipping weight 13 lbs. Bed of lathe is machined. Workmanship first-class. Equipped with wood turning chuck. Can be fitted with 3 in. face plate and drill chuck as special equipment. Order one today. Price $5.00 cash with order. SYPHER MFG. CO., DEPT. C TOLEDO, OHIO

CONVERT YOUR BICYCLE INTO A MOTOR-CYCLE Fits any wheel.



Best hill climber. Most reliable. More STEFFEY'S in use than all others. LOWEST PRICES. Cash or instalments. Send Stamp for circular.
Agents wanted.
Steffey Mfg. Co., Dept. E, 5025 Brown St., Phila., Pa.



SMALL ENGINES

Perfected Gasoline Engines—½, 1 and 1½ h. p.—for Farm and Shop use. Price, $27.50 and up. Also,
WASHING MACHINES
We ship on trial. Send for Booklet and Special Offer.
SIEVERKROPP ENGINE CO.
1401—19th St., Racine, Wis.
STARTER for FORD CARS



SAVE 25% to 60%
on slightly used
GRAFLEX-KODAKS
Cameras and Lenses of every description. Equal to new. Save money. Write now for **Free Bargain Book and Catalog** listing hundreds of money-saving bargains in slightly used and new cameras and supplies. All goods sold on 10 days' Free Trial. Money back if not satisfied. You take no chances dealing with us. We have been in the photographic business over 16 years. Write now.
CENTRAL CAMERA CO., Dept. 175, 124 S. Wabash Ave., Chicago



INSYDE TYRES Inner Armor for Auto Tires. Double mileage, prevent blow-outs and punctures. Easily applied to any tire. Thousands sold. Details free. Agents wanted. Amer. Accessories Co., Dept. 53, Cincinnati

www.americanradiohistory.com

high speed traveling facilities for suburbanites, who have to travel ten to twelve miles every night and morning to and from business, such as those who live in the rapidly developing Westchester County section, where undoubtedly many hundred thousand of New York's future populance will reside, as well as those who will make their homes on Long Island.

As the illustration shows, the monoflier is divided into several floors, and if desired, each floor may be subdivided into compartments. The lower floor is preferably reserved for luggage, freight and mail, while the upper floor may be very well utilized for the electric motors operating the propellers and lifting planes. Stairways lead from the lower floors to the upper floor or floors, depending upon the size of the car. The main frame-work of the car is composed of rolled steel sections, and the rest of the structure including the floors and outer covering is of aluminum, the seams being electrically welded so as to present a perfectly smooth surface on the entire exterior in order to minimize the resistance to the air. The windows, which afford an excellent view to the passengers as they skim along over the tops of the skyscrapers far above the city and the surrounding country, are fitted with the new unbreakable glass. Also the outer contour of the windows and doors are made so as to fit very tightly and to preserve an even surface both vertically and horizontally for the purposes aforementioned.

Some other novel features involved in the design of this aërial monoflier, which seem to possess great practicability are as follows: The inventor points out that in order to impart greater stability to the car, its longitudinal axis should preferably be located below the top of the monorail. In other words, the greater part of the weight should be distributed on a line below the monorail level, which line is at a point about one-third the height of the car from the top of the same. The large wheels in the interior slot of the car, which rest on the upper or monorail, are heavily flanged. In order to provide against the possibility of the vehicle leaving the track vertically under the influence of the air pressure beneath its wings, the lower portion of the third rail rollers may be given a circular flange, which in the case under consideration would bear against the lower flange of these rails, and thus serve to maintain the car in contact with the rails. The car could be made longer as desired, but, of course, it could not be made too long, or otherwise it would be impossible to turn curves, unless they had very long radii.

Most probably the reader has become interested in the general working principles of such an aërial monoflier system, particularly in the probable arrangement of the stations, which could be of several types, as our illustration herewith shows. Some of the stations could be erected on the roofs of tall buildings where these were of appropriate height for the purpose, and in some cases where the railway past directly thru the tower of the skyscraper, the station could be built in the "hole in the wall", as it might be called. Each station could be designed in several ways—for instance, it might in some cases be provided with one platform, and the passengers on the monoflier in this case would have to descend from the upper to the lower floors by means of the stairways provided in the car, before reaching the station. The station platforms could be enclosed and provided with sliding doors, so as to be draft-proof in the cold weather, and high speed express elevators would carry the passengers from the aërial railway station to the street, or by taking a local elevator, they could alight on any floor of the building—all of which seems very good from a strictly engineer point of view.



Different Metals Require Different Hack Saw Blades

If you want to cut structural steel or brass pipe efficiently, you need a different hack saw than for cast iron or machine steel, and you certainly can't work as coarse a blade in a light machine as in a heavy one. To try to do everything with the same blade is simply to do most of it inefficiently.

Starrett Hack Saws

do the most work with the least effort and in the shortest time because each one is made to meet the exact requirements of different metals in different powered machines.

Our Hack Saw Chart will help you select the proper blade for any kind of work, and you can depend upon it. Our Service Department will help you solve your cutting problems and increase the efficiency of your cutting-off department.

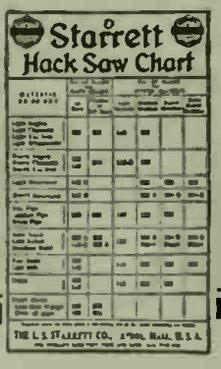
Write us today. Ask for Catalog No. 21 LE.

THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers.
Manufacturers of Hack Saws Unexcelled.

ATHOL, MASS.

NEW YORK LONDON CHICAGO



42-908

Learn Telegraphy-Wireless

Right In Your Own Home, in your spare time

Remarkable opportunities are offered experienced wireless operators and telegraphers. The demand is greater than the supply—steady positions at increased pay and rapid advancement are assured.

DEPENDABLE KNAPP ELECTRIC SPECIALTIES

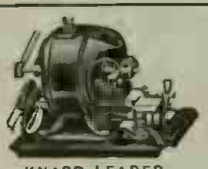
Combination Wireless-Telegraphy Outfit



will soon make you an accomplished operator. Teaches Light and Sound Signals, both Radio and Morse. Outfit consists of exceptionally fine Telegraph Key, Buzzer, 3 Binding Posts, Lamp, Lamp Socket and Control Switch—all mounted on a highly finished base. Two outfits can be operated at considerable distance apart for sending and receiving practice.

$3.00

This Same Outfit Without Lamp $2.50

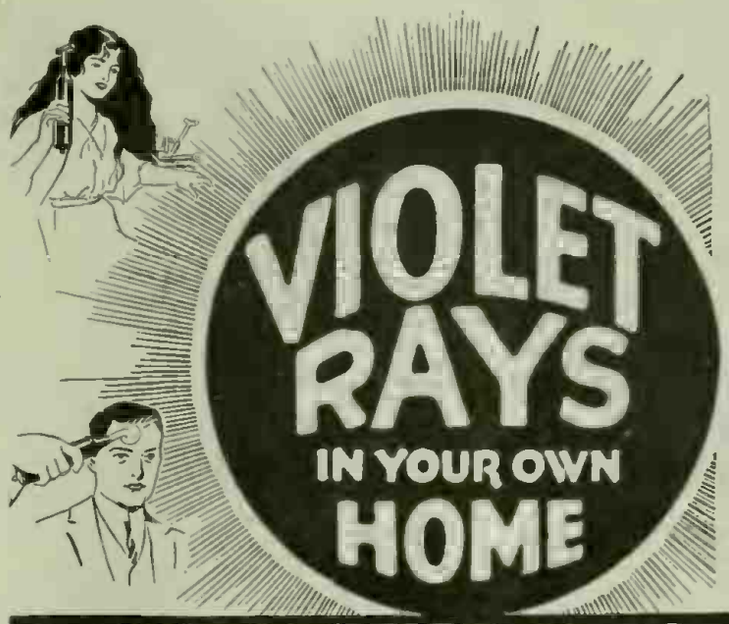


KNAPP LEADER
Radiates real power-plant efficiency. Two Speeds and Reverse.
Price, Complete, $3.50

Order to-day. Or your dealer can secure it for you. Descriptive circular and catalog of celebrated Knapp Motors and Electrical Specialties from 10c up mailed free on request.

Knapp Electric & Novelty Co.
523 West 51st Street New York City

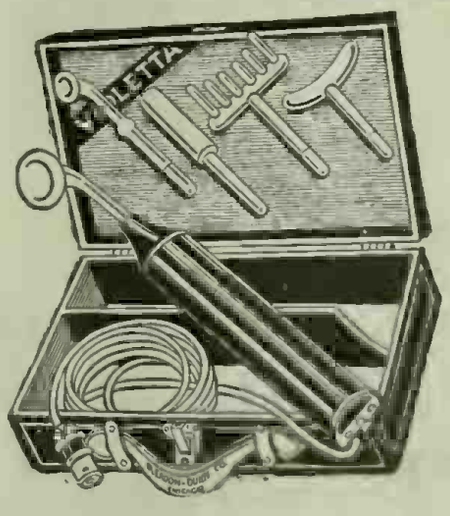
www.americanradiohistory.com



Magic-Like Relief for

Asthma
Barbers' Itch
Boils
Blackheads
Bunions
Callous
Catarrh
Chilblains
Colds
Corns
Constipation
Dandruff
Deafness
Earache
Eczema
Eye Disease
Falling Hair
Hay Fever
Headache
Goitre
Insomnia
Lumbago
Nervousness
Neuralgia
Neuritis
Obesity
Pains
Paralysis
Piles
Pimples
Pyorrhea
Rheumatism
Skin Diseases
Sore Throat
Sprains
Tonsilitis
Whooping Cough

TRY THE VIOLETTA FREE



NOW in your own home you can have wonderful Violet-Ray treatments exactly as are given by eminent physicians and beauty specialists throughout the country. Now you can rid yourself of headaches, catarrh, constipation, eczema, insomnia, lumbago, nervousness. Relieve your pain from neuritis, rheumatism, and other disturbances. Multiply your bodily health, vitalize your nerves, double or treble your energy by using Violet-Rays. Sleep better, increase your strength, and improve your appetite and digestion. Soothe your nerves, reduce or increase your flesh. Tone and strengthen the entire system. Beautify your complexion. All with Violet Rays!

Not a Vibrator

The Violetta is not a Vibrator. It is not a machine that contracts the muscles—it does not shock, it does not pound the muscles—it is absolutely painless. Violet-Rays administered by the Violetta are wonderful even for infants. Relieve pain and suffering in every part of the body. Simple tests prove that Violet-Rays pass completely through every part of the body, stimulating every cell and organ. It is electricity in its highest remedial form.

Read What Physicians and Users Say

Trixie Friganza, well known actress says "Cheerfully will I add my praise for Violetta. It's the best 'pain chaser' and 'soother' I've had the good fortune to find. It's WONDERFUL. It cured my brother of neuritis. As for myself I use it for facial treatments and general massage, I cannot say too much for it."

Dr. Bert H. Rice, of Vinton, Iowa, says: "I have good results with the Violetta High Frequency Instrument in all cases of neuralgia. Almost instant relief in Facial Neuralgia."

K. L. Allen, D. C., 205 Boone National Building, Boone, Iowa, says: I have had very good results with the application of High Frequency Current in cases of Paralysis, Rheumatism and Neuritis and think it a great help in drugless healing."

Dr. Daniels, Lisbon, North Dakota, says: "Have used the VIOLETTA in such cases as Goitre, Bronchitis, Pleurisy, Neuritis, Neuralgia, and Lumbago, and find it very beneficial. In fact, I would not be without it in my office."

Frank Borzone, Seattle, Wash., says: "I purchased the VIOLETTA for my wife who was suffering from an acute attack of Sciatica. From the very first treatment it induced peaceful rest and she is entirely well now."



Free Book Coupon
BLEADON-DUN CO.
Dept. 2D.
11 So. Desplaines St., Chicago, Ill.

Please send me your free book and 10 Days Trial offer on Violetta Violet-Ray Machine.

Name.....

Address.....

City.....

BOOK FREE

Write today without fail. Mail coupon or just a postcard. Let us send you our 32-page beautifully illustrated free book, describing the Violetta in detail. Read the amazing phenomena produced by Violet-Ray High Frequency current. Why it produces stimulation and sedation. How to give spinal treatments with the Violetta, how to treat various ailments, including nervous troubles, rheumatism, obesity, hay-fever, skin treatments, facial treatments. Mail coupon or postal right now before you turn this page.

BLEADON-DUN CO.
Dept. 2D
11 So. Desplaines Street Chicago, Ill.

LOCATING ENEMY GUNS BY FLASH AND SOUND

(*Continued from page* 14)

As the name suggests, "sound ranging" is based for its operation on the transmission of sound, either thru the air or thru the earth, whenever a gun is fired. Some of this work is performed in conjunction with the flash spotters, for by observing the flash of a distant gun, and then counting the seconds on a split-second watch until the sound is heard, the distance at which the gun is located may be accurately computed, as the velocity of sound thru air is about 1,100 feet a second. The velocity of light is practically instantaneous, or 186,000 miles per second, and secondly it serves very accurately to consider the flash of the gun as the starting point of the onward journey of the sound wave. The accurate locating of any gun is accomplished by having two observers take telescopic or other sightings on the gun, and noting the distance between the two observers and the angles as measured on their respective instruments. Thus it is a simple matter to solve accurately by triangulation the definite location of the enemy cannon.

This is only one side of "sound ranging" science, however, as applied to modern artillery tactics, and the scientists and engineers connected with the work of the artillery, particularly the locating of enemy gun positions, early in the war worked out a highly sensitive sound detecting apparatus which picked up the sound of enemy guns, even at a great distance, as transmitted thru the earth. For this purpose detectaphones and Audion amplifiers prove highly efficacious. Enemy guns 15 miles distant were accurately located by this means, the same triangulation maneuvers as previously outlined being followed. Two and usually three observation (sound-detecting) points being employed, advantage being taken of the values as given by the velocity of sound when transmitted thru the earth, and also by the difference of time at which these sounds arrive at different sound-detecting stations. Used in conjunction with the regular angular measurements, the locating of enemy guns became as simple to General Pershing's artillerymen as weighing out a pound of butter would be to a groceryman.

EXPERIMENTS IN RADIO-ACTIVITY.

Part III.

(*Continued from page* 35)

radio-activity noticed that radium induced an activity into substances placed in its vicinity. This induced activity was found to consist of an active deposit formed by the disintegrating radium. In the spinthariscope the lens portion was found to assume this induced activity because of its proximity to the active substance. This may be easily shown by use of the electroscope, described in the first article. Using the spinthariscope in the possession of the author, the following results were obtained:—empty, the electroscope discharged in 700 seconds; the lens portion was then removed and introduced into the electroscope. This time it only required 320 seconds. This conclusively shows that radium induces an activity into other objects exposed to its radiations. This induced activity, however, soon decays. Other uses for the spinthariscope will suggest themselves to the reader, but in any case he will certainly never regret purchasing or else making one.



Radiograph Taken by the Author, Using An E. I. Co. Spinthariscope with Lens Removed. The Figure "U" Was Cut from Brass Sheet.

(*To be continued*)

www.americanradiohistory.com

"Slickest Trick You Ever Saw"



ONE MINUTE it's a roadster—with sturdy, roomy wagon-bed, big enough to haul ice, wood, and tools, "an' everything." The next minute it's the niftiest speedster you ever saw—a real coaster, BUILT for coasting, with stream-line body, long and lean like a greyhound. The

Auto-Wheel Convertible Roadster

like its older brother, the Auto-Wheel Coaster, is built very much like an automobile, with oval spokes, roller-bearings, and steel axles. Tires of steel, to give long, hard service.

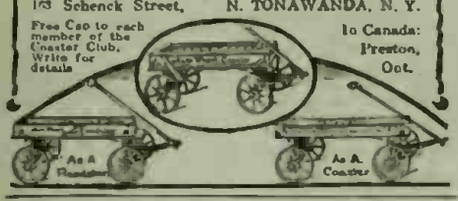
FREE—FELT PENNANT

to every boy who sends us the names of three coaster wagon dealers, mentioning which one handles the Auto-Wheel. Our color catalog goes with pennant.

BUFFALO SLED COMPANY,
183 Schenck Street, N. TONAWANDA, N. Y.

Free Case to each member of the Coaster Club. Write for details

In Canada: Preston, Ont.



BOYS Build and Fly Your Own Training Plane



Train yourself in Aviation. Be an Amateur Aviator with an Aeroplane of your own. Learn how Aeroplanes are built; learn the principles of construction, operation and control. We sell IDEAL Accurate Scale Drawings, and Building and Flying Instructions which show you how to build a perfect Model Aeroplane, 3 ft. size, that will rise from the ground by its own power and fly like a big one. Send now for the Drawings and Instructions for the one you want to build.

Drawings and Instructions for
Curtiss Military Tractor
Bleriot Monoplane
Nieuport Monoplane
Taube Monoplane
Curtiss Flying Boat
Wright Biplane
Cecil Peoli Racer

25c EACH
Set of Seven $1.50 postpaid

Ideal Model Aeroplane Catalog 5c—None Free

Tells about Model Aeroplanes, Racing Aeroplanes, Flying Toys, and parts and supplies to build them with. 48 pages. Sent only upon receipt of 5 cents.

IDEAL AIRPLANE & SUPPLY COMPANY
159-161 Wooster St., New York City

BOYS BUILD THIS CAR



This nifty little car driven by gasoline motor, can be built by any boy. Parts are furnished by us and are very cheap. Send 2c cents for building plans and price list of parts showing how to build this lads' car.

SYPHER MFG. CO.
156 Warren Street
TOLEDO, OHIO.



BIG BUNCH OF FUN 10c

1 New Airship Game with Airships, 1 Chess and Checker Board and men, 1 Chinese Dip-se-lu-le, 1 Set Dominoes, 12 Other Games, 19 Lessons in Magic, 12 Money Making Secrets, Wireless Code, 18 Pictures Pretty Girls, 3 Puzzles, & New Ford Joke Book. All for 10c with large Catalogue.

Dept. 72
American Toy Co., Lowell, Mass., U. S. A.

STAMPS

50 diff. Belgium (large bi-color), China, Jamaica, Portugal, Venezuela, etc., 10c; 100 diff., nice packet, 20c; 1,000 well mixed, 40c; 100 var. U. S., 50c; 1,000 hinges, 10c; Agts. wanted, 50%. List free. I buy stamps. L. B. Dover, Overland, Mo.

SCIENCE IN SLANG
THE SPECKS IN SPACE

(Continued from page 45)

last is one octillion, five hundred seventy-five septillion. The weight of the Sun is two octillion."

"Then the Sun weighs twenty-three decillion, forty nonillion grains," put in Punk.

"Approximately," returned Stokes, with his quaint smile.

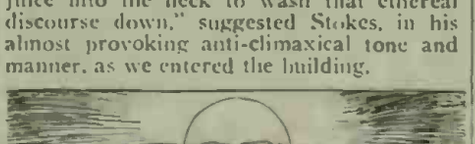
"Do you think that the lines of—er, force, or electricity, that are radiated from the Sun act upon the Earth turning on its diurnal axis and traveling in its course around the Sun in the same manner as the armature of a dynamo?" enquired Bill Dean.

"That is possible, I suppose. At least the radiations from the Sun are, more than likely, responsible for our electrical phenomena and along with it—but we do not know to what extent tho—plant and animal life.

"Some have one theory, some have another, but I would not be surprised at some new stuff that will do to our dope what Galileo did to the old 'Seven Stars' idea. From the thought that our planet was the center (natural to the more or less egotistical Man) of the universe, to the idea that the Sun was IT and then that the Pleiades are the center. Some say they are—we cannot disprove it, as far as I know of the matter. But that is not saying it is final. At present we have no way of peering way out into the infinite space and discerning the outer stellar orbs. With the innovation of the instrument that makes it possible, we will step on a stride further as Galileo did with his telescope, and discover other systems and the orbs that go to make up the system. The more, I believe, we go into the study of the universe and its gloriousness the more aware will we be of its true greatness and vastness.

"Now, as we have inches and feet as linear measurements, we have the distance between the Sun and Earth as the 'Astronomical Unit'—then, when ascertaining the distance of a star way out there in the vast infinite depths that we cannot reach or understand by figures nor even imagination, but can only term Space, by determining its parallax, we are only able to express its distance in 'Light Years'—and when you stop to consider that light travels at the rate of 186,000 miles per second—well buy a tablet and figure it for yourself. To our minds, we cannot conceive of anything without beginning nor end (excluding the circle), and to our minds things must have three dimensions to be understood by us. Now the universe has apparently no beginning nor end as far as we are able to discern.

At this point we drew up at a road house, or Inn. "How about a shot of raspberry juice into the neck to wash that ethereal discourse down," suggested Stokes, in his almost provoking anti-climaxical tone and manner, as we entered the building.



AN OMISSION

We wish to state that credit for the photographs accompanying the article entitled "The City of Splendid Night," by Amos Stote, publisht in the January, 1919, issue, should have been given to the New York Edison Co.

Supplied with current from the light socket, a two-fan electric ventilator has been invented which, when set in a window, draws in fresh air and expels that already in a room.



"I Can Succeed!"

"What other men have done with the help of the International Correspondence Schools, I can do. If the I. C. S. have raised the salaries of other men, they can raise mine. If they have helped others to advance, they can help me. To me, I. C. S. means 'I CAN SUCCEED.'"

Make up your mind right now that not another day shall pass until you have made *your* start toward success.

For 27 years men in offices, stores, shops, factories, mines, railroads, and in the Army and Navy have been winning promotion and increased salaries through the I. C. S. More than 100,000 men and women are getting ready *right now* with I. C. S. help for the bigger jobs ahead.

No matter where you live, the I. C. S. will come to you. No matter what your handicaps, or how small your means, we have a plan to meet your circumstances. No matter what career you may choose, some one of the 280 I. C. S. Courses will surely suit your needs.

When everything has been made easy for you—when one hour a day spent with the I. C. S. in the quiet of your own home will bring you a bigger income, more comforts, more pleasures, all that success means—can you let another single priceless hour of spare time go to waste? Make your start right now! This is all we ask: Without cost, without obligating yourself in any way, put it up to us to prove how we can help you. Just mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6188, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ ELECTRICAL ENGINEER
- ☐ Electric Lighting and Rys.
- ☐ Electric Wiring
- ☐ Telegraph Engineer
- ☐ Telephone Work
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Machine Shop Practice
- ☐ Toolmaker
- ☐ Gas Engine Operating
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MINE FOREMAN or ENGR.
- ☐ STATIONARY ENGINEER
- ☐ Marine Engineer
- ☐ Ship Draftsman
- ☐ ARCHITECT
- ☐ Contractor and Builder
- ☐ Architectural Draftsman
- ☐ Concrete Builder
- ☐ Structural Engineer
- ☐ PLUMBING AND HEATING
- ☐ Sheet Metal Worker
- ☐ Textile Overseer or Supt.
- ☐ CHEMIST
- ☐ SALESMANSHIP
- ☐ ADVERTISING
- ☐ Window Trimmer
- ☐ Show Card Writer
- ☐ Sign Painter
- ☐ Railroad Trainman
- ☐ ILLUSTRATING
- ☐ Cartooning
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Pub. Accountant
- ☐ TRAFFIC MANAGER
- ☐ Railway Accountant
- ☐ Commercial Law
- ☐ GOOD ENGLISH
- ☐ Teacher
- ☐ Common School Subjects
- ☐ Mathematics
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ AUTOMOBILE OPERATING
- ☐ Auto Repairing
- ☐ Navigation
- ☐ AGRICULTURE
- ☐ Poultry Raising
- ☐ Spanish
- ☐ French
- ☐ Italian

Name _____
Present Occupation _____
Street and No. _____
City _____ State _____



TYPEWRITERS

$10 AND UP. ALL MAKES. SAVE $25 TO $50 on rebuilt at the factory by the well-known "Young Process." Sold for low cash—installment or rented. Rental applies on purchase price. Write for full details and guarantee. Free trial. YOUNG TYPEWRITER CO., Dept. 619, Chicago

www.americanradiohistory.com

Some Government War Secrets

—and the reason for the Victory Liberty Loan

"WE HAD promised the Allied war-chiefs that we would have in France by July of last year, 600,000 men. On that date we had a little over 1,900,000. We had behind them nearly 2,000,000 in this country under training who would have been on the front before July, 1919, and we had behind those 4,000,000 men as many more men as were necessary to do the job.

"Four million men in France meant at least 20,000,000 tons dead weight of shipping to take care of them, and we had that program under way and were making our maximum output just about the time the armistice was signed. Twenty million tons of shipping at present cost means just about $4,000,000,000 or a little over.

"Did you know that those 2,000,000 men in France, who did so much to bring the war to an end, had only one small battery of American-made artillery behind them; just one battery of 4.7 and a few big naval rifles! The rest of the artillery used by the American soldiers was made by Frenchmen in France. But, on the way was a great stream of guns and shells that would have blown the German army off the earth. But that stuff had just come into large production in November, 1918. And it is for the deliveries on that big peak production that we have to pay in December and January and will have to continue to pay for in February."

* * *

"Our program for tanks, of which few got into action, was, I have been told, to provide for a tank in 1919 for every 75 feet of the front."

* * *

"Those are some of the things that cost money, and practically none of those great supplies of artillery, of shells or tanks, even of ships, practically none of that stuff was ever used. What an awful waste! We are asked to pay for a dead horse that never drew a load! It is discouraging, paying for something that is no good!

"Well, let's see if it's any good. Do you realize that the German army was never really routed; that except for a little bit of a stretch down in Alsace-Lorraine it was never fighting on German soil? They were brave soldiers, the German soldiers. They still had millions of them on the Western front. And yet they surrendered while they were on foreign soil. They had a fleet which had required years and years and years to build and it flew the white flag without firing a shot."

* * *

"I cannot believe that these great stores of munitions were wasted. In addition to the bravery of the American doughboy that arrived in France and got into action in numbers about the 15th of July and turned the tide and drove the Germans back, in addition to his bravery and his almost reckless spirit of determination, for which the praise cannot be too high, I say in addition to that, I believe there was one other factor that brought this war to an end at least one year before the most optimistic of us had dared to hope for. One other factor, and that was that Germany, her general staff, knew that back of the few hundred thousand Americans that really got into big action, and back of the 2,000,000 in France, was another 2,000,000 ready; and despite the fact that we had practically no artillery of American make on the Western front, that there was a great stream of American-made artillery on the way. And it is my conviction that the German staff knew that if they prolonged the war into 1919, they were inviting, not certain defeat, but certain annihilation."

* * *

"*We are asked to pay for things that were never used;* we are asked to pay for shells that never were fired; for cannon that never reached the battlefront, but we are asked to pay for those things that helped in a major way to bring this war to an end in 1918 instead of 1919. And the bringing of this war to an end twelve months before we could logically look for it means that *we are asked to pay for saving the lives of 100,000 or 200,000 American boys who would have died on foreign soil had the war continued another year.*"

—Extracts from a speech by Hon. Lewis B. Franklin, Director War Loan Organization, U. S. Treasury Department.

LIBERTY V LOAN

Victory Liberty Loan

The "Clean-up" Button

Space contributed by

ELECTRICAL EXPERIMENTER
SCIENCE & INVENTION

Prepared by American Association of Advertising Agencies cooperating with United States Treasury Department

www.americanradiohistory.com



Edited by H. GERNSBACK

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries address to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are publisht here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTICE TO CORRESPONDENTS

Questions on Patent Advice are answered in this department every month, and naturally each question must take its turn. We have received so many letters during the past months that it is absolutely impossible for us to answer them all in the "Experimenter." Thus, for instance, the answers appearing in this issue are of letters going back as far as Oct., 1918. We would therefore urge our correspondents to bear this in mind, and if an answer is wanted quickly, correspondents should make themselves acquainted with the rules printed above.

Sectional Automobile Radiator

(318) Edwin Schade, Camden, N. J., writes: "I have noted in a recent magazine a photograph of a pile of automobile radiators that have been damaged in the war. It has been my experience in repairing the present type of radiator that it takes anywhere from one-half hour to as high as three days to fix a leak. This is true especially when it happens to be in the interior. My idea is to build a radiator in units. Should one or more units be damaged, they could be replaced by others in a very short time. Kindly advise if such an idea would be of any benefit, and if it could be patented.

A. It is doubtful that a device of this kind would prove satisfactory, for the reason that there would probably be a good deal of trouble to interconnect the various sections, and there would probably be just as much trouble in keeping these connections from leaking as in a well-made radiator. That a device of this kind can be patented is also very doubtful to us.

Telephone Appliance

(319) R. C. Kennan, Indianapolis, Ind., submits a drawing and description of a telephone appliance which is designed primarily to eliminate trouble for the man who talks several feet away from the phone and expects people to hear him on the other end of the line. The arrangement also permits using the phone without holding the receiver in the hand. Our correspondent wishes our advice if this device is patentable and if we think a market exists for such a device.

A. This is one of those devices of which probably five thousand have been patented in various forms in the past. Our correspondent's device has a lever at the end of which the receiver is fastened. The arm and the receiver swing in a half circle, and is then locked. The subscriber can then talk without using his hands. The hook connection is automatically established as soon as the lever is raised.

A There is nothing new to this and, as we stated, many thousand similar ones have been patented in the past. There does not seem, moreover, to be a market for such an appliance.

Trolley

(320) Frederick E. Barber, Syracuse, N. Y., encloses a sketch and description of a device to keep the pole of a trolley from jumping off the wire. Our advice is asked.

A. We have exprest our views as to trolleys a great many times in these columns. Our advice to trolley inventors is: "don't". Our ideas were fully exprest in a recent answer to one of our correspondents in these columns. We refer to our March issue, page 825, Patent Advice No. 308

Magazine Mailer

(321) Carlyle Rudolph, Minneapolis, Minn., says: "Is there such a thing as a magazine mailer? A machine that folds, wraps, stamps and gets magazines all ready for mailing. I have an idea which I think is worth something, but don't like to start on it until I know if there is anything similar in use."

A. There are certainly machines to do this. For instance, the ELECTRICAL EXPERIMENTER is folded and wrapt every month on a machine of this kind. While the machine does not automatically stamp the wrappers, this, however, can readily be accomplisht by a simple attachment on the market now. If our correspondent has something fundamentally new, he is advised to get in touch with any of the large printing houses who have such machines and he can hear from them as to what the requirements are.

Safety Elevator Device

(322) Ralph E. Hast, Elkins, W. Va., explains his invention as follows: "The idea of this invention is to have a device on elevator doors which, when the doors were closed, would close a circuit, allowing the operator to ascend or descend, but when the doors are *not* closed the circuit would be open, thus rendering it impossible to operate the elevator. The device on the doors would be a partly concealed socket which operates easily but forms a constant circuit when closed and cannot be jarred out of place."

A There is nothing new in our correspondent's idea. Safety devices of this kind have been used for many years, and are in use right now. Take for instance the New York Subway Elevators, particularly the ones at 181st Street and Broadway, operate with this device.

Depth Bomb

(323) George W. Curtis, Detroit, Mich, has invented a depth bomb which works on the sea water-conductivity plan by means of which contacts are closed when the sea water enters the intake of the bomb. Our advice is asked as to the practicability of this device.

A. There is nothing new about this device—many bombs of this kind having been proposed during the war. The regular depth bombs, however, working on the hydro-static principle, are very much simpler and better.

U.S. PATENTS



Don't Lose Your Rights

Before disclosing your invention to any one send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

LANCASTER & ALLWINE

255 OURAY BLDG.,
WASHINGTON, D. C.

PATENTS

TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
164 Owen Building, Washington, D. C.
2276-8 Woolworth Bldg., New York City

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE OF CONCEPTION." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention we will give our opinion as to its patentable nature.

Our illustrated Guide Book, HOW TO OBTAIN A PATENT, sent Free on request. Contains full instructions regarding Patents, Trade-Marks, Foreign Patents, Our Methods, Terms and 100 Mechanical Movements illustrated and described. Articles on Patent Practice and Procedure, and Law Points for inventors.

An actual search of United States patents made in all cases before preparing application for patent

Electrical Cases a Specialty Highest References Prompt Attention Reasonable Terms

FREE COUPON!

VICTOR J. EVANS & CO., Patent Attorneys

New York Offices: 1001 to 1007 Woolworth Bldg. Pittsburgh Offices: 514 Empire Bldg. Philadelphia Offices: 135 S. Broad St.
Main Offices: 779 Ninth Street, N. W., Washington, D. C.

Name *Address*

www.americanradiohistory.com

PATENTS COPYRIGHTS TRADE MARKS DESIGNS

U.S.PATENTS

Our facilities for securing patents enable us to give prompt and reliable service at reasonable rates. Inventors are invited to write to us regarding questions appertaining to securing patent protection. All matters receive prompt attention. Send sketch for preliminary examination.

Books free on request

A. M. BUCK & CO.

Patent Attorneys

205 Second National Bank Bldg., Washington, D. C.

PATENTS

LACEY & LACEY

Attorneys-at-Law—Patent Practice Exclusively
Solicitors of
U. S. and Foreign Patents
Trade-Marks, Copyrights

639 F Street, N. W., Washington, D. C.

Write Us for Our Free Inventors' Book
PATENT-SENSE
ESTABLISHED 1869

PATENTS

INVENTORS: Send us sketches or a model of your invention and a description of the device for advice in regard to the best way of obtaining patent protection. Our practical experience covers a period of twenty years. Our hand-book on patents is sent free on request. All communications strictly confidential. Write us today.

TALBERT & TALBERT
Patent Lawyers
4287 Talbert Bldg. Washington, D. C.

Competent Patent Service
By a Former Examining Official of the U. S. Patent Office
NORMAN T. WHITAKER
Lawyer and Engineer
480 Whitaker Bldg. Washington, D. C.
Branch Office, 87 Nassau St., New York City.
INQUIRIES INVITED

PATENTS

Hand Books on Patents, Trade Marks, etc., sent free. Our 70 years of experience, efficient service, and fair dealing assure fullest value and protection to the inventor. Patents procured through us receive free notice in Scientific American.

MUNN & CO., 618 Woolworth Bldg., N. Y.
Washington Office, 625 F St., Washington, D. C.

STAMMERER



Send 10 cents for my remarkable book, "How To Stop Stammering." Kill the fear of stammering. Re education the key.
The Hatfield Institute, 109 N. Dearborn St., Chicago, Ill.

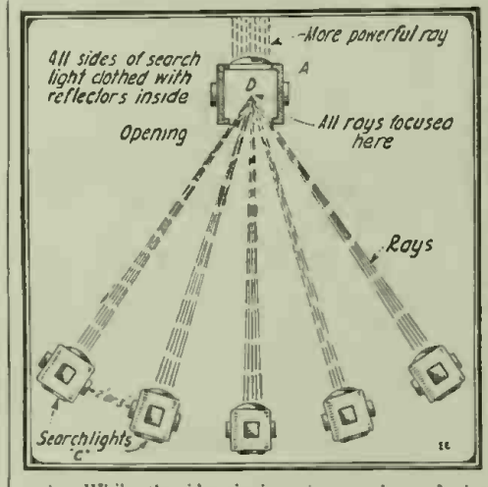
Phonograph Needle

(324) R. W. Napper, B. Guiana, S. America, asks us: "Do you think that a patent of any value could be secured on a double-ended gramaphone needle, i. e., a needle sharpened at both ends? This would tend to save steel, as each needle could be used *twice* instead of only once."

A. We do not think that a needle of this kind would be of great benefit and we believe a needle of this kind was once tried. The reason is that a needle of this sort cannot be held as securely as one with the squared off end; it tends to rattle because the upper end is not supported except by a sharp point.

Searchlight

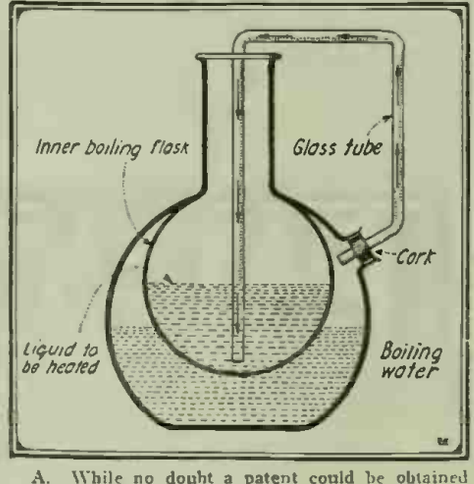
(325) Joel Silver, Newark, N. J., submits the following idea: "I think that if about five searchlights have their rays focused on the inside of another larger searchlight (see illustration) there will be more power; hence a small searchlight, with the aid of others, can be made more powerful. The rear of the main light (A) is cut open (B). All the searchlights (C) have their rays focused upon the center (D) of A. With very good reflectors and a very powerful lens, I am quite sure that a longer distance will be obtained. That is, it will be five times as powerful as one of its size."



A. While the idea is ingenious and no doubt novel, it certainly is not practical, for nothing could be gained either electrically or economically to arrange the searchlights as shown. The reason is that one searchlight can be made to give the same amount of light by using large enough carbons and consuming a corresponding amount of current. Of course, a multiplicity of searchlights are used in a great many cases, but not to concentrate the light on a point. They are usually employed to throw the light over an extended surface.

Chemical Flask

(326) Eug. Lavigne, Montreal, Can., submits diagram and sketch of a combined water bath and boiling flask. It is shown in our illustration. He wishes to know if this idea is patentable and if it is practicable.



A. While no doubt a patent could be obtained on this device, we do not think it would be of much value for the reason that it could be used only in very few cases. As our illustration shows, the evaporating water would flow into the central flask and it is quite certain that more or less water would find its way into the central flask, where surely it is not wanted or needed. This is our main objection to the idea.

In the June issue: "HOW TO FINANCE AND MANUFACTURE A PATENT," by Jay G. Hobson.
A very important article for all interested in patents.

Patents Promptly Procured

Send sketch or model for actual search of U. S. Patents. Highest references. Personal service. Moderate fees. Write for Free Patent Book.

GEORGE P. KIMMEL, Patent Lawyer
99-T Loan & Trust Bldg. Washington, D. C.

PATENTS

Inventors Invited to Write for Information and Particulars
Highest References. Best Results.
Promptness Assured.
WATSON E. COLEMAN
Patent Lawyer
624 F Street N. W. Washington, D. C.

How to Get Rid of Moles



A simple, safe home treatment—15 years' success in my practice. Moles (also BIG growths) Dry Up.

Ask for Free Booklet of Full Particulars

WM. DAVIS, M.D.
4140 State Street Perth Amboy, N. J.

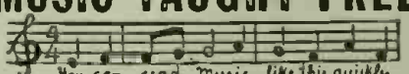
LEARN WATCH REPAIRING



You can learn by our modern and original system of instruction every part of the Watch Repairing Trade at home as good or better than at a shop. You can earn money while learning and secure a well paying position or start in business after completing our course of instruction. Good watch repairers are always in demand and earn from $20 to $35 per week. For particulars apply to the

Milwaukee School of Watchmaking 165 Mason St., Milwaukee, Wis

MUSIC TAUGHT FREE



In Your Home. Write today for our booklet. It tells how to learn to play Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced pupils.
American School of Music, 57 Lakeside Bldg., Chicago

"Hang Your Own Lighting Fixtures"

One Light Bracket $1.05—4 Light Shower $6.15 Semi-Bowls $5.85—Plate & Ball 85c, complete with glassware, Wired, Fine finishes. Send for Photos complete line.

ERIE FIXTURE SUPPLY CO.
Sta. C., Erie, Pa.

SELENIUM CELLS

Guaranteed 99% pure selenium

Made by people who know their business, for the most difficult work, requiring very sensitive, quick acting cells.
Special cells to order.

THE SELENIUM LABORATORIES,
New York Offices, 56 West 45th St.

EASIEST SHORTHAND



Learn in 8 evenings home study; then acquire speed with K. I. Shorthand. Amazingly simple, easy. Approved by experts. Write dictation, messages, etc., rapidly as spoken, after brief pleasant practice. Favorite method for personal use; make notes at lectures, meetings; keep confidential diary. Big help to any profession or business; aid to your career. Used in Army, Navy, courts, commercial schools; by public and private stenographers, teachers. Slight cost. K. I. Shorthand—for busy people, including YOU. Proof Lessons. Guarantee and Brochure with Testimonials free, postpaid. Address: KING INSTITUTE, EL 300, Station F, NEW YORK CITY



Feldman's "Geyser" Electric Water Heater

Instantaneous Hot Water

FELDMAN MFG. CO.
1500 Times Bldg. New York City

RAISE BELGIAN HARES For Us



HUGE PROFITS easily and pleasantly made. We furnish stock and pay you $6.00 a pair and express charges for all you raise. Contract and book "Fortunes in Hares", by mail Free.
NATIONAL FOOD & FUR ASSOCIATION
Dept. 24 MILWAUKEE, WISC.

www.americanradiohistory.com

COLD LIGHT

(*Continued from page 23*)

proper conditions the small light wave may be given off by the electron without affecting the whole molecule in the least. *That is cold light.*

An interesting experiment can be performed with a vacuum tube, which illustrates completely the principle of light production by ionization, and at the same time explains the principle of the Moore light. Few people, other than scientists, realize what a peculiar thing the production of light in a vacuum or Geissler tube is. The light is evidently not the product of heat, but depends on the fact that the electric spark breaks the gas molecules up into charged particles or ions. And this phenomena is most noticeable when a certain degree of exhaustion is reached in the tube.

When air is pumped out of a tube in which there is an electric spark discharge, several different stages, as shown in Fig. 3, are successively reached. At first the discharge in the tube is the ordinary disruptive spark. In the next stage it forms a quiet thread of light thru the tube. Then the thread of light becomes a broad pencil of light, and finally with more exhaustion the whole tube is filled with a soft luminous glow, which is technically known as the *positive column*. This is the point of highest conductivity of the tube, and may be reached with an ordinary air pump. With further exhaustion, by means of a special air pump, the resistance increases, the cold light disappears, and the point is reached where X-ray phenomena and fluorescence appear. The color of the light in the tube depends on the gas used in the tube and is undoubtedly the product of the ions. Just before the war a Frenchman, Claude, devised a means of producing in quantities the rare gas, *neon*, which gives an intense yellow light in a vacuum tube. The carbon dioxid which Moore uses gives a white light. Other gases, possibly rare ones, may be found which are better still, and *helium* has been suggested as a standard by some. However, up until the time the U. S. Government discovered the way of producing it in immense quantities for balloon work, during the war, it was too rare to be practical. The more the conditions in such a light can be improved, and the more nearly the light is a pure ionization or cold light, the higher the luminous efficiency will be. An interesting table is given, showing the progress which has been made up to the present, including the vacuum tube.

Luminous Efficiency of Various Illuminants

Candle	2 per cent
Gas mantle	5 per cent
Carbon lamp	6 per cent
Flaming arc	15 per cent
Vacuum tube	40 per cent

REVOLUTION COUNTER FOR DYNAMOMETER

(*Continued from page 39*)

duration of thirty seconds. The time element may be changed at will by the use of saws of any desired number of teeth.

To start the apparatus, the starter button is brought into action until both brushes bear on the metal drum. This completes the circuit and engages the clutch thru the electro-magnet and spring thus starting the counter. At every swing of the pendulum, the circuit thru the solenoid is made and broken, thus drawing the saw—as illustrated—thru a circumferential distance equal to one tooth. After thirty swings of the pendulum one brush is again bearing on the insulated section of the drum and the counter clutch is disengaged. A reading of the counter gives accurately the number of revolutions of the dynamometer in thirty seconds. This counter may also be used in connection with a fuel weighing apparatus.

Contributed by W. H. WEBER.



Become an Electrician In One Year Here

Or Learn An Electrical Trade In 6 Months

THIS school teaches electricity thoroughly, from the very fundamentals, including the laws and principles of electricity and the theory of direct current—together with practical lectures and problems, actual training in laboratory work and electrical machine departments of designing, building, repairing, installing, operating, etc. And the faculty here are practical electrical engineers who know how and what to teach because they know what knowledge and ability the great field of Electricity requires.

As one example of this school's thoroughness and practical training and development witness the pictures above showing view of Motor Generator Department, where students actually generate Electricity, making all connections and performing all the necessary operations, on the same practical basis as in a power plant or large industrial concern.

The thoroughness in essentials here, the practical training and able faculty, together with this school's broad facilities and intensive abilities, are the reasons why you can become an Electrician here in one year, or master one of the Electrical Trades in 6 months.

If you are determined to achieve success in the Electrical Field this is your school. You will acquire and accomplish more in a shorter time at a less cost and be a fully developed, practical electrical man when you finish. Mail the coupon at the right and get complete illustrated and descriptive details of the advantages this school affords. If interested in Electrical Engineering with B.S. degree, check same on coupon. Mail the coupon now.

R. O. T. C. UNIT

The War Department of the U. S. Government has recently authorized Junior and Senior Reserve Officers' Training Corps Units in this school. Students in courses listed below are entitled to join Junior Unit if they wish to do so. R. O. T. C. membership offers such advantages as: Complete free uniform equipment, free summer training camp trip, summer uniform outfit and free special technical instruction. Membership and all obligations cancelled on termination of school work.

You Can Earn While You Learn

WE will provide you with part time employment to help defray your expenses here and give you actual outside experience — without interfering with your class hours—which is fully explained in our catalog. Mail the coupon.

School of Engineering of Milwaukee

An Electrical Technicians' Institute

Department of Practical Electricity

(88) 373 Broadway, Milwaukee, Wis.

MAIL THIS COUPON NOW

School of Engineering of Milwaukee,
(88) 373 Broadway, Milwaukee, Wis.

Without obligating me, please furnish details of course (of courses) checked below.

- Electrician
- Electro-Technician
- Electrical Engineer (3 yrs.)

SPECIAL 6 MONTHS' COURSES

- Draftsman
- Electrical Trouble & Lineman
- Electrical Wireman
- Electrical Motor Repairman
- Telephone Trouble & Repairman
- Electrical Meterman

NAME .....

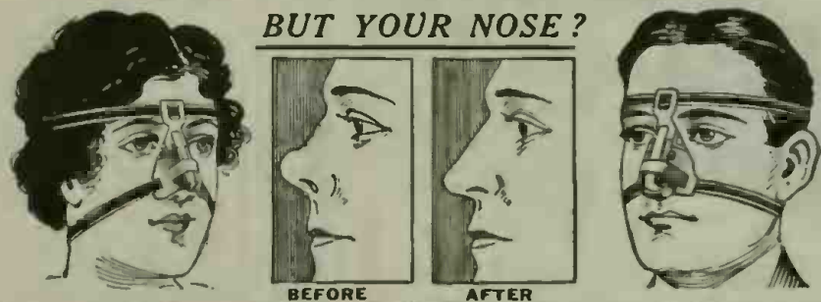
ADDRESS .....

CITY ..... STATE .....

EDUCATION ..... AGE .....

YOU HAVE A BEAUTIFUL FACE

BUT YOUR NOSE?



BEFORE AFTER

IN THIS DAY AND AGE attention to your appearance is an absolute necessity if you expect to make the most out of life. Not only should you wish to appear as attractive as possible, for your own self-satisfaction, which is alone well worth your efforts, but you will find the world in general judging you greatly, if not wholly, by your "looks," therefore it pays to "look your best" at all times.

Permit no one to see you looking otherwise: it will injure your welfare! Upon the impression you constantly make rests the failure or success of your life. Which is to be your ultimate destiny? My new *Nose-Shaper*, "Trilety" (Model '24) corrects now ill-shaped noses without operation, quickly, safely and permanently. Is pleasant and does not interfere with one's daily occupation, being worn at night.

Write today for free booklet, which tells you how to correct ill-shaped noses without cost if not satisfactory

M. TRILETY, Face Specialist **1162 Ackerman Bldg., Binghamton, N. Y.**

www.americanradiohistory.com

MURDOCK
No. 55



Pre-War Prices

Complete 2000 Ohm Double Set	Complete 3000 Ohm Double Set
$4.00	$5.00

Without exception the best radio receiver value in the world.

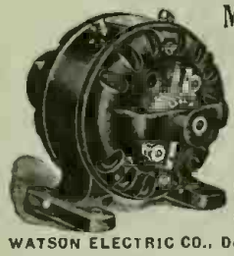
Positive satisfaction guaranteed. **Fourteen Days' Trial,** and money back if they don't make good. **Get Your Set Now.**

We are prepared to supply promptly your requirements for good radio instruments.

Ask for Bulletin No. 19.

WM. J. MURDOCK CO.
55 Carter St
Chelsea, Mass.

Pacific Coast Representatives:
The Keeler White Co.
221 Second St., San Francisco, Calif.



MAKE ELECTRICTY BY HAND

Simply turn the crank and make 110 volts A.C. While they last

Only $5.00

Order from this ad.

House-Lighting Plants

$225 to $2,100. Battery Chargers. Dynamos. Motors, all sizes. State agents with $500 capital wanted.

WATSON ELECTRIC CO., Dept. 14, Gas Building, Chicago

WIRELESS IS SIMPLE

when the Summers' theories of wireless are applied to wireless systems, transmitting and receiving apparatus. Will advance the wireless art by leaps and bounds. Get on the right track with your experiments. This booklet should be in every home and school. United States and foreign copyrights. Price $2.00 registered postpaid to any part of the world.

Address FRANK E. SUMMERS, Memphis, Mo.

RADIO DEPARTMENT
Continued

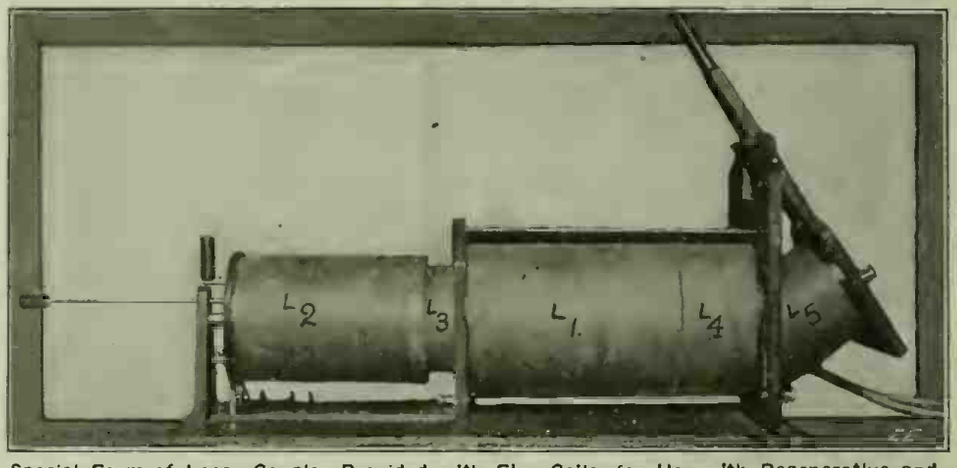
New Regenerative Vacuum Tube Circuits
(*Continued from page 33*)

these wave lengths, the proper size inductances are always to be utilized. It is advisable to use this circuit whenever large amplifications are desired at extremely low wave lengths. Tests have been made with this circuit in comparison with other low wave length regenerative circuits, and it was found that the above circuit gave better and more efficient results and that it was possible to produce regeneration in the plate circuit with much greater ease than that obtainable with the usual type of circuit.

A similar but a more complicated circuit is shown in Fig. 5. The radio frequency bridging condensers C_3 and C_4, are used to permit radio frequency currents to pass freely to the plate.

circuit is to amplify the audio frequency currents of the first vacuum tube. This audio amplification is accomplisht thru coils L_6 and L_7, which are mutually coupled with this arrangement, and it is possible to amplify the signals to 1000 or more times their original value. It was possible, in tests, to amplify signals received from a distance of 5000 miles to such a value as to cause the incoming signals to be heard twenty feet away from the telephone receiver. The telephone receiver was equipt with the proper megaphone.

In Fig. 7 is delineated a radio telephone circuit using a vacuum tube for the generation of sustained oscillations. The grid and plate are coupled magnetically thru inductance L_2, which also energizes the antenna circuit thru inductance L_1. Condenser C is used to tune the oscillatory circuit CL_2. The plate voltage in this work is considerably higher than the plate voltage used in receiving sets and it usually ranges from 300 to 1500 volts. This is usually accomplisht by the use of the generator G. The inductance L_3 which is a choke



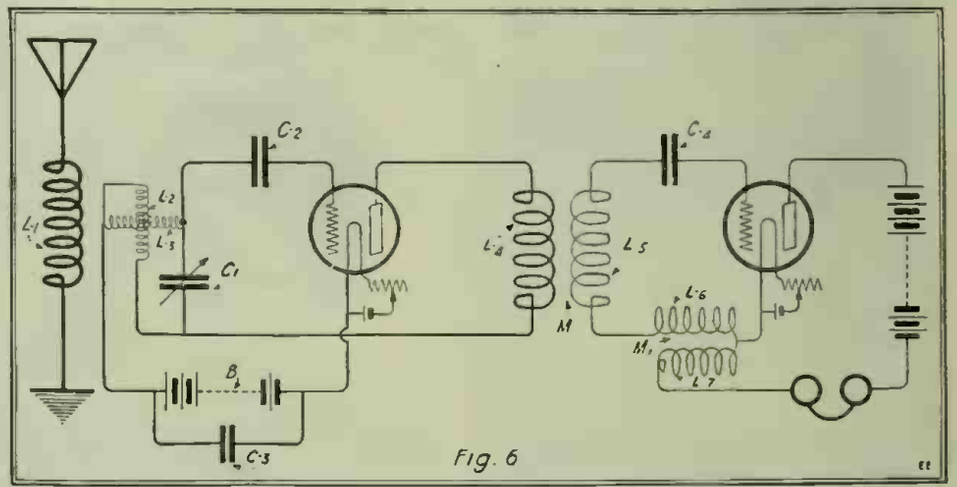
Special Form of Loose Coupler Provided with Five Coils, for Use with Regenerative and Wireless Telephone Audion Circuits Here Described.

With all the above circuits so far described, it will be noticed that the regenerative coupling is accomplished in the antenna circuit, thereby amplifying the incoming radio frequency oscillations and therefore producing maximum amplification without the loss of any feeble currents due to coupling in the secondary oscillatory circuits, which means of regeneration of incoming signals is accomplisht with present forms of circuits. Thus, it is seen that direct results and better efficiency can be accomplisht with the circuits described.

Fig. 6 outlines a circuit similar to Fig. 5 in which the plate of the first vacuum tube is coupled magnetically thru coils L_4 and L_5. The purpose of another vacuum tube coil is used to prevent high frequency currents from the plate circuit entering the generator. Modulation is accomplisht by shunting a telephone transmitter T, thru a resistance R and battery B across the grid and filament of the tube, as indicated.

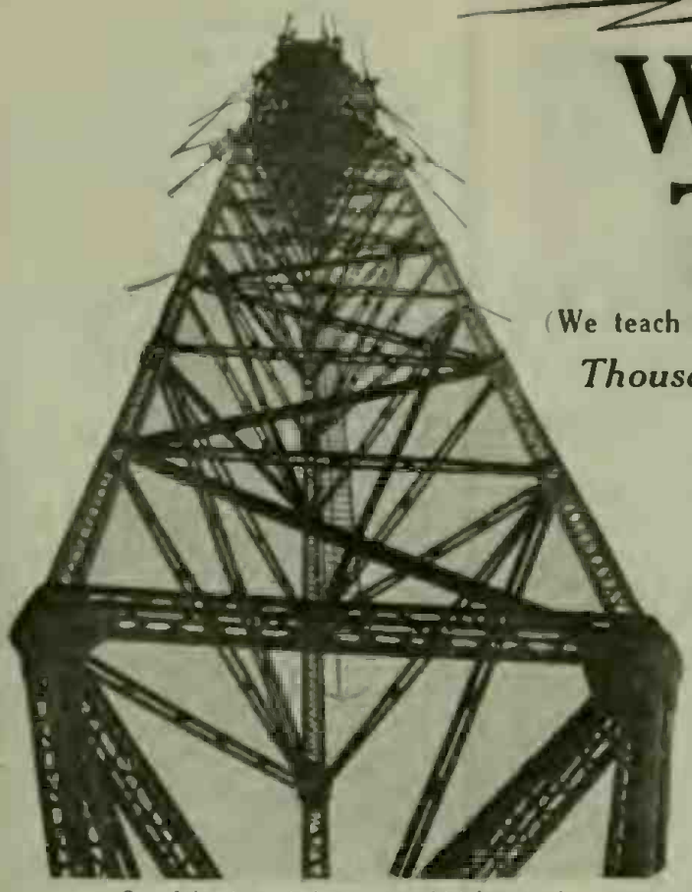
Another successful circuit is shown in Fig. 8 and voice modulation in this circuit is accomplisht by coupling the telephone transmitter thru an induction coil I, comprising coils L_8 and L_9. The primary L_8 is connected to the transmitter and battery B, as shown. The modulated wave is imprest upon the grid in the vacuum tube, which wave is superimposed upon the main radio frequency oscillations.

(*Continued on page 76*)



Two Stage Audion Amplifier, the Circuit of the Second Audion Being Magnetically Coupled to the First Audion Circuit. Amplifying Power 1,000 Times and Better.

www.americanradiohistory.com



One of the giant wireless towers which keeps us in constant communication with Europe

Wireless in Ten Weeks

(We teach you in your own home during your spare time)

Thousands of operators needed for America's Merchant Marine

The age of wireless is here. The experimental stage has passed. Wireless now equals in importance telegraphy, and telephony. It has assumed its place among the great commercial industries of the earth. So rapid has been the development and growth of wireless in recent years that there has been left in its wake a tremendous shortage of operators. Actually thousands upon thousands are now needed for permanent "peace time" positions offering wonderful opportunities for advancement.

Earn up to $200 per month

In the short period of ten weeks we can make of you a wireless operator, a man with a profession, independent, and not subject to the rise and fall of wages in the labor market. Salaries are as high as $200 per month. There is a position in the merchant marine, the army, the navy, or a land station, awaiting everyone completing our course. We give you this training at home, by mail, in your spare time. It is not necessary for you to lose any time from your work to take the course.

Free Instruments—

While a student of our course, we present absolutely FREE to every student enrolling with us a Standard Set of Instruments (the same as used by the Government in testing applicants for first grade commercial licenses). This machine sends and records messages.



Travel the world over or locate at a land station in America.

America is spending billions of dollars on the mightiest navy and merchant marine in the world. Practically all vessels are being equipped with wireless apparatus of the most up to date type. Thousands of operators are needed now. The field affords a wonderful opportunity for the man who starts now to master wireless.

Our students actually pass the commercial examination in ten weeks or less.

Get your instruction from the Nation's Capitol. Our course is endorsed by officials of the U. S. Government.

The National Radio Institute, headed by authorities who have been closely allied with governmental training of students, has perfected an easily mastered course in wireless telegraphy whereby students are taught completely in ten weeks, either here in Washington at our large residence school or at home by mail. Many of our students are ready to take up actual wireless work in much less time. The course is founded on actual practice, hence the rapid progress of the student.

A Valuable Book Free

Our booklet, "Wireless—The Opportunity of Today and the Greatest Field of the Future," gives you complete information in regard to our course, the quick and easy methods by which you can master wireless and other important facts you should know. It is free. Just mail the coupon. No obligation whatever on your part.

NATIONAL RADIO INSTITUTE
Dept. W
14th and U Streets, N. W. Washington, D. C.

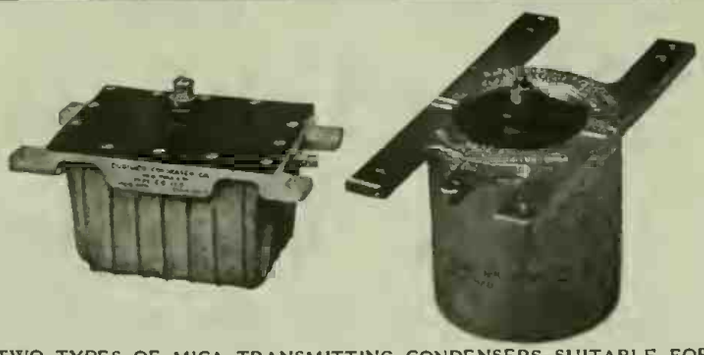
FREE COUPON

NATIONAL RADIO INSTITUTE,
Dept. W, Washington, D. C.

Send me, free of charge, your booklet "Wireless—The Opportunity of Today and the Greatest Field of the Future," with full particulars regarding your famous 10 weeks' Home Study Course, and your Special Free Instruments Offer.

Name .....
Address .....
Town ..... State .....

www.americanradiohistory.com



TWO TYPES OF MICA TRANSMITTING CONDENSERS SUITABLE FOR MODERN AMATEUR APPARATUS. 21000 VOLTS. .004 MFD.

Make Your Wireless Apparatus Send Further
Last Longer and Work Better

The wireless amateur and experimenter is once more busy constructing apparatus for use the moment that orders go forward allowing amateur stations to open.

The kind of apparatus you used before the war doubtless answered your purpose nicely, but just consider the tremendous advancement made in the art during the past two years and you will appreciate your modern apparatus must contain several new types of equipment to bring it up to date.

DUBILIER
MICA CONDENSERS

proved their real worth in the Navy, the Signal Corps, and as a part of the equipment of the fighting Airplanes both here and abroad since 1916.

You can now purchase a genuine DUBILIER MICA CONDENSER for your new set for any voltage and capacity. They replace Leyden Jars with greater efficiency and without brush discharge and with negligible losses. They are compact and indestructible.

Made in any capacity and up to 1,000,000 volts. Special condensers supplied for experimental work.

Used in practically every Government installation.
DUBILIER MICA CONDENSERS are now ready for your use.

	Type A	Navy Type
.002—21000 volts	$11.00	$18.00
.004—21000 volts	20.00	35.00

DUBILIER CONDENSER CO., Inc., 217 Centre St., New York

For Great Britain, Address DUBILIER CONDENSER COMPANY, Ltd., 1 & 3 Stephen St., London, W. 1., England

Boys! You Can Make Your Own Electrical Apparatus with the aid of these wonderful books
Home-made Electrical Apparatus

By A. M. Powell



Three wonderful big books, chuck full of just the sort of information you have been looking for and at a price within reach of your pocket book. Each volume is printed on heavy paper, contains 75 pages and over 60 **illustrations, complete working drawings for making every sort of electrical apparatus.** Written so you can understand them. The price is only 25 **cents per copy**—practically the cost of publication. See partial table of contents below and order now. The supply is limited.

Vol. I Contains *working drawings* and directions for making all sorts of Static Machines, Static Apparatus, Home-made Batteries, Storage Cells, Transformers, Rectifiers, etc.

Vol. II contains *working drawings* and directions for all sorts of Voltmeters, Ammeters, Galvanometers, Switches, Rheostats, Telegraph Keys, Sounders, Telephones, Shocking Coils, Spark Coils, Experiments, etc., etc.

Vol. III contains *working drawings* and directions for making all sorts of Dynamos, Motors, Electric Engines, Miniature Lighting Plants, Wireless Telegraph Apparatus, Tesla Coils, Wireless Telephone, Electroplating, Experiments, etc., etc.

Any of these wonderful books will be sent to you *postpaid* for 25 cents.

COLE & MORGAN, Inc., *Publishers and Booksellers*
P. O. Box 473, C. H. Sta., New York City

The Breakers
Atlantic City's Newest Fire-Proof Hotel



Ocean Front. Unusually attractive during the Autumn and Winter seasons.

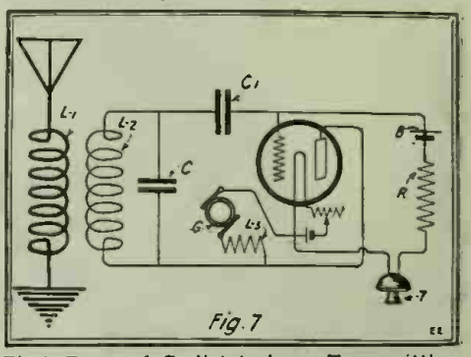
American and European Plans

Luxurious lobbies, spacious verandas and sun parlors overlooking the ocean. Charming afternoon musicales and evening concerts. A palatial residence for those seeking rest and recreation. Sea water baths. Fireproof garage. Illustrated booklet sent on request.

NEW REGENERATIVE VACUUM TUBE CIRCUITS.

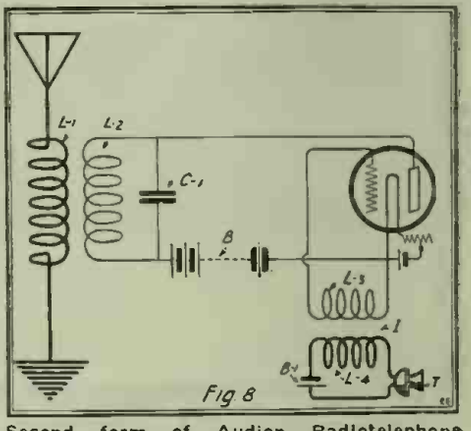
(*Continued from page 74*)

Another circuit to accomplish the same result as above, is indicated in Fig. 9, in which case the oscillations are started thru the coupling coil M and the voice modulation imprest upon the grid circuit is ac-



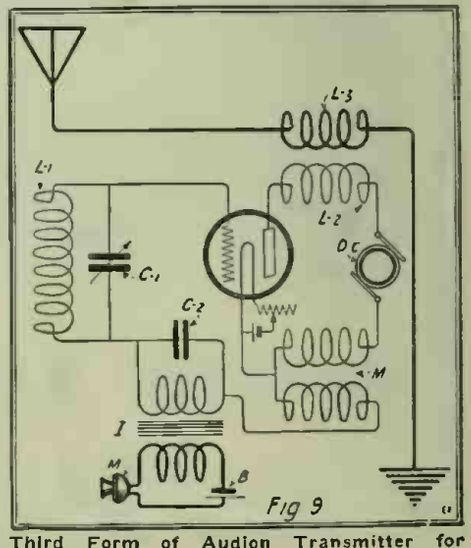
First Form of Radiotelephone Transmitting Circuit, Utilizing an Audion, of Interest to Amateurs.

complished thru the telephone induction coil whose secondary is connected thru the grid and one leg of the coupling coil M, and the other to the main oscillatory coil inductance L_1. The primary of the induction coil is connected with the microphone and battery as indicated. Tuning is accomplished with condenser C_1, which is in the oscillatory circuit C_1L_1. Energy trans-



Second form of Audion Radiotelephone Transmitter with Magnetically Coupled Modulating Circuit.

ferred to the antenna circuit is accomplished thru the plate inductance L_2, inductively coupled to the antenna inductance L_3. To reduce the impedance of the grid circuit due to the high inductance of the secondary of the telephone induction coil, it is necessary to shunt a capacity C_2 of considerable magnitude to overcome this excess impedance.



Third Form of Audion Transmitter for Radiotelephony.

www.americanradiohistory.com

PUTTING IT OVER ON FRITZ.

(Continued from page 22)

see the sector thus marked out—by triangulation the position of every wireless sender could be ascertained—abandoned. This prediction came true every time, and tho the secret was guarded jealously during the war, it now can be let out, as Germany is harmless, and every other nation knows just how the prophecy was made.

It was not often that the Germans kept Allied brains working overtime on a puzzle. In a single instance, however, the Huns thought up a devilishly clever plan for getting secret information into Germany. This was called for weeks and weeks the "Nauen-Madrid Buzz."

Nauen, of course, was the official German Government wireless station, while in Madrid, Spain, was situated a station capable of sending messages to any part of the German empire in Europe. During all the months of the war in which direct communication between Germany and the outside world was practically severed official war bulletins and "inspired" news came out from Nauen thru Madrid. The latter station sent back neutral news and views of the war.

In the spring of 1917, however, came a queer development. Every now and then Nauen would seem to be badly bothered by "static" or by some imperfection in the sending apparatus. The station would emit an unintelligible buzz, like unto no message known to operators. This was regarded with grave suspicion by the Allied intelligence departments, and when Madrid started the same thing a whole corps of military wireless detectives were assigned to the problem. No one doubted that this was some new form of communication, but what on earth could anyone make out of that continuous buzz?

Weeks past with no light on the question. The two stations had grown bolder and were using the buzz constantly. Valuable information leaked to the enemy, and it was made practically certain that the "buzz" was responsible.

The mystery was solved by the help of a lucky accident. The technique of studying every code wireless message of the enemy had been to take down the sounds of the spark on a cylinder phonograph record; this gave the intelligence officer an accurate reproduction at any time he desired. On the occasion mentioned an officer had been trying to establish some basis of similarity between several of the records without success, when his machine ran down. As the needle grated to a stop on the cylinder the officer sat up suddenly. He thought he detected something that sounded just a little like a message!

He wound the phonograph and turned its speed indicator down so that the record revolved only a few times a minute. Then he applied the needle again. Aha! *There was something there!*

Tho this arrangement gave him insufficient to enable him to solve a code, he had the idea. Next the phonograph cylinder was attached to a motor, revolving at three hundred revolutions a minute, and several records taken at high speed of the peculiar buzz. When these records were re-run at moderate speed it was simple; the messages were decoded in an hour and were found to be questions and answers on topics the Germans were not even supposed to know existed!

The method used by the Germans and by the Madrid operator had been simply to punch in the message on a perforated paper roll. Then running this thru the sending equipment at high speed the message had gone into the ether waves at too rapid a rate to be caught by ordinary methods. At the other end the receiving station used the phonograph equipment to catch and record the message.



Brandes "Superior" Head Set, complete with head band, $6. A professional set within the means of every amateur. 2000 ohms.

Five Points of BRANDES Superiority

Brandes wireless headsets score 100% on the five factors that determine the efficiency and value of receivers for both professional and amateur use.

Sensitiveness: Brandes receivers do more than make weak signals *audible;* they make them *readable*,—clear and sharp This is because both receivers are exactly matched in tone.

Dependability: Made by hand by an organization which manufactures wireless receivers *only*, carefully measured by a micrometer for exact construction, and tested against a standard receiver—Brandes headsets can be counted upon for absolute dependability under every condition.

Lightness: Because Brandes headsets were first designed for professionals, they are so made that they can be worn long hours without discomfort.

Service: With ordinary care, Brandes receivers give service indefinitely. Hundreds of owners would not exchange sets several years old for new ones.

Appearance: Compact in size, correct in head band design, with an orderly arrangement of cords, and made from the finest materials, Brandes headsets have a handsome, efficient appearance.

Booklet "E" will be sent upon receipt of 4c in stamps.

C. BRANDES, INC. 32 UNION SQUARE NEW YORK CITY

Complete line of Brandes receivers for those in Western States and Pacific Coast. Catalogue "E" on request.

Balboa Building FORD KING San Francisco, Cal.

Commercial Telegraph Apparatus Bargains

Standard twenty ohm Telegraph Sounders at	$2.00 each
Standard Telegraph Keys at	1.25 each
110 Volt A.C. Dynamos	
Three Bar.....	1.75 each
Four Bar.....	2.25 each
Five Bar.....	2.75 each

For other bargains see pages 90 & 91

Skinderviken Telephone Equipment Co.

Abbreviated Address

STECO-2118-2136 N. Clark St. CHICAGO

TELEGRAPHY

Both wire and wireless, and Station Agency taught thoroughly and quickly, BIG WAGES NOW PAID, some of our recent graduates procuring $138.00 per month to start. Great opportunities for advancement. Our school the oldest and largest—annual enrollment 600 students. Endorsed by railway, telegraph, wireless and government officials. Expenses low—chance to earn part. Catalog free. Write.

DODGE' INSTITUTE, 22nd St. Valparaiso, Ind.



De Forest's New Catalog

illustrating and describing the very latest and best in

RADIO APPARATUS

For Discriminating Users

is ready for mailing. Complete information regarding the De Forest "Unit" Set, "Honey Comb" Coils (a radical departure from previous forms of apparatus), variable air and fixed condensers, wavemeters, variometers, detectors, etc., will be sent upon receipt of 10c to defray postage.

De Forest Radio Tel. & Tel. Co.

1391 Sedgwick Ave. New York City

www.americanradiohistory.com

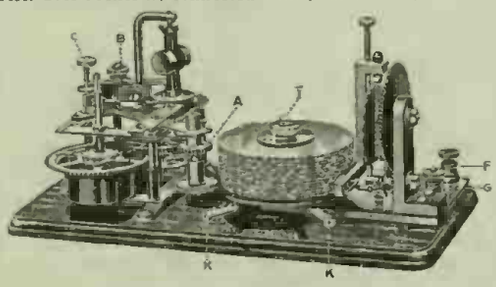
LEARN TELEGRAPHY WITH THE OMNIGRAPH

The Omnigraph Went to War-- But It's Home Again

During the war, scarcity of material and orders from the Government and from the leading Universities, Colleges, Telegraph and Technical Schools, closely connected with the Govt. in teaching the Codes, made it impossible for us to make prompt shipments to individuals and to the trade.

We are now filling all orders promptly.

The Omnigraph Automatic Transmitter will teach you the Continental and the Morse Codes, at home, in half the usual time and at the least possible expense.
THE OMNIGRAPH, connected with your Buzzer, or with Buzzer and Head Phones or with Sounder, will send you unlimited Wireless or Morse Code messages, by the hour and at any speed you desire. Impossible to anticipate.
We offer the **Omnigraph** as a positive success and with the strongest of endorsements. It has been adopted by the U. S. Government, Department of Commerce, and is used to test all operators applying for Radio licenses. Many leading Telegraph Schools use **The Omnigraph** to send to their students in preference to hand sending. Ask us for their names if you so desire. We have hundreds of unsolicited testimonials and with permission we are publishing one of them.



205 New Jersey Ave.,
Anglesea, New Jersey.
Feb. 17th, 1919.

The Omnigraph Mfg. Co.,
39 Cortlandt St., New York City.
Dear Sirs:—Received my Omnigraph No. 2 with a set of Morse and an extra set of Continental Dials and wish to thank you for your prompt shipment.
Five minutes after I had received the box, I had it unpacked and working. I cannot praise it too much and a friend of mine as soon as he heard it, said: "Why, man, that sends PERFECT Morse and Wireless." I will give you all the praise that I can. I myself doubted that the machine would do all you stated but it does all you state AND THEN SOME.
Hoping to be of help to you and wishing you the best of success in your business, I remain
Very truly yours,
(Signed) Thomas W. Braidwood,
Pres. Cape May County Radio Asso.

205 New Jersey Ave.,
Anglesea, New Jersey.
Feb. 20th, 1919.

The Omnigraph Mfg. Co.,
39 Cortlandt St., New York City.
Dear Sirs:—In reply to your letter of 19th inst., I am GLAD to give you permission to use my previous letter in any way you see fit.
Two weeks ago I could not receive enough Morse to understand what a person was saying but today I can receive about ten words per minute on my Typewriter when the OMNIGRAPH is sending.
I have a First Grade Commercial Radio Operator's License and am using the OMNIGRAPH to better my receiving and to fit me for land telegraphy.
Wishing you the best of success for the future, I remain,
Very truly yours,
(Signed) Thomas W. Braidwood, Radio 3 U Z.
Pres. Cape May County Radio Asso.

If you are a beginner, it will make you an operator in the shortest possible time.
If you are already an operator, the OMNIGRAPH will make you a better one.

Send for free catalog describing 3 different models—$9.00 to $23.00—or order direct through your Electrical Dealer. We sell the **Omnigraph** under the strongest of guarantees—you must be satisfied or your money back.

THE OMNIGRAPH MFG. CO., 39 L. Cortlandt St., New York

How did you learn to talk? By listening.
JUST LISTEN,—THE OMNIGRAPH WILL DO THE TEACHING



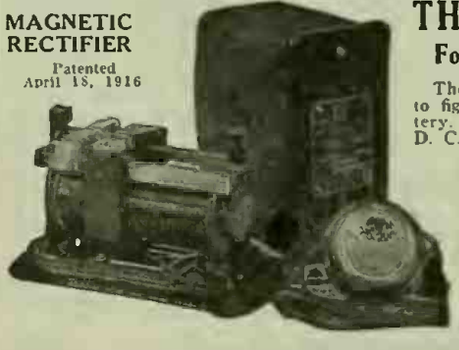
DUCK'S BIG 300 PP. Wireless & Electrical

Catalog is now as it always has been, the largest and most complete and dependable Wireless Catalog published. Mailed for 12c in stamps or coin which may be deducted on first order of one dollar. Catalog not sent otherwise. This catalog costs us twice the price of other catalogs.

Everything in wireless *worth while* is listed in this catalog. The experienced amateur will tell you to see our catalog before buying. You are thereby insured against an unwise purchase. It is the *Beacon Light* to guide you right in the selection of your wireless apparatus. No bigger or better values are obtainable elsewhere. Send for revised price list. It is yours for the asking.

THE WILLIAM B. DUCK CO., 230-232 Superior St., Toledo, Ohio

MAGNETIC RECTIFIER
Patented
April 18, 1916



THE F-F BATTERY BOOSTER

For Home Charging and Service Stations

The wireless ban will soon be lifted, and it is time to figure what Rectifier you need to charge your battery. The F-F Outfit is furnished for either S. C. or D. C. current and attaches to any light socket, making a convenient, simple, economical, and reliable home charging situation.

The battery must be charged often to maintain a high point of efficiency and keep the plates above the critical sulphation point. This will prolong indefinitely their life and usefulness.

Write for Bulletin No. 12.

The France Manufacturing Company
Cleveland, Ohio

Advertising Talks
NUMBER 2

IF you have ever stopped to figure out the terrific cost involved in publishing a magazine, and the small amount of money that you pay for your issue each month, you probably wonder how a publisher can afford to give you as much as he does. If it were not for the advertising carried, he could not do it. Your 20c would not buy a magazine one-half the size, or quality, of the "Experimenter" unless that magazine were supported by the advertisers who use its columns every month.

The *Electrical Experimenter*, especially, costs a vast sum of money every month to produce. The magnificent wash drawings and expensive cuts that you see in every issue and which have made the "Experimenter" famous are only one of the many items that makes the publishing of your magazine a severe and heavy strain. The price you pay for your copy helps to meet part of this expense, but the advertisers foot the most of the bills. Don't let that fool you, however. They are not doing it for any love of the "Experimenter"—it is a business proposition with them. Each and every one have something that they feel is of interest to you. Perhaps it is a piece of merchandise that they want to sell; a new wireless outfit, a correspondence course that they know will improve your mind and equip you to earn more money; maybe it is a book or a novelty that you would enjoy having; but, whatever it is, they are willing to pay their good money to support the magazine in order that the magazine can print their advertisements.

The more advertisers we have, the more income there is each month, and the publishers of the *Electrical Experimenter* have committed themselves to putting back into the magazine, in enlarging its size, and improving its articles, and its drawings, every penny that comes in through the circulation or advertising. You will notice that with this issue eight more pages of *pure text* have been added, making this number the biggest ever published. This was made possible by the big increase in advertising during the past few months. You can help the work along and make the magazine still larger and better, if you will purchase what you need and the things you require in your work or for your pleasure, from the advertisers who are helping you. Read what they have to say in every issue, and when you want anything, no matter what it is, look it up in the advertising columns of the "E.E." and send your orders to those firms who are helping give you a magazine that you would not want to do without.

Live concerns that advertise sell better goods and at a cheaper price, *quality considered*, than unknown firms who persist in "hiding their light under a bushel." Next month I will tell you the real reasons why the quality of any advertised article has to be the very best and show you why you should patronize your own advertisers for this one reason, if for no other.

Advertising Manager.

www.americanradiohistory.com

Mesco Telegraph Practice Set

For Learning Telegraph Codes



The Practice Set comprises a regular telegraph key, without circuit breaker, a special high pitch buzzer, one cell lied Seal Dry Battery, and four feet of green silk covered flexible cord.

The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes.

List No.		Price
342	Telegraph Practice Set, with Battery and Cord	$3.24

Weighs 4 lbs. packed.

Price does not include postage.

MESCO Combination Practice Set for learning the Morse and Continental Visual and Audible Codes



This outfit is the only reliable instrument which will enable students to become proficient operators in the U. S. Naval Service, because it is equipped with a buzzer and miniature lamp enabling the user to master both the visual and audible signals quickly.

List No. 52—Practice Set with Red Seal Battery and Cord $4.05

Weighs 4 lbs. packed. Price does not include postage.

Send for the New Edition of Our Catalog W28

It is pocket size, contains 264 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

Send for the Catalog Now

Manhattan Electrical Supply Co., Inc.

NEW YORK: 17 Park Place — CHICAGO: 114 S. Wells St. — ST. LOUIS: 1106 Pine St.

San Francisco Office: 604 Mission St.



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle massage. Can be used with or without electric current.

All users of the Lek-Tro-Shav speak well of it

A barber says—"Have shaved for years and have never used any shaving device near its equal."

A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."

No. 1 Made for use from Light Socket.

No. 2 Made for use from Dry Battery.

Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.

VIBRATING ELECTRIC RAZOR CO.

Dept. 122. Omaha, Nebr.

PRACTICAL CHEMICAL EXPERIMENTS

(*Continued from page 34*)

clean cut, due to the shears. Since new wool is distinctly elastic, there is a certain amount of *give* to the fibers when subjected to tension. In the case of wool that has been scoured and dyed, the elasticity has somewhat decreased, the fibers becoming considerably firmer. If subjected to tension and rupture, the break has the appearance of a fracture, like a bone.

Referring to Figs. 9 to 18, inclusive, Fig. 9 shows shoddy made from new, fine, blue worsted clips. Notice the great variety of broken ends of fibers, and also the tendency of the fibers to split or tear lengthwise. The fibers showing the side breaks are evidently due to a tearing action of the shoddy machine.

Fig. 10 is a shoddy made from new, fine, black worsted clips. Here again may be noticed their peculiar terminal fractures, where the fiber has been pulled asunder. One of the fibers has a number of *spines* projecting from it. These so-called *spines* are really the fiber cells, which, no doubt, were loosened by the tension on the fibers in the machine. Note that both Figs. 9 and 10 represent new wool that has been simply mechanically reduced to shoddy, and at no time carbonized.

Fig. 11 is shoddy made from carbonized brown serge. Here it may be seen what indicates the brittle character of the fiber, devoid of elasticity. The breaks of the fibers are seen to be quite abrupt.

Fig. 12 is a shoddy made from brown serge that has been carbonized and subsequently stript. The abrupt character of the breaks is plainly noticeable, while at the same time the fibrils comprising the body of the wool fiber are very distinct. Their presence may be attributed to the chemical action of the stripping.

Fig. 13 shows fibers made from blue serge that had been first carbonized, then stript, and afterwards dyed green. Here again we notice the tendency to break longitudinally, and where a terminal break occurs, the fibrils appear distinctly.

Fig. 14 is shoddy from the same batch as that shown in Fig. 12, except that it has been dyed a full red. Here we notice that one of the fibers has been split longitudinally, while the other three fiber terminals show break characteristics that indicate the brittleness of the stock.

Fig. 15 was originally a brown serge that had been carbonized, then stript, afterwards dyed a deep orange, and finally garneted. A great majority of the breaks of fibers in this sample are extremely abrupt. There appears to be no longitudinal ruptures, and this seems to indicate little or no elasticity. Even the fibrils do not show plainly.

Fig. 16 is a shoddy made from brown serge that has been carbonized, stript and dyed an olive shade. Here again we see the abrupt fractures of the fiber and a tendency to longitudinal splitting. The fibrils are entirely wanting.

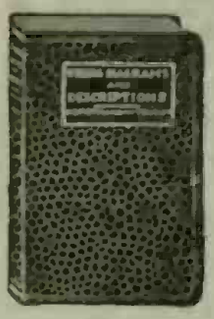
Fig. 17 is a shoddy made from various knit goods of different colors that were first carbonized, then stript, and afterwards dyed blue, producing finished colors of varied hues. The fibers show a rather curious side abrasion; a form of mutilation that appears to be quite common in this lot of shoddy.

Fig. 18 is a shoddy made from serges that were carbonized, stript and dyed a deep maroon. It will be seen that the tendency of some of the fibers is to split longitudinally. The terminal shown is characteristic of a fiber pulled apart lengthwise, when the fibrils have a tendency to separate, forming a brush-like head.

The various characteristics above re-

Drake's Practical Mechanical Books

For Home Study

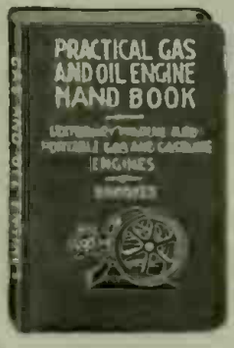


Pave the way for the big positions—the fat pay-envelopes. Written in non-technical language—easy to read—easy to understand. We will send any book postpaid—keep them five days—if not entirely satisfied return the books and your money will be refunded in full. Order direct from this page. Use the coupon.

Electrical Books

Electric Motor Control Systems and Methods. Leatherette	$1.50
Electrical Tables and Engineering Data. Leatherette	1.50
Motion Picture Operation. Leatherette	1.50
Alternating Current. Leatherette	1.50
Wiring Diagrams and Descriptions. Leatherette	1.50
Armature and Magnet Winding. Leatherette	1.50
Modern Electric Illumination. Leatherette	1.50
Modern Electrical Construction. Leatherette	1.50
Electricians' Operating and Testing Manual. Leatherette	1.50
Drake's Electrical Dictionary. Leatherette	1.50
Electric Motors, D and A. Leatherette	1.50
Electrical Measurements and Meter Testing. Leatherette	1.50
Drake's Telephone Handbook. Leatherette	1.50

Automobile Books



Automobile Ignition. Leatherette, $2.00

Brookes' Automobile Handbook. Leatherette .. $2.00

Automobile Starting and Lighting. Leatherette .. $1.50

Ford Motor Car, Truck and Tractor Attachments. Cloth, $1.00

Ford Motor Car, Truck and Tractor Attachments. Leatherette .. $1.50

Automobile Catechism and Repair Manual. Leatherette $1.25

Gas and Oil Engine Handbook. Cloth ... 1.00

Gas and Oil Engine Handbook. Leatherette 1.50

Modern Language Courses



French Without a Teacher, Spanish Without a Teacher, German Without a Teacher. By Professor Phillip Schuyler Allen, University of Chicago. An entirely new home series of modern foreign languages. Simplest, easiest-to-master language method ever devised. French, Spanish or German. Pocket size. Each $1.25

Mail the Coupon NOW

Order on our five day money back plan.

FREDERICK J. DRAKE & CO.,
1009 Michigan Ave., Chicago, Ill.

Enclosed find ($.....), for which please send me prepaid the books checked in this adv. (or list attached). It is agreed that I may return same in 5 days if not entirely satisfied, and money will be refunded in full.

Name .....

Address .....

www.americanradiohistory.com

414 PAGES
145 ILLUSTRATIONS



$1

ELECTRICITY!

HERE'S just the book on Electricity that you need to answer your many questions—to solve your knotty problems, to teach you new kinks, to be your memory for tables, rules, formulas and other Electrical and Mechanical facts that some people try to carry in their heads—and fail.

With this "Little Giant" I. C. S. Electrical Engineer's Handbook in your pocket, toolchest, on your work bench, drawing table or desk, an hour or a day need not be lost "digging up" some forgotten rule, some unfamiliar fact; you'll just turn to the very complete index and get it "in a jiffy." Just a few of the subjects treated are:

Electricity and Magnetism; Electrical Symbols; Batteries; Circuits; Magnets; Direct and Alternating Currents; Dynamos and Motors; Belts; Shafting; Electroplating; Electrical Measurements; Meters; Arc and Incandescent Lamps; Mercury Arc Rectifiers; Transformers; Insulation; Electric Cars; Single and Multiple-Unit Control; Transmission; Rail Welding; Tables of Wires—Sizes, Capacities, etc.,—Mathematical Rules; Formulas, Symbols; Tables of Constants, Equivalents, Roots, Powers, Reciprocals, Areas, Weights and Measures; Chemistry; Properties of Metals; Principles of Mechanics; First Aid, etc.

The Electrical Engineer's Handbook is one of 22 I. C. S. Handbooks covering 22 Technical, Scientific and Commercial subjects. (See titles in coupon below.) They have the contents of a full-size book condensed into pocket-size ready to go with you anywhere and be at your instant command. Substantially bound in cloth, red edges, goldleaf stamping, printed from new, clear, readable type on good quality book paper and illustrated wherever a picture will help.

No Risk Money-Back Offer!

The price of the famous I. C. S. Handbooks, of which more than 2,000,000 have been sold and are in practical everyday use, is $1 per copy. So confident are we that you will find them exactly what you need for ready reference in your work, that we stand ready to promptly and cheerfully refund your money if for any reason you are not fully satisfied with their value. Simply send a letter or the coupon below, enclosing $1 for each book wanted. If at any time within 10 days you wish to return the books, your money will be refunded.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6187 Scranton, Pa.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6187, SCRANTON, PA.

I enclose $_____ for which send me postpaid the Handbooks marked X, at $1.00 each. I may return any or all and get my money back within ten days from receipt:

☐ Electrical Engineer's	☐ Advertiser's
☐ Telegph. and Teleg. Engineer's	☐ Business Man's
☐ Mechanic's	☐ Bookkeeper's
☐ Steam Engineer's	☐ Steno. and Correspondent's
☐ Westinghouse Air Brake	☐ Salesman's
☐ Civil Engineer's	☐ Window Trimmer's
☐ Coal Miner's	☐ Cotton Textile Worker's
☐ Concrete Engineer's	☐ Farmer's
☐ Building Trades	☐ Poultryman's
☐ Plumber's and Fitter's	☐ Mariner's
☐ Chemist's	☐ Automobiles

Name _____

Street and No. _____

City _____ State _____

Telegraph Pictures
BY ELECTRICITY



A complete set of two machines of this marvelous equipment for only $19.50. Instructive, mystifying and useful. This picture of President Wilson was telegraphed by these machines. Will transmit pictures, maps, drawings and hand writing. Picture telegraphing is the coming science. Write today.

J. LEISHMAN CO., Dept. T Ogden, Utah



SPECIAL KON-VER-TER SLIDE RULE

"Hamilton" Improved Slide Rule instantly adds, subtracts, divides, multiplies, converts fractions or decimals of an inch or both. Gives sines, co-sines, versed sines, co-versed sines, tangents, co-tangents, secants, co-secants of angles, Square root, cube root, roots to the fifth powers, logarithms, circumferences, area and diameters of circles. Most complete slide rule of its kind ever made. This rule is five and four-tenths inches in diameter. Instructions with each rule. PLAIN UTILITY RULES $1.00 SPECIAL DE LUXE, white celluloid $2.50 Postpd. *Agents and dealers wanted.*

J. C. HAMILTON & CO., 7 Water St., Dept. B., Boston, Mass.

ferred to, and illustrated, will serve to draw attention to what one must look for in an examination of cloth that is believed to contain shoddy. In masses of shoddy such as are usually taken for microscopic examination, there will always be found many short fibers due to mechanical breaking of long fibers, but to separate them is an operation of great delicacy, tho yielding results of no value.

THE "BURNING" TEST

Vegetable fibers may be readily distinguished from animal fibers by burning. Animal fibers, such as Wool and Silk give off the smell of burnt horn. They do not fire like vegetable fibers, but cease to burn when removed from the flame, and the burnt portion curls up, forming a hard cinder at the end of the thread. Vegetable fibers, on the other hand, give off a slight smell of burnt wood when ignited. They burn away very rapidly with a flash, leaving no hard cinder, but a white or gray ash only. The above tests broadly distinguish vegetable from animal fibers, but further chemical examination is necessary to distinguish mixtures of any of them when woven into cloth. (See Fig. 19.)

Referring again to Figs. 1 (Cotton) and 4 (Linen) we can readily distinguish the difference by means of the microscope as shown. If the fabric is without starch, oil makes linen translucent and cotton opaque. The finish must be washed out of highly finished materials before this test can be used.

A test to distinguish between linen and cotton, which only an expert, or at least a person having quite some experience, can perform, consists of what is known as the *"tearing"* test. The linen weaves in general are more difficult to tear than cotton. The torn ends of the linen threads appear uneven in length and the individual fibers are twisted in every direction. The sound of tearing linen is shrill, and that of cotton dull or muffled.

An easy way to distinguish between the highly-sized and calendered *Cotton Damask* and true *Linen Damask* is to boil a sample. After being dried and ironed, if it is *cotton it will have a dull and somewhat fuzzy appearance*, while the *luster and smoothness of real linen will not be affected* by this treatment. *Mercerized Cotton Damask* keeps more luster than untreated cotton, but less than linen.

Since the price of pure, new wool is relatively high, it is the practise of manufacturers to mix other materials with it, the most common of which is *"Shoddy."* Such goods have many uses, being a full-bodied, but flimsy fabric, it is made chiefly into cheap cloth, table covers, etc. Manufacturers state that the best grade of worsted shoddy—that having long fibers—is superior to a low grade, short staple, new or virgin wool; also that it is impossible to get the texture and finish required for some of the best grade goods *without* the use of some shoddy. Owing to the fact that shoddy is made from wool fibers, as stated under the heading "Shoddy," it is very difficult to determine its presence by chemical means, owing to the fact that it will respond to the same tests as applied for wool. The microscope is the most accurate means available for determining the presence of shoddy in woolen cloth. It is true that the rough feel and cheap appearance of the fabric gives some idea of the presence of a *large percentage of shoddy*, but the famous "feeling test" for cotton or shoddy in moderate quantities must give way today to a more scientific analysis, as herein given.

Shoddy is not alone as an adulterant of woolens. Cotton is employed quite extensively. It is a simple matter to detect the presence of cotton, *as wool is dissolved in alkalies* and *not affected by acids* while on the other hand *cotton is dissolved by acids* and *not affected by alkalies*. Fig. 20 shows

WANTED
Immediately

WIRELESS operators are in demand owing to the expansion of our Merchant Marine. Pay has increased to $110 per month plus all expenses.

THE Y. M. C. A. Radio Schools give thorough practical courses with individual instruction. Our graduates fill responsible positions.

THIS is *your* opportunity. Classes now forming. Excellent dormitory facilities. Complete laboratory equipment. Write today for illustrated booklet.

Y. M. C. A.
NEW YORK CITY

Manhattan Branch: 154 East 86th St. Tel. Lenox 6051
Brooklyn Branch: Marcy Ave. Near B'way Tel. W'msburg 3800



CHEMICALS for THE EXPERIMENTER

Send today for FREE Catalogue

DON'T PAY FANCY PRICES for chemicals. Buy highest quality for lowest price. Our unique system of standardization guarantees you at all times the most for your money. Send today for interesting free booklet describing the money-saving, value-giving, N-S plan and listing hundreds of chemicals, chemical glass ware, and apparatus.

THIS RELIABLE MAIL ORDER HOUSE world famed for its wireless telegraph apparatus and experimenters' supplies, has been urged by hundreds of its patrons to establish a chemicals department. In answer we offer what we believe to be the most complete amateur experimental chemistry in the U. S. Buy where you are always assured of *Standard Quality, Standard Quantity, Standard Package, Standard Price.*

THE NEWMAN-STERN CO.
Department E E CLEVELAND, O.

STANDARDIZED N-S Co. CHEMICALS

The Newman-Stern System

WIRELESS apparatus, Raw Materials, Magnet wires, motors, experimenters' needs, novelties listed in our Catalogue C-3. Assure yourself of prompt service and right prices by buying from this world famed, reliable, experimenters' Supply House.

The Newman-Stern Co., Cleveland, O.

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 180 Big Pages, 500 Illustrations, 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy." 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 20 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.

WIRELESS

Send 6 cents in stamps or coin for which we will send our latest Cyclopedia Catalog No. 20 as described.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

Send To-day for the
"Electrical Worker's Friend"

An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting A.C. motors. Special at $3.50

Or write for full particulars of this valuable book.

SMITH & SMITH
1S24 LOWRIE ST., N.S., PITTSBURGH, PA.

www.americanradiohistory.com

110-V. TRANSFORMERS

8 Volt Secondary



Consumes so little current will not move ordinary meter

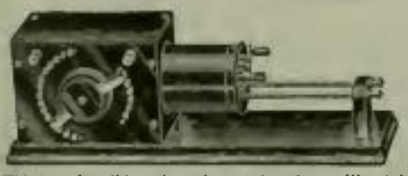
$1.00 Postpaid

Only $1.00

No. 10 gives 3 currents — 6, 12 and 18 volts secondary. Ideal for experimental work. A standard transformer, guaranteed. Complete with plug $2.00 postpaid. Order from this ad

NATIONAL TRANSFORMER CO.,
Dept. 13, 3124 No. California Ave., Chicago

ARNOLD NAVY MODEL LOOSE COUPLER



This coupler did real work and "made good". Ask the fellow "In Radio Service". Order your instrument NOW for future delivery. Later there is bound to be a rush, result: delay. A small deposit will insure delivery when you want it

J. F. ARNOLD
2062 Lexington Ave., near 128th St., N. Y.
Established 1910

Not Toys But Real Apparatus

the same as used by all operating companies. You had better send us your order immediately to insure prompt delivery, as this equipment will not last long at these prices.

110 Volt Hand Generators....	3 bars, each	$3.00
	4 bars, each	4.00
	5 or 6 bars, each	5.00
Telephone transmitters with arms, each..		.75
Good ringers complete with bells, each....		.50
Telephone receivers, each.....		.75
Condensers, ½ to 2 M.F., each.....		.50
Induction coils, each.....		.50
Relays, each.....		1.50
Repeating coils, each.....		2.00
Real complete C.B. wall type telephone...		4.50
Slightly used dry cells, per dozen.....		1.25

Please send money-order or cash with your order

ELECTRICAL SPECIALTY COMPANY
Dept. E, 48-50 So. Front St., Columbus, Ohio
Dept. E, 128 No. 11th St., Philadelphia, Pa.

???????
Will Your Station Be Ready
???????

ALL AMATEURS WILL CELEBRATE OPENING NIGHT. OVERHAUL YOUR STATION NOW. DON'T DELAY.
WRITE FOR DESCRIPTIVE BULLETIN and proposition on supersensitive receiving apparatus, smooth running rheostats, knobs, levers, switches, contacts, etc.

Audiotron Sales Co.
1940 Leavenworth St. San Francisco

MARKO
STORAGE BATTERIES
ARE GOOD—TRY ONE
Paul M. Marko & Co., Inc.
1402-1412 Atlantic Ave.
Brooklyn, N. Y.

WIRELESS TELEGRAPHY

Our 14 weeks course prepares you for MERCHANT MARINE paying $110 per month and expenses. RADIO INSPECTORS receive $1,200 to $3,500 per year. Our instructors are licensed by U. S. government; school fully equipped and largest of its kind in America. Tuition small and payable weekly. We guarantee to qualify you. Board and room in Washington at reasonable rates while taking the course. Particulars on request. SERVICE RADIO SCHOOL, 902 Pa. Ave. N. W., Washington, D. C.

a convenient method of testing for cotton and wool. One glass contains a solution of Caustic Potash or Caustic Soda into which is immersed a sample of the wool to be tested. A precipitat indicates the relative amount of cotton and other substances present. Likewise when cotton is immersed in an acid, the precipitat will show the relative amount of adulterants. See Fig. 7.

It is easy to determine heavily-weighted silk material by burning a small sample. Pure silk burns rapidly, smells like wool, and produces a small amount of brittle, curled-up ash. Material which is heavily-weighted will have an ash which is stiff and which often holds the shape of the sample. Cotton is frequently mixt with silk. It is easy to detect cotton in silk by the microscope, as the fibers of silk are round and smooth, while the cotton fibers are ribbon-like and fuzzy. See Fig. 8. Cheap but heavy silks are usually loaded with lead in granular form. A chemical test for lead will readily reveal its presence.

QUESTIONS AND ANSWERS

Ques. No. 5. Edward J. Walsh, Lexington, Ky., wants to know how he can remove Iodin stains from light clothing.

Ans. You fail to state whether the material from which you desire to remove the stains is starched or unstarched. This is an important factor. Stains which are present in unstarched material produce a brown or yellow stain. Whereas on starched materials, the presence of starch causes the stain to become deep blue or black.



Fig. 21. Removing Iodin Stains from Light or Other Colored Cloths By Application of Ammonia. The Ammonia May Be Applied With a Glass Rod or Sponge, and Should Be Immediately Washed Out as Soon as the Iodin Stain Is Removed.

For unstarched stains, sponging with Ammonia, or alcohol, the latter being frequently used on materials which water would injure. See Fig. 21.

Starch, such as prepared for laundry purposes may be used for washable materials. Immerse the stained parts in the starch and boil. It first turns blue and then disappears. Flour may be used in the same manner as the starch.

For starched materials, the stains may be immersed in a dilute solution of Sodium thiosulfate (known photographically as "Hypo") and then rinsed thoroly. Sodium sulfite (not sulfate) may be used in the same manner as the thiosulfate. Another method is to soak the stains in dilute ammonia (sp. gr. 0.95) until they disappear.

LISTEN TO ME!



Be A CERTIFICATED ELECTRICIAN

THIS IS YOUR CHANCE OF A LIFE TIME

I am Chief Engineer of the great Chicago Engineering Works. I am in close official touch with the electrical world. I know how badly we need trained electricians who can take charge of important work as experts. Right now there is such a need for executive electricians that I am making a special effort to help meet the demand. I am publishing this special announcement to secure a certain number of ambitious men whom I will personally train by mail for the wonderful opportunities that are open.

I WILL MAKE YOU a Trained Electrician

I don't care how young or old you are, just as long as you can read and write and have a spark of ambition. I don't care where you live or what you do. I don't care if you don't know a blessed thing about electricity. Just give me a little of your spare time for a short period and I'll show you the quick way to success in electricity. You can qualify to earn **$36 to $100 a week** with opportunities for greater earnings.

I Train You by Mail!

Your spare time will do. No interference with your regular duties. I understand just what you must know and I have devised a wonderful way of instructing by mail. I positively guarantee your satisfaction.

Free Wonderful Electrical Outfit

Absolutely free. Not a penny cost to you now or later. To those who act at once I will give a wonderful set of Electrical Equipment with my compliments. Write me at once. I have only a limited number of sets to be given free. Drop me a post card or letter.

Write! You will have to act quick to get in on this opportunity. Write me today for full particulars. Drop me a post card. *Write Now.*

CHIEF ENGINEER COOKE,
Chicago Engineering Works,
Dept. 525
441 Cass Street, Chicago, Illinois

www.americanradiohistory.com

Super-Sensitive Microphone ONLY $7.50



This instrument is offered at an extremely low price. It is excellent for building your own amplifier. Can also be used in many experiments where a sensitive microphone is required.

Detectagraph, $15



Detectagraph $15

This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord, Receiver, Headband, Case and Battery.

Send for One Today and Convince Yourself.



THE $15 MICROPHO DEAF-PHONE

is a super-sensitive instrument which has been developed to meet the demands for a practical and efficient hearing device at an extremely low price. It is equal to any $35 instrument made and superior to most of them. The outfit consists of One Super-Sensitive Transmitter with cord connector; One Super-Sensitive Ear Piece with small black cord; One Black Single Headband; Black Case and Two Batteries. WRITE TODAY FOR FREE BOOKLET

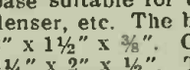
G. BOISSONNAULT CO.
26 CORTLANDT STREET NEW YORK
Makers of Super-Sensitive Microphone Apparatus

Experimenters — Manufacturers!

BASES — INSULATION



Fine black composition base suitable for detector, fixed condenser, etc. The bottom has a cavity 3" x 1½" x ⅜". Over all dimensions 4¼" x 2" x ½". Two holes for binding posts and two for fastening down to table. Post paid.....30c



An excellent Base for detectors. Has binding post holes and holes for mounting detector parts. Black composition 3¼"x2"x½". Post paid, 32c

Manufacturers Send for Discounts in Quantity.

Bakelite panels, about		
9 x 19 x ¼	Black XX	$4.00
19 x 19 x ¼	Black XX	8.00
9 x 19 x 3/16	Black XX	3.00
19 x 19 x 3/16	Black XX	6.00

A. H. CORWIN & CO.
5 Kirk Place Newark, N. J.

TELEGRAPHY AND RADIO

DAY AND EVENING CLASSES
SEND FOR PROSPECTUS
IN SUBJECT INTERESTED

EASTERN RADIO INSTITUTE
899-B Boylston St. Boston, Mass.

WIRELESS BOOKS *Send for Catalogue*

BUY NOW and Save a Dollar

PRACTICAL WIRELESS TELEGRAPHY By E. E. Bucher and THE WIRELESS AGE for one year. $2.75. *Regular price, $3.75.*

WIRELESS PRESS, INC., 33 ELM ST., NEW YORK.

AMATEURS ATTENTION!

With our No. 5A receiving set, consisting of double slide tuner, galena detector, fixed condenser, switch and binding posts for aerial, ground and receivers mounted on beautifully finished quartered oak base, shore stations and ships at sea come in with surprising clearness. Price $4.50. Receivers 75c up. Send 25c for set of 3 rubber knobs 1" dia. suitable for loose-coupler switch knobs, detector handles, etc. 5c in stamps brings copy of code.

McMAHON & ST. JOHN,
56 West Ave., So. Norwalk, Conn.



Printing Cheap

Cards, circulars, labels, book, paper. Press $6. Larger $20 Job press $35 up. Save money. Print for others, big profit. All easy, rules sent. Write factory for press catalog, TYPE, cards, paper. THE PRESS CO. D-47 Meriden, Conn.

HOW THE FRENCH LOCATED SUBMARINES.

(*Continued from page 9*)

major problems, if not indeed the predominant one, to be met with in working out a more selective and accurate form of submarine listening device was that, whatever its form, it should be susceptible of operating and functioning on any vessel while it was under full headway, and further, that the indications given by the instrument of the direction of such sounds should be sufficiently accurate to permit the commander of the vessel on which it was installed to set a straight course for the indicated spot where the submarine lay in wait for its prey. Contrary to general opinion, many authentic instances are on record where submarines were surprised in this way during the war and sent to the bottom, sometimes by armed merchantmen or converted yachts, and again by fast destroyers or submarines. The English in particular seem to have obtained very gratifying results in fighting the U-Boats with their own submarines.

Lieut. Walser designed his apparatus after first carefully studying a well known, yet heretofore overlooked, principle of physics, viz: that sound, identical to light, upon passing thru one medium into another, is *refracted*. The orthodox theory concerning the complex light beam or ray from a given object states that they comprise a number of component waves, which may be considered as parallel when their source is situated a sufficient distance, and which parallelism is upset only when an obstruction is placed in their path, when they are thus caused to enter a new medium having a density of a different value from that in which they were propagated. Lieut. Walser had the forethought to perceive that sound waves must follow the same theory. To prove his theory, he interposed in the path of sound waves a device which would respond to various vibrations, and which formed what we might term an *acoustic lens*. As has been found in explaining the theory of light transmission, a similar effect takes place in sound transmission thru the air or water and other mediums, and the result of thus interposing such an acoustic lens or vibrating member causes the individual waves composing the complex wave propagated from a given source to come to a focus. This has the two-fold effect of intensifying the individual waves and also of isolating them precisely from other sounds emanating from the sources foreign to the one being localized. Naturally, the different sources of sound will create a corresponding number of foci, of which the geometric focus can be ascertained by mathematical computation. In a similar manner from the position of the sound focus which corresponds to any individual source of sound, the definite direction of that source can be readily estimated.

The accompanying illustrations show the "Walser submarine detector" gear as installed on French vessels, and the detail view shows how the sound detecting lenses, which are fitted into large steel bulges or "blisters", secured to the hull of the vessel, are connected to two trumpets, which may be traversed in a circle above them, so as to accurately localize the various sounds heard from different vibrating diaframs comprising the lenses. One trumpet picks up and localizes the sounds from the *port* lens, and the other the sounds picked up and intensified by the *starboard* lens. The spherical segments supporting the multiplicity of lenses is indicated by *A* in the detail figure. This segment is provided with a circular series of openings, *B*, each of which contains a sensitive vibrating diafram, *C*. The general effect of this arrangement is to focus all of the sounds picked up, the focal points all lying on a circle, *I*. As aforementioned, the vessel fitted with this apparatus has two of these lenses, one to *port*

Just to Get Acquainted

we will mail you 4 issues of

THE PHOTO-PLAY WORLD

The one by which all others are governed - **for $1.00**

The Photo-Play World contains only the best pictures—Stories and Articles. Has a Staff of America's Foremost Writers.

Subscribe Now
35c a Copy $3.50 a Year

THE PHOTO-PLAY WORLD
Bulletin Bldg. Dept. E. E. Philadelphia, Pa.

Yankee Wireless 50¢

The only dependable wireless set at a low price. It is not a toy and with little practice you can send and receive clear messages anywhere as quick as a flash



THE YANKEE

is for two complete stations—with Morse code and instructions for operating. We will also include our picture code attachment, which will enable the operator to send and receive pictures and photographs by wireless. The complete Yankee Wireless set can be obtained only from us All charges paid for 50¢ money order.

A. & B. MFG. CO., 1365 Peoria St., Chicago, Ill.

CLEARTONE PHONOGRAPHS
$4.00 to $200.00 Retail



Needles 45c per thousand in lots of 500,000 Motors $1.35 to $14.75 each. Tone Arms and Reproducers $1.30 to $8.75 per set. Main Springs 20c to 90c each. Records, Needles, Sapphire Points and Parts at reasonable prices.

Write for our 84 page catalogue, the only one of its kind in America, illustrating 33 different styles of Talking Machines and over 500 different Phonographic Parts.

LUCKY 13 PHONOGRAPH COMPANY
Export Dept. 46B E. 12th St., N. Y., U.S.A.

ENINGER WILL SAVE

BIG MONEY SAVINGS FOR YOU

$40



Used and rebuilt motorcycles, single and twins. $25 to $100. Used bicycles, $5.00; tandems, $10. All machines guaranteed in good working order. New bicycles and motorcycles at Factory prices. You save dealers' profits. Motorcycle and automobile tires cheap. $3.00. Complete line of parts and supplies.

Send for catalog

Eninger Cycle Co., Rochester, N.Y.

YOU 25 TO 50 DOLLARS

Electricians

Get up-to-date in HOUSE WIRING! Save TIME, MONEY, LABOR and MATERIAL by using our 98 GENUINE BLUE PRINT DRAWINGS, containing all the latest diagrams and connections known in house wiring—every diagram and connection up-to-the-minute as used by first class electricians for wiring BELLS, BURGLAR ALARMS, LIGHTS, ANNUNCIATORS, FIRE ALARMS and ELECTRIC GAS LIGHTING. These drawings are bound in the form of a flexible book 19 x 12] for convenience in using on the job. Send for them, and if they don't make you more efficient as a wireman and save you many times their cost as a contractor, return them and money will be refunded—you can't afford to be without them. ONE DOLLAR postpaid. Send for circulars on other sets of drawings.

PATENT SPECIALTY COMPANY
P. O. Box No. 583 San Francisco, Cal.

Combination A. C. and D. C.

Eight Inch DESK FAN



detachable plug and 8 ft. of cord. Will operate on A.C. or D.C. current, 100 to 125 volts, 30 to 60 cycles; weight 10 lbs.; black enamel finish; height 11½ in. A real fan—not a toy. Price $6.50. Agents wanted.

THE TEWNO CO.
150 Chambers St., New York

MATHEMATICS MADE EASY



The Arcascope—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 85 cents Postpaid. Order today before you forget.

Dept. S, L. J. LEISHMAN CO., Ogden, Utah

GET ON THE VAUDEVILLE STAGE



I tell you how. Fascinating profession for either sex. Big salaries. Experience unnecessary. Splendid engagements always waiting. Opportunity for travel. Theatrical agents and authorities endorse my methods. Thirty years' experience as manager and performer. Illustrated book "All About Vaudeville" sent FREE. Frederick La Delle, Sta. 49, Jackson, Mich.

www.americanradiohistory.com



Tobacco Habit BANISHED in 48 to 72 Hours

No craving for tobacco in any form when you begin taking Tobacco Redeemer.

Don't try to quit the tobacco habit unaided. It's a losing fight against heavy odds and means a serious shock to the nervous system. Let the tobacco habit quit YOU. It will quit you, if you will just take Tobacco Redeemer, according to directions for two or three days. It is a most marvelously quick and thoroughly reliable remedy for the tobacco habit.

Not a Substitute

Tobacco Redeemer contains no habit-forming drugs of any kind. It is in no sense a substitute for tobacco. After finishing the treatment you have absolutely no desire to use tobacco again or to continue the use of the remedy. It makes not a particle of difference how long you have been using tobacco, how much you use or in what form you use it—whether you smoke cigars, cigarettes, pipe, chew plug or fine cut or use snuff, Tobacco Redeemer will positively banish every trace of desire in from 48 to 72 hours. This we absolutely guarantee in every case or money refunded.

Write today for our free booklet showing the deadly effect of tobacco upon the human system and positive proof that Tobacco Redeemer will quickly free you of the habit.

Newell Pharmacal Company.
Dept. 521 St. Louis, Mo.

AK TABLETS FOR All Pain

Headaches
Neuralgias
Colds and La Grippe
Women's Aches and Ills
Rheumatic and Sciatic Pains

Ask Your Druggist for A-K Tablets
(If he cannot supply you, write us)

Small Size **10c** — Dozen Size **25c**

AK Fac-Simile

See Monogram AK on the Genuine

The Astikamola Remedy Company, St. Louis, Mo.
Write for Free Samples

LEARN HOW TO BREATHE-RITE FOR HEALTH



At Best Supply Houses or sent direct for.....$2.00
Booklet free
BREATHE-RITE CO., Dept. 2, Ann Arbor, Mich.

PHOTO CRAFT
THE NEW PHOTOGRAPHIC JOURNAL

Devoted to the Art of Picture Taking and Nature Work with the Camera.
Four Competitions with Valuable Cash Prizes Leading to a Fifth.
Send 10c for three months' trial subscription.
Photo Craft Magazine, Ann Arbor, Mich.

and one to *starboard* of the keel. Just over these two lenses, there is built a specially solid sound-proof room or cabin, in which the operator of the submarine detector is located. The arrangement of the apparatus is such that the operator can sit in the center of the cabin with the listening helmet on his head, and by means of two ear trumpets. *D*, in the diagram, any sounds passing thru the lenses can be quickly picked up and localized for direction. One trumpet takes care of the sounds from the port lens and the other the starboard lens.

By means of the large rotating drum, which appears just to the right of the operator, the edge of said drum being calibrated, so that as the handle of the drum is turned the trumpets over the lenses are rotated about the respective focal circles of any sounds received. The control drum, which is manipulated by the operator, revolves the trumpets, *D*, which are pivoted on a fork, *E*, thru the movement. *H*. *J* represents the counterweight, which by means of cord, *K*, maintains the trumpet in such a position that its axis is always pointed toward the center of the spherical lenses. The function of the counterweight, *L*, is to maintain the balance of the movable arm on which the trumpet is supported, while the weights, *M*. *M'*, cause this arm to oscillate about the pivots, *N*, *N'*, in such a way that the rolling of the vessel is counterbalanced, thus tending to keep the mouth of the trumpet in the same horizontal plane at all times. The complete apparatus is carried by the metal frame marked *O*.

With the apparatus in use, the operator hears the sound with the greatest intensity and sharpness when the trumpet axis is in line with the focus of that particular sound. He can also hear a certain sound when the trumpet is anywhere in the vicinity of the focal point. The operator proceeds in any event to explore the various foci by manipulating the central control drum, which revolves the trumpets around the focal circles. This centralized control drum having been calibrated beforehand, it becomes a simple matter for the observer to accurately locate the direction of a certain sound, or more strictly speaking,—its origin, as soon as he has manipulated the trumpet to the proper focal setting, so as to hear the received sound with the greatest intensity and clarity. By a quick calculation based upon the value of the minimum intensity of the sound received, the range of the submarine can be approximately calculated. It is then a comparatively simple matter to steer a straight course for this spot, and if the object of the search turns out to be a submarine, then the destroyer will pass over it and discharge depth bombs upon it.

Of course the wiseacre will say, it is all very well to locate a submarine and then steering a course so indicated for the object of dropping several carloads of "ash cans" (depth bombs, in navy vernacular) upon it, but what about the movements of the U-Boat, which may have paddled off a mile or so from the spot so dear to the heart of the naval officer. This problem would seem to be solved by the fact that contrary to the usual apparatus utilized for such purposes heretofore, the operator may keep right on taking the soundings of the submarine, while the vessel is under full headway and moving toward it. The sensations experienced by the submarine detection officer located in his steel-bound cubbyhole down near the keel of the on-rushing vessel, as the sound of the submarine's engines and propellers pound louder and louder in his ear trumpets, probably can be better imagined than described, for the submarine commander may have a "card up his sleeve" and be just about scrappy and clever enough to lay for the on-coming destroyer or war vessel and discharge a torpedo at it or open up with a broadside from some nifty "seven inchers."



ASK YOUR BOSS "Does it Pay to Train?"

Put it up to the man who employs you. Don't hesitate. He'll respect and appreciate your interest. He knows the value of training—and will gladly tell you how much more you would be worth to him as a trained worker. If you're in doubt ASK THE BOSS. Ask him anyway.

A Bigger Job The position **in Your Factory** you'd like most in your factory is not beyond your reach. You can get that position any time you will fit yourself for it. Aim as high as you like and you will find that American School training will enable you to qualify for the job you want. KNOWING HOW doubles and trebles your earning power. If you don't think so—ASK THE BOSS.

Why Not Try This Guaranteed Training

The American School training is so thorough, complete and up-to-the-minute that it absolutely guarantees satisfaction or your money back. In other words, you can take ten full examinations in the Course you select. Then, if you feel you are not progressing—that the instruction will not enable you to advance—you simply notify us and your money will be refunded in full. The success of our thousands of students warrants this confidence in our ability to fit you for a better paid and more congenial position.

TRAINING Decides Your Pay

Make sure of this: the men who get more money in your factory than you do know more. Your position and pay at all times, and in any job, is governed simply by what you can DO. And that depends on what you KNOW. Make some of your spare time bring SUCCESS to you. Study in idle moments with GUARANTEED TRAINING. Make your start TODAY for a better job by checking and mailing the coupon. Free Bulletin and full details will be promptly mailed you without any obligation.

SATISFACTION GUARANTEED

AMERICAN SCHOOL
OF CORRESPONDENCE
Dept. G-7445 CHICAGO, U. S. A.

TRAINING THE KEY TO SUCCESS

Explain how I can qualify for the position checked. ASC

....High School Graduate	....Lawyer
....Electrical Engineer	....Business Manager
....Elec. Light & Power Supt.	.... Certified Public Accountant
....Hydroelectric Engineer	....Accountant and Auditor
....Telephone Engineer	....Bookkeeper
....Telegraph Engineer	....Stenographer
.... Wireless Operator	....Fire Insurance Expert
....Architect	....Sanitary Engineer
....Building Contractor	.... Master Plumber
Civil Engineer	.... Heating and Vent. Engineer
....Structural Engineer	....Automobile Engineer
....Mechanical Engineer	....Automobile Repairman
....Shop Superintendent	.... Airplane Mechanic
Steam Engineer	.... General Education Course
....Draftsman and Designer	.... Common School Branches

Name .....

Address.....

www.americanradiohistory.com

1/4 H.P., 110 volts, A.C. 60 cycle, single phase, 1750 R.P.M.

MOTORS



We have 1000 NEW WASHING MACHINE MOTORS. These are of standard manufacture and carry the regular factory guarantee. Shipped in original boxes. Complete as cut.

Bought from Bankruptcy Stock

Suitable for operating Coffee Grinders, Cream Seperators, Bottle Washers, Air Compressors Small Lathes, Etc.

Mail $3.00 cash or Money Order. We will send C.O.D. subject to full examination.

MONEY BACK GUARANTEE

$18.50 EACH

Special Quantity Prices Regular Value $36

MANUFACTURERS' DISTRIBUTER

BARGAINS in Small Motors and Generators Write for Catalogue

CHAS. H. JOHNSTON - West End - Pittsburgh, Pa.

4 Famous Books!

EACH ONE A BIG SUCCESS!

THE BOOKS YOU MUST HAVE



Wireless Course in 20 Lessons

By S. Gernsback, A. Lescarboura and H. W. Secor. E. E.

A course that tells you everything you can possibly want to know about "Wireless" starting off in lesson No. 1 by explaining the Principles of Electricity. The second and third lessons are devoted to magnetism, motors, generators and wiring. And then, by simple, easy stages, this wonderful Course takes you into "Wireless". The mysteries of "Wireless" are unfolded to you by the use of such simple language so skillfully used that of necessity you must understand every word. The subject is not treated superficially, however, for there is a whole lesson devoted to the Theory and Mathematics of this epoch marking subject. To lend charm to the Course, the last lesson (No. 20) is devoted to a history of Wireless and the men who developed it.

Size of book is 7 x 10¼ in., 160 pages, 350 illustrations, 30 tables.

Flexible cloth cover....per copy $ 50
Stiff cloth cover.....per copy 1.00

Postpaid

Experimental Electricity Course in 20 Lessons

By S. Garnsback and H. W. Secor. E.E.

A Course of the theory and practice of Electricity for the Experimenters. This is undoubtedly one of the most complete and comprehensive treatises of this special subject ever published. The book is written by the same authors as the famous "Wireless Course in 20 Lessons".

Every phase of experimental electricity is treated comprehensively in plain English. It is a book not only for the beginner but for every experimenter and student of Electricity. New Experiments are described and explained and nearly every application of Electricity in modern life is given in simple language.

The book contains 192 pages and more than 400 illustrations.

Flexible cloth cover...per copy $.50
Stiff cloth cover.....per copy 1.00

Postpaid

No. 1. How to Make Wireless Sending Apparatus

No. 2. How to Make Wireless Receiving Apparatus

By 20 Radio Experts.

Two Remarkable Books

Book No. 1 contains 100 pages, size 7 x 5 in. and 88 illustrations, paper bound.

Book No. 2 contains 100 pages, size 7 x 5 in. and 90 illustrations, paper bound.

These two books have been written and published entirely for the wireless enthusiast who wants to make his own radio apparata. They contain more information on how to make it than any other books we know of. Only strictly modern radio apparata are described in these books and the illustrations and descriptions are so clear and simple that no trouble will be experienced in making the instruments.

Book No. 1—How to make Wireless Sending Apparatus 25c
Book No. 2—How to make Wireless Receiving Apparatus.....25c

Postpaid

THE EXPERIMENTER PUBL. CO. Book Dept. 233 Fulton St., New York

THE THOUGHT RECORDER

(*Continued from page 12*)

ent upon wave motion, it should not be surprising therefore that thoughts or active thinking should give rise to wave motion as well.

This theory is greatly strengthened by the fact that it has been proven beyond doubt that active thinking necessitates an expenditure of energy. If you sit perfectly quiet in a chair without expending any visible muscular energy, and if you concentrate very hard upon a certain problem, it is not infrequent that perspiration appears on your forehead from the simple effort of thinking. Of course, this is rather a complex phenomenon, as the perspiration is not produced directly, but rather indirectly by the nerve centers working upon the human organs, principally the heart. Nevertheless, we know that thinking proper calls for an expenditure of energy in the brain itself. That this energy is considerable can also be shown experimentally.

It therefore cannot come as a surprise that the act of thinking should give rise to a direct wave motion, sending out from the brain certain waves in an analogous manner, to the spoken word which produces sound waves of a certain wave length. It is quite probable, however, that thought waves are simply another form of ether waves, the same as radio waves or light waves. Just as light rays traverse thru a thick glass pane without suffering any appreciable loss, just so will thought waves probably pass readily thru the human skull. If once we admit this theory it follows that it should be possible to detect such waves, and the only thing we need to know about them are the wave length and other important characteristics. We may take it for granted that the human brain, sensitive as it is, probably is not at all sensitive to these waves, and that by suitable apparatus it should become possible to detect such waves.

Just what apparatus are necessary to detect thought waves, or the effects therefrom, the writer does not venture to predict, but there is no doubt that the apparatus will be eventually found. Very little is known about the emission of the thought waves, and as a matter of fact the entire mechanism which produces thoughts is practically an unknown quantity, but every effect can be translated and recorded if once we understand its fundamentals.

Thus, fifty years ago the recording of the voice would have appeared just as fantastic as the recording of thought appears today. People then rightly said, how could it be possible to hold the spoken word; it goes into the air and vanishes instantly. But once acoustics were better understood, it became a simple matter for the inventor of the phonograph to record the voice. Similarly, the day will come when thoughts will be recorded in an analogous manner. All that is necessary, as stated above, is suitable apparatus, and this should be easy to find.

The writer, in suggesting the audion as a thought-wave detector, does not do so because he thinks that it is suitable in all respects, or even feasible. His main idea is to set the stone rolling, and get other people to think about the problem, when sooner or later something surely will emerge. The writer has suggested the audion because it is known as one of the most sensitive electrical detecting apparatus for wave motion which we have today. If thoughts give rise to electrical waves, then by winding a few turns of wire on a headband and slipping it over the head, it should be possible to detect the presence of thought waves in the audion. On the other hand, too, the audion is enormously sensitive to capacity effects,

www.americanradiohistory.com

as is well known. Thus, for instance, an oscillating audion is so sensitive that when the human hand is approached to it at a distance of even two feet, the presence of the hand will be heard plainly in the telephone receiver. If this is the case, the disturbance created in the mind should certainly make its presence felt in the audion, for thinking being first of a chemical nature, the act certainly must give rise to capacity effects. But let us assume that active thinking does not give rise to waves, electrical or otherwise, then the mere chemical action (and resulting capacity effects) should produce a disturbing influence upon the audion. These variations, if ever so slight, could then be amplified by the use of an audion or other amplifier, and the resultant effect be sent into an Einthoven string galvanometer. The small mirror attached to the string of the galvanometer will send its luminous pencil upon a light-sensitive paper tape which moves at a certain rate of speed in front of the mirror. The result will be a wavy line traced upon the paper tape in the well-known manner. The paper tape traveling on will pass thru its fixing tank, and from there will emerge from the outside of the machine after it has past thru a small drying chamber heated by electrical coils.

From this, it will be understood that a man sitting in front of his Thought Recorder will be able to actually see on a tape his recorded thoughts, the same as the telegrapher working on a trans-Atlantic cable watches his tape and its wavy line produced by the Syphon recorder, emerging from the latter. Of course, it will be necesary for everyone to learn the "thought alphabet" just as the stenographer today must learn the various characters, or as the child is taught how to read and write, and as the cable operator must learn how to read the Syphon recorder "alphabet." All this, however, is simple, and is only an educational feature once the apparatus has been invented.

The objection naturally comes to the mind immediately that even if we have a machine to record the thoughts, all we will get on the tape will be a jumble of confused thoughts, and we might get a lot of things on the tape that were not meant for recording or registering at all. Such criticism, of course, is beyond controversy for the simple reason that when you write a letter by hand or on the typewriter, you have also at first a lot of confused thoughts, but you do not record such thoughts even by hand or by machine. It often happens after you have written down certain thoughts that you must change them. The same is true of the thought recorder, of course.

Here the man who is doing the recording has a push button in his hand, shown at A in our illustration; if he does not press the button nothing is recorded. Once he wishes to record his thoughts in an orderly manner, he pushes the button and the tape begins moving simultaneously—he will begin thinking in an orderly and slow manner the subject he wishes to record. He will think just as hard and just the same as if he were to pen down his thoughts by hand. The machine will then do the rest. If he thinks the wrong thoughts, naturally the wrong thoughts will be recorded, exactly the same as if he had written them by hand. There is no difference. In our illustration, our artist has endeavored to show what will happen in the future business office when the thought recorder comes into universal use. The business man of tomorrow will dictate his correspondence on the thought recorder, while his stenographer, who is perfectly familiar with his "thought writing," will type out the correspondence from the tape, which is kept moving by electric motors, in front of her eyes. A foot pedal stops or starts the motor, and there is also a reversing attachment so the tape will run backwards should she wish to re-read a certain portion of the tape.



Become a Doctor of **Chiropractic**

Advanced Science of Spinal Adjustment

Here is your opportunity to prepare yourself to enter the profession of Chiropractic—the modern science of relieving ills and ailments through spinal adjustment. No matter where you live or what you are now doing, you can enter this uncrowded profession—a profession of good incomes. Some of our graduates report they are making $3,000 to $5,000 and more a year. We teach you by mail or in class.

FREE 22 Complete Charts in Drugless Healing

As an extra inducement to quickly secure new students we will give you, absolutely free, our 72-page book and 8 Anatomical Charts, beautifully lithographed in lifelike colors, that regularly sell for $15, also complete set of colored Nerve, Pain Area, Concussion and other Charts that regularly sell for $16.50.

Don't miss this liberal offer. Get these free charts by all means. See how you may qualify as a Doctor of Chiropractic and what splendid opportunities this profession offers you for gaining an independence. Never before has the demand been so great for Doctors of Chiropractic. To meet this demand, we must have more students immediately. Write today.

Our Lessons Teach You how to make Spinal Adjustments for speedy relief of

Headache	Neuralgia
Indigestion	Neuritis
Lumbago	Catarrh
Epilepsy	Fevers
Pleurisy	Jaundice
Constipation	Dyspepsia
Rheumatism	Paralysis
Asthma	Etc., Etc.

Learn At Home To Be a **CHIROPRACTOR**

No special talent or advanced education necessary. If you have common school education, the way is open to you. This institution trains you either by mail or in class. Learn in your own home in your spare moments to be a Doctor of Chiropractic. It offers you a profession of dignity and prestige. Let us prove how YOU can make a good income. Makes no difference where you live or what you do now, you should be able to qualify rapidly for this great work.

Mail Free Coupon at Once

No obligation to you whatever. Put your name and address on the free coupon or letter or postcard and get the story of Chiropractic. You will be amazed, fascinated by the facts gathered together in our free book. Be sure to write at once if you want the free charts. Mail the free coupon or a postal today, right NOW!

AMERICAN UNIVERSITY
Manierre Bldg. Dept. 487 Chicago

Mail Coupon Today

FREE CHARTS
AMERICAN UNIVERSITY,
Manierre Bldg., Dept. 487 Chicago

Gentlemen:—Without cost or obligation, send me by mail, your new illustrated, 72-page book and your Free Charts Offer.

Name.....

Address.....

City.....

What 15c will bring You from the Nation's Capital

Washington, the home of the Pathfinder, is the nerve center of civilization; history is being made at this world capital. The Pathfinder's illustrated weekly review gives you a clear, impartial and correct diagnosis of public affairs during these strenuous, epoch-making days.

The little matter of 15c in stamps or coin will bring you the Pathfinder 13 weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth and only the truth; now in its 26th year. This paper fills the bill without emptying the purse; it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you would appreciate a paper which puts everything clearly, fairly, briefly—here it is. Send 15c to show that you might like such a paper, and we will send the Pathfinder on probation 13 weeks. The 15c does not repay us, but we are glad to invest in new friends. The Pathfinder, Box 676, Washington, D.C.



Long Distance Phones $1

At last a real low priced telephone scientifically made in the Alrams Laboratories. It is not a toy and has all the features of the high priced telephones. You can have a corking good time with it. For instance, if you want to call your friend simply lift the phone off the hook and it will automatically signal and connect you with the next station. Then you can talk with your friend over the phone as long as you like. You will have your own private telephone and calling system with no operators to bother you or listen to your conversation. You can easily set up these long distance telephones from your house to the house of your friend wherever it may be located, across the street, next door or next block, or further, and you can talk as long as you want. There is no expense in operating these telephones. They are so scientifically constructed that no batteries are required. The phones supply their own current by means of a patented cable. This cable is guaranteed for lifetime without renewing. Each set of telephones are packed complete in a box containing 2 telephones, wires and complete instructions for installing and operating. Postpaid for $1.00. Satisfaction guaranteed. The Alrams Co. The House of Quality Peoria & 13th St., Chicago

www.americanradiohistory.com

FREE TO YOU!

Read this Remarkable Offer!



OFFER No. 1

Wireless Course

The most comprehensive Wireless Course ever printed. Contains 160 pages, 350 illustrations. Size of book 6¾"x10". Very fine flexible cloth cover.

FREE with a year's subscription.

Add 5c for postage

OFFER No. 2

Experimental Electricity Course

This masterpiece contains 160 pages, 400 illustrations. Size of book 5"x9". Printed on extra thin paper, so book can be slipped into pocket. Handsome flexible cloth cover.

FREE with a year's subscription. Add 5c postage

OFFER No. 3

How to Make Wireless Sending Apparatus
By 20 Radio Experts

How to Make Wireless Receiving Apparatus
By 20 Radio Constructors

These books are by far the most successful wireless books on the market. Size of each book 5"x7", well bound on good book paper. Covers in two colors. We really cannot praise these books too highly. Each book contains 100 pages and from 88 to 90 illustrations. BOTH books FREE with a year's subscription. Add 5c for postage

This is a very limited offer. It may be withdrawn at any time, due to the tremendous cost of paper, which IS JUST DOUBLE WHAT IT WAS ONE YEAR AGO. We have only a limited supply of these fine books on hand; after they are gone we cannot reprint the books until conditions become normal again. Now is your chance.

The publishers of this journal have earned an enviable reputation of giving more than 100 cents' worth for each dollar spent with them. Profit by this liberal opportunity NOW; it may never be made again.

HERE'S THE OFFER

Subscribe to the ELECTRICAL EXPERIMENTER for one year, at the regular subscription price of $2.00 per year (Canada, foreign and N. Y. C. $2.50) and we will send you either books shown in one of the above offers. If you subscribe for two years, two offers will be given, etc.

If you are a subscriber at present take advantage of this wonderful opportunity anyway. If you do, we will extend your present subscription.

This Offer Limited. *Act Now.*

EXPERIMENTER PUB. CO.
223 FULTON STREET NEW YORK CITY

FILL IN — TEAR OUT — AND MAIL

5-19

Gentlemen: Please enter my subscription to the ELECTRICAL EXPERIMENTER for the term of .... year..for which I enclose herewith $..... You will also send me at once FREE your book..... as per offer No.....

.....

.....

Name.....

Address.....

www.americanradiohistory.com

The True Wireless

By Nikola Tesla

(Continued from page 63)

greatly from the intensity of the received impulses because the electric nivean between the mountains is raised, as I have explained in connection with my lightning protector in the EXPERIMENTER of February.

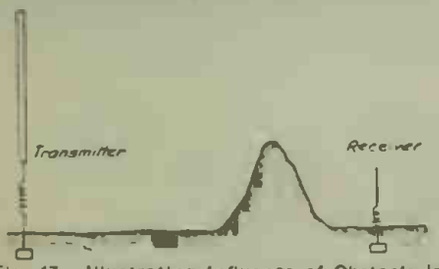


Fig. 17. Illustrating Influence of Obstacle in the Path of Transmission as Evidence Against the Hertz-wave Theory.

Again in Fig. 19 two transmitting circuits, one grounded directly and the other thru an air gap, are shown. It is a common observation that the former is far

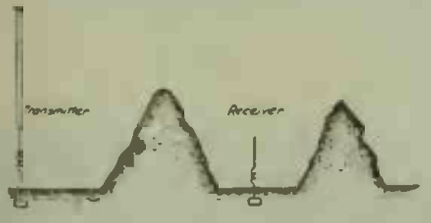


Fig. 18. Showing Effect of Two Hills as Further Proof Against the Hertz-wave Theory.

more effective, which could not be the case in a transmission with Hertz radiations. In like manner if two grounded circuits are

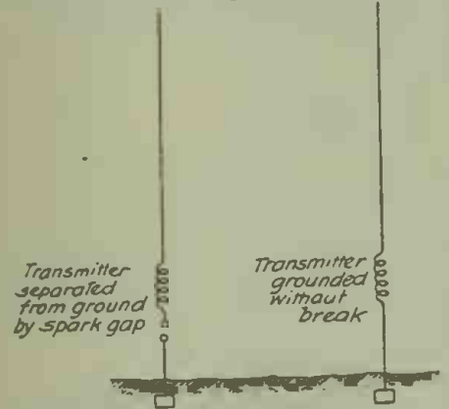


Fig. 19. Comparing the Actions of Two Forms of Transmitter as Bearing Out the Fallacy of the Hertz-wave Theory.

observed from day to day the effect is found to increase greatly with the dampness of the ground, and for the same reason

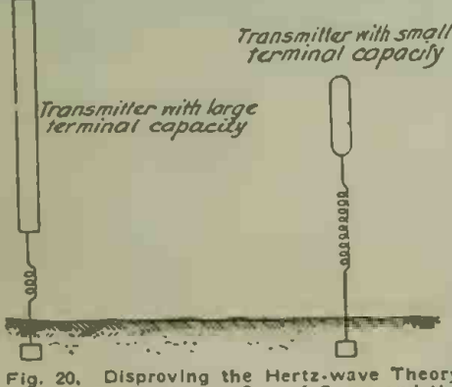


Fig. 20. Disproving the Hertz-wave Theory by Two Transmitters, One of Great and the Other of Small Energy.

also the transmission thru sea-water is more efficient.

An illuminating experiment is indicated in Fig. 20 in which two grounded transmitters are shown, one with a large and the other with a small terminal capacity. Suppose that the latter be 1/10 of the former but that it is charged to 10 times the potential and let the frequency of the two circuits and therefore the currents in both antennas be exactly the same. The circuit with the smaller capacity will then have 10 times the energy of the other but the effects on the receiver will be in no wise proportionate.

The same conclusions will be reached by transmitting and receiving circuits with wires buried underground. In each case the actions carefully investigated will be found to be due to *earth currents*. Numerous other proofs might be cited which can be easily verified. So for example *oscillations of low frequency* are ever so much more effective in the transmission which is inconsistent with the prevailing idea. My observations in 1900 and the recent transmissions of signals to very great distances are another emphatic disproval.

The Hertz wave theory of wireless transmission may be kept up for a while, but I do not hesitate to say that in a short time it will be recognized as one of the most remarkable and inexplicable aberrations of the scientific mind which has ever been recorded in history.

TO ALL RADIO AMATEURS

We have received many thousands of communications from radio amateurs for the past few months asking us about the status of their radio stations, and when they will be allowed to operate them again.

Inasmuch as there has been no official information as to the reopening of amateur stations, during the armistice, we can only say that in all likelihood, amateurs will not be allowed to operate until actual peace has been signed. In his executive order of April the 6th, 1917, President Wilson closed all radio stations in the United States by an act approved in the Radio Law of August 13, 1912.

Such a measure, according to law, is only for the duration of the war, there being at present no legislation which prevents any station, amateur or otherwise, from operating after peace has actually been declared. Therefore, the minute newspapers announce that peace between the United States and the Central Powers has been signed, *all amateur stations automatically revert to their former status*, and amateurs need not wait for permission to operate their stations, once peace has been declared.

EDITOR.

WRINKLES, RECIPES & FORMULAS.

(Continued from page 42)

If carbon dioxid is to be generated, fill tube A with marble chips and tube B with dilute hydrochloric acid.

It is evident that the parts of the generator can be easily cleaned and new chemicals put in. The completed apparatus is shown in Fig. 3.

Contributed by S. WEISINGER, JR.



Strengthen Your EYES!

Preserve Your Most Precious Possession

Your sight is your most precious gift. Weak eyesight means weak power of observation, eye strain, eye disease, and untold inconvenience. Take no chances with your eyes—you cannot get along without them. Make them stronger every day instead of weaker. Let us send you Bernarr Macfadden's wonderful new Course in "Strengthening the Eyes." Send no money—just mail coupon.

Glasses Do Not Remove the Cause of Eye Trouble

Instead, the eyes come to depend on them more every day. Glasses are eye crutches! They blindly bolster up the eyes—they do not strengthen them. It has been definitely proven that practically all defects of the eyes can be cured without glasses. Most people now wearing glasses can be freed from the inconvenience, and expense of constant breakages, by strengthening and correcting their vision through the simple, yet effective eye educational exercises recommended by Mr Macfadden.

Eye Defects Removed

This remarkable new Course teaches you how to use your eyes without strain at all distances—how to do without glasses—how to remedy cross eyes or squint eyes—how to restore the normal sight—how to restore perfect control to eye nerves and muscles.

Beneficial Results at Once

No drugs, medicines or operations. The Course includes a simple, yet thoroughly scientific system of eye educational exercises which strengthen the eyes exactly as the muscles of the body can be strengthened through body exercises. Results are immediate, and improvement continues daily. One woman writes: "I notice a great improvement in my eyes since learning to use their sight." Another user says, "Your Eye Strengthening Course' fine. My eyes are already improving." Still another writes, "Words cannot express my great gratitude for these excellent books." (Names on request.)

Send No Money

Let us send you this new Course "Strengthening the Eyes" on five days' approval. There are twenty-eight simple little lessons which will show you the way to strengthen and preserve your sight—the gift of the gods! Try the exercises, then return the Course if not satisfied and you will owe nothing. If, however, you feel that the Course will help your eyes wonderfully, send only $5.00.

Mail Coupon!

If you value your eyes, if you wear glasses and want to get rid of them, if your eyes are weak or strained, or if you want to insure freedom from eye troubles, mail coupon now and investigate this New Course "Strengthening the Eyes." Send no money—but mail coupon now, as this offer may never appear again.

Physical Culture Pub. Co.
Dept. 5605
119 W. 40th St.
New York City

Physical Culture Publishing Company
Dept. 5605
119 West 40th Street
N. Y. C.

Gentlemen:
Send me your Course "Strengthening the Eyes" which I will return in 5 days or send you $5 in payment for the course.

Name .....
Address .....



WANTED — Railway Mail Clerks

Age 18 to 35
$1100 to $2000 Year
Common Education Sufficient
Sure pay.
Life job.
Pull unnecessary.

Franklin Institute
Dept. E101
Rochester, N. Y.

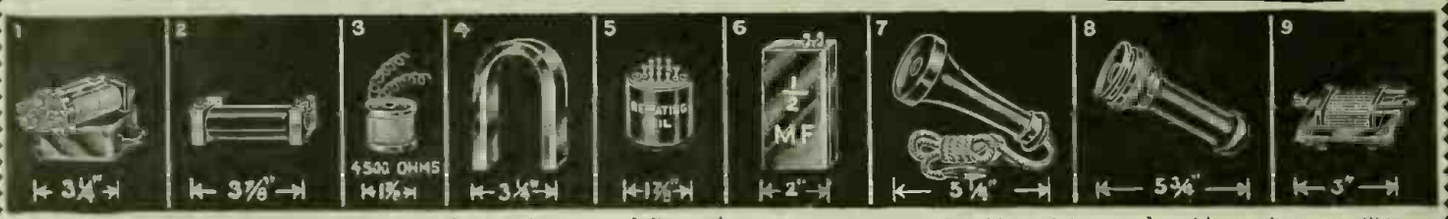
COUPON

Sirs: Send me, without charge, (1) sample Railway Mail Clerk Examination questions; (2) schedule showing places of all U. S. Government coming examinations; (3) list of other government jobs now open, and (4) free book describing them.

Name .....
Address .....

www.americanradiohistory.com

FOR EXPERIMENTERS ONLY!!



WE have in the past held many extraordinary sales, but we believe that the present one eclipses all by the wonderful values we are offering. The goods which we offer on this page are all standard telephone apparatus. Every piece we are offering is equipment that for one reason or another was discontinued by the telephone companies. If you wanted to buy any of the pieces which we offer herewith, from the manufacturers, the price would at least be ten times what we are asking for it. You can readily ascertain this for yourself by looking over our wonderful prices.

We have bought a large block of these goods and have a large quantity of every item on hand. Immediate shipment can be made on all of the goods in practically any quantity within reason. *Shipment within twenty-four hours* will be made if you use the coupon at the bottom of this page. This coupon saves you several days and your order will then be considered a rush order. We guarantee every piece to be as represented, and we will refund the money if goods are not exactly as claimed by us.

NO. 1 TELEPHONE RELAY. 1500 ohms—has two silver-contact springs and is very sensitive. Can be used wherever a sensitive relay is needed. It is adjustable and can be used for a variety of purposes.
No. 1 Relay—shipping weight, 2 lbs. Price..... **$1.50**

NO. 2 STANDARD TELEPHONE Induction Coil. primary 1 ohm, secondary 55 ohms. Used wherever you need a good induction coil. Has primary and secondary and iron wire core; fibre heads.
No. 2 Induction Coil as described—shipping weight, 2 lbs. Price..... **$0.50**

NO. 3 STANDARD RESISTANCE wound with German silver wire—4,500 ohms, can be used as a choke or plain resistance, and has many other uses that readily suggest themselves to the experimenter.
No. 3 Standard Resistance as described—shipping weight, 4 oz. Price..... **$0.40**

NO. 4 HORSESHOE MAGNET. size 3¼ inches wide x 5 inches high. Will lift about 1 lb. Quality such as used on magnetos, which means the best.
No. 4 Horseshoe Magnet — shipping weight, 2 lbs. Price..... **$0.30**

NO. 5 REPEATING COIL (Transformer). This is a standard small repeating coil and is used by all telephone companies. It has 4 different windings and eight contacts. Entirely enclosed in iron. The resistance being respectively 72 and 120 ohms, and 90 and 100 ohms. Diagram is furnished. Can be used for wireless, for boosting signals, etc.
No. 5 Repeating Coil—shipping weight, 2 lbs. Price..... **$0.50**

NO. 6 ½ M.F. CONDENSER. This is a standard telephone condenser and has ½ microfarads. Condenser comes in neat metal casing. This condenser is used in connection with spark coils to absorb the vibrator spark. Invaluable for test buzzers to absorb spark and make the sound of buzzer more steady. Is also used by every experimenter in connection with wireless where a fixed capacity is needed. Several of these condensers should be in every experimenter's laboratory.
No. 6 Condenser, ½ M.F.—shipping weight, 1 lb. Price..... **$0.50**

NO. 7 DOUBLE POLE BELL TELEPHONE RECEIVER—hard rubber casing with 4 ft. cord and tips. Standard 75 ohms—very powerful magnets. This receiver can be used in connection with any ordinary telephone work, and you will even find it sensitive enough for short distance wireless work.
No. 7 Bell Telephone Receiver—shipping weight, 3 lbs. Price..... **$0.80**

NO. 8 STANDARD TELEPHONE RECEIVER with Metal Head. This receiver is made by Stromberg Carlson Co., with genuine hard rubber handle and ear cap. A very good fool-proof as well as sensitive receiver that cannot be put out of order if you try. Used for the same purpose as No. 7 Telephone Receiver.
No. 8 Standard Telephone Receiver—shipping weight, 3 lbs. Price..... **$0.75**

No. 9 IMPEDANCE COIL (Close Core Transformer). This is a very fine little transformer and is used extensively in connection with telephone work. It is in reality an A.C. transformer for which you would pay $5.00 if you had it made to order. The primary has 0.15 ohms, secondary 2000 ohms. It can be used for a variety of purposes that will suggest themselves to every experimenter. Can be used successfully to boost wireless signals. Also in connection with audions, etc. An A-1 instrument. Size 3 x 3 inches.
No. 9 Impedance Coil—shipping weight, 2 lbs. Price..... **$0.65**



NO. 10 MICROPHONE AND BRACKET. An A-1 sensitive microphone of the carbon grain type. Has hard rubber mouthpiece and enamel steel bracket, the instrument being 10 inches long. This microphone, in connection with our No. 7 or 8 Receiver and No. 16 Ringer Box, will constitute a complete telephone outfit, good to speak 50 miles or more, at a remarkably low price.
No. 10 Microphone and Bracket—shipping weight, 5 lbs. Price..... **$1.00**

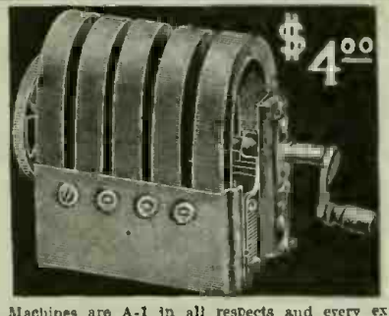
NO. 11 REPEATING COIL (Transformer). A standard repeating coil used for telephonic work. The coil windings are encased in an iron tube 2¼ inches in diameter. There are eight terminals for the four windings to connect to and the instrument is invaluable in connection with radio work to boost up signals, audion work, etc. Many interesting uses will be found for this coil. Resistances are: 100, 120, 145, 175 ohms.
No. 11 Repeating Coil—shipping weight, 8 lbs. Price..... **$2.00**

NO. 12 POLARIZED RINGER with Bells. The resistance of the two coils is 1250 ohms each. The armature is perfectly adjustable. Bell will work on any magneto. We also furnish blue print with ringer showing how *a first class polarized relay* can be made by anyone using only a few pieces of metal and screws.
No. 12 Polarized Ringer with Bells—shipping weight, 2 lbs. Price..... **$1.50**

NO. 13 POLARIZED RINGER with Bells. This is the same kind of ringer as the No. 12, except that it is not adjustable and that the resistance is less. First class in all respects. Blue print furnished with this to *make polarized relay* same as with No. 12. Solenoids on this ringer are worth more than the price we ask for the entire ringer, and do not forget a powerful magnet that goes with it.
No. 13 Polarized Ringer with Bells—shipping weight, 2 lbs. Price..... **$1.00**

NO. 14 HARMONIC RINGER. This ringer is also polarized and has a powerful magnet. It works on 66.6 cycles and any magneto will operate it if run at a certain speed. A very finely built instrument. Resistance of each coil being 200 ohms. Can be converted into a polarized relay by substituting a very fine leaf spring inside the heavy one furnished. A most interesting instrument with which to experiment.
No. 14 Harmonic Ringer — shipping weight, 4 lbs. Price..... **$1.60**

NO. 15 RINGER without Bells—630 ohms. This also is a polarized ringer and has an adjustable armature. The adjustment is done by means of the top screw. A beautiful little instrument. With this instrument, too, we furnish a blue print showing how a *polarized relay can be built*. You should have several of these beautiful little instruments. They are worth their weight in gold; the powerful magnet alone being worth more than the price we ask for the entire instrument.
No. 15 Ringer—shipping weight, 2 lbs. Price..... **$0.80**



No. 55 5-bar magneto, 110 Volt A. C. Generator

This is one of the most powerful magnetos ever built, when manufacturers could afford to put good stuff into them; equipt with transmission, make and break, etc. Transmission wheels are all brass, crank handle furnished. This magneto, as well as the other ones listed below, will light a 110-volt lamp merely by turning the crank handle slowly. While this magneto gives alternating current only, it can be rewound so it will light up a number of four, six and 10-volt lamps, all depending upon the thickness of the wire you wind on the armature. As we furnish these magnetos, they will give a powerful alternating current and you will not be able to stand the current when grasping hold of the terminals. This makes an ideal shocking machine. All our generators can be transformed into a direct current machine by equipping it with a home-made commutator. Machines are A-1 in all respects and every experimenter should have one of them in his shop. Many other experiments which can be performed with this machine will readily suggest themselves to any experimenter. The magnets furnished with these generators are very powerful, each one being able to lift one pound easily.

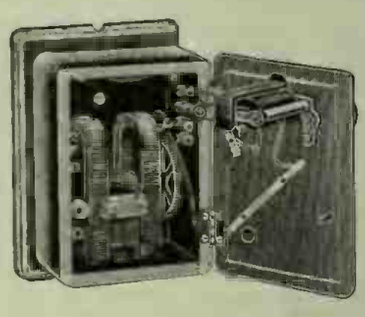
NO. 55 5-BAR MAGNETO GENERATOR as described—shipping weight, 25 lbs. Price..... **$4.00**

NO. 33 3-BAR GENERATOR. same as described above except that it has only 3 bars, and is somewhat smaller.
No. 33 3-bar Generator—shipping weight, 10 lbs. Price..... **$2.00**

NO. 44 4-BAR GENERATOR, same as No. 55 except that it has 4 bars, and is somewhat smaller.
No. 44 4-bar Generator—shipping weight, 15 lbs. Price..... **$3.00**

NO. 66 6-BAR GENERATOR, same as No. 55 except that it has one more magnet and the armature is somewhat larger and more powerful. This is the biggest type made and is extremely powerful.
No. 66 6-bar Generator—shipping weight, 30 lbs. Price.. **$4.50**

No. 16 Western Electric Ringer Box



complete with 2500 ohm polarized ringer, bells in front of cabinet. The magneto furnished is of the two-bar type, brass gear transmission to drive it, and crank on the outside of the cabinet. The cabinet is of polished oak, piano finish and if you mount our No. 10 microphone and bracket in front of the cabinet and use our No. 7 or 8 receiver, and then use a switch to break the current you have a first-class telephone outfit at a ridiculously low price. This ringer box is one of the greatest bargains that has ever been put out. Even if you do not need it for telephonic work, you should have it as the instruments themselves are worth much more money than we ask for the entire outfit.

No. 16 Western Electric Ringer Box—shipping weight, 15 lbs. Price..... **$4.50**

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 176 Big Pages, 400 illustrations, 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy," 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 20 measures 7x5¾". Weight ½ lb. Beautiful stiff covers.

ELECTRO IMPORTING CO., 231 Fulton Street NEW YORK

RUSH

Cut out and attach to your order. It will leave us within 24 Hours.



ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

I enclose herewith 6 cents in stamps or coin, to cover postage, for which please send me your latest Cyclopedia Catalog No. 20 as described.

NAME .....

ADDRESS .....

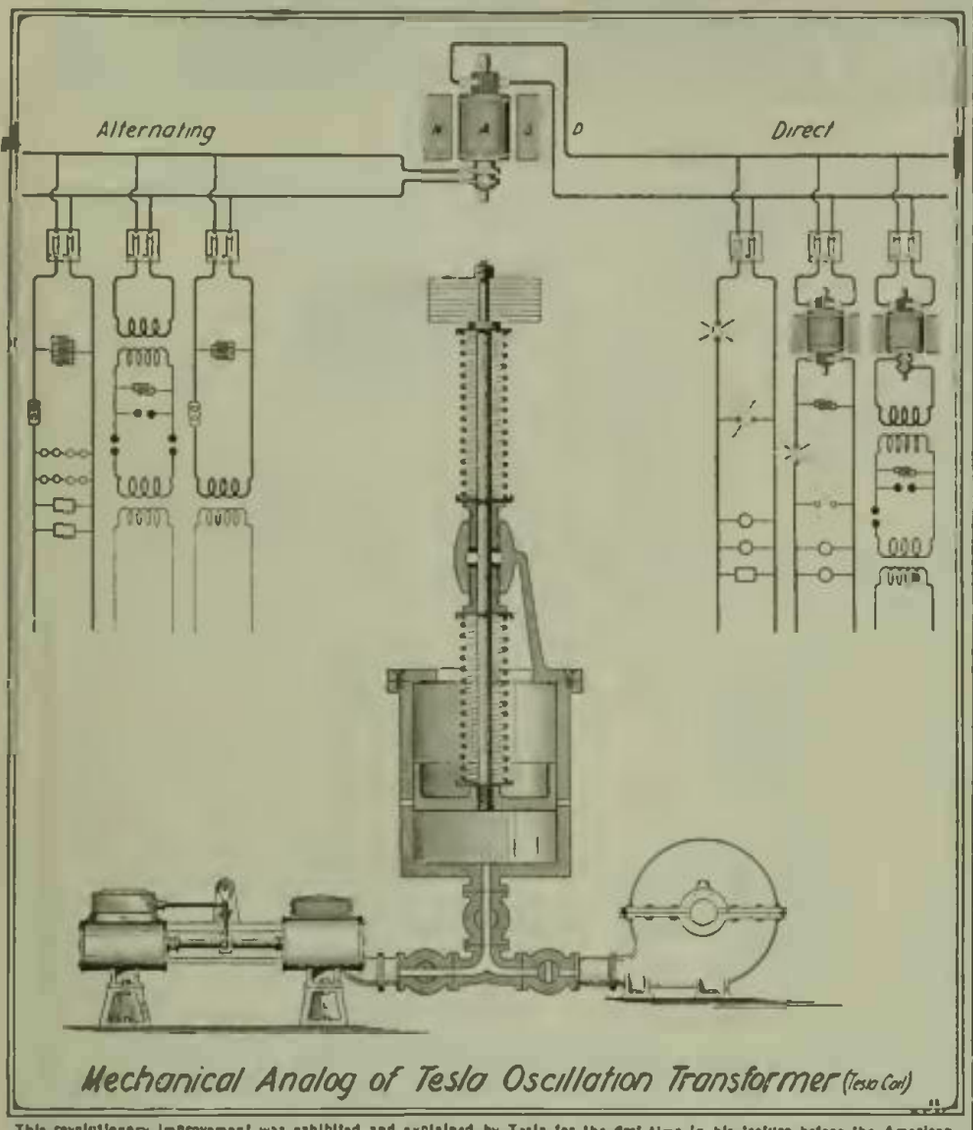
STATE.....E. E. 5-19

www.americanradiohistory.com

My Inventions

(*Continued from page 65*)

engineers of a defect involved in the transformation by the new method, namely, the loss in the spark gap. Subsequent investigation showed that no matter what medium is employed, be it air, hydrogen, mercury vapor, oil or a stream of electrons, the efficiency is the same. It is a law very much like that governing the conversion of mechanical energy. We may drop a weight from a certain height vertically down or carry it to the lower level along any devious path, it is immaterial insofar as the amount of work is concerned. Fortunately however, this drawback is not fatal as by proper proportioning of the resonant circuits an *efficiency of 85 per cent* is attainable. Since my early announcement of the invention it has come into universal use and wrought a revolution in many departments. But a still greater future awaits it. When in 1900 I obtained powerful discharges of 100 feet and flashed a current around the globe, I was reminded of the first tiny spark I observed in my Grand Street laboratory and was thrilled by sensations akin to those I felt when I discovered the *rotating magnetic field*



Mechanical Analog of Tesla Oscillation Transformer (Tesla Coil)

This revolutionary improvement was exhibited and explained by Tesla for the first time in his lecture before the American Institute of Electrical Engineers May 20, 1891. It has made possible to generate automatically damped or undamped oscillations of any desired frequency and, what is equally important, of perfectly constant period. It has been instrumental in many great achievements and its use has become universal. The underlying principle may be briefly stated as follows: A source of electricity is made to charge a condenser and when the difference of potential at the terminals of the latter has reached a predetermined value, an air-gap is bridged, permitting the accumulated energy to be discharged through a circuit under resonant conditions, this resulting in a long series of isochronous impulses. These are either directly used or converted to any desired volume or pressure by means of a second circuit inductively linked with the first and tuned to the same. The above diagram is taken from Tesla's lecture before the Franklin Institute and National Electric Light Association in 1893 and shows more elaborate arrangements of circuits, now quite familiar, for the conversion of ordinary direct or alternating currents into high frequency oscillations by this general method. In the mechanical apparatus illustrated, an attempt is made to convey an idea of the electrical operations as closely as practicable. The reciprocating and centrifugal pumps, respectively, represent an alternating and a direct current generator. The water takes the place of the electric fluid. The cylinder with its elastically restrained piston represents the condenser. The inertia of the moving parts corresponds to the self-induction of the electric circuit and the wide ports around the cylinder, through which the fluid can escape, perform the function of the air-gap. The operation of this apparatus will now be readily understood. Suppose first that the water is admitted to the cylinder from the centrifugal pump, this corresponding to the action of a continuous current generator. As the fluid is forced into the cylinder, the piston moves upward until the ports are uncovered, when a great quantity of the fluid rushes out, suddenly reducing the pressure so that the force of the compressed spring asserts itself and sends the piston down, closing the ports, whereupon these operations are repeated in as rapid succession as it may be desired. Each time the system, comprising the piston, rod, weights and adjustable spring, receives a blow, it quivers at its own rate which is determined by the inertia of the moving parts and the pliability of the spring exactly as in the electrical system the period of the circuit is determined by the self-induction and capacity. Under the best conditions the natural period of the elastic system will be the same as that of the primarily impressed oscillations, and then the energy of the movement will be greatest. If, instead of the centrifugal, the reciprocating pump is employed, the operation is the same in principle except that the periodic impulses of the pump impose certain limitations. The best results are again obtained when synchronism is maintained between these and the natural oscillations of the system.

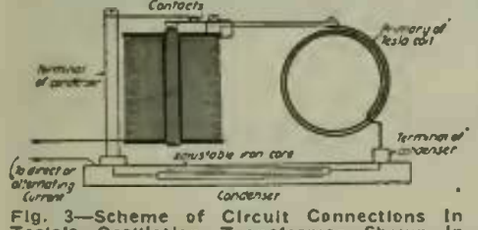


Fig. 3—Scheme of Circuit Connections In Tesla's Oscillation Transformer Shown In Fig. 1. The Secondary Circuit Which Slips Into the Primary Is Omitted.

Typewriter Sensation



FREE TRIAL

Use as You Pay

Only $4.00 a month until the low total price of $53.15 is paid, and the machine is yours.

This is absolutely the most generous typewriter offer ever made. Do not rent a machine when you can pay $4.00 a month and own one. Think of it—Buying a $100.00 machine for $53 15. Cash price, $50.35. Never before has anything like this been attempted.

Standard Visible No. 10

Smith Premier

Perfect machines, Standard size, full 84 character one motion keyboard. The entire line of writing completely visible at all times, has the tabulator, the two-color ribbon, with automatic reverse, the back spacer, ball bearing type bars, ball bearing carriage action, in fact every late style feature and modern operating convenience Comes to you with everything complete; tools, cover, operating book and instructions, ribbon, practice paper—nothing extra to buy. You cannot imagine the perfection of this beautiful reconstructed typewriter until you have seen it. I have sold several thousand of these perfect latest style Model No. 10 machines at this bargain price and every one of these thousands of satisfied customers had this beautiful, strictly up to date machine on five days' free trial before deciding to buy it. I will send it to you F. O. B. Chicago for five days' free trial. It will sell itself, but if you are not satisfied that this is the greatest typewriter you ever saw, you can return it at my expense. You won't want to return it after you try it—you cannot equal this wonderful value anywhere.

You Take No Risk—Put in Your Order *Now*

When the typewriter arrives deposit with the express agent $9.15 and take the machine for five days' trial. If you are convinced that it is the best typewriter you ever saw, keep it and send me $4.00 a month until our bargain price of $53.15 is paid. If you don't want it, return it to the express agent, receive your $9.15 and return the machine to me. I will pay the return express charges. This machine is guaranteed just as if you paid $100.00 for it. It is standard. Over one hundred thousand people own and use these typewriters and think them the best ever manufactured

The supply at this price is very limited, the price will probably be raised when my next advertisement appears, so don't delay. Fill in the coupon today—mail to me—the typewriter will be shipped promptly. There is no red tape. I employ no solicitors—no collectors—no chattel mortgage. It is simply understood that I retain title to the machine until the full $53.15 is paid. You cannot lose. It is the greatest typewriter opportunity you will ever have. Do not send me one cent. Get the coupon in the mails today—sure.

Harry A. Smith, 758, 218 N. Wells St., Chicago

H. A. SMITH, 758, 218 N. Wells St., Chicago, Ill.

Ship me a No. 10 Smith Premier F.O.B. Chicago, as described in this advertisement. I will pay you the $44.00 balance of the special $53.15 purchase price, at the rate of $4.00 per month. The title to remain in you until fully paid for. It is understood that I have five days in which to examine and try the typewriter. If I choose not to keep it I will carefully repack it and return it to the express agent. It is understood that you give the standard guarantee for one year.

Name .....

Address .....

.....

BE A C.P.A. **ACCOUNTANCY**

The Highest Paid Profession taught thoroughly in a few months of home study by new system. FREE BOOK International Accountants Society Dept. 39E, 2626 S. Mich. Ave. Chicago

www.americanradiohistory.com

SKINDERVIKEN TRANSMITTER BUTTON

Transmitting Violin Music

Fig. 1 shows how the music of a violin can be transmitted by means of the Skinderviken button. The button may be attached to any part of the violin and if it is not desired to drill a hole into the violin which may be valuable, there are numerous places where the button can be attached by means of a small nut, or if this is not desired a small lump of sealing wax into which the thread part of the button is quickly prest before it cools, will do nicely. Music can thus be transmitted from one room to another.

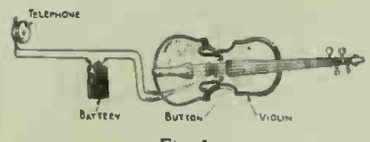


Fig. 1

Transmitting Piano Music

Fig. 2 shows how to transmit piano music at a distance. The button is attached to the front sounding board by drilling a very fine hole into the panel, or should this not be desired, it can be attached by sealing wax as described under Fig. 1. The wire can, of course, be concealed as desired. An interesting stunt can be performed by interposing a battery into the line, and the receiver shown in our diagram can then be the ordinary house telephone receiver. Piano music can then be transmitted to your friend who may be hundreds of miles distant, and the music will be absolutely clear. The same stunt can also be performed, of course, with the violin as shown in Fig. 1.

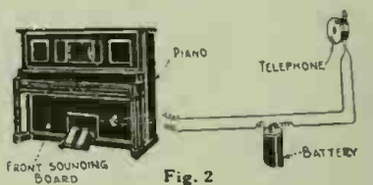


Fig. 2

A Loud Talker

Fig. 3 shows how an ordinary telephone receiver can be made into a loud talker. Very often it is desired to have a telephone conversation come in so loud that every one in the room can hear it clearly. Our illustration shows how this can be done. The telephone receiver connected to the incoming line is attached to the top of the base board as shown. The only alterations will be as follows: The cap is unscrewed and its hole is enlarged somewhat to take the Skinderviken button as shown. A thin iron nut is then attached, necessary on account of the pull exerted upon it by the telephone receiver. If the telephone receiver is a single pole type, the arrangement as shown in diagram is O. K. If a double pole receiver is used, a small iron plate instead of the nut must be used, as otherwise the pulling effect will not be so good, altho still appreciable. It is important that the nut does not touch the telephone pole piece, as otherwise the transmission will not take place. It will be necessary to underlay the diafram with a few paper washers in order to raise it sufficiently. After the Skinderviken button has been attached, it is necessary to enclose it in a sort of sound-proof box as shown in illustration. This box may be a turned wooden box, but an old telephone receiver shell will do nicely. It should be attached by means of sealing wax as shown, making it entirely sound-proof. The two transmitter wires are then connected to a loud talking receiver which may be an ordinary pony telephone receiver (single pole), which must be wound to *five ohms* or otherwise the results will not be satisfactory. By winding the receiver spool full *and evenly* with No. 26 enamel wire, you will get about five ohms. The battery between the standard receiver and the 5 ohm receiver must be ascertained by experiment, usually from four to six volts and sometimes as high as ten volts are required. It should be noted that the Skinderviken button does not easily burn out and can stand about one ampere continuously. The more battery current put on, the louder the voice. The important part now to consider is the transmitter horn, which must be made of white bristol board, the same as used on visiting cards. Buy it at any stationery store. The horn may be from 14 to 30 inches long, and the opening at the small end should be about ½ inch. It can be attached by means of sealing wax to the receiver cap. On the loud talker, the ordinary receiver diafram will do, altho one a trifle heavier works better. No magnet is used in this receiver as the pull on the diafram is electro-magnetic as well as the transmission of the voice. This device talks very loud.

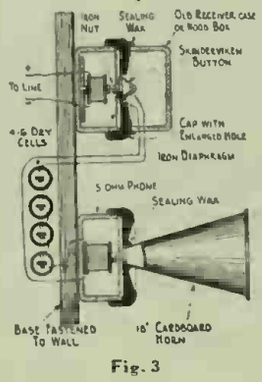


Fig. 3

How to Make a Telephone Extension

Fig. 4 shows how you can make a telephone extension to an existing telephone system. Suppose you are a telephone subscriber and you wish to have another extra phone somewhere in the building for someone else to listen in: all you need is a Skinderviken button mounted on a cigar box as shown. When the receiver is taken off the hook, it is placed on top of the cigar box directly over the transmitter button and from there the usual line runs thru a battery to the receiver. The distant party can then hear what is being said. If it is desired to have him reply also, in that case it will be necessary for him to talk into a Skinderviken transmitter and an extra line with a telephone receiver near the house phone. The party who makes the connection would then naturally have to take the receiver and place it over the mouthpiece so that the party at the other end of the wire could hear what is said. This arrangement is not shown in the diagram, but it is self-evident.

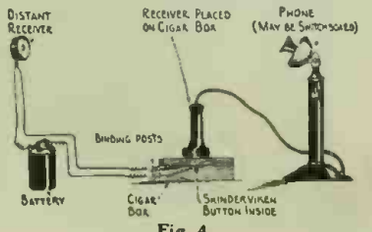


Fig. 4

"Howler," and Telegraph Practice Set

Fig. 5 shows an interesting instrument called "Howler". It is used in connection with telegraph practice instruments. It gives a loud clear musical tone every time the telegraph key is depresst. From two to three dry cells are used. The construction is somewhat similar as explained in No. 4 and the illustration is self-explanatory. The underlying idea is that the single pole telephone receiver works the Skinderviken transmitter which in turn again operates the telephone receiver, giving rise to a clear note; the same as if you take an ordinary telephone receiver of your house phone and place it over the transmitter mouthpiece, only you will find that the tone of the device described above is much better and clearer. This instrument probably constitutes one of the best and simplest learner's outfits. It can, of course, also be used as a radio test buzzer, simply by connecting one of the transmitter wires to the detector. It works very well indeed.

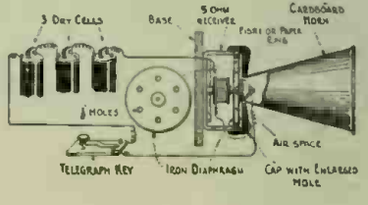


Fig. 5

SKINDERVIKEN BUTTON COMPLETE $1.00 PREPAID

Skinderviken Telephone Equipment Co. Address us as STECO, 2118-2136 N. Clark St., Chicago, Ill. or New York City, N. Y.

www.americanradiohistory.com

SKINDERVIKEN TRANSMITTER BUTTON

$1.00 ppd.

YOU can easily make a highly sensitive detectophone by using a Skinderviken Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. Think of the fun you would have with such an instrument! It's very simple, too, and inexpensive.

You can install an outfit in your home and hear the conversation being held all over the house. You can connect up different rooms of a hotel. *Our outfit was used by secret service operatives during the War. It is being used on the stage.* So much for its commercial adaptations! *You* can procure apparatus of the same type.


Actual size



Fig. 3



Fig. 6

One of the main advantages of the Skinderviken Transmitter Button lies in its ultra-sensitiveness. You can place it in any position you like. It is the greatest invention in micro-phones and has won recommendations from men of high standing in the scientific world. It is being used all over the world. You can mount it most anywhere. In figures 3, 4 and 5 are shown some unusual and practical methods. Card board boxes, stove pipes, stiff calendars and hundreds of other places will suggest themselves to you. The buttons cannot be seen by any one in the room as they are so small and light. Only a small brass nut is exposed to the view.



Fig. 4



Fig. 5

BARGAINS

These prices are very low

All equipment is GUARANTEED. The apparatus is the same as sold by us to large telephona companies. 110 volt telephone generators.

3 bar	$1.75	Weight 6½	lbs.
4 bar	2.25	" 8	lbs.
5 bar	2.75	" 10	lbs.
Ringers 80 ohm	.35	" 1	lb.
" 1000 ohm	.75	" 1	lb.
Silk cords, 6 ft. 3 cond.	.20	" 3	oz.
" " 6 ft. 4 cond.	.20	" 3	oz.
" " 3 ft. 2 cond.	.10	" 1	oz.
Transmitters complete with Steco transmitter button	$1.50	12	oz.
Induction coils	.35	6	oz.

Full directions for connecting up the button for use as a detectophone are given in booklet No. 4 which is sent with each button. Figures 1 and 2 of this advertisement, two of the many illustrations in booklet No. 4, show the circuit connections of the detectophone.

The only instruments needed to complete a detectophone outfit, in addition to a Skinderviken Transmitter Button are a receiver, battery, and, if desired, an induction coil.

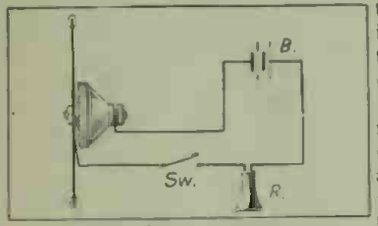


Fig. 1
Transmitter Button mounted on Diaphram. Simplest circuit.

AMONG electrical experimenters the button has created a sensation. It is not uncommon to receive unsolicited letters like these: "I received transmitter button today and I wish to inform you that it works great and is *the best I have ever seen or heard of for the price.* I will certainly recommend it to my friends. I wish to thank you for your good service."

$1.00 ppd.

"I have been using one of your transmitter buttons, and it has proved to be worth more than its value in my experimenting." "I received one (Transmitter Button) some time ago, and they are just O. K. for experimentary." "I have been using one of your transmitter buttons for experimental work and it certainly lives up to all you say for it *and then some.*"



Fig. 7

Mr. H. Gernsback, editor of this magazine, who is the dean of electrical experimenters, said: "In writer's opinion, obtained by actual elaborate tests, your Transmitter Button is probably most efficient device of its kind on market today, due to its simplicity and other outstanding features. Should have a great future."

Figures 6, 7 and 8 suggest some very interesting experiments. That of reproducing music at a point far removed from the phonograph is very popular with experimenters. The Skinderviken Transmitter Button is mounted in a very small hole in the under side of the sound arm. (Note: This hole will not injure the quality of the music.) When the phonograph is being played, the sounds produced are transformed by the Skinderviken Transmitter Button into a varying electrical current. The receiver, which is located in another room, reproduces the music at that point.

Figures 7 and 8 illustrate the methods of transmitting sound by means of the vibrations in a body while speaking. Speech will be reproduced by the receiver just the same as if the experimenter had spoken into a transmitter. In these experiments the Skinderviken Transmitter Button is mounted on a small iron disc.



Fig. 8

The same circuit connections apply to all experiments, regardless of how the transmitter button is mounted

The Skinderviken Transmitter Button operates on one or two dry cells. It often happens that two cells produce too much current and the sounds are deafening. We recommend either one fresh cell or two worn out cells.

We have the utmost faith in our transmitter button. We guarantee satisfactory service or we will refund the purchase price. Boys — Young and old—send in a dollar bill RIGHT NOW! You can't lose. If you're not satisfied, you receive your dollar back. Isn't that fair?

Send a 3c stamp for a copy of Booklet No. 4.

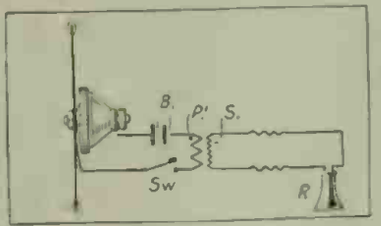


Fig. 2
Transmitter Button mounted the same but with Induction Coil.

USE THIS COUPON

STECO, 2134 North Clark St., Chicago, Illinois, or New York City, N. Y. (Use Pencil) E. E. 5-19

Gentlemen:—Please enter an order for

Enclose sufficient postage for mailing

[ ]	Skinderviken transmitter buttons	@ $1.00	prepaid	
[ ]	110 volt generators bars	@	Wt. lbs.	
[ ]	Ringers ohms	@	Wt. lbs.	
[ ]	Cords conductor ft.	@	Wt. lbs.	
[ ]	Induction coils	@ .35	Wt. lbs.	
[ ]	Transmitters with T. Button	@ 1.50	Wt. lbs.	
[ ]	Telegraph Keys	@ 1.25	prepaid	

Ship to.....

.....

.....

Send Booklet No. 4. [ ]

www.americanradiohistory.com

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section seven cents a word for each insertion. No advertisement for less than 50c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. Ten per cent discount for 6 issues. 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the June issue must reach us not later than April 22.

The Circulation of the Experimenter is over 100,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Automobile Accessories.

Liquid Silk Automobile Polish, finish lasts as long as new car, or money back. Sample 25c. prepaid. Liquid Silk Mfg. Co., Delanson, N. Y.

Ford power Mechanical Products greatly increase ability Ford Cars, Sedans, Trucks, Tractors, Racers, "4 Speed Forward Auxiliary Transmission"; Double Power, High, Low; Reverse; Powerful Motor Brake descending hills; "Absolute Neutral." Easy winter cranking. "Full-power" "16-Valve Cylinder Head," 20%-64% Power increase, government test. Other Ford Power Devices coming. Opportunity agent, dealer, owner. Send for trial plan K. Victor-Ford Trans. Mfrs., 246-248 W. 54th, New York.

Fords run 34 miles per gallon with our 1919 carburctors. Use cheapest gasoline or half kerosene. Start easy any weather. Increased power. Styles for all motors. Runs slow high gear. Attach yourself. Big profits for agents. Money back guarantee, 30 days trial. Air-Friction Carburetor Co., 270 Madison St., Dayton, Ohio.

Aeronautics.

Flies 2,000 Feet—Manhattan Racer, 26" wing spread, made finest materials, strictly a speed and distance aeroplane for amateurs. Great for spring and summer outdoor sport. Complete materials, knockdown, carved propellers, assembling and flying instructions. $3.50 Postpaid in U. S. Blueprint only, 35c. Postpaid. Blueprint Bleriot racer, guaranteed 600 foot flyer, 35c. Postpaid. Hec Aeroplane Co., 6 West 48th Street, New York City, N. Y.

Motorcycles.

Motorcycles from $25 up—New and second-hand. Easy terms, large list to choose from, all makes. Send 4c. stamp for Bulletin "A." Peerless Motorcycle Co., Watertown, Mass.

Telegraphy.

Telegraphy (both Morse and wireless) and Railway Accounting taught thoroughly and quickly. Big salaries now paid. Great opportunities. Oldest and Largest School—est. 45 years. Catalog free. Dodges Institute, 7th St., Valparaiso, Ind.

Stamps and Coins.

100 Different Stamps 10c., 200, 25c. Michaels, 5600 Prairie, Chicago.

Free—Packet Valuable Stamps to Applicants 50% Approval. Benj. Forbes, 160 Devilliers, Pittsburgh, Pa.

300 Different Stamps, 35c; 100 different U. S. 21c. C. Reitter, Box 1054, Detroit, Mich.

78 Different Stamps to approval applicants. Enclose 5c. Harland Burgett, 419 Spring St., Lima, Ohio.

For Sale—Twenty large American cents, all different dates, for only $1.55. Old coins bought up to 1916. Catalogue, 10c. Savage, 436 Melville St., Rochester, N. Y.

Stamps—61 all different free. Postage, 3c Mention paper. Quaker Stamp Co., Toledo, Ohio.

Stamps—Send 25c. for our collection. Some fine ones. Facastenhz, 425 LaGrave, Grand Rapids, Mich.

California Gold, Quarter size, 27c.; Half-dollar size, 53c.; Dollar size, $1.10; Large cent, 1820, and catalogue, 10c. Norman Shultz, Kings City, Mo.

500 Finely Mixed United States or Foreign Stamps, 12c. Philatelic Star, Madison, N. Y.

Old Money Wanted.

We Buy and Sell Old Coins. $2 to $500 each paid. Keep All Old Money; you may have valuable coins. Send 10c. for New Illustrated Coin Value Book, 4 x 6. Guaranteed prices. Get posted. Clarke Coin Co., Box 110, Le Roy, N. Y.

Tricks, Puzzles and Games.

Magic—Card Tricks—Sensational Escapes—Jokes—Novelties. Everything in the amusement line. Large illustrated catalog of a thousand tricks free. Write today. Largest amusement goods manufacturers in the world. Heaney Magic Co., Desk 200, Berlin, Wisconsin.

Leading Magical Magazine! All magicians like it! You will, too! Why? The value is there. Sample, 10c.; three months, 25c.; year, $1.00. Eagle Magician, Dept. E. Minneapolis, Minn.

Black Art Hindoo Experiments. 1919 Edition, 25c. Invisible Ink. Free Trick. Catalogue each order. Linhorst Magic X Shop, St. Louis.

1000 Stage Tricks with 500 illustrations. Catalogue 10c.; small catalogue free. Hornmann Magic Co., Sta. 6, 170 Eighth Avenue, New York.

Tricks, Puzzles, Jokes, Toys, Games, Novelties, Doll and Cane Racks, Plays, Wigs, Stage Supplies, Escapes and Illusions. Large 1917 catalog free. Oakes Magical Co., Dept. 549, Oshkosh, Wis.

100 Kinds Wire and Steel Puzzles. Catalog and leader, 10c.; postpaid. Western Puzzle Works, St. Paul, Minn.

77 S. Spencer Street,
Aurora, Ill.
Feb. 6, 1919.

Editor E. E.

Dear Sir:—The small ad I had in the February issue is surely bringing some great results, about six letters each day from all over the United States and Canada.

I would like to know the price of one insertion of the one-inch ad I am inclosing also cost of six insertions.

Please answer quickly.

Yours truly,

HOWELL RANG.

Exchange Ads.

For Sale—Single barrel shotgun, 110 v. Portable electric heater, Hawkins' Guides, Zeno chewing gum vending machine, and other articles. For description and prices, send three-cent stamp. Earl Brown, 514 Virginia Ave., Martinsburg, W. Va.

Wanted—Small motion picture machine for home, price about $10. Donald Porter, Frazee, Minnesota.

Sell—Motorcycle engine; telescope; chemicals; electric motor. Shank, 521 Jefferson St., Dayton, Ohio.

For Sale—1 K.W. Packard transformer, round detector and amplifier bulbs. Will buy old type General Electric Induction Fan Motor. Harry Weber, 1113 Walnut St., Dover, Ohio.

Wanted—Rifle telescope sight and Kraig rifle or carbine. A. L. Chamberlin, Box 132, Davenport, Iowa.

Bargains—Cyclopedia Applied Electricity, $15.00; Popular Science Library, $10.00; Excellent condition. First money order takes same prepaid. T. H. Blacknall, Box 107, Raleigh, North Carolina.

Sale—Regenerative Receiver, Storage Battery, other apparatus. Write for description. Thompson, 36 John St., Worcester, Mass.

For Sale—Twin Motorcycle, or engine, New Sayville Rotary spark gap, $7.00. Two Portable Wireless Sets, spark coils, wireless and electrical instruments. H. Gary, 600 Main St., Aurora, Ill.

Wanted—Smith motor wheels. Johnston, 9 Rutherford, Binghamton, N. Y.

Wanted—Small Graflex camera. A. Hofman, P. O. Box 809, City Hall Sta., N. Y.

For Sale—Wireless instruments. Vincent Natalish, 68 West 56th St., New York City.

Head Set—New Brandes distance phone—3,000 Ohm, $13.50, sell $8.00. Send stamp, large list Receiving Electrical apparatus. Dare, 94 Clinton Ave., Brooklyn, N. Y.

For Sale—Omnigraph five dials clock driven wireless code, quenched gap, polarized relay 5 ohms, stepup transformer. Will accept no less than $25 for outfit. Pastime Theatre, Union Hill, N. J.

Exchange Ads.—Continued.

Sell—Variety of articles, apparatus, etc. Write wants. Send stamped envelope. Vernon Palen, Sparta, Wisconsin.

"Multi-Audi-Fone", brand new, $15. Try this with your Audion or any detector. C. Francis, Box 1504, Providence, R. I.

Wanted—Quick! Volumes 1, 2, and 3 "Electrical Experimenter" either bound separate or any odd copies purchased. Good prices offered. Write for particulars and price to Box 70, Care Electrical Experimenter.

For Sale—Receiving set $10.85; consists of 15 and 7 inch double slider coupler, cat-whisker, detector, 14 point loading coil 17 and 3 inch. Have other wireless things. Send for list quick. George Faunce, 5 Green Street, Millville, N. J.

Cheap—Cyclopedia Applied Electricity. Stamps, Coins, junk. Howorth, University, Miss.

Exchange—Cycle-car for Smith Motor Wheel or bicycle engine or $50. Send stamp for particulars. Carl Mayo, Orleans, Mass.

Wanted—Whimshurst Static Machine. All letters answered. J. Picucci, 670 57th St., Brooklyn, N. Y.

For Sale—Shaw Motor attachment, $20. Harold Lambert, Haverstraw, N. Y.

Typewriter—Like new—For sale or exchange. John Galbreath, Rogers, Ohio.

For Sale—25 Watt Dynamo parts, $10. ½ K.W. Transformer Coil, $5. Electro Oscillation Transformer, $5. Loose Coupler, $2. Navy Receiving Transformer, $15. Blitzen Variable Condenser, $3. Murdock Variable Condenser, $3. Variable Condenser, $2. Ground Switch, $1.50. 2000 ohm phones, $2.50. Home Medical Apparatus, $3.50. Post Card Projector, $3.50. Bell Ringing Transformer, $1.50. $30 Mecanno, $20. All in good order. First draft or money order takes them. Burrows Rogers, Cainsville, Mo.

Sell or Exchange—Ford Gray & Davis Starting and Lighting system; Shaw bicycle motor attachment. Want Dynamo ½ K.W. or larger, 24 to 60 volts direct current, or screw cutting lathe 8" swing or larger. Frank Pantel, Muscatine, Iowa.

For Sale—Blueprints of motor windings, see ad under Blueprints, etc., this issue. Charles L. Chittenden, 811 West 181 St., Kansas City, Mo.

I have wireless apparatus and other things for sale. Write for list now. George Sharp, 73 Everett Ave., Providence, R. I.

Sale—Send stamp for list of wireless instruments, all bargains. Geo. Sprouls, 5624 Palethorpe St., Philadelphia, Pa.

Sell—New $50 Phonograph, $25. C. Gillespie, 72 Woodward, Buffalo, N. Y.

Sell—Motorcycle engine, $10.00; Magneto, $3.00; Spark coils, $1.50; Generator, $1.25; Motor, 75c. Harley-Davidson Motorcycle, $30.00. Ruben Hilborn, Brown City, Michigan.

Wanted—½ K.W. transformer, Packard or Thorderson. Clyde Stream, 2537 Elmwood, Kansas City, Mo.

Boys! Big mechanical Engineering Set. Contains three motors. All for $75.00, cost a lot more. Send cash in registered letter. Russell McQuilkin, Millport, Col. Co., Ohio.

Pocket Tester for electricians, trouble-shooters and maintenance men. For use in place of lamps on 90 to 500 volt lines for locating shorts, grounds, opens and blown fuses. Size 2½" x 5", in neat leather case with leads for testing. $1.50 postpaid. Falls Electric Shop, Cuyahoga Falls, Ohio.

Sell—White Cross Vibrator. Almost new, half price. Write Wm. Waldrip, Attico, Ind.

Sale—Swop. Whole Laboratory! Electrical Bargains. Write for list. All answered. Chas. Derrick, Grampian, Pa.

For Sale—$60.00 Regina Vacuum Cleaner with attachments, $25.00. P. Crawford, 13 Ten Broeck St., Albany, N. Y.

Sell—5 H.P. 2 cylinder gasoline engine, $46. Will exchange for screw cutting lathe. Herbert Sicklesteel, 802 12th St., Detroit, Mich.

Scenery for Hire.

Collapsible Scenery for all Plays. Amelia Grain, Philadelphia, Pennsylvania.

www.americanradiohistory.com

Agents Wanted

Easy, Pleasant Work for mechanics, shop men, clerks, during spare hours, will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Co., 98 Bar St., Canton, Ohio.

Insyde Tyres, inner armor for automobile tires, double mileage and prevent punctures and blowouts. Quickly applied. Costs little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, O.

Mechanical Novelty for Old and Young. Barrel of Laughs—Amusement and Fun Everybody possible customer. Samples with particulars, 25c. Rullet Co., Hartford, Conn.

Klean-Rite Marvelous Washing Compound. Whirlwind seller. Great Repeater. Big Profits. Shipments prepaid. Special offer and samples free. Bestever Products Co., 2426-E5 Polk St., Chicago, Ill.

$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Ave. D, Decatur, Ill.

Miracle Motor-Gas amazes motorists. 3c. worth equals gallon gasoline. Eliminates carbon. 300% profit. Isom, Idaho, wires: "Ship 500 packages. Made $70 yesterday." Samples free. Chas. A. Butler, Sec'y, Dept. 70, Toledo, Ohio.

"History of the World War," by Francis A. March, brother of General March. Authentic, complete—750 pages—illustrated—official photographs. Freight paid—credit given. Agents making fortunes. Free Outfit. Victory Publishing Company, 649 Manhattan Bldg., Chicago, Illinois.

Install Farm Lighting Plants. Big Profits. Get our Agency Plans at once. Wolkee Co., Louisville, Ky.

Cameras, Supplies—Photo Developing.

Kodakers: How would you like to get a 9 x 11 enlargement of your best negatives free? Drop us a card right now asking about it. Films developed at 10c. per roll, prints 3c., 4c. and 5c. each. Satisfaction guaranteed. Ford's Foto Studio, Ellensburg, Washington

Mail Us 15c with any size Film for development and 6 velvet prints. Or send 6 negatives any size and 15c. for 6 prints, 8 x 10" mounted enlargements 35c. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke, Va.

Frane's Brownatone 25c. Tones 250 pictures beautiful brown; easy as washing prints. Frane, Eureka, Ill.

Special Trial Offer. Your next Kodak film developed, 5c. Prints 2c. each. Moser & Son, 1910 St. James Ave., Cincinnati, O.

Clean, Neat, Perfect Kodak Finishing at the lowest prices. Work returned the same day received. Send film for sample print and copy of Catalog on Developing, Printing, Enlarging and Hand Coloring, also copy of Photo Craft Magazine, which will help you make better pictures. Photo Craft Co., Box 60, Ann Arbor, Mich.

Make real mystic photos without camera or plates by using Star Photo Papers. No experience necessary. Complete outfit for making 15 pictures, 25c. Abrams Co., 1305 Peoria St., Chicago.

Any six or eight exposure film up to Post Card size developed and printed, 10c. or enlargement, 8 x 10, your favorite negative, 20c. Special Introductory offer to show high quality work. Associated Photo Co., Dept. 12, Cincinnati, Sta. A.

Chemicals.

Chemicals and Laboratory Apparatus for analysis and experimenting. April list 5c. Frane, Eureka, Ill.

Chemicals or Chemical apparatus—We have just what you need. Our lists are without end. State your requirements. We also make up experimental sets of any value. The particulars of our standard sets will be furnished upon request. Zeigler Experimental Laboratory, Rochester, N. Y.

Stammering.

Stammering permanently eradicated at home. Cure positively guaranteed. Particulars free. Cheshire Training System, Keene, N. H.

For Advertisers.

Unheard-of Trial Offer! Inch display or 30-word classified advertisement ten weeks, $1.00. Record Advertiser, Box 2E, Houston, Va.

"Quick-Action Advertising How it is Building Business for the Progressive Advertisers of America"; A little story of results told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th St., New York.

Business Opportunities.

Make Die-Castings. Sketch, Sample, Booklet, and Proposition, 12c. Byrd & Blair, Box 227E, Erie, Pa.

Why Sell Perfumes and Toilet Goods for others? Make your own; get all the profits. Particulars, Laboratory Box 1316-X— Memphis, Tenn.

Manufacturer desires electrical specialties. Devices or supplies having possibilities of large sales wanted. What have you? North Phila., Pa., P. O. Box 5801.

Earn Money at Home. "The Reliable Plan" tells how. Ten cents. Edw. C. Maher, Dover, New Jersey.

Victory—Mechanical Toy Soldier window attraction. 30 inches high. Salutes, turns head, points with finger, etc., as set. Well made, nicely dressed officers, privates, Uncle Sam, etc. Electrically operated. Does some stunt every half minute or oftener as set and will salute soldier and pay no attention to other if desired. Representative wanted in each city and town. Write for prices. The John M. Biggs Co., Box 324, Chattanooga, Tenn.

Dollars Yearly in Your Back Yard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. Metz, 313 East 89, New York.

Enter a new business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks at small expense; no further capital required; no goods to buy; job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston, Mass.

Build Up an Income in Oil—Others are doing it—Why not you? Today is the opportunity. Join our easy monthly payment plan now—it may mean hundreds in profits. Write for information. National Oil Drilling Co., Dept. K, Houston, Texas.

$30.00 a week evenings. I made it with a small mail order business; continued my regular job daytime. Free Booklet tells how. 2 cents postage. Albert W. Scott, Cohoes, N. Y.

Patents for sale. To buy or sell patents address Patent News-H, Washington, D. C., only inventors' newspaper published.

Install Farm Lighting Plants. Big Profits Get our Agency Plans at once. Wolkee Co., Louisville, Ky.

"Quick-Action Advertising—How it is Building Business for the Progressive Advertisers of America"; A little story of results, told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet, which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th Street, New York.

Are you in search of a formula to produce a certain preparation? If so, perhaps we can help you. We are ever on the alert and closely following the development of the industrial arts in all its branches. Our standard price for each formula or process issued is Thirty-five cents. Let us hear from you. Industrial Methods Bureau, 320 Fifth Ave., New York City.

Iceless Refrigerators. Particulars for stamp. Bachman, Box 57, Fullerton, Penn.

Hurry: Our First Issue. Plans and specifications for building National Advertising Weather Service. Sales talk picture of finished machine, etc. Profit $150.00 for manufacturer. Protected territory. Descriptive literature, terms and picture 25 cents. None free. National Sales Co., Box 421, Lima, Ohio.

Start a profitable business manufacturing "Puffed Crisp". Delicious confection. Whirlwind money-maker. Machine, Instructions complete $6.50. Samples 10c. Bestever Products Co., 2426-E5 Polk St., Chicago.

Want to make $30 a week in spare time? Particulars, 20c. Walker, Box 465, Dayton, Ohio.

Opportunity—I have a comprehensive, electrical idea; available for development, that should revolutionize a certain industry. Interesting research is here afforded experimenters and inventors in something new, useful and worthwhile for amateur and experienced electrical people. Postpaid three dollars. Roy Y. Hughes, Electrician, Mitchell, South Dakota.

Big possibilities in new profession. Easy to learn in comparatively short time. Field of practice unlimited. Many so engaged earning $2,500.00 to $10,000.00 a year. Exceptional opportunities for women. Write to Howard College, 527 S. Ashland Blvd., Chicago, Illinois.

Collections.

How to Collect Accounts; also Exposure of Membership and Contract Collection Agencies. Booklet 25c. Smith Mercantile Agency, Jefferson, Ohio.

For Men.

Razor Blades sharpened right. Single edge 25 cents, double edge 35 cents Kreneclge Shop, 7 South 10th, Philadelphia, Pa.

Help Wanted.

30 Men-Women, 18 or over, wanted immediately. U. S. Government positions. Commence $92 month. Vacations. Common education sufficient. Hundreds Permanent Peace Positions. Write immediately for list. Franklin Institute, Dept. E 26, Rochester, N. Y.

Wanted Ambitious Workers to start Collection Bureaus. Be independent—make big income yearly. We train and refer business to you. "Scientific Facts" free. National Collection Bureau, Dept. 20, 65 Maynard, Columbus, O.

Dollars Saved—Used correspondence courses, bought and sold. MacMichael Educational Bureau, Victor, N. Y.

Be a Detective. Good income. Excellent opportunities to travel. Particulars free. Write American School of Criminology, Dept. E, Detroit, Mich.

Make Die-castings. Sketch, Sample, Booklet and Proposition, 12c. Byrd & Blair, Box 227F, Erie, Pa.

Books.

Books for Real Live People. Lists free. J. E. Sheridan, 417 E. 151st St., New York.

Dear Reader—If Occult, New-Thought and Scientific books appeal to you, send for my catalog, it's free. I have books on Personal Magnetism, Concentration, Spiritualism, Clairvoyance, Seership, Will, Mind, Hypnotism, Mesmerism, Character Reading, Healing, Mysticism, Success, Salesmanship, Mechanics, Entertainment, etc. A. W. Martens, J-49, Burlington, Iowa.

24 Money-Making Formulas, 25c. $15 course in candy making—6 complete lessons for 50c. Both books 60c. Alton Studio, Alton, Iowa.

Where to Buy Right; How to Advertise; no expense 2—25c. Box 115, San Francisco, Calif

Invisible Inks—30 formulas, 15c. Horton P. Jones, Perry, Ia.

"Nature Book" facts every married and engaged person should know, 35c. Central Company, 509 Ninth Avenue, New York.

World-Romic System, Masterkey to All Languages. Six Textbooks, $1.44. French Chart, 35c; Spanish, 37c; Aviation Dictionary, $1.50. French-English Aviation Dictionary, 61c. Languages, 143 West 47th, New York.

To Get Better Pictures: Read the Amateur Photographers' Weekly; illustrated; weekly prize competitions; print criticisms; many unique features; $1.50 per year; three months' trial subscription 25c. Abel Publishing Company, 401 Caxton Bldg., Cleveland, Ohio.

Old E. E. Back Numbers: We have some valuable old E. E. back numbers on hand as follows: 1915—Jan., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec., price each 35c. 1916—Jan., Feb., March, May, June, Sept., Dec., price each 35c. 1917—Jan., April, May, Aug., Nov., Dec., each 35c. 1918—Jan., Mar., May, 35c; 1918—June, July, Aug., Sept., Oct., Nov., Dec., each 20c. 1919—Jan., Feb., Mar., Apr., 20c. We can fill orders at once upon receipt of your remittance, and if you have not these numbers already, now is your chance to get them, as they probably will be snapped up very quickly. Experimenter Publishing Co., 233 Fulton St., New York City.

Health.

Tobacco or Snuff Habit Cured or no pay; $1.00 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

Pyorrhea—H. E. Kelty D. D. S., M. D., pyorrhea specialist for 15 years, has developed a successful home treatment for pyorrhea. Purifying, healing, preventative. Full month's treatment and booklet $1.00. Circular free. Dr. H. E. Kelty, 106 Gladwin Ave., Leonia, N. J.

Cigarette, pipe or chewing habit conquered. Nature's method. Guaranteed. Write for free brochure. Edw. J. Woods, TA-300, Station F, New York.

Formulas.

500 Formulas. Resilvering Mirrors, Renewing Dry Batteries, Luminous Paint, Mechanics' Soap, 25c. Catalogue 2c. Ideal, 5501-E North Robey, Chicago, Ill.

20,000 Formulas. $1.00 postpaid. List 4c. Oscar C. Hanson, Mentor, Minn.

Consult Us when in need of definite and reliable data concerning any trade formula or industrial process. Our standard price for each formula or process issued is Thirty-five cents. Write us now. Industrial Methods Bureau, 320 Fifth Ave., New York City, N. Y.

News Correspondents.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Continued on page 94

www.americanradiohistory.com

For Inventors.

Inventors. Protect your idea before exposing it. Advice Free. Inventor's Patent Service, Park Row Building, New York City.

600 Mechanical Movements, also illustrations and explanations of 50 perpetual motions. My book, Inventors' Universal Educator, 4th edition, tells how to procure and sell a patent for your new invention. Government and other costs. Covers the matter from A to Z. 140 pages elegantly bound. Contains noted Court decisions on Patent cases. Mechanical Movements greatly assist inventors—suggest new ideas that might prove of great aid in perfecting inventions. Tells how to select an attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers. Price $1. Postage free. Fred G. Dieterich, 603 Ouray Building, Washington, D. C.

Inventions Commercialized. Cash or royalty. Adam Fisher Mfg. Co., 205 St. Louis, Mo.

Inventors join National Institute of Inventors, World Building, New York City; membership society 1,900 strong; will help protect, develop, finance and market your invention. Absolutely no charge. Write for booklet.

Patent Attorneys.

Patents Procured—Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C., or 2278-T Woolworth Bldg., New York.

M. F. Miller, Ouray Building, Washington, D. C. Patent Attorney, Mechanical and Electrical Expert. Best quality of work and results. Moderate charges. Advice free.

Millions spent annually for ideas! Hundreds now wanted! Patent yours and profit! Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. American Industries, Inc., 212 Patent Dept., Washington, D. C.

Inventions Patented. Trade-marks Registered, Labels, Prints and Publications Copyrighted, reasonable fees; correspondence solicited; detailed information free; booklets. Jaynes & Jaynes, 702 Kellogg, Washington, D. C.

Protect Your Invention. Personal Service. Send sketch for honest advice. J. Reaney Kelly, 732 C, Woodward Bldg., Washington, D. C.

Patent Your Own Inventions. Save attorney's fees; we prepare applications; furnish full instructions and give satisfaction. Free information. Carl Larsen Co., Park Row Building, New York City.

James N. Lyles—Patents, trade-marks, copyrights. 734-D Eighth St., N. W., Washington, D. C.

Patents—My fee payable in monthly installments. Send sketch for advice. Booklet free. Frank Fuller, Washington, D. C.

John M. McLachlen, Atty. at Law, Patents, Trade Marks, Copyrights, 410 McLachlen Bldg., Washington, D. C.

Patent Attorney, Electrical Engineer, Mechanical Expert; Thorough Personal Service. Frank Ledermann, 21 Park Row, New York.

Printing.

100 Quality Printed Envelopes, size 6¾, 50c. Postpaid. Name cards same price. R. Wiese, Atlantic, Iowa.

100 Engraved Style Visiting Cards 50c; 100 Emblem Cards 70c. H. Gregory, Warwick, N. Y.

Wireless.

Complete receiving sets $8.50, $9.50 and up. Instruments, parts, minerals. Circular for stamp. Inquiries invited. Jenkins, 923 Purchase Street, New Bedford, Mass.

Switch Points. Binding Posts, Switch levers, and small parts, send 2c for catalogue describing these and other goods. A. W. Bowman & Co., 23 Church St., (Harvard Square), Cambridge, Mass.

Before you build that new set get our free circular on switches and contact points. Hard rubber knobs used. Eureka Secondary Co., 6939 S. May St., Chicago, Ill.

Radio Apparatus of Quality—Manufactured to your own specifications. Radio Engineering Company, Baltimore, Md.

Bargains—¼" Wireless Coils complete, guaranteed, 90c., except postage. Also Wireless Coils without vibrators, 45c., except postage. A. Dubs, 1534 Pitkin Ave., Brooklyn, N. Y.

Our Universal Radio Receiving, Detector, and Transmitting apparatus. The best that science and skill can manufacture. If interested write for catalogue. Universal Radio Mfg. Corporation, Elmira, N. Y.

Amateurs! Drop us a postal and receive interesting information that is of vital importance to you and future amateur radio. American Institute of Radio Engineering, Omaha, Nebr.

Gold Catwhisker is best for mineral detectors. Hard drawn 18 Kt. Gold Wire 26 B. & S. 3½ inches, 50c. Sterling silver, 15c. Geo. Schuler, Jr., 126 W. 46th St., New York City.

Patents for Sale.

Automobile Direction Indicator, Electrically operated. Just Patented. Manufacturing cost low. Ability to Finance means money. Royalty or contract. Investigate. L. A. & A. A. Ownbey, 1210 East 5th St., Chattanooga, Tenn.

Miscellaneous.

Wanted—Small Gasoline and Steam Engines. Cash paid for 1 to 4 cylinder light weight Motors. ¼ to 10 H.P. Johnston, West End, Pittsburgh, Pa.

Blacksmith, Listen! Prepare for big wages in Navy and Arsenal with Toy's Modern Methods doing hard jobs easy. Forging and making solid welds, hardening and tempering to a standard, with colored tempering charts. All for one dollar. Sample free. W. M. Toy, Sidney, Ohio.

Snow Plow. Removes snow from sidewalks, etc. Easy to raise or lower. Thoroughly tested. Can also be used as toy. A. H. Tallyn, Benson, Ill.

Be a Top Notcher—Get into the 100% Class. Be Prosperous. Powerful. Happy. Our system has shown thousands HOW. It can show YOU. No guesswork. Proved. A true-to-life Personality Sketch and first lesson on Happier Living for 10c. and birthdate. Thomson-Heywood Co., Dept. 350, Chronicle Bldg., San Francisco, Cal.

For Sale—Choice Silver Black breeding foxes. Reid Bros., Bothwell, Ont., Canada.

Julian's Liquid Fishing Lure. Doubles your catch. Trial bottle, One Dollar. George Julian, Albany Building, Boston, Mass.

Special—Cardboard tubing, impregnated, 5" diameter. 20c per foot. Postage extra. Mater, 335 East 93d St., New York.

Plastography Instruction with model or mould, $2.00. Success awaits you. P. B. Spahr, York, Penn.

Fancy Mice—30 Varieties; send stamp for list, or 50c for book giving full information on varieties, housing, breeding, etc. Holman's Mousery, Dedham, Mass.

Music composed to words. Bauer Bros. (formerly of Sousa's Band), Oshkosh, Wis.

Marvelous! Send for our time-saving multiplication table. Products of any amounts readily calculated. Handy pocket size card. Price 10 cents (coin) by mail. Remittance with orders. Tabluated Information Card Co., 2040 Chestnut St., Philadelphia, Pa.

"Opportunity Adlets" bring quick results. Our 100,000 circulation, net. Other firms are making money—so can you. For proof address Classified Department, Electrical Experimenter, 233 Fulton St., New York City.

Motors, Engines and Dynamos.

Small Motors and Generators: 1000 New Motors and Generators from Bankruptcy Stock, ¼ H. P. A. C., $18.50 each; ½ H. P., $30.00. Battery Charging Sets—Robbins & Myers new outfits, all sizes, $30.00 each and up. Charging, Lighting and Moving Picture Arc Generators, $10.00 each and up. Motors for all phases of current. Immediate delivery. Less than ½ regular prices. Write for late bulletin. Johnston, West End, Pittsburgh, Penna.

For Sale—Motors, all sizes. Write your wants. We have them. E. Billstone, Jamestown, N. Y.

Gas Engines for every purpose. Marine, rowboat, stationary and motorcycle. Engines from $10 up. Guaranteed one year. Write United Motor Repair & Supply Co., 305-309 Broadway, New York.

500 Watt Motors, Modern, Efficient, cost me $12. Investigate! Duplicate! Clark, Barnes Road, Newton, Mass.

50-H.P. Gasoline Engine, 4 cylinders, aluminum, cost $1,500. Will take $450. Geo. B. Boutelle, 324 N. Eutaw St., Baltimore, Md.

10 Volt, 20 Ampere Dynamo, brand new, under half price. Call Saturday evening, 354 Convent Ave., New York.

Novelties.

Latest Fad, $1.00. Blanket flag sofa pillow. Covered with 24 flags, 8 shield of arms, satine lined. Fletcher & Fletcher, 1711 S. Oregon Ave., St. Louis, Mo. Agents write for particulars.

Snappy girl pictures. You will like them and want more; 20 for 25c. Write today. Smith's Novelty, (Dept. 5) 6735 Elizabeth, Chicago, Ill.

For the Hair.

I was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have good hair-growing results. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E. 32nd St., BA-300. New York.

Personal.

Are you self-conscious—embarrassed in company—lacking in self-control? These troubles overcome. C. E. Veritas, 1400 Broadway, New York City, N. Y.

Electrical Supplies & Appliances.

Make Your Own Transformers. Costs a few cents to make. Will ring bells, buzzers, etc. No batteries required. Guaranteed, instructions, 25c. Abrams Co., 1305 Peoria St., Chicago.

Install Farm Lighting Plants. Big Profits. Get our Agency Plans at once. Wolkee Co., Louisville, Ky.

Repairing and rebuilding Galvanometers, Voltmeters, Ammeters on any electrical instruments. V. W. Bradbury, Winnsboro, La.

Propellers for Air Propulsion. Practice and Professional blades made to order. Crawford Motor and Aeroplane Manufacturing Co., Pittsburgh, Pa.; New Orleans, La.

Inventors' and Manufacturers'. Experimental work, models, tools, instruments, light machinery. Over twenty years' specialized experience working from samples, blue prints, rough sketches, explanations. Customers' supervision in machine shop permitted. Manufacturers' and Inventors' Electric Co., 29D Gold St., New York.

Get the proper apparatus for your experiments. Coils, Electro-magneto, Solenoids, Resistances, Inductances and Condensers, designed and constructed to your order. J. E. Fast, 5840 W. Erie St., Chicago, Ill.

Problems and advice in Radio, Mathematics, Electricity, Chemistry, etc., answered by experts for $1.00 and up. Paragon Technical Bureau, 329 East Fifth Street, New York City.

10 Security Ford Locks, new, at $3.50 each, regular $5.00 locks; 100 ampere combination Ford Locks for switch at $2.00 each, new, regular price $3.50; one Palor Cut 6" Electric Fan, new, at $4.25; one telephone, new, 50c.; one Premo Camera, No. 1—3½ x 4¼ Second-Hand at $6.00. Electrical, Optical and Technical Supplies. H. C. Hancock, Bogota, N. J.

Look! Save Money! Heavy aluminum 10 x 12 sheets, fifty cents; inch strip, 12c. ft. Heavy 1¼ inch brass strip, 18c. ft.; ¾ inch, 10c. ft. Postpaid. Robert Duffield, Detroit, Mich.

25c. in coin will answer that question on Storage Batteries. Henry G. Oakes, 81 Triangle St., Buffalo, N. Y.

Look! Penlites exact representation of fountain pens, 65c.; 6½" tubular flashlight, $1.05. Postage 5c. extra on either. Extra batteries sold. J. McLardie, 424 Edgewater, Dayton, Ohio.

Will buy and sell anything electrical, chemical or mechanical. Send for list and send in list and prices. Box 255, North Bennington, Vermont.

24 Dry Cells Recharged for 40c. Instructions, 10c. Walker, Box 465, Dayton, Ohio.

Blue Prints.

Blue Prints of Motor windings. 108 A.C. connections, 132 D.C. armature windings, complete 240 diagrams $5.00 cash. Send 25c. for 12 samples or write for particulars. Charles L. Chittenden, 811 West 18th Street, Kansas City, Mo.

Blue Prints: ⅛ H.P. Gas Engine, 30c; ¼ H.P. Steam Engine, 50c; ⅛ H.P. Boiler and Engine, 70c; all 3 for $1.00. Circulars on Castings and Engines for stamp. Universal Gas Motor Co., 364 Monadnock, Chicago.

Instruction.

Typewriting learned easily and quickly at home by Modern Fingering Gymnastic Method. New discovery by long experienced typewriting instructor makes expert typists. Demand increased salary. Complete course, twelve lessons, five dollars. Guaranteed. Enroll today. School of Modern Method Typewriting, Warren, Ohio.

Over 100 Branches thoroughly taught by mail. For "Free Tuition", apply Carnegie College, Rogers, Ohio.

Song Poems Wanted.

Write the Words for a Song. We write music and guarantee publisher's acceptance. Submit poems on war, love, or any subject. Chester Music Co., 918 So. Michigan Ave., Room 265, Chicago.

You Write the Words for a Song—Submit poems on war, love, or any subject. Chester Music write music, guarantee copyright and assist in securing publisher. Metropolitan Studios, Room 113, Morton Bldg., Chicago, Ill.

Phonographs.

Build Your Phonograph. "Perfection" high-quality spring and electric Motors, Tone Arms, Reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Indiana.

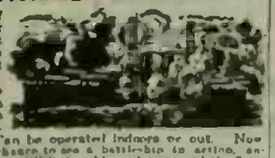
Build Your Own Phonographs and manufacture them for profit. Drawing instructions, Parts, Price List, Blue Prints, etc., complete, sent free upon request. Write today. Associated Phonograph Co., Dept. E-1, Cincinnati, Ohio.

Letter Specialists.

Letters That Land Orders and Money Orders—written for $4.00; three for $10.00. Guaranteed. Criterion Service, Dept. 3, West New York, New Jersey.

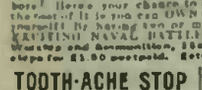
www.americanradiohistory.com

GREATEST TOY SENSATION OF THE DAY!
FIGHTING DREADNAUGHT
SENSATIONALLY REALISTIC!!!



Here is a model of Uncle Sam's fighting monsters. Eight big guns, each of which flashes, at correct intervals, from twelve to twenty times. Extra ammunition always obtainable. Absolutely harmless. Can be operated indoors or out. Now before leaving your chair to go to battle—bid to action, engage the enemy—and finally SINK the ship and command the fleet yourself by having two or more battleships, you can stage EXCITING NAVAL BATTLES in your own home. Price complete for 2 ships and ammunition, 15c, the set for 4 ships, 25c, a fleet of 8 ships for $1.50 postpaid. Extra Ammunition, 8 cents per box.

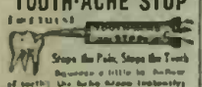
TOOTH-ACHE STOP



Stops the Pain, Stops the Tooth

Squeeze a little in hollow of tooth; the tube does instantly the pain is done, forming an obtundent filling. Accompanying harmless. Have it ready for the next bad attack. 25c per tube, postpaid.

"SAFETY 1st" PINS



A clever novelty. The National Safety First Movement is made them very popular. Buy some and show your sympathy with the movement. Also useful for sewing at amateur theatricals and the like. Sent by mail, 3 for 10c, 6 for 15c, 12 for 25c, postpaid.

Mysterious Ghost



This is not a pretty sight but dare to face it if you can. Place the ghost in a dark room and it will appear to float about in the air. Lots of fun on your mother-in-law. Price only 15 cents postpaid, or three for 40 cents.

INKLESS PEN



WRITES with WATER and needs no dipping. Makes its own ink. Fashionable sweet color. Better and cheaper than fountain pens. Writes just better with one dip in plain water. No trouble, no bother, no expense. Presents for all. With Nickel Plated Holder 10 cents. 5 for 35c. Gold plated and fine inch plated, by mail, two for 10c p. pd.

SIMPLEX TYPEWRITER ONLY $2.50



Cheap But Good. So Simple a Child Can Use It. We Guarantee the Writing.

Though an astronomically cheap, this machine is a thoroughly practical Typewriter. We guarantee it not to produce a poorer piece of work than the $1,000 machine. It does not seem possible at the price, but all we need say is see one of the cards and you will be convinced. With the exception of a few parts, it is an exact duplicate of a world beat machine in two directions, and as long a practice will make you an expert operator. It can't be otherwise. It tells you when about here a typewriter ought to be. Think what it means! Here's a typewriter that is a typewriter and not a toy! The Practical typewriter for every department in every business or professional, and to get it, as to its correspondence of any business or professional, and to get it now. You should not miss this chance of securing a Bargain. The letters are of the finest and most perfect kind, and are arranged that the letters most used are before the operator most of the time, making him to write rapidly. The writing is visible as the writing and at the end of each line a slight turn of the roller moves the carriage which makes it work and forces the paper forward, giving the printer the space for the next line. For each other to be desirable to have a writing. Each typewriter packed in a strong box with full printed instructions for use. You cannot be a typist unless you have one. Send by mail, postpaid. Price complete, $2.50.

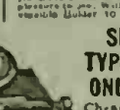
Johnson Smith & Co., Dept. E 7, 3224 N. Halsted St., Chicago

SQUIRT RING



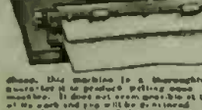
You may have a lot of fun with the Sparkling Rose Squirt Ring. It consists of a handsome gold plated ring, attached to a rubber bulb, so arranged that the latter is quite out of view when the ring is in the proper position. Both are attractive. Unless you are the closest fellow to be the center of attraction, don't be alarmed if you are invited to get the ring of your own. Just squeeze the rubber bulb and the wearer of the ring will be showered with a spray of water. Price 30 cents, postpaid. Extra bulbs, 5 cents each.

Wonderful X-Ray Tube



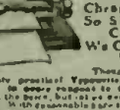
A wonderful little instrument producing optical illusions both startling and interesting. With it you can see what is apparent in the bones of your fingers, the inside of a lead pencil, the inside of a watch, seeing in a nice glass, and many other amusing illusions. A perfect representation of the human skeleton is obtained instantly explained. Price 10 cents, 3 for 25 cents, 1 dozen, 75 cents. Sent by mail, postpaid.

Sneezing Powder



Place a very small amount of this powder on the back of your hand and blow it into the face of anyone in the vicinity of the victim. The effect will be startling without leaving the remotest trace. It is most amusing to hear those who, as they never suspect the real cause, but think they've caught it from some other. Sneezing, coughing and sneezing run rampant will be having the time of your life. For parties, public gatherings, and meetings, are fine, as any place at all where there is a gathering of people. It is the greatest joke out. Price 12c per box; 3 for 30c. *By Express Only.*

STAGE MONEY



With a bunch of these bills, it is easy for one person of limited means to appear prosperous. By handing a small bill to the proper time and peel off of a genuine bill or two from the outside of the roll, the effect created will be found to be all that is desired. Prices, postpaid: 15 Bills 10c, 50 Bills 25c, 125 Bills 50c, or $3.00 thousand.

NEW BOOK ON ROPE SPLICING

USEFUL KNOTS, HITCHES, SPLICES, ETC.

Neo Different Knots Are Made and What They Are Used for. Knots to Add Knots to Avoid.

A most practical handbook giving complete and simple direction for making all the most useful knots, hitches, rigging, splices, etc. Over 100 illustrations. All about wire rope attachments, lashing, blocks, tackles, etc. 31 Handy Knots Illustrated. Of great value to mechanics, riggers, campers, boatmen. Price 20c p. pd.

Johnson Smith & Co., Dept. E7, CHICAGO

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night

The very latest discovery in the science world. NEW LUMINOUS PAINT, which, applied to the surface of any article, causes rays of white light, rendering it perfectly visible in the dark. The BRIGHTEST AND THE MOST BRILLIANT PAINT KNOWN. Quite simple to use. Anyone can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the point of a pencil, which placed in your mouth lights match boxes, and innumerable other articles; thus making your own Luminous Outfits. Luminous Sensation Outfit, containing enough paint to coat several small articles, Price 25c. Larger size 50c and $1 postpaid. Johnson Smith & Co., Dept. E 7.

MUSICAL KAZOO



With the Musical Kazoo you can, without any practice whatever, play real jazz tunes, classical music, or any other kind of music, with the instrument producing a humorous, buzzy sound.

Kazoo, snare drum, Punch and Judy, etc. No notes to forget. It is simplicity itself. Produces excellent duets. You do not have to take it, but can sing, hum or whistle any desired melodies. Used with surprising results at society meetings, picnics, club or school entertainments, dances, serenades, parades, outings, etc. Fun for the third to thousands and there are pictures and marching tunes, etc. Excellent for recital or instrumental accompaniment, either with or without other musical instruments. Price 15c p. pd.

MAGIC FLUTE



Wonderfully Sweet Toned and Musical

Paid 15c Paid

A marvelous musical instrument. Its simple mechanism produces music whether it be the lowest tones of a quick, step or the soul. Used with surprising results at society meetings, picnics, club or school entertainments, dances, serenades, parades, outings, etc. Fun for the third to thousands and there are pictures and marching tunes, etc. Excellent for recital or instrumental accompaniment, either with or without other musical instruments. Price 15c p. pd.

All the Latest Surprising and Joke Novelties

Phone's Serpentine Eggs, box	10c
Miniature Water Pistol	10c
Snapping Snake (very lifelike)	10c
Fake Matches (Fool your friends)	10c
Fool Auto Puzzle (Latest)	10c
Mysterious Cube, solves itself	10c
Rubber Razor (very formidable)	10c
Rubber Bargain Tobacco Pouch	10c
Rubber Somewhere (great joke)	10c
Comic Photograph (see behind you)	10c
Comic Mind Reading Mystery Coin	10c
Thurston's Mysterious Trick Coin	10c
Fortune Teasers, pair	10c

Johnson Smith & Co., Dept. E 7, 3224, N. Halsted St. CHICAGO

Boys, you can have Movies of your own home with this latest model
MOVING PICTURE MACHINE

Uses Standard Films same as the larger machines. Very easily managed. Simply turn the handle. Good Variety of Films always obtainable.

PRICE Complete ONLY **$2.50** Postpaid anywhere including Two Films

Extra Films, 15c each postpaid



THIS IS A GENUINE MOVING PICTURE MACHINE and the motion pictures are clear, sharp and distinct. The Moving Picture Machine is finely constructed, and carefully put together by skilled workmen. It is made of Russian Metal, has a beautiful finish, and is operated by a finely constructed mechanism. The projecting lenses are carefully ground and adjusted, triple polished, standard double extra reflector, throwing a ray of light many feet, and enlarging the picture on the screen up in three or four feet in area. The light is produced by a safety carbide generator, such as is used on the largest automobiles. This throws a dazzling white light on the screen.

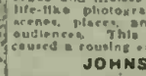
It is a solidly constructed and durable Moving Picture Machine. The mechanism is exceedingly simple and is readily operated by the most inexperienced. The pictures shown by this marvelous Moving Picture Machine are not the common, crude and lifeless Magic Lantern variety, but are life-like photographic reproductions of actual scenes, places, and people which never tire its audiences. This Moving Picture Machine has caused a rousing enthusiasm wherever it was used.



JOHNSON SMITH & CO.

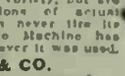
Dept. E 7 3224 N. HALSTED ST., CHICAGO

ANARCHIST BOMBS



Capsule of a little glass vial, containing a liquid from a chemical which will produce a most horrible odor. One dropped in a room full of people will cause more consternation than a flamboyant shout. The smell will entirely disappear in a short time. 3 Bombs for 25c, shipped by express only with a Dollar's worth of other merchandise.

ITCHING POWDER



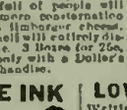
This is another good practical joke; the intense discomfort of your victims in scratching themselves is thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is vigorous scratch, then some more scratch, and still more scratch. More and more, and still more scratch. More and more, and still more scratch. 5 cents per box by mail postpaid to any address. Five packages for 20 cents. By express only, 50 cents per hundred. Dollar's worth of other merchandise.

INVISIBLE INK



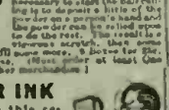
The most confidential message can be written with this ink, and no one will be the wiser. Cannot be seen unless you know the secret, invisible for any length of time. Keep your business and other private matters from prying eyes. Great fun for playing practical jokes. Only 15c a bottle.

LOVE LETTER INK



Writing written with this remarkable ink vanishes entirely in a few seconds if desired, leaving the paper QUITE BLANK. 15c p. pd.

LUMINOUS INK



Writing can be READ ONLY IN A DARK ROOM. Quite invisible at daytime. Very remarkable. 15c bottle; 3 for 40c postpaid.

JOHNSON SMITH & CO.

MULTIPLYING BILLIARD BALLS

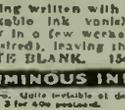
The Best Feat of Its Kind



This trick is so effective as to be surprising. The performer holds forward his hand for examination, and immediately it is returned to him he proceeds to roll the balls off his thumbs and fingers and a strong ball magnetic appears. The balls are held in the palm of the hand in full view of the audience by the tips of the fingers of the left hand, and even while being placed in position, another self engages partially removes the appearance. Finally the magician apparently pulls it from some hid and yet another ball is the result. The feat can then be repeated, the balls disappearing one after another until none remains. It is a very interesting trick that is quite easily performed by following the directions that accompany the apparatus. Price complete, 25 cents, postpaid. JOHNSON SMITH & CO.

GOOD LUCK RING

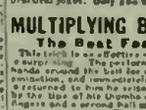
Gold and Green Onyx



A VERY striking and uncommon ring. Made of a combination of gold and cross-bones design. Silver cross-bones flash as some sparkling gem of the ocean. A never failing object of interest. Can be used in many to bring Good Luck to the wearer. Remember the name Good Luck Ring, and what it will do. Unconditionally guaranteed to be satisfactory in every respect or money refunded. Price, postpaid, 25 cents.

LOADED CIGARETTES

Just Like Genuine Cigarettes. Get Laid Real Interest



A box containing ten apparently genuine Cigarettes. They resemble a real cigarette in appearance and are filled to smoking. They appear so real, and afford as good a smoke before they tell that the victim is taken entirely by surprise. A most practical joke. Price per box, postpaid, 10 cents. Johnson Smith & Co., Dept. E-7

THE "LITTLE GIANT" TYPEWRITER

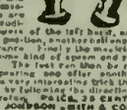
A First Class Writing Machine For $1.25



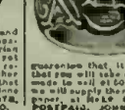
A per cent little typewriter for $1.25. There are a few things you must know before you can do a typewriter like those needle and beak-nosed do not represent the cost of the machine. The machine is too cheap to be purchased. No such purchase we can confidently recommend our Little Giant. It is strongly made, but simple in construction, so that any one can quickly learn to operate it, and the work is done with pen and ink. The letters of the alphabet most frequently used being so grouped as to enable one to write rapidly, the numerals, 1 to 10, and the characters being together. With this machine you can send your best girl (provided she has letters), address envelopes, make out bills, and do almost any kind of work requiring a large or expensive machine. With each typewriter we send a tube of ink and full printed instructions for using the machine. Price complete $1.25 by mail postpaid.

SERPENT'S EGGS

Each box contains 12 Eggs, which are no larger than a grain of oats. When lit with a match, however, each one gradually hatches itself into a Snake several feet long, which curls and twists about in a most lifelike manner. Price per box 10c, postpaid. Johnson Smith & Co.

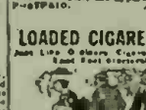


MYSTIC SKELETON



A jointed figure of a skeleton 14 inches in height, will dance to music and perform various gymnastic and amusements while in operation may be any distance from it. The figure may be controlled by the spectators. When hanged back to the operator it is simply placed on a chair or table, when it will perform the same motions with ease and grace. At the command of the operator it will bow, make up, dance, &c. We send each with each skeleton, by the aid of which anyone can readily make it perform. 10c postpaid.

CIGARETTE ROLLER



Very neat and handy. Weighs less than a quarter of an ounce. It makes better cigarettes than you can buy for a dollar. You can use just the tobacco you prefer and thus have nicer smoke than ready made, and more of them besides saving half of your money. Just try one and make your cigarettes just to your own liking. Price only 10c or 3 for 25c postpaid, with roll instructions for use. JOHNSON SMITH & CO.

MIDGET ILLUSTRATED BIBLE

A Great Curiosity

The Smallest Bible in the World

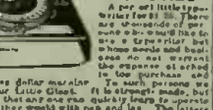


The Midget Bible is a perfect reproduction of a work of art. It is about the size of an ordinary stamp, and contains only FORTY-TWO AND FIFTY PAGES of the NEW TESTAMENT, profusely illustrated. The Bible is a wonder. Can be sold to bring good luck to the owner. Must be seen to be appreciated. Price, only 12 cents. Three Bibles for 30 cents, and we will send you 100 for $6.00. Good money can be made selling these Midget Bibles among your friends, churches, Sunday schools, bazaars, etc. Send for a few and try it.

The CONJURER'S CASKET

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment

ANYONE CAN DO THEM 50c

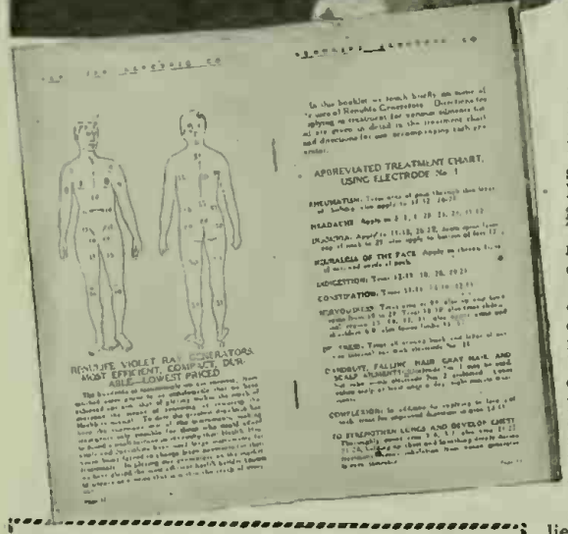


It is great fun mystifying your friends. Get this Conjurer's Cabinet, and you will be the interested fellow in your district. It contains the apparatus for a number of tricks, including The Disappearing Rose, that, when placed on the lapel of your coat, vanishes from sight at will; the Magic Vase and Ball Trick in Wooden Ball is placed inside, and upon replacing the lid has disappeared and is found in someone else's pocket; The Magic Wand with which you can perform all your finger almost at will; the Wonderful Card Trick in card is placed in an envelope, and when opened an entirely different card and altogether is found; The Disappearing Lump Trick a coin is placed in the hole wooden barrel, and when opened again, is found to have vanished without a trace; the Coin and Handkerchief Trick, in which a coin is made to change into a coin of another denomination; The Famous Mesmerized Penny that defies the law of gravitation, and sticks to the back of the hand, fingers, wall, clothing, etc.; The Glass Goblet and Vanishing Coin Trick a coin is dropped into a glass of water, and when the water is poured out the coin has vanished; Wand Trick, by means of which a borrowed coin can be

Now made simple and perfectly safe

TREAT YOURSELF With The Wonderful *Health Restorer* VIOLET RAY





You Can Have Bodily Vigor, Success-Attaining Energy, Attractive, Healthful Beauty

All at practically no cost—The great benefits of the *Violet Ray treatments* heretofore only procurable at big expense from physicians and beauty specialists are now available in your own home. Look over list of treatments below. Send for particulars.

How Violet Ray Benefits

Electricity from your light socket is transformed into health and beauty-giving Violet Ray—powerfully effective, yet gentle, soothing, perfectly safe. Voltage is raised from ordinary lighting current to *thousands of volts*, giving tremendous penetrative force. The irresistible, revitalizing powers of *Renulife Violet Ray* are carried at once to every nerve cell, fibre and part of body. Blood is enriched and purified by a flood of oxygen, giving added vitality and strength. Assimilation and digestion improved—functions restored to normal—extra supply of fresh blood quickly brought to area treated, removing congestion and supplying nourishment. While relieving pains and aches, the manifest results of disorders, it removes the deep-seated cause; combines the benefits of electricity, vibration, exercise, stimulation and oxidation.

Painless Electricity

Science has modified electricity that the weakest may stand its force without fear or pain. Every tissue and fibre is saturated, patient experiencing only a sensation of relief, as if standing in a ray of sunshine. *Violet Ray high frequency* has no comparison with old, crude, electrical batteries and shocking current. Every jar and shock is removed. The effects are marvelously rapid. Relief can be given in one or more treatments. Often cures are accomplished in that time. It is positive and certain in action. If you value your health, and want to keep or restore your good looks and gain vitality, throw away medicine bottles—take this sensible, scientific means. *Violet Rays* work with nature. Every day's delay makes relief more difficult.

Renulife Violet Ray
HIGH FREQUENCY GENERATORS

Offered on a Most Liberal
TRIAL PLAN
Learn the Wonderful Benefits by Actual Use

Send for Booklet, "Health via Violet Ray."

COUPON FOR BOOK and Special Information

RENULIFE ELECTRIC CO.,
636 Marquette Bldg., Detroit, Mich.

Please send without obligation, your book "Health," explaining Violet Ray treatments with Renulife Generators; also give full particulars as to its application for ailments checked below

TREATS SUCCESSFULLY

..Abscesses	..Facial Neuralgia	..Obesity
..Anemia	..Falling Hair	..Pain in Abdomen and Chest
..Asthma	..Female Complaints	..Paralysis
..Arteriosclerosis	..Goitre	..Piles
..Baldness	..Gout	..Pimples
..Blackheads	..Haemorrhoids	..Pyorrhea
..Brain Fag	..Hay Fever	..Rheumatism
..Bronchitis	..Infantile Paralysis	..Scars
..Bunions	..Insomnia	..Sciatica
..Bruises	..Lameness	..Skin Diseases
..Catarrh	..Locomotor Ataxia	..Sore Throat and Throat Diseases
..Colds	..Lumbago	..Sprains
..Chilblains	..Nervous Affections	..Toothache
..Dandruff	..Neuralgia	..Weak Eyes
..Deafness and Ear Diseases	..Neuritis	..Wrinkles
..Eczema		..Warts and Moles
..Enlarged Prostate		

Name.....

Address.....

.....

RENULIFE ELECTRIC CO., 636 Marquette Bldg., Detroit, Mich.

CANADIAN RENULIFE ELECTRIC CO.
236 Netting Bldg., Windsor, Ont.

SALES REPRESENTATIVES WANTED



Unequaled for scalp and hair



Brings beauty parlor to your home



Inhaling ozone. For Catarrh, throat and lungs. Marvelous local results with general tonic effect



Treatment for general debility, nervousness, etc.

www.americanradiohistory.com



Every Electrical Man Wants These Books and we ship them FREE for your inspection



Flexible Covers — Handy Pocket-Size Volumes

10 Volumes — 3500 Pages — 4700 Pictures

$1 Per Volume

$1 Per Month

Just what you need to know to succeed in ELECTRICITY

EVERY electrician, every engineer, every mechanic should know about these wonderfully helpful instructive books, which give in plain words a complete working knowledge of electrical engineering in all its phases.

You run into some new electrical problem almost every day. The information you need to help you in your every day work is in

HAWKINS ELECTRICAL GUIDES

These books place electricity at your finger ends. They cover every imaginable subject, principle, theory, problem, trouble, and way of doing things electrically. Every subject is indexed so that you can turn right to it. They are a study course and a reference guide in one, written in plain every day language—no wasted words—only what you need to know—chock full of up-to-the-minute electrical knowledge. The guides are a complete course in electrical engineering. They will help you in every detail of the day's electrical work. You can't ask an electrical question that Hawkins Guides can't answer.

What Electrical Men Say

Helped Him Make Good

"It is only right for me to recommend highly the Hawkins Guides, for they have been of the greatest assistance to me in placing me in my present position as Superintendent of Construction Department of one of Ohio's largest Electrical Companies. I would like to see every man have a set of Hawkins Guides."
Geo. Knecht, Columbus, Ohio.

In the Naval Electrical Dept.

"The Hawkins Guides are great help to me in the Naval Electrical Department, which they cover very thoroughly." C. J. Cornell, U. S. Receiving Ship, Brooklyn, N. Y.

Superintendent

"I am now superintendent of the Dunnville Hydro-Electric Systems, and Hawkins Guides were a great help to me in holding down a responsible position."
W. E. Swartz, Dunnville, Ontario.

Wireless Operators

"I have worked wireless for ten years—but I wish I had these books years ago, as they have saved me a great deal of trouble." H. Marshall, Steamer M & B No. 2, Walkerville, Ont.

Pocket-Size Flexible Covers

The books are small enough to slip into your coat pocket—handsomely bound in flexible black covers.

You can carry each volume with you until you have mastered its contents. 3,500 pages of actual information and 4,700 illustrations. Once you see these books and put them into actual use you will never again want to be without them. Try it at our expense.

SEND NO MONEY

It will cost you nothing to receive these books—to look them over—ask them all the questions you can think of—use them in your work—study them—pick up some information that will increase your earning ability. We will ship you the entire set of 10 volumes entirely FREE. This is a sign of our confidence in the guides. Pure gold does not object to being tested. Keep them for seven days and if you do not decide that you can't get along without them, return them to us and owe us nothing.

When you decide to keep them you only have to pay $1.00 down and remit the balance of $9.00 on the easy payment of $1.00 a month till paid for.

Use this coupon to get the books. It will pay you many times over.

THEO. AUDEL & CO.
72 Fifth Ave. New York, N. Y.

SEND NO MONEY - USE THE COUPON

READ THIS PARTIAL LIST OF CONTENTS

No. 1 Contains 348 pages, 398 illustrations. Electrical signs and symbols—static and current electricity—primary cells—conductors and insulators—resistance and conductivity—magnetism—induction coils—dynamo principles—classes of dynamos—armatures—windings—commutation—brushes, etc.

No. 2 Contains 348 pages, 394 illustrations. Motor principles—armature reaction—motor starting—calculations—brake horsepower—selection and installation of dynamo and motors galvanometers standard cells—current measurement resistance measurement voltmeters—wattmeters—watt hour meters—operation of dynamos—operation of motors, etc.

No. 3 Contains 300 pages, 423 illustrations. Distribution systems—wires and wire calculations—inside, outside and underground wiring—sign flashers—lightning protection—rectifiers—storage battery systems, etc.

No. 4 Contains 270 pages, 379 illustrations. Alternating current principles—alternating current diagrams—the power factor—alternator principles—alternator construction—windings, etc.

No. 5 Contains 320 pages, 614 illustrations. A. C. Motors—synchronous and induction motor principles—A. C. commutator motors—induction motors, transformers; losses, construction, connections, tests—converters—rectifiers, etc.

No. 6 Contains 298 pages, 472 illustrations. Alternating current systems—switching devices—circuit breakers—relays—lightning protector apparatus—regulating devices—synchronous condensers—indicating devices—meters—power factor indicators—wave form measurement—switch boards, etc.

No. 7 Contains 316 pages, 379 illustrations. Alternating current, wiring power stations—turbines; management, selection, location, erection, testing, running, care and repair—telephones, etc.

No. 8 Contains 332 pages, 436 illustrations. Telegraph—simultaneous telegraphy and telephony—wireless—electric bells—electric lighting—photometry, etc.

No. 9 Contains 322 pages, 627 illustrations. Electric railways—electric locomotives—car lighting—trolley car operation—miscellaneous applications—motion pictures—gas engine ignition—automobile self-starters and lighting systems, electric vehicles, etc.

No. 10 Contains 513 pages, 599 illustrations. Elevators—cranes—pumps—air compressors—electric heating—electric welding—soldering and brazing—industrial electrolysis—electro plating—electro-therapeutic—X-rays, etc.

Also a complete 126-page ready reference index of the complete library. This index has been planned to render easily accessible all the vast information contained in the 10 electrical guides. There are over 13,500 cross references. You find what you want to know instantly.

THEO. AUDEL & CO.
72 Fifth Ave.
New York, N. Y.

Please submit me for examination Hawkins Electrical Guides (price $1 each). Ship at once, prepaid, the 10 numbers. If satisfactory I agree to send you $1 within seven days and to further mail you $1 each month until paid.

Signature.....

Occupation.....

Employed by.....

Residence.....

Reference..... E. E. May

www.americanradiohistory.com



These Are The Hours That Count

MOST of your time is mortgaged to work, meals and sleep. But the hours after supper are *yours*, and your whole future depends on how you spend them. You can fritter them away on profitless pleasure, or you can make those hours bring you position, money, power, *real success* in life. Thousands of splendid, good-paying positions are waiting in every field of work for men *trained to fill them*. There is a big job waiting for *you*—in your present work or any line you choose. Get ready for it! You can do it without losing a minute from work or a wink of sleep, without hurrying a single meal, and with plenty of time left for recreation. You can do it in one hour after supper each night, right at home, through the International Correspondence Schools.

Yes—You Can Win Success in an Hour a Day

Hundreds of thousands have proved it. The designer of the Packard Twin Six and hundreds of other Engineers, climbed to success through I.C.S. help. The builder of the great Equitable Building, and hundreds of Architects and Contractors, won their way to the top through I.C.S. spare-time study. Many of this country's foremost Advertising and Sales Managers prepared for their present positions in spare hours under I.C.S. instruction.

For 28 years men in offices, stores, shops, factories, mines, railroads—in every line of technical and commercial work—have been winning promotion and increased salaries through the I.C.S. Over 100,000 men are getting ready *right now* in the I.C.S. way for the bigger jobs ahead.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 6186, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

☐ ADVERTISING	☐ ELECTRICAL ENGINEER	☐ MECHANICAL ENGINEER
☐ SALESMANSHIP	☐ Electrician	☐ Mechanical Draftsman
☐ Traffic Management	☐ Electric Wiring	☐ Machine Designer
☐ BUSINESS (Complete)	☐ Electric Lighting	☐ Machine Shop Practice
☐ Commercial Law	☐ Electric Car Running	☐ Boilermaker or Designer
☐ Certified Public Accountant	☐ Heavy Electric Traction	☐ Patternmaker
☐ Higher Accounting	☐ Electrical Draftsman	☐ Toolmaker
☐ Railway Accountant	☐ Electric Machine Designer	☐ Foundry Work
☐ BOOKKEEPER	☐ Telegraph Engineer	☐ Blacksmith
☐ Stenographer & Typist	☐ Telephone Work	☐ Sheet-Metal Worker
☐ Good English	☐ ARCHITECT	☐ STEAM ENGINEER
☐ Window Trimmer	☐ Architectural Draftsman	☐ Stationary Fireman
☐ Show-Card Writer	☐ Contractor and Builder	☐ MARINE ENGINEER
☐ Sign Painter	☐ Building Foreman	☐ GAS ENGINE OPERATING
☐ CIVIL SERVICE	☐ Carpenter	☐ Refrigeration Engineer
☐ Railway Mail Clerk	☐ Concrete Builder	☐ CIVIL ENGINEER
☐ Mail Carrier	☐ PLUMBER & STEAM FITTER	☐ Surveying and Mapping
☐ CARTOONIST	☐ Heating and Ventilation	☐ R. R. Constructing
☐ Illustrator	☐ Plumbing Inspector	☐ Bridge Engineer
☐ Perspective Drawing	☐ Foreman Plumber	☐ SHIP DRAFTSMAN
☐ Carpet Designer	☐ CHEMIST	☐ Structural Draftsman
☐ Wallpaper Designer	☐ Analytical Chemist	☐ Structural Engineer
☐ Bookkeeper Designer	☐ MINE FOREMAN OR ENGINEER	☐ Municipal Engineer
☐ TEACHER	☐ Coal Mining	☐ NAVIGATION ☐ Spanish
☐ Common School Subjects	☐ Metal Mining	☐ Motor Boat Runs'g ☐ French
☐ High School Subjects	☐ Metallurgist or Prospector	☐ AGRICULTURE ☐ Italian
☐ Mathematics	☐ Assayer	☐ Fruit Growing
☐ AUTOMOBILE OPERATING	☐ TEXTILE OVERSEER OR SUPT.	☐ Vegetable Growing
☐ Automobile Repairing	☐ Cotton Manufacturing	☐ Live Stock and Dairying
☐ Auto. Electrical Work	☐ Woolen Manufacturing	☐ POULTRY RAISING

Name _____

Occupation _____ Employer _____

Street and No. _____

City _____ State _____

Canadians may send this Coupon to International Correspondence Schools, Montreal, Can.

Your Chance Is Here!

No matter where you live, the I.C.S. will come to *you*. No matter what your handicaps, or how small your means, we have a plan to meet your circumstances. No matter how limited your previous education, the simply written, wonderfully illustrated I.C.S. textbooks make it easy to learn. No matter what career you may choose, some one of the 280 I.C.S. Courses will surely suit your needs.

Make Your Start Now!

When everything has been made easy for you—when one hour a day spent with the I.C.S. in the quiet of your own home will bring you a bigger income, more comforts, more pleasures, all that success means, can you afford to let another single priceless hour of spare time go to waste? Make your start right now! This is all we ask: Without cost, without obligating yourself in any way, put it up to us to prove how we can help you.

Just Mark and Mail This Coupon

THE CAREY PRINTING CO. INC.
NEW YORK

www.americanradiohistory.com

TK
7800
E54
V.7
no.

Engin
Serials

JUNE, 1919
20 cts.

ELECTRICAL EXPERIMENTER

SCIENCE AND INVENTION

OVER 175 ILLUST.

REG U.S. PAT. OFF.



AN AËRIAL RESCUE AT SEA

SEE PAGE 108

LIBRARY OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

OVER 100,000 COPIES MONTHLY — LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION

www.americanradiohistory.com

BE A CERTIFICATED ELECTRICIAN



I WILL TRAIN YOU AT HOME

A REAL POSITION LIKE THIS—FOR YOU

The country needs thousands of trained, Certificated Electricians to fill good positions—and at big pay. It's all a matter of knowing how, and I will teach you by up-to-date, modern instruction. You can learn at home, without interfering with your regular work, by my highly successful method of *Home Instruction* in *Practical Electricity*.

Prepare NOW and be ready in a few months to earn your $46 to $100 A WEEK

Send for this Book

My book, "HOW TO BECOME AN EXPERT ELECTRICIAN," has started thousands of young men on the way to splendid success. A new edition of this has just been printed. I want every young man interested in Electricity to have a copy, and will send you one, ABSOLUTELY FREE AND PREPAID. Write me today.

How I Train My Students

As Chief Engineer of the Chicago Engineering Works I know exactly the kind of training a man needs to enable him to get and hold good positions, and to earn big pay. I have trained hundreds of men who are holding splendid electrical jobs.

I give each of my students personal attention and a complete and thorough training. I give him a SPLENDID ELECTRICAL OUTFIT FREE, and much of the training is done by actual work. When my students graduate and receive their Certificate, they are ready for a real position. But *still more*, at any time you wish you can come to our splendidly equipped Electrical Shops for special training. No other school can give you this.

A Real Opportunity for YOU

Wishing is never going to make your dreams come true. You've got to *study*—to *learn*. A man is worth possibly $2 or $3 a day from his neck down—and no more; but there is *no limit* to what he can be worth from his neck up.

A *trained mind* is what gets the big pay. It is this training that you need, and I can train you in a few months. Are you ambitious to make a real success—then send me the coupon—today.

Electrical Outfit FREE

To every student who answers this ad I am giving a Splendid Electrical Outfit of standard size Electrical Tools, Instruments, Materials, etc., *absolutely free*. Furthermore, to every Electrical Student I give a truly *valuable* surprise that I cannot explain here.

Free Employment Service

I am continually receiving requests from employers to send them trained Electrical men. I assist my students to secure good positions. I keep in touch with them for years, helping and advising them in every possible way.

Write Now—Don't Delay

Delay never got you anything. Action is what counts. Get started—and get started now. Write me, or send me the coupon, right NOW.

L. L. COOKE, *Chief Engineer*
CHICAGO ENGINEERING WORKS
441 CASS ST. Dept. 26 CHICAGO

USE THIS "FREE OUTFIT" COUPON

CHIEF ENG. COOKE,
Dept. 26, 441 Cass St., Chicago, Ill.

Sir: Send at once, fully prepaid and entirely free, your book, particulars of your special offer and coupon for this month.

Name .....
Address .....
City .....
State .....

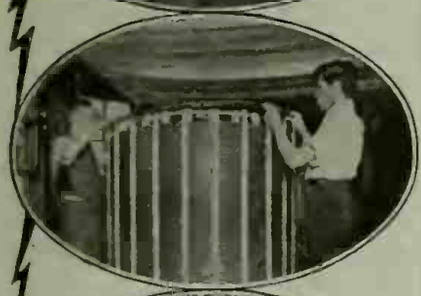
YOU CAN DO IT

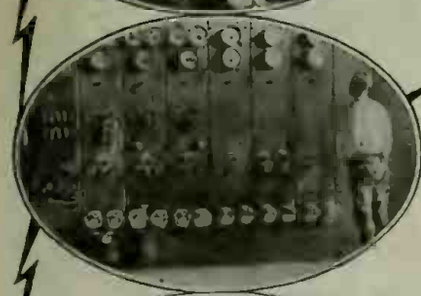
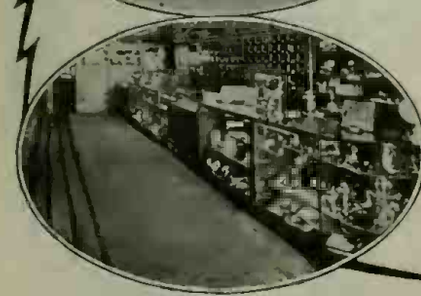
You benefit by mentioning the "Electrical Experimenter" when writing to ad

www.americanradiohistory.com

Learn ELECTRICITY as in practice



Electricity as experts know it—

RIGHT before you there is pictured a compact set of books which contains all the information you require to advance to the highest positions in the world of electricity. No instruction, no consultation by correspondence is necessary. The entire subject is before you, clearly written and clearly illustrated.

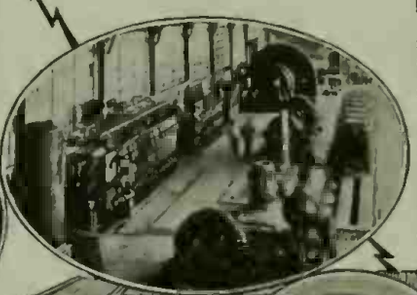
Whether you have spent years with electricity, or are a mere beginner, CROFT'S LIBRARY OF PRACTICAL ELECTRICITY will enable you to master modern practice, and fit you quickly for one of the thousands of responsible positions now open to those who are properly trained in electricity.

NOT ONE CENT IN ADVANCE

In twenty years' practice Terrell Croft has learned many things about electricity. As apprentice, as lineman, as draftsman, and finally as electrical engineer with the Westinghouse Company, he has learned the practical man's wants.

With his own practical experience, and with the co-operation of a score of other authorities, he has completed what is considered the most valuable study and reference course ever attempted.

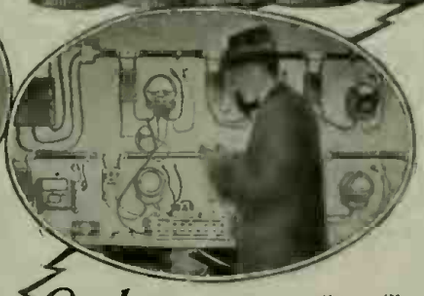
No other set of books or course of instruction ever adhered so closely to actual work. Nothing else of the kind ever told so vividly the story of electricity as experts know it.





CROFT'S LIBRARY of PRACTICAL ELECTRICITY

8 Vols.-Flexibly bound-3000 Pages 2100 Illustrations



A SET of books which covers the wide subject of electricity completely, comprehensively and practically cannot be adequately described, therefore we extend to every reader of this paper an invitation to examine the books absolutely free.

Merely fill out the coupon below and return to us. We will ship the books, all charges prepaid, for ten days' free use. The books are pocket-size. Carry one or two with you to work, and look them over evenings. Test their usefulness by using them in connection with your work. Keep them ten full days. Then return them at our expense if you think they will not enable you to know electricity as experts know it.

Pay only $2 per month for eight months if you are thoroughly pleased.

This is your opportunity. Will you grasp it?

Only $2 per month for 8 months for a complete electrical education

McGraw-Hill Book Co., Inc.,
239 W. 39th Street,
New York, N. Y.
Gentlemen: The CROFT LIBRARY OF ELECTRICITY reached me March 3 and more than came up to my expectations. I have been in the electrical business for fifteen years, and know the general run of electrical books. Terrell Croft's Library is the best I have ever had the pleasure of examining.
Yours truly,
EDWARD T. HOFF,
713-3rd Avenue,
Asbury Park, N. J.

Free Examination Coupon

McGraw-Hill Book Co., Inc.
239 W. 39th St., New York

Gentlemen:—Please send me the Library of Practical Electricity (shipping charges prepaid), for 10 days' free examination. If satisfactory I will send $2 in ten days and $2 per month until $16 has been paid. If not wanted, I will [illegible] return shipping instructions.

Name .....
Home Address .....
City and State .....
Where Employed .....
Occupation .....

Ex-6-19

LIBRARY SEP 2 8 1999 UNIVERSITY OF TORONTO

www.americanradiohistory.com

Electrical Experimenter

233 FULTON STREET, NEW YORK

Publisht by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer;) 233 Fulton Street, New York.

Vol. VII. Whole No. 74 **JUNE, 1919** **No. 2**

AN AËRIAL RESCUE AT SEA.....Front Cover
From a painting by George Wall
LISTENING TO THEATRE CRITICS..... 105
ELECTRIC DRIVE ON U. S. S. "NEW MEXICO"..... 106
By Charles M. Ripley, of the General Electric Co.
NEW AËRIAL DEVELOPMENTS, by H. Gernsback..... 108
HUNTING SUBMARINES BY SOUND, by Brewster S. Beach.... 110
THAT ONE-MAN SUBMERSIBLE..... 111
MY INVENTIONS, PART V, by Nikola Tesla..... 112
FILMING "TALKING MOVIES" IN GLASS HOUSES..... 114
By H. Winfield Secor
CALL UP WIFEY ON THE STOVE-PIPE RADIO..... 115
TIN CAN MODELS—A NEW ART, by George Holmes..... 116
MAKING A PRACTICAL ELECTRICIAN..... 117
CLOSE-UPS OF NEW SCIENTIFIC MOVIES..... 118
PARIS LETTER 119
By Jacques Boyer, Paris Correspondent of the ELECTRICAL EXPERIMENTER
POPULAR ASTRONOMY—"THE EVOLUTION OF THE STARS" 120
By Isabel M. Lewis of the U. S. Naval Observatory
PRACTICAL CHEMICAL EXPERIMENTS—EGGS AND THEIR PRESERVATION, by Albert W. Wilsdon..... 122
EXPERIMENTS IN RADIO ACTIVITY, PART IV (Conclusion)... 123
By Ivan Crawford
HOW TO BUILD AN EFFICIENT MEDICAL COIL SET..... 124
By H. Winfield Secor
A SMALL HIGH FREQUENCY OUDIN COIL, by E. W. Cooke... 126
EXPERIMENTAL MECHANICS, LESSON XII, PRACTICAL GRINDING OF TWIST DRILLS, by Samuel D. Cohen..... 127
"HOW TO MAKE IT" DEPARTMENT, PRIZE CONTEST..... 128
WRINKLES, RECIPES AND FORMULAS. Edited by S. Gernsback. 130
THE RADIO LEAGUE OF AMERICA—AMATEUR RADIO RESTORED, by H. Gernsback..... 131
THE MOON'S ROTATION, by Nikola Tesla..... 132
RADIO DEPARTMENT—TESLA BULBS 134
THE ALEXANDERSON "BARRAGE" RECEIVER..... 135
THE ROGERS UNDERGROUND AËRIAL FOR AMATEURS..... 136
LEARNING THE CODE, by Howard D. Wildman..... 138
RADIO CONSTRUCTOR DEPARTMENT..... 139
CHOKE COILS—THEIR THEORY, CONSTRUCTION AND DESIGN, by Prof. F. E. Austin..... 140
LATEST PATENTS DIGEST 141
WITH THE AMATEURS—PRIZE LABORATORY CONTEST..... 142
SCIENCE IN SLANG, by Emerson Easterling..... 143
THE ORACLE 144

EDITORIAL

Tree Wireless

IN 1904, during Army maneuvers in California, General, then Major, George O. Squier, of the U. S. Signal Corps, made the important discovery that it was possible to receive radio messages, using live trees as an aërial. He found that by merely driving a metallic spike into the tree trunk, a few feet above the ground, and by connecting the wire from his radio receiving instruments to the spike, messages would come in astonishingly well over this new "aërial".

The invention, while important, received but scant notice, even in the scientific press of that day. Indeed, the majority of radio people knew very little about the invention, and those who did know considered the tree aërial as a freak, along with the bed-spring aërial and others of a similar nature.

During the war, however, the discoverer of the system, who had now become Major General Squier, Chief Signal Officer of the Army, made many new experiments with trees and radio. Recently, before the Physical Society, General Squier delivered a highly interesting lecture on the subject, and from what transpired, it is certain we have merely scratched the surface of an important invention.

General Squier, for instance, has been in constant communication with Europe for months, receiving messages from all of the large radio stations located in England, France, Italy and Germany, using nothing but trees for his aërials. But that was not all. He demonstrated that it was just as easy to *send* radio messages over a tree as it was to receive them. Indeed this holds true not only for telegraph messages, but radio telephone communication has been actually carried on between trees over a distance of *three miles!* So far no attempt has been made to increase this distance, altho it is obvious that any distance, depending only upon the power of the sending instruments, can be bridged in this manner.

That this system proved of immense value during the war can be readily imagined. Our signal corps men for that reason never were troubled with the communication lines in their rear, as long as there was a live tree about. No conspicuous wire aërial was needed for their radio work; code messages flew back and forth from the most extended points of our lines, right under the Germans' noses, who never suspected innocent-looking trees as being the carriers of priceless information.

General Squier thinks that the tree aërial will soon supplant the wire antenna entirely; even the big commercial stations, he thinks, can make excellent use of his discovery. The radio amateur particularly, will find the trees about his house a new and welcome source for his experiments. Many parents and landlords object to unsightly aërials on or about the house. An innocent-looking tree—if there is one near at hand—now solves the problem for the ambitious amateur. And the higher the tree, the better the results.

The new botanical antenna, on the other hand, brings us many new and interesting problems. One—and a curious one at that—is: How to figure the *wave length* of such an aërial! No doubt General Squier has, or will work out a standard formula for us. Undoubtedly, too, the wave length will vary from year to year—due to the growth of the tree. Then, too, in Spring, before the leaves are on the tree, the wave-length should be slightly less than in the summer time, due to the smaller area and resultant capacity. Also it would seem that in the winter time, the wave-length of the tree would be much less than in the Spring, due to the conducting sap receding from the branches.

Suppose you were to "spike up" every tree in a small wood—say, a thousand trees! The enormous area exposed to the ether, would theoretically give us a wonderfully effective antenna. We say theoretically, because we do not know how the immense added capacity would affect our instruments.

H. GERNSBACK.

The ELECTRICAL EXPERIMENTER is publisht on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions. Canada and foreign countries, $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 20 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. A green wrapper indicates expiration. No copies sent after expiration.

All communications and contributions to this journal should be address to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

ELECTRICAL EXPERIMENTER, Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered U. S. Patent Office.

Copyright, 1919, by E. P. Co., Inc., New York. The Contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.

The ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris.

Member of the Audit Bureau of Circulation.

www.americanradiohistory.com

The New Social Order

THE way is being prepared for a social order more wonderful than anything ever heretofore dreamed of; the conflict of modern science with theology; the study of comparative religions; the tremendous power of new social movements; all of these are but preparing the way for the new order.



Men, now understand that for every condition there is an adequate and definite cause, so that when a given result is desired, they seek only the cause by which this result may be obtained.

The discovery of a reign of law marked an epoch in human progress. It eliminated the element of uncertainty and caprice from the lives of men, and substituted law, reason and certitude.

These laws operate with scientific exactitude and those who have succeeded in obtaining a working knowledge of them, are enabled to break the bonds of environment; control elementary forces and utilize the potentialities of Infinity.

The Master Key tells of these wonderful Natural Laws and therefore substitutes definite principles for uncertain and hazy methods. An understanding of this scientific truth is the imperative condition, the underlying verity, the necessary precedent to every truly successful business or social relation.

Men are finding that permanent success is built upon honor, not upon dishonor; they are finding that the greatest and most penetrating mind loses its way hopelessly and can form no conception of the results of an action based upon a false premise.

The Master Key avoids theory, speculation and abstractions of all kinds. It confines itself to the operation of natural laws. These laws are clear, concise, definite and positive and can be demonstrated by any one.

The Master Key is not interested in conditions or effects, but in the cause by which the effects are produced; it is therefore limitless and has rewards hardly to be expressed in words.

All conditions are the result of the operation of this law, but unfortunately, the law will operate to our disadvantage just as readily as for our benefit and for this reason many are unconsciously creating discordant, destructive, inharmonious, poverty stricken conditions instead of conditions of health, abundance, elegance, beauty, refinement and wealth. It is simply a question of understanding; a question of knowing how to take advantage of natural laws.

If you have any objective in life, which you have not as yet succeeded in taking, or if you wish to change any condition, physical, mental, financial or environmental, or if you wish to add an asset of inestimable value to your present resources, the Master Key has a message for you.

A copy will be sent to any address without cost or obligation of any kind.

CHARLES F. HAANEL
423 GRANITE BUILDING
ST. LOUIS, MO.

www.americanradiohistory.com

Now made simple and perfectly safe

TREAT YOURSELF With The Wonderful *Health Restorer* VIOLET RAY





You Can Have Bodily Vigor, Success-Attaining Energy, Attractive, Healthful Beauty

All at practically no cost—The great benefits of the *Violet Ray treatments* heretofore only procurable at big expense from physicians and beauty specialists are now available in your own home. Look over list of treatments below. Send for particulars.

How Violet Ray Benefits

Electricity from your light socket is transformed into health and beauty-giving Violet Ray—powerfully effective, yet gentle, soothing, perfectly safe. Voltage is raised from ordinary lighting current to *thousands of volts*, giving tremendous penetrative force. The irresistible, revitalizing powers of *Renulife Violet Ray* are carried at once to every nerve cell, fibre and part of body. Blood is enriched and purified by a flood of oxygen, giving added vitality and strength. Assimilation and digestion improved—functions restored to normal—extra supply of fresh blood quickly brought to area treated, removing congestion and supplying nourishment. While relieving pains and aches, the manifest results of disorders, it removes the deep-seated cause; combines the benefits of electricity, vibration, exercise, stimulation and oxidation.

Renulife Violet Ray
HIGH FREQUENCY GENERATORS

Painless Electricity

Science has modified electricity that the weakest may stand its force without fear or pain. Every tissue and fibre is saturated, patient experiencing only a sensation of relief, as if standing in a ray of sunshine. *Violet Ray high frequency* has no comparison with old, crude, electrical batteries and shocking current. Every jar and shock is removed. The effects are marvelously rapid. Relief can be given in one or more treatments. Often cures are accomplished in that time. It is positive and certain in action. If you value your health, and want to keep or restore your good looks and gain vitality, throw away medicine bottles—take this sensible, scientific means. *Violet Rays* work with nature. Every day's delay makes relief more difficult.

Send for Booklet, "Health via Violet Ray."

Offered on a Most Liberal
TRIAL PLAN
Learn the Wonderful Benefits by Actual Use

RENULIFE ELECTRIC CO., 637 Marquette Bldg., Detroit, Mich.

CANADIAN RENULIFE ELECTRIC CO.
237 Netting Bldg., Windsor, Ont.

SALES REPRESENTATIVES WANTED

COUPON FOR BOOK and Special Information

RENULIFE ELECTRIC CO.,
637 Marquette Bldg., Detroit, Mich.

Please send without obligation, your book "Health," explaining Violet Ray treatments with Renulife Generators; also give full particulars as to its application for ailments checked below

TREATS SUCCESSFULLY

..Abscesses	..Facial Neuralgia	..Obesity
..Anemia	..Falling Hair	..Pain in Abdomen and Chest
..Asthma	..Female Complaints	..Paralysis
..Arteriosclerosis	..Goitre	..Piles
..Baldness	..Gout	..Pimples
..Blackheads	..Haemorrhoids	..Pyorrhea
..Brain Fag	..Hay Fever	..Rheumatism
..Bronchitis	..Infantile Paralysis	..Scars
..Bunions	..Insomnia	..Sciatica
..Bruises	..Lameness	..Skin Diseases
..Catarrh	..Locomotor Ataxia	..Sore Throat and Throat Diseases
..Colds	..Lumbago	..Sprains
..Chilblains	..Nervous Affections	..Toothache
..Dandruff	..Neuralgia	..Weak Eyes
..Deafness and Ear Diseases	..Neuritis	..Wrinkles
..Eczema		..Warts and Moles
..Enlarged Prostate		

Name.....

Address.....

.....



Unequaled for scalp and hair



Brings beauty parlor to your home



Inhaling ozone. For Catarrh, throat and lungs. Marvelous local results with general tonic effect



Treatment for general debility, nervousness, etc.

www.americanradiohistory.com

New Stomachs for Old In 48 Hours

By R. S. Thompson


EUGENE CHRISTIAN

THOUSANDS of people who suffered for years with all sorts of stomach trouble are walking around today with entirely re-made stomachs—stomachs which have been re-made in from 48 to 72 hours! They enjoy their meals and never have a thought of indigestion, constipation or any of the serious illnesses with which they formerly suffered and which are directly traceable to the stomach.

And these surprising results have been produced not by drugs or medicines of any kind, not by foregoing substantial foods, not by eating specially prepared or patented foods of any kind, but by eating the plainest, simplest foods *correctly combined!*

These facts were forcibly brought to my mind by Eugene Christian, the eminent Food Scientist, who is said to have successfully treated over 23,000 people with foods alone!

As Christian says, man is what he *eats.* What we take into our stomachs today, we are tomorrow. Food is the source of all power, yet not one person in a hundred knows the chemistry of foods as related to the chemistry of the body. The result is we are a nation of "stomach sufferers."

Christian has proved that to eat good, simple, nourishing food is not necessarily to eat correctly. In the first place, many of the foods which we have come to regard as good are in reality about the worst things we can eat, while others that we regard as harmful have the most food value.

But perhaps the greatest harm which comes from eating blindly is the fact that very often two perfectly good foods when eaten at the same meal form a chemical reaction in the stomach and literally explode, liberating dangerous toxic poisons which are absorbed by the blood and circulate throughout the system, forming the root of all or nearly all sickness, the first indications of which are acidity, fermentation, gas, constipation and many other sympathetic ills leading to most serious consequences.

And yet just as wrong food selections and combinations will destroy our health and efficiency, so will the right foods quickly create and maintain bodily vigor and mental energy. In my talk with Eugene Christian, he told me of some of his experiences in the treatment of disease through food—just a few instances out of the more than 23,000 cases he has on record.

One case which interested me greatly was that of a young business man whose efficiency had been practically wrecked through stomach acidity, fermentation and constipation, resulting in physical sluggishness which was naturally reflected in his ability to use his mind. He was twenty pounds underweight when he first went to see Christian and was so nervous he couldn't sleep. Stomach and intestinal gases were so severe that they caused irregular heart action and often fits of great mental depression. As Christian describes it, he was not 50 per cent efficient either mentally or physically. Yet in 24 hours, by following Christian's suggestions as to food, his constipation was relieved, although he had formerly been in the habit of taking large daily doses of a strong cathartic. In five weeks every abnormal symptom had disappeared—his weight having increased 6 lbs. In addition to this, he acquired a store of physical and mental energy so great in comparison with his former self as to almost belie the fact that it was the same man.

Another instance of what proper food combinations can do almost overnight was that of a man one hundred pounds overweight whose only other discomfort was rheumatism. This man's greatest pleasure in life was eating. Though convinced of the necessity, he hesitated for months to go under treatment, believing he would be deprived of the pleasures of the table. He finally, however, decided to try it out. Not only did he begin losing weight within a few hours, regaining his normal figure in a matter of weeks, but all signs of rheumatism disappearing, and he found the new diet far more delicious to the taste and afforded a much keener quality of enjoyment than his old method of eating, and wrote Christian a letter to that effect.

But perhaps the most interesting case that Christian told me of was that of a multi-millionaire—a man 70 years old, who had been traveling with his doctor for several years in a search for health. He was extremely emaciated, had chronic constipation, lumbago, and rheumatism. For over twenty years he had suffered with stomach and intestinal trouble which in reality was superaciduous secretions in the stomach. The first menus given him were designed to remove the causes of acidity, which was accomplished almost overnight. And after this was done he seemed to undergo a complete rejuvenation. His eyesight, hearing, taste, and all of his mental faculties became keener and more alert. He had had no organic trouble—but he was starving to death from malnutrition and decomposition—all caused by the wrong selection and combination of foods. Almost immediately after following Christian's advice this man could see results, and after six months he was as well and strong as he had ever been in his life.

These instances of the efficacy of right eating I have simply chosen at random from perhaps a dozen Eugene Christian told me of, every one of which was fully as interesting, and they applied to as many different ailments. Surely this man Christian is doing a great work.

I know of several instances where rich men and women have been so pleased with what he has done for them that they have sent him a check for $500 or $1,000 in addition to the amount of the bill when paying him.

There have been so many inquiries from all parts of the United States from people seeking the benefit of Eugene Christian's advice and whose cases he is unable to handle personally that he has written a little course of lessons which tells you exactly what to eat for health, strength and efficiency. This course is published by The Corrective Eating Society of New York.

These lessons, there are 24 of them, contain actual menus for breakfast, luncheon, and dinner, covering every condition of health and sickness from infancy to old age and for all occupations, climates, and seasons.

Reasons are given for every recommendation based upon actual results secured in the author's many years of practice although technical terms have been avoided. Every point is explained so clearly that there can be no possible misunderstanding.

With these lessons at hand it is just as though you were in personal contact with the great food specialist, because every possible point is so thoroughly covered that you can scarcely think of a question which isn't answered. You can start eating the very things that will produce the increased physical and mental energy you are seeking the day you receive the lessons, and you will find that you secure results with the first meal. This of course, does not mean that complicated illnesses can be removed at one meal, but it does mean that real results can nearly always be seen in 48 hours or less.

If you would like to examine these 24 little Lessons in Corrective Eating, simply write The Corrective Eating Society, Department 1646, 443 Fourth Avenue, New York City. It is not necessary to enclose any money with your request. Merely ask them to send the lessons on five days' trial, with the understanding that you will either return them within that time or remit $3.00, the small fee asked.

The reasons that the Society is willing to send the lessons on free examination without money in advance is because they want to remove every obstacle to putting this knowledge in the hands of the many interested people as soon as possible, knowing full well that a test of some of the menus in the lessons themselves is more convincing than anything that can possibly be said about them.

Please clip out and mail the following form instead of writing a letter, as this is a copy of the blank adopted by the Society, and will be honored at once

CORRECTIVE EATING SOCIETY,

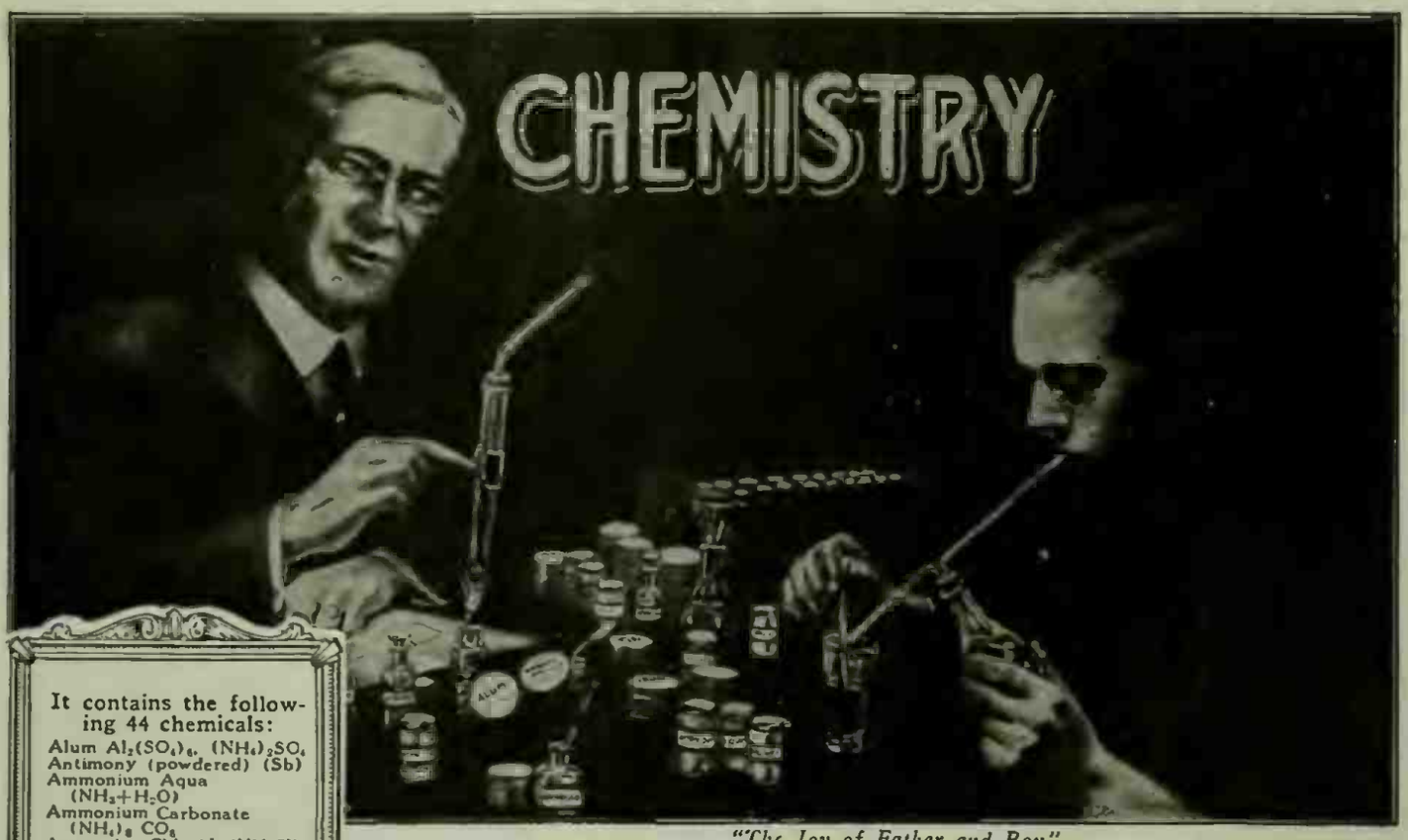
Dept. 1646, 443 Fourth Ave., New York City.

You may send me prepaid a copy of Corrective Eating in 24 Lessons. I will either remail them to you within five days or send you $3.

Name..... Address.....

City..... State.....

www.americanradiohistory.com



"The Joy of Father and Boy."

"ELECTRO"

Chemical Laboratory

We present herewith to our friends our new E. I. Co. Chemical Laboratory which contains real chemicals and apparata to perform real chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.

It contains the following 44 chemicals:

Alum $Al_2(SO_4)_6$, $(NH_4)_2SO_4$
Antimony (powdered) (Sb)
Ammonium Aqua (NH_3+H_2O)
Ammonium Carbonate $(NH_4)_2CO_3$
Ammonium Chloride (NH_4Cl)
Ammonium Sulphate $(NH_4)_2SO_4$
Barium Chloride $(BaCl_2)$
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride $(CaCl_2)$
Calcium Oxide (CaO)
Calcium Sulphate $(CaSO_4 2H_2O)$
Charcoal (Carbon) (C)
Chloride of Zinc $(ZnCl_2)$
Copper Sulphate $(CuSO_4)$
Ferrous Sulphate $(FeSO_4)$
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5(OH)_3$
Hydroehloric Acid (HCl)
Iodine (I)
Iron Chloride $(FeCl_2)$
Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
Magnesium Carbonate $(MgCO_3)$
Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
Nickel Chloride $(NiCl_2)$
Oxalic Acid $(H_2C_2O_4)$
Sodium Bicarbonate $(NaHCO_3)$
Sodium Borate $(NaBO_2)$
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate $(NaNO_3)$
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride $(SnCl_2)$
Sulphate of Nickel $(NiSO_4)$
Sulphate of Zinc $(ZnSO_4)$
Sulphuric Acid (H_2SO_4)
Tin (Granulated) (Sn)
Zinc (Metal) (Zn)
Zinc Carbonate $(ZnCO_3)$

The following apparata are furnished:

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube
Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure
Glass Tubing
One book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

DESCRIPTION OF THE OUTFIT:

The outfit consists of forty-four (44) Chemicals all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) enough to make dozens of experiments with each. See list of Chemicals herewith.

The apparata furnished are all of the best obtainable make and of standard laboratory size and shape. A list of the 17 pieces of apparata furnished with this outfit is printed also herewith.

The Instruction book is a real **Chemistry Course for the Beginner.** Some of the Contents are: **Division of Matter:** This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. **Chemical Nomenclature.** This explains in simple language the derivation of the chemical names of the Elements and their compounds. There is a chapter on **Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms,** etc.

A good part of the book is devoted to Weights and Measures. The Metric System, the English system and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights, Volume, Capacity and Length; Per Cent solutions; Conversion of Measure expressed in parts; Poisons and their antidotes; Technical and common name of chemical substances; Formulas for Cleaning various substances, etc., etc.

Among the 100 Experiments are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to Make Chlorine Gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

The price is still $5.00

Shipping Weight 10 lbs.

(Can be shipped by Express only.) Send your order today to:

TRADE MARK **THE ELECTRO IMPORTING CO., Mfrs.** TRADE MARK
231 FULTON STREET NEW YORK CITY

See our full page Ad, on page 182 for Free Cyclopedia

www.americanradiohistory.com

How I Stopped Forgetting In One Evening

How in One Evening I Discovered the Secret of a Good Memory and in Six Months Increased My Business One Hundred Thousand Dollars

By William Gerard

WHO would ever have thought that a $100,000 increase in my business would come from a simple secret learned in one evening. And yet, that is just what happened. I look back on it today, and can hardly believe that it is only six short months since I learned from David M. Roth, the famous memory expert, how to make my memory do wonderful things that I never before dreamed possible.

I consider the evening I met Mr. Roth one of the most momentous in my life. It was at a dinner of the Seattle Rotary Club. Mr. Roth was present and started his exhibition by asking sixty of those present to introduce themselves to him by name. Then he requested a gentleman at the blackboard to write down names of firms, sentences and mottos on numbered squares, meanwhile sitting with his back to the writer. After this, he was asked by various Rotarians to tell what was written down in the specific squares. Mr. Roth gave the entire list without a mistake. After finishing with this, Mr. Roth singled out and called by name the sixty men to whom he had been introduced earlier, and who in the meantime had changed seats and mixed with others present.

After the meeting, I was introduced to Mr. Roth by a mutual friend, and congratulated him upon his marvelous feats of memory. To my surprise, Mr. Roth said, "Why, Mr. Gerard, such things are nothing at which to marvel. Anyone can do these things and even greater things with his memory. A good memory is not a gift. Any person of average intelligence can easily develop his memory. I, myself, am an example of this fact. As a young man my memory was so poor I could hardly remember a man's face or name 20 seconds. I soon realized that this bad memory would scare away any chance I had for success. Right then and there I determined to improve my memory. And now, after 20 years of attention to the subject, I feel that I can do as much for other people's memories as I have done for my own. I have recently finished work on a simple and practical course through which anyone can improve his memory until it becomes a veritable sponge for absorbing facts, faces, names and all the information one wants to remember. This course contains all of my secrets and principles. If you will write to my publishers in New York, the Independent Corporation, you can make arrangements for examining the course without charge."

Needless to say I wrote the Independent Corporation, asking to examine the course. In a few days I received the seven lessons together with a little booklet of letters from many men telling what they had already done through the aid of the course. It was very encouraging for me to read the letter from C. Louis Allen, who at the age of thirty-two became president of the million dollar Pyrene Manufacturing Company, and is now the president of the Sales Company bearing his name.

"Now (says Mr. Allen) that the Roth Memory Course is finished I want to tell you how much I have enjoyed the study of this most fascinating subject. Usually these courses involve a great deal of drudgery, but this has been nothing but pure pleasure all the way through. I have derived much benefit from taking the course of instruction and feel that I shall continue to strengthen my memory. That is the best part of it. I shall be glad of an opportunity to recommend your work to my friends."

You may be sure that after reading the balance of the letters telling of *real results*, I went right at the course that very evening. I expected to find the lessons "brain breakers", but to my surprise, the Roth Course was as easy and fascinating as a game. I hated to put it by that evening and surprised my wife by repeating backwards, forwards and all ways fifty words of all sorts. My wife could not understand how a person with a memory so poor as mine could do such a thing after only about one hour's study. But the course gives the secret of a good memory *right at the start.* I played the memory improving game for a few minutes each evening for a month. And the further I got the more fascinating the game became. Long before a month was up I had amazed my family and my friends on a number of occasions by various memory feats, and to them the astounding difference in my memory was nothing short of a miracle.

And now, my memory behaves so efficiently that my business has felt the impetus of my increased mind power and has responded in a joyously lucrative fashion. Within the last six months my sales have jumped up $100,000—*with no "war-baby" or external force to boost my business.*

The reason I know that my business expansion is due to my own increased power is that I seem to have a new grip upon affairs. I employ old facts and experiences, give them a new twist and have thereby revitalized my business methods. I now remember and apply all that I have heard other people have learned. Nothing slips my mind that can be used to some business advantage. I find and store in my new, iron-bound memory real nuggets of facts and experiences that other people casually let drop. When a condition arises, I just seem to open a certain drawer of my mind, then take out and marshal together all facts and precedents that I have learned. My memory has become an ally that never fails to help me push my business ahead "on high."

I now seize many golden opportunities that before would have slipped by and been out of reach by the time I woke up.

You see the Roth Course has done vastly more for me than merely teach me how to remember names and faces, telephone numbers, etc. It has done more than make me a more interesting talker. It has done more than give me confidence in myself.

Mr. Roth's Course has endowed me with new business perspective. It has made me a keener observer. It has given me a new sense of proportion and values. It has given me visualization—which after all is the true basis of business success.

I feel that I owe the Roth Memory Course a great debt—in fact, a $100,000 debt. I feel that telling my story to the readers of The Electrical Experimenter Magazine is only a small payment for what the course has done for me. Any power that can increase a man's business $100,000 and increase his mind power 90% deserves that man's sincere and truthful endorsement. I *know* that this is what the Roth Memory Course has done for me and for my business. Not alone am I happy to be able to tell my story as it happened, but I am gratified to know that anyone can do the same thing. A mere glance over the first lesson will show that there is a course, not for "high brows" who love to bathe in theory, but practical and easy instructions for every man, woman or child, who knows the enormous value of a good substantial memory. This same hand of mine that gave out $5 for the Roth Course took in $100,000 as a result, and in telling my experience, I feel that in a small way, I am repaying the great debt that I owe to the David M. Roth Memory Course.

WILLIAM GERARD.

AMAZING MEMORY FEATS

Any man, woman or child of average intelligence can easily and quickly acquire a sure and exact memory.

When David M. Roth, the famous expert, first determined to cultivate his memory he did it because he had a poor memory. He actually could not remember a man's name twenty seconds. He forgot so many things, that he knew he could not succeed unless he did learn how to remember.

Today there are over ten thousand people in the United States whom Mr. Roth has met at different times—most of them only once—whom he can name instantly on sight. Mr. Roth can, and has, hundreds of times at dinners and lectures, asked from fifty to one hundred people to tell him their names and telephone numbers, and business connections, and then, after turning his back while they changed seats, has picked each one out by name and told him his telephone number and business.

These are only a few of the scores of other equally "impossible" things that Mr. Roth does—and yet a few years ago he could not remember a man's name twenty seconds. You too can do these wonderful things.

SEND NO MONEY

So confident is the Independent Corporation, the publishers of the Roth Memory Course, that once you have an opportunity to see in your own home how easy it is to double, yes triple your memory power in a few short hours, that they are willing to send the course on free examination.

Don't send any money. Merely mail the coupon or write a letter and the complete course will be sent, all charges prepaid, at once. If you are not entirely satisfied send it back any time within five days after you receive it and you will owe nothing. On the other hand, if you are as pleased as are the thousands of other men and women who have used the course, send only $5 in full payment. You take no risk and you have everything to gain, so mail the coupon or a letter now before this remarkable offer is withdrawn.

Independent Corporation

Publishers of The Independent Weekly

Dept. R-1106 119 West 40th St., New York

Please send me the Roth Memory Course of seven lessons. I will either remail the course to you within five days after its receipt or send you $5 in full payment of the course.

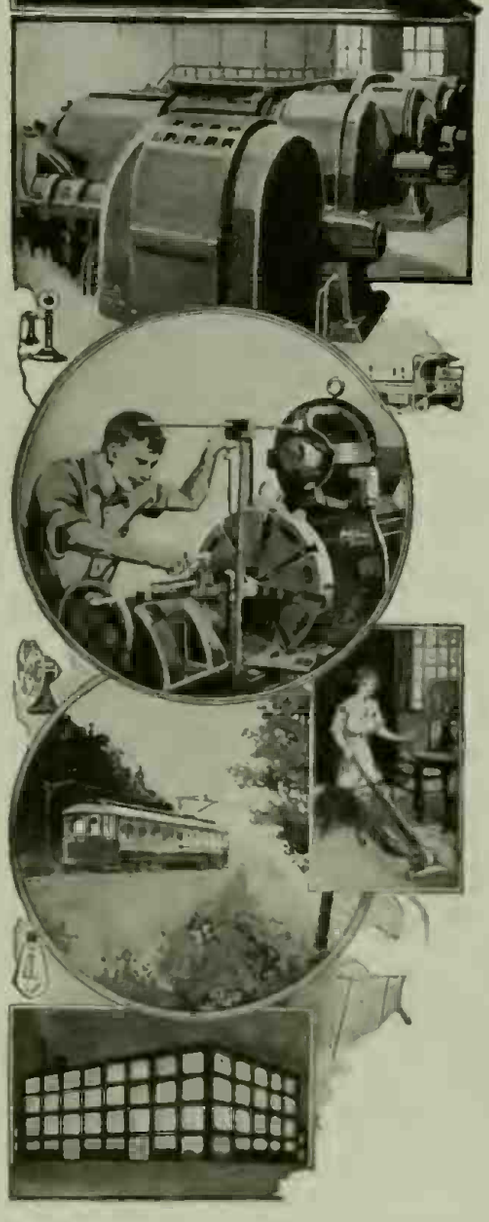
Name .....

Address .....

El. Exp. 6-19

www.americanradiohistory.com





Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 5,500 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Let us explain this course to you in person. If you can't call, send now for 64-page book—it's FREE to you

New York Electrical School
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

.....(NAME)

.....(ADDRESS)

New York Electrical School

29 West 17th Street, New York

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

ELECTRICAL EXPERIMENTER

H. GERNSBACK – EDITOR
H. W. SECOR – ASSOCIATE EDITOR

Vol. VII. Whole No. 74 JUNE, 1919 No. 2

Listening to Theater Critics

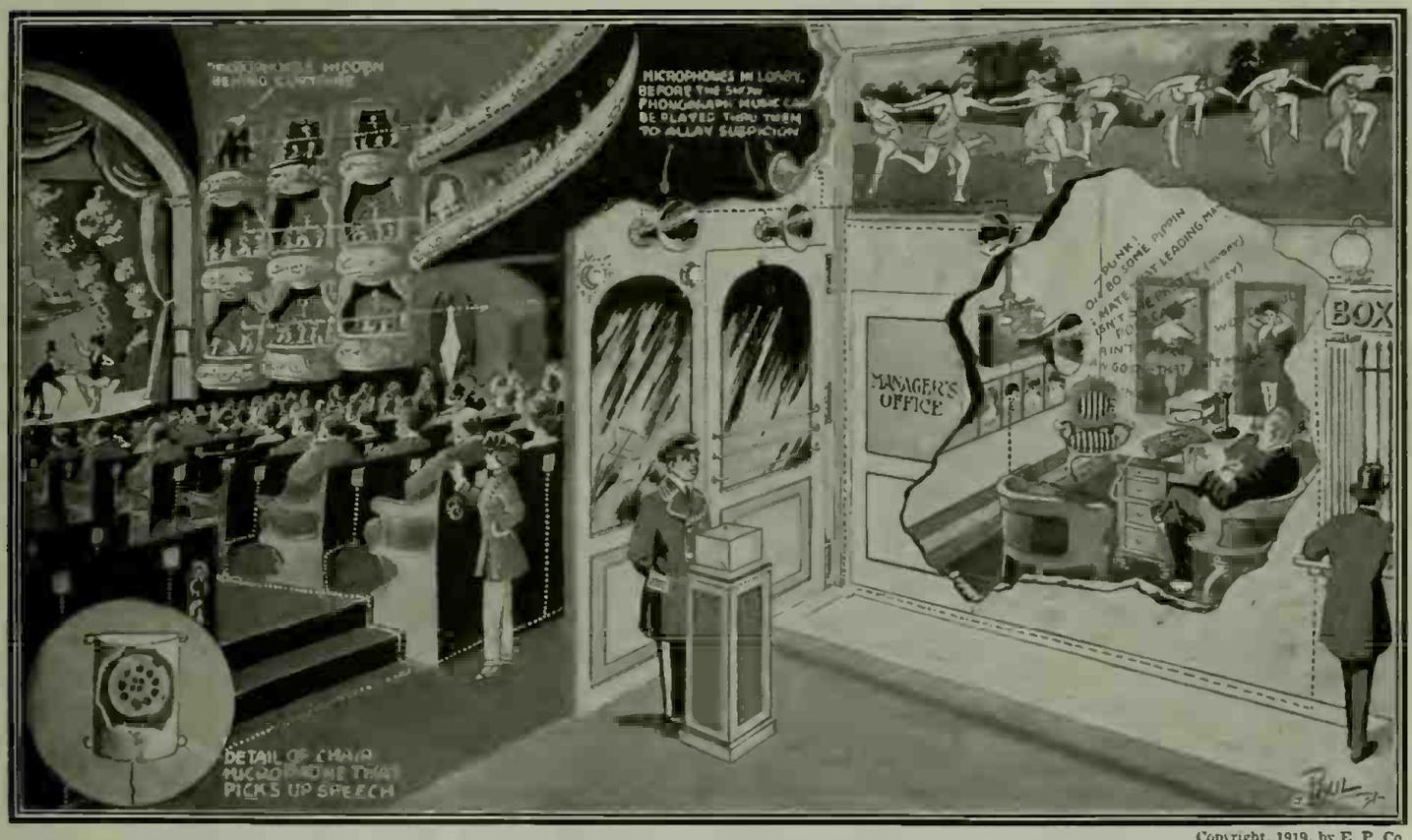
WE of the present generation have seen the dictograph or supersensitive telephone, applied to almost every purpose imaginable, from listening to the whispered machinations and plottings of criminals to the honeyed words of the philanderous husband making love to a chorus girl.

But now comes the very latest application of the dictograph, for the purpose of overhearing the criticisms of theater audiences, and it took Chicago to show us the way. In that city there is a large motion-picture theater completely equipt with dictograph transmitters or microphones, liberally sprinkled thruout the auditorium, so that the manager, by means of a small switchboard installed in his private office, may overhear the conversations, caustic or otherwise, regarding Bessy Tinkletoes and the merits and demerits of the corseted leading man, not to mention the "villiun" and the dashing, smashing "soubrette."

The *microphones* or sound-detecting apparatus, camouflaged so as to be invisible, are secured on the backs of the various chairs in the orchestra or balcony, and are connected up with separate wires leading to a switchboard in the manager's office, so that as the switch is turned, the respective microphones are switched into circuit alternately. The current modulations set up by even a whisper several feet away from one of these microphones act on a loud-speaking telephone at the manager's desk. It is also possible to connect up such apparatus with a set of head receivers strapt to the ears, the same as in the regular dictaphone sets used by crime investigators, after the fashion made famous by Detective Burns and other defenders of the common law.

Not only is it possible with such an arrangement to place microphones or sound detectors on the backs of seats in the auditorium, but they may be placed in the boxes behind portieres, and in many other advantageous and inconspicuous positions. It is rather difficult to conceal them in the foyer, but by a little clever subterfuge and ingenuity exercised by the engineers having charge of the installation, this problem is quite easily solved. For instance, an old trick of the showman may be put into play, namely, that to allay suspicion on any trick, you must convince the public that everything is apparently as it seems; and bearing in mind P. T. Barnum's famous lines—"The public likes to be fooled," and "There's one born every minute," we proceed in the present case to do a little fooling of the public ourselves, and thusly do we do it; by placing the microphones in a series of small ornamental horns about the lobby, in the bases of which there are also arranged loud-speaking telephone devices. Before the performance and during intermissions, when the foyer and lobby

(*Continued on page* 162)



Copyright, 1919, by E. P. Co.

A New Idea Tried Out in a Chicago Theater—Eavesdropping on the Critics in the Audience. The Remarks of These Self-appointed Dramatic Critics Prove Very Valuable to the Enterprising Theater Manager, As a Failing Show May Be Revised and Strengthened So As to Make a Real "Hit." The Super-sensitive Microphone or "Dictograph" Solves the Problem—the Instruments, Distributed Thruout the Auditorium, Can Be Switched Onto a "Loud-talking Reproducer" in the Manager's Office, in Any Order Desired.

www.americanradiohistory.com

Electric Drive on U. S. S. "New Mexico"

By CHARLES M. RIPLEY

THE battleship *New Mexico* is the pride of the United States Navy, and her electric drive is the pride of the *New Mexico*. How the electrical machinery looks, how it works, why the electric drive is preferable to other forms of propulsion, how she looks inside and outside, is here related by one of the men who recently was a passenger on Uncle Sam's latest superdreadnaught, riding between the Brooklyn Navy Yard and Rockland, Maine.

This latest leviathan weighs 32,000 tons and requires 32,000 horsepower or *one horsepower per ton*. Her weight is equivalent to a bar of iron weighing one pound to the foot and forming a band of iron from the North to the South Pole with enough in addition to reach from Maine almost to the borders of Florida. She is so huge that it requires ten tugs to push her from her pier in Brooklyn Navy Yard out into the East River. From the platform called the "crow's nest" at the top of the mast down to the level of the water is 120 feet, or equal in height to a ten-story building.

The battleship can generate enough electricity to run the giant General Electric Works and the Schenectady Railway Company.

Motors Drive Propellers.

Like everything else that is electrical, the *New Mexico* is the cleanest institution of her kind. There are no engines or turbines connected with the propeller shafts—only electric motors. There are no grates under the boilers—merely oil burners. There is not a coal or ash shovel on the ship; nor are there any cinders, smoke, dust, or soot.

The *New Mexico* "coals" thru a 6-in. hose, that is because she burns only oil for her power. The total oil capacity of the dozen or more compartments is 3,400 tons or 6,800,000 lbs., or nearly a million gallons. If the *New Mexico* were an automobile with a mileage of 20 miles per gallon, this amount of oil would drive her close to 20 million miles or a distance equal to 80 times to the moon. But a 32,000-ton battleship does not equal the mileage of a flivver, for it weighs as much as 60,000 of those vehicles, and must plow thru the water displacing her own weight of water each time she runs her own length, 624 feet. The cost of fuel is more important on ship board than on land, and this is emphasized by the fact that on the 2,000-mile trial trip alone she will displace over 620,000,000 tons of water.

From Oil to Electricity.

Following the energy of the oil fuel thru the different processes until this energy drives the propellers electrically is an entertaining and instructive trip. Escorted by courteous officers, you start for one of the three boiler rooms. You must open and close several steel bulkheads in the watertight compartment and descend steel ladders and steel steps apparently equivalent to those in a five-story building. On the way down you must pass thru an "air lock" similar to those which give the excavators access to the caissons used in building the foundations of the skyscrapers 90 feet under Broadway, or in constructing the piers under big bridges in the middle of the river. The officer who escorts you is very careful to close the steel door behind you before he opens the one in front of you.

High Air Pressure.

No sooner are the bolts loosened than you feel the increased air pressure swish into your ears. This is because the air in the fire-room is maintained at a higher pressure than the outside air. All the air which the firemen breathe is pumped air. There is more oxygen in a cubic foot of this air than there is in ordinary air. This increased pressure and increased oxygen are both useful in providing the proper combustion in the boiler.

How Smoke Screens Are Made.

If the *New Mexico* wishes to throw a smoke screen, the men in the fireroom merely turn a few tiny hand valves in a ¼-in. pipe and, presto! inky blackness will vomit from the single smoke stack and blacken vast sea areas. This is a very nice study of how different mechanical mixtures of oil and air will bring about different chemical combinations between oil and oxygen. One of these combinations eliminates smoke by effecting almost perfect combustion; while the other creates a heavy black smoke which will practically blindfold the enemy. And three little ¼-in. pipes in each boiler are all that is needed to do this.

THE day of the all-electric superdreadnaught, not to mention electrically driven war vessels and merchant ships of smaller size, has arrived. In the present article Mr. Ripley gives us an interesting authoritative description of his trip on Uncle Sam's latest superdreadnaught, the "New Mexico", with her 32,000 horse-power electric propelling plant. Like everything else that is electric, the "New Mexico" is the cleanest institution of her kind. There are no engines or turbines directly connected with the propelling shafts—only powerful electric motors. There are no grates under the boilers—merely oil burners. Electrical propulsion not only does away with reversing turbines, but also does away with reduction gears, with their accompanying mechanical loss. The battleship "New Mexico" can travel a distance of 7,500 knots at 12 knat speed before it will be necessary to take on more fuel. The electric equipment totals nearly 100,000 horsepower, including over 100 loud speaking telephones, nearly 200 electric fans, electric gyroscopic compasses, and in fact "Electricity" rules the day everywhere about this modern naval wonder.

Size of Boilers.

It is said that no other 32,000-ton battleship has as few as nine boilers. There are three boiler rooms, each in a separate compartment, and each room contains three large boilers. Each of these nine boilers can deliver over 4,000 horsepower and contains three miles of 2-in. seamless pipes. Put end to end the pipes in all nine boilers would make a seamless tube 27 miles long. The Pennsylvania has 12 boilers and the Oklahoma has 12, altho its tonnage is only 27,500.

The history of the steam engine shows that its inventor, James Watt, thruout his entire life opposed any steam pressure higher than 5 to 10 lbs. per square inch. The *New Mexico's* boilers supply *steam at 250 lbs. per square inch!*

Superheated Steam.

After the steam is generated, and has past thru the big pipe away from the water in the boiler, it is again brought in contact with the flames of the furnace and is superheated to a still higher temperature. In fact, as the steam leaves the boiler it is about 450° F., or hot enough to melt solder and tin.

Superheated steam gives super-results. This is because the steam turbine is class among engineers as a "heat engine" and the more heat that is supplied in this steam the more energy is available for power.

Two Power Plants.

For propulsion there are two electric power plants in separate compartments. They are way down low in the *New Mexico* close to the boilers. Each of these power plants alone is able to drive the battleship at a speed of 18 knots. (A nautical mile, or knot, is 6,080 feet, as against 5,280 feet in a land mile.)

Turbine Electric Plant.

In two separate steel compartments 15 by 45 ft. are located the two turbine generator sets, each not over 27 ft. long. The turbine itself is little larger than a hogshead of molasses laid over on its side. It seems almost incredible that this small machine can generate 16,000 horsepower from steam.

The engine rooms of most ships of the past have been a tangle of bending and curving pipes, and in order to move about the men had to stoop down to go under them or climb over them or squeeze between them. When one of these pipes burst it practically meant the death of every man in the engine room. One of the advantages of these power plant rooms in the *New Mexico* is the fact that there is only one steam pipe in the room, and that is only 16 ft. long.

Steam Turbine.

In each of these two power plants the steam turbines make electricity for driving the battleship. From the outside the most interesting thing about these wonderful rotary steam engines, called turbines, is their small size, their light weight, and the fact that they are so perfectly enclosed that you cannot see anything move. A turbine of 16,000 horsepower when compared in size and weight with the great triple and quadruple expansion steam engine that had been used up until recent years, is practically a watch charm—a little toy. There is only rotary motion in the steam turbine.

Inside the casing are ten wheels arranged side by side like the coins are kept in a bank. In the rims of all of these wheels are hundreds of buckets against which the steam strikes. The steam enters at one end of the turbine and dashes against the buckets of each of these wheels, one after the other; and as it strikes against these buckets the wheels and the shaft to which they are fixt all turn around. This shaft drives the electric generator immediately adjacent, and in it the mechanical power is turned into electricity. Then eight copper wires only slightly larger than a garden hose convey the 16,000 horsepower thru the steel walls to the next compartment where the switchboard is located. Electric fans in the power plant ventilate the room and also *cool the generator*, and the heated air is pumped outside.

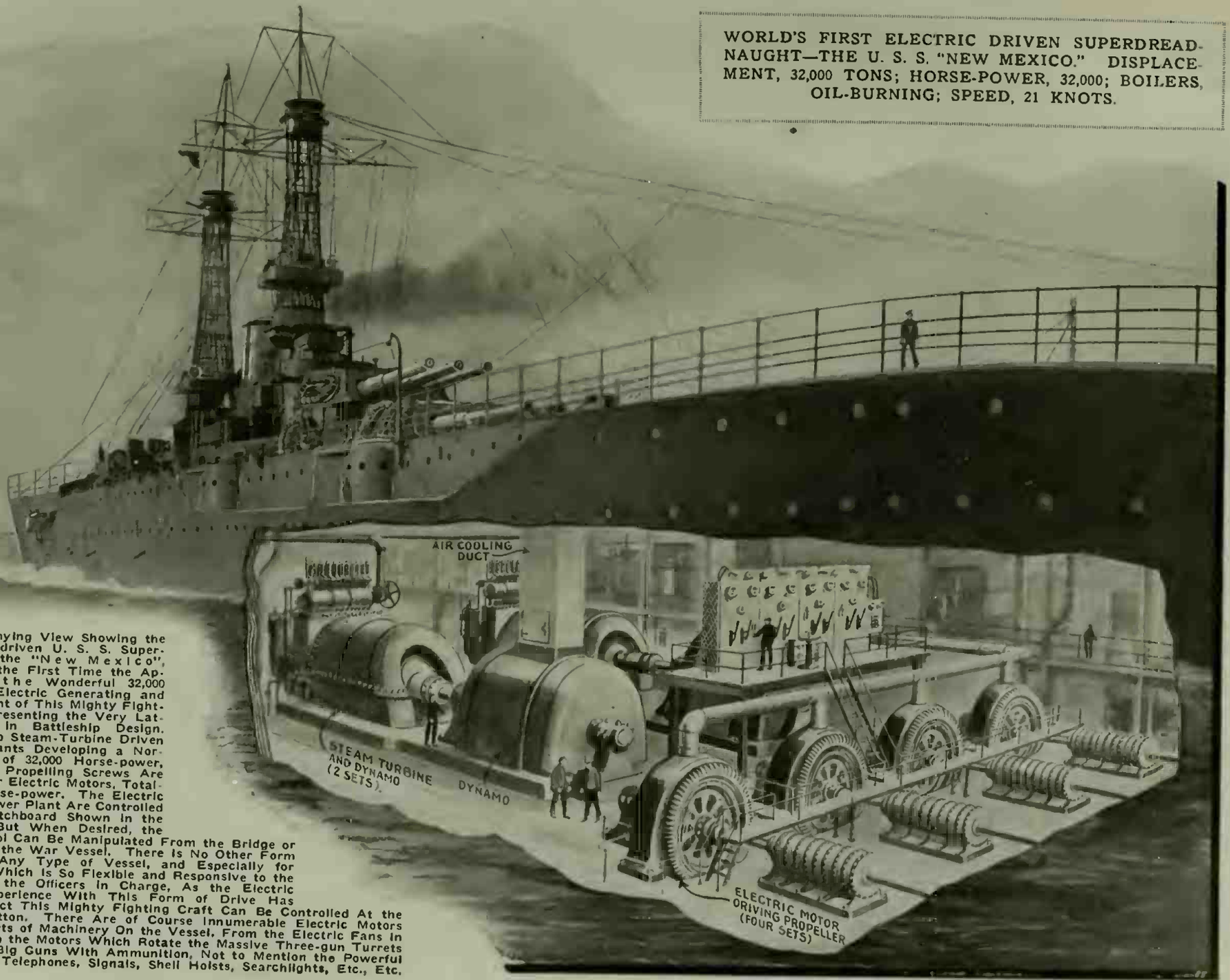
The Switchboards.

When the eight electric wires leave the power plant room, they go to the electric switches back of the switchboard. Here the ship is controlled upon receipt of in-

(*Continued on page* 183)

www.americanradiohistory.com

WORLD'S FIRST ELECTRIC DRIVEN SUPERDREADNAUGHT—THE U. S. S. "NEW MEXICO." DISPLACEMENT, 32,000 TONS; HORSE-POWER, 32,000; BOILERS, OIL-BURNING; SPEED, 21 KNOTS.



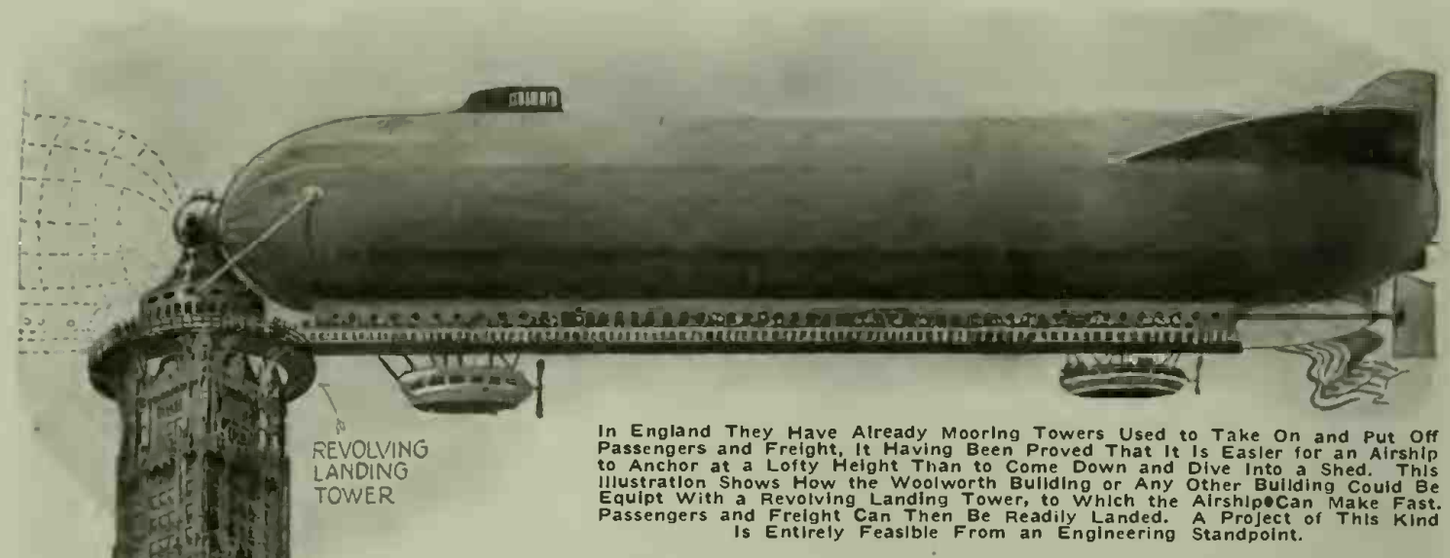
The Accompanying View Showing the New Electric-driven U. S. S. Superdreadnaught, the "New Mexico", Discloses for the First Time the Appearance of the Wonderful 32,000 Horse-power Electric Generating and Propelling Plant of This Mighty Fighting Ship—Representing the Very Latest Advance in Battleship Design. There Are Two Steam-Turbine Driven Generating Plants Developing a Normal Capacity of 32,000 Horse-power, and the Four Propelling Screws Are Driven by Four Electric Motors, Totaling 32,000 Horse-power. The Electric Motors and Power Plant Are Controlled From the Switchboard Shown in the Power-room, But When Desired, the Electric Control Can Be Manipulated From the Bridge or Pilot-house of the War Vessel. There Is No Other Form of Drive for Any Type of Vessel, and Especially for Battle-ships, Which Is So Flexible and Responsive to the Commands of the Officers in Charge, As the Electric Drive, As Experience With This Form of Drive Has Proven. In Fact This Mighty Fighting Craft Can Be Controlled At the Push of a Button. There Are of Course Innumerable Electric Motors Driving All Sorts of Machinery On the Vessel, From the Electric Fans in the Kitchens to the Motors Which Rotate the Massive Three-gun Turrets and Feed the Big Guns With Ammunition, Not to Mention the Powerful Radio Station, Telephones, Signals, Shell Hoists, Searchlights, Etc., Etc.

Copyright, 1919, by E. P. Co.

www.americanradiohistory.com

Recent Aërial Developments

By H. GERNSBACK



In England They Have Already Mooring Towers Used to Take On and Put Off Passengers and Freight, It Having Been Proved That It Is Easier for an Airship to Anchor at a Lofty Height Than to Come Down and Dive Into a Shed. This Illustration Shows How the Woolworth Building or Any Other Building Could Be Equipt With a Revolving Landing Tower, to Which the Airship Can Make Fast. Passengers and Freight Can Then Be Readily Landed. A Project of This Kind Is Entirely Feasible From an Engineering Standpoint.

WHEN the Zeppelin, that is, the rigid type of airship, first appeared it had many inherent faults. Probably the greatest one was the inflammable gas carried in the sectional ballonets.

As fast as the Zeppelins were constructed they were destroyed mostly by fire due to electric sparks, which set on fire the inflammable hydrogen gas.

Secondly, the landing arrangements as used by the Germans were very inefficient, and it was not infrequent that the huge airship became wrecked when coming down to earth prior to entering its mooring shed. In the air, the Zeppelin type is safe enough, and even the severest storms can be ridden out with comparative safety, that is, all storms except electrical storms, which not infrequently set the dirigibles on fire, due to lightning.

Recently, the English have proposed a novel manner for landing passengers, and no longer do the huge airships of the rigid type descend to earth to discharge their passengers or cargo. The device used is a sort of huge hitching post in the form of a high tower held fast by means of cables and stays. The upper part of the tower has a revolving top section with which the nose of the airship comes into contact, and to this it is made fast. The passengers and cargo leave and enter by means of this revolving top and descend or ascend to earth by means of elevators. These towers are anywhere from three to five hundred feet high, and the airship can "land" and make fast to the tower with comparative safety, as has been actually demonstrated in England.

It makes no difference which way the wind blows or how hard, the airship will simply take its position, similar to a wind vane, where it offers the least resistance to the wind. It will ride out the most severe storm very readily in such a position and in comparative safety. This also has been actually demonstrated.

The fire danger is now being reduced entirely by the use of an American idea, helium gas, which has approximately the same lifting power as hydrogen, but which is absolutely non-inflammable.

It does seem that for many years to come the rigid type of airship will probably be the one destined to carry passengers and freight, while for a long time, the airplane will only act as a secondary unit, or as a feeder. In other words, the airship will be used to cover long distances, while the airplane will cover short distances, bringing passengers and freight to the central dirigible depots.

We have today airships with a capacity of 2,000,000 cubic feet of gas, and it will not be long until the 5,000,000 cubic foot gas dirigible will be in use. Aviation authorities think that such airships will be in operation not later than 1923.

When it is considered that the huge present-day English airships have a capacity of 2,000,000 cubic feet of gas, and which can now cover a radius of 4,000 miles without coming down to earth or renewing their supplies, it will be seen that universal aërial transportation is a feature much closer at hand than is realized by most of us.

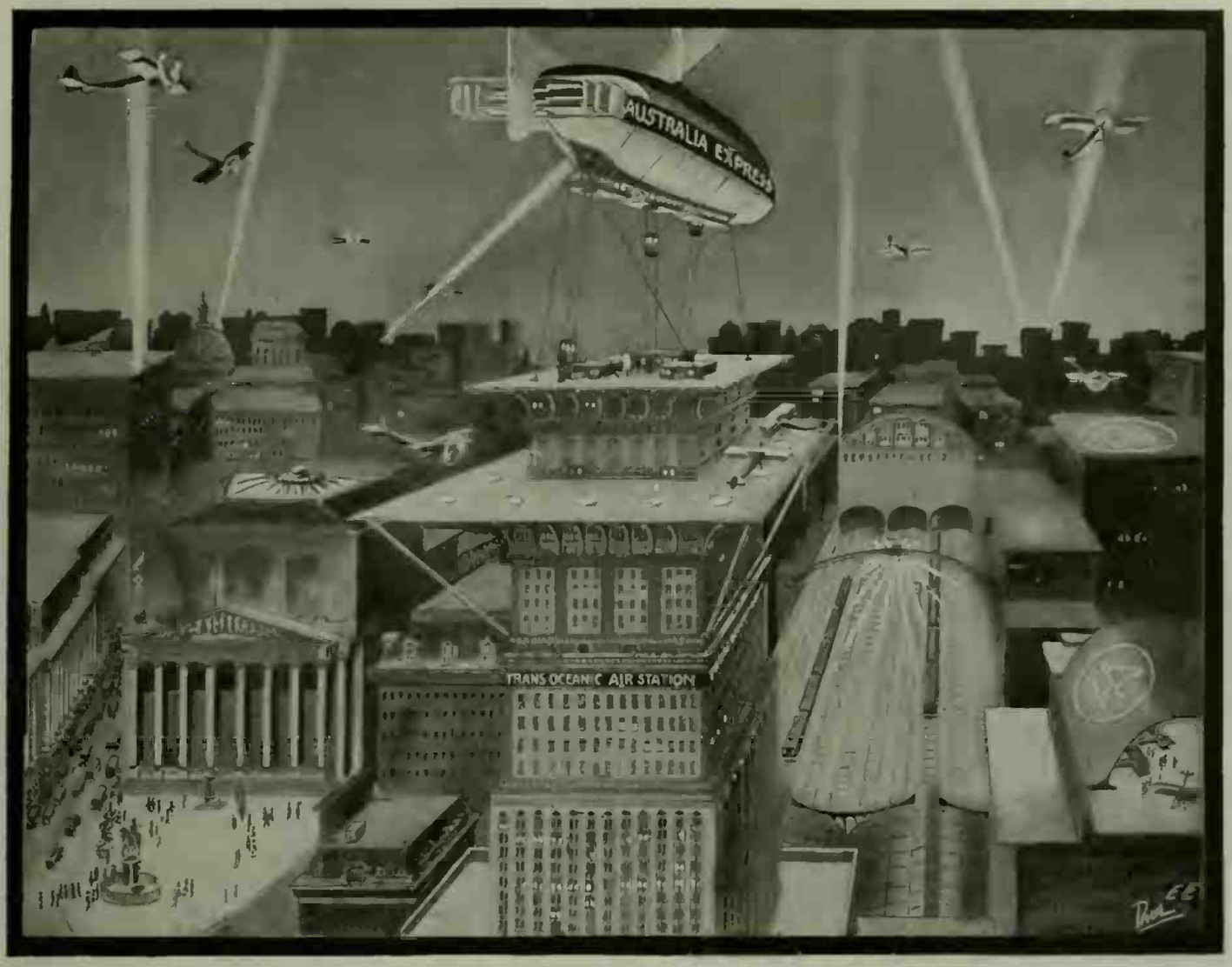
There is little doubt that before this year has ended one or more dirigibles will have crost the Atlantic Ocean. Flying at their present rate of speed, which is sixty miles per hour, it will be seen that the trip from London to New York will take only 2 to 2½ days. The huge 5,000,000 cubic feet of gas airships will probably fly at the rate of 100 miles per hour. The length of the trip will then be cut down to about 1½ days.

While the aërial tower which we discust above is probably satisfactory, it has many objections, the most important one being that it is an expensive item, and, moreover, if the airship is to rely upon such a structure, it will be almost impossible for it to come down to earth to land passengers *except at such points where the mooring towers are located.* This is a clear disadvantage.

In the accompanying illustration the writer wishes to advance an idea which so far has not been tried out, but which can be readily adapted. The idea is simply to moor the dirigible by means of four cables, which are thrown from the aërial flier. The passengers then will be able to ascend or descend from the airship by means of light elevators operated between the dirigible and earth. These elevators, electrically operated, need not be very heavy and can be constructed of aluminum, duralumin, or some such material. The power to operate these elevators can be taken from the engines of the dirigible itself, and it will be quite an easy matter to take from fifteen to twenty passengers on a single trip.

Our illustration shows the city of London, in the year 1925, with one of these dirigibles made fast to the aërial depot; we see here two elevators operating and taking on passengers and freight. The air-

www.americanradiohistory.com



The Heart of London as It Will Appear Very Shortly When the Plans Now Undergoing Completion Are Realized. It Having Been Demonstrated That It Is Very Difficult to Bring Down the Huge Airships to the Ground—Many Zeppelins Having Been Wrecked That Way—It Has Been Proposed to "Land" Airships on Top of Specially Elevated Stations as Here Shown. The Airship would Be Simply Anchored by Means of Four or More Steel Cables. Then, by Using a Number of Light Elevators or Lifts, the Passengers as Well as Freight Can Be Taken on or Put off, as Our Illustration Clearly Depicts. This Is Not a Dream of Tomorrow, but Plans Are Actually Under Way to Make This Feature a Realization. It will Be Seen That the Airplanes Merely Act as a Sort of "Feeder" and They Will Be Used Mostly to Bring Their Passengers or Freight to the Trans-Atlantic Landing Station.

ship shown belongs to the regular trans-Atlantic Service and makes the trip between London and Perth, Australia in 4½ days. Should it become necessary to discharge or take on freight at non-important centers, it will be a simple matter to moor the airship by means of its cables even over a city which has no elaborate landing station. Nothing but four points to which to make the cables fast are required. The elevators which are carried by the airship will do the rest.

Our cover illustration shows a spectacular method of an aërial rescue at sea, which immediately demonstrates the practical use of these elevators. Indeed, the airship does not need to make fast to the wrecked airplane; it will keep its position simply by running either one or more of its propellers in order to keep from drifting. This is quite simple even for the present-day airship, as it is possible by means of its propellers to hover over a certain spot even with a strong wind blowing. In this case, the elevator cables only are made fast to the wrecked flyer, the gasoline tanks of which have been set on fire. After the elevator cables are made fast, it will be a comparatively simple matter to take off the passengers, and, if necessary, the freight, for the buoyancy of the airplane in the water will probably keep it afloat for some time. After everybody is taken off, the elevator is hoisted, the elevator cables pulled in, while the airship proceeds on its way.

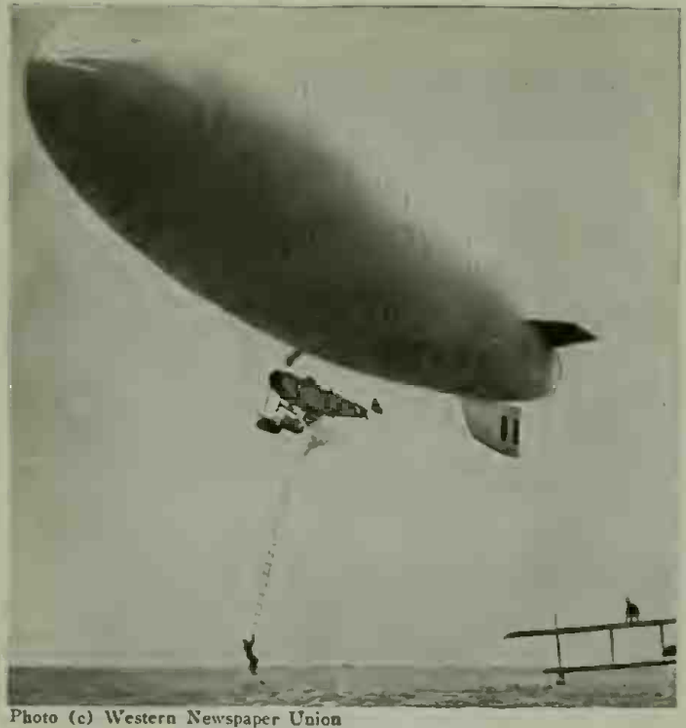
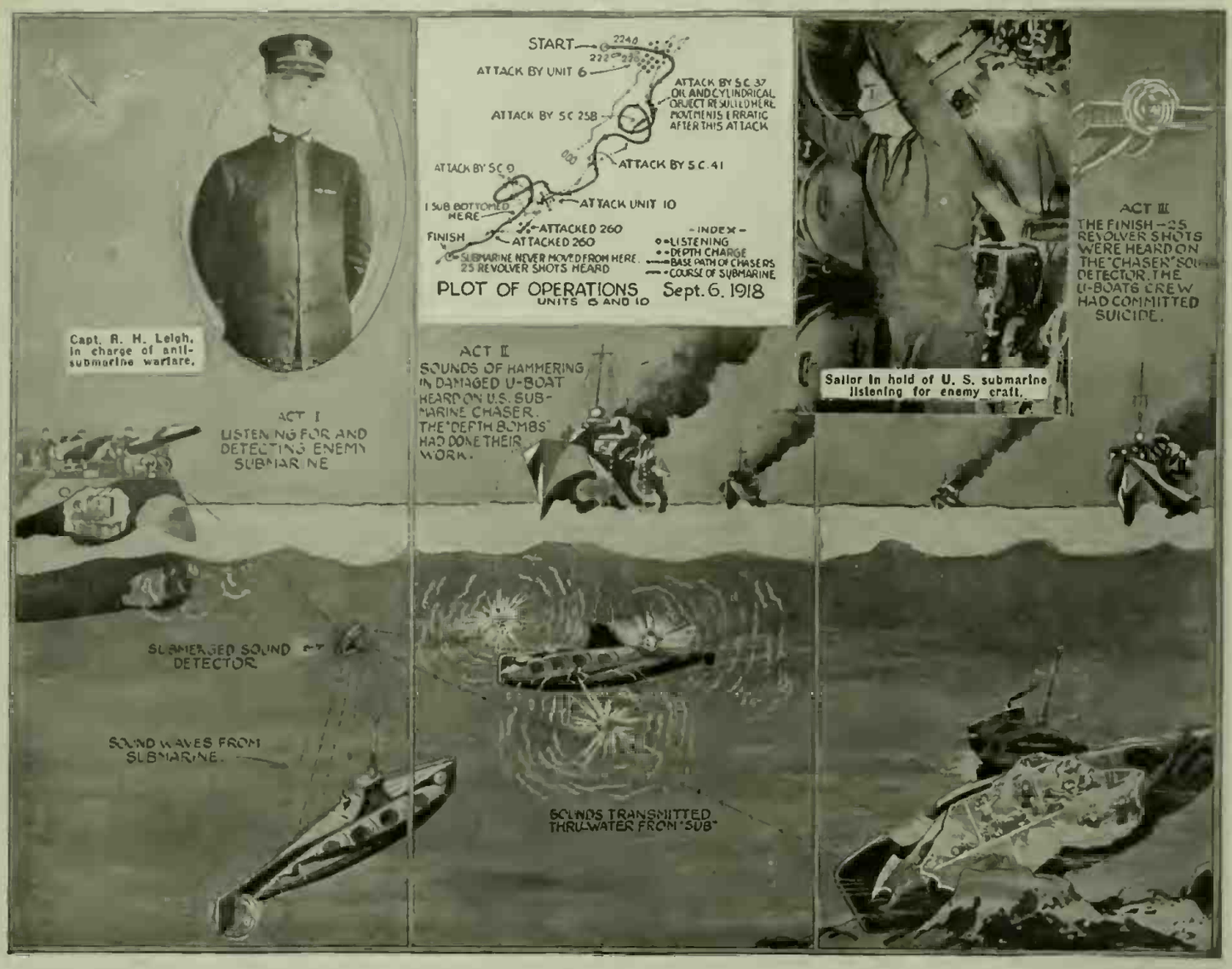


Photo (c) Western Newspaper Union

This Remarkable Snapshot Shows One of Our Navy's Dirigibles Rescuing Two Airmen Who Recently Fell Into the Sea with Their Flying Boat off Key West, Florida. One of the Aviators Can Be Seen Climbing up the Rope Ladder.

This spectacular rescue might seem to be a thing of the future, but indeed it is not. Our photograph herewith shows that the very same thing has already been accomplisht on a smaller scale. Very recently the United States Navy equipt its dirigibles with rope ladders, which made it possible to rescue aviators from the sea. That such a move was indeed wise, our photograph demonstrates better than words. Our remarkable snapshot shows one of the Navy's "blimps" rescuing two airmen who recently fell into the sea with their flying boat off Key West, Fla. The nose of the airship was simply turned into the wind, and after some maneuvering it finally managed to get directly over the disabled flyer. The two marooned airmen experienced no difficulty in grasping the rope ladder and climbing aboard the airship, none the worse for their adventure.

www.americanradiohistory.com



Hunting the U-boats by "Sound" Proved a Successful and Profitable Allied Naval Game—So Successful in Fact That, Had the War Lasted Another Year, the U-boats Would have Been Driven Completely from the Seas.

Hunting Submarines by Sound

By BREWSTER S. BEACH

How Yankee Scientists Beat the German U-Boats

THE United States Navy Department, after nearly two years of the closest censorship, has just given approval to the publication of certain data relating to the development in the United States during the war of submarine detecting devices, which were used to signal advantage by this country and the Allies in prosecuting and bringing to a successful conclusion the campaign against the German U-boat.

The apparatus may be termed the composite work of the General Electric Company, Submarine Signal Company, Western Electric Company, the National Research Council, assisted and advised by many eminent scientists, engineers and research specialists—chief among whom were Drs. W. R. Whitney, Irving Langmuir and W. D. Coolidge, Prof. R. A. Millikan, Prof. Max Mason, and others.

Realizing that the prompt solution of the submarine problem was the key to a successful termination of hostilities, Secretary Daniels, immediately upon America's entrance into the conflict, appointed a special board to devise ways and means to overcome it.

At the suggestion of Dr. Whitney, director of General Electric Company's research laboratories, a group of scientists was formed at Nahant, Mass., under Dr. Irving Langmuir, where the results of extensive research activity were put to practical tests under actual conditions as nearly as possible approaching those in European waters.

Another group under Prof. Millikan, head of the Physics Department of the University of Chicago, was organized at New London, Conn., where the work of both bodies was later co-ordinated.

Out of the efforts of these two groups and the work carried on in Schenectady assisted by Allied commissions of scientific men, there grew the American Submarine Detector—a development of the old principles of sound wave transmission in water in an altogether new and startling manner, and just how efficient this "detector" proved we shall see later.

The apparatus finally perfected and put to immediate use, was first designed to hang overhead from naval craft amidship below the water line and it depended for its direction-getting qualities on the peculiar and heretofore little understood faculty

THIS article describes the effort made by American scientists, under the stress of tremendous urgency, to invent and perfect an instrument to successfully locate submarines while in a submerged condition, at a time when every instant of delay meant further loss to shipping, and the fate of the Allied cause practically depended on the immediate defeat of German U-boat warfare. The Submarine Detector, as eventually evolved by them, utilizes old principles in a new and startling way. It is based on the theory of sound-wave transmission thru the water and depends for its direction-getting qualities on the peculiar and heretofore little understood faculty of the human ear to detect the direction of sound by the shifting of that sound from one ear to the other.

www.americanradiohistory.com

of the human ear to detect the direction of sound by the shifting of that sound from one ear to the other.*

Early Experiments

Every possible application to which electricity had been put was studied with painstaking care by experts during the development of the "Submarine Detector," and many experiments were carried on at New London and at Nahant with pliotrons, with amplifiers, with the Fessenden oscillator, which had been developed by the Submarine Signal Company, and with other similar instruments, before the proper combination of the principles of electricity and acoustics produced the final and successful device subsequently used.

Specialists in physics and acoustics from the great technical schools, such as Columbia University and Harvard, from the Research Laboratory of the G. E. Co. and the W. E. Co., and in fact from all over the United States, played a prominent part in the work done, particularly by the New London Group, altho unfortunately the armistice was signed before the latest devices developed here could be put into extensive use on the other side of the water.

Owing to the interference of sounds made by the listening ship's own motors, it was found more practical to stop the engines when about to take observations and this added greatly to the effective range of the instrument.

To overcome this obstacle, another device was developed *which could be trailed off the stern a hundred or so feet away* where the engine noises of the ship were out of range and the sound was then brought into the operator in the ship's hold.

A third adaptation of the listening principle was an instrument which protruded thru the hull and was a stationary part of the vessel's equipment. A somewhat circular device was constructed for use on submarines, but all of them were used to advantage.

While demonstrating the device to the British Admiralty, our American engineers were asked to study the question of fitting submarine detection units to airplanes, balloons and dirigibles.

After some experimentation, followed by more practical tests and conferences with the Lancashire Group of scientists at Harwich, apparatus was developed which met these needs and many *aircraft* were equipt with sound detectors *which rendered it possible for them to follow the course of the enemy submarine after they had seen her submerge, a valuable faculty which such craft did not possess until the introduction of the American detector.*

Allies Adopt Yankee Invention

However, when the devices had proved themselves eminently satisfactory after exhaustive experimentation here, the Navy Department organized a special Service Party under Capt. R. H. Leigh of the Bureau of Steam Engineering to demonstrate the detectors to the British Admiralty. Shortly after the arrival of this party abroad, the American submarine detectors were universally adopted by all the Allied navies.

It was found to be much superior in many ways to any of previous development, and came to be considered one of the most effective offensive weapons ever used against the submarine.

To sum up the results achieved by these American listening devices it is only necessary to recount a few pertinent points to illustrate the device's practicability.

In spite of it all, initial experiments proved slow of entirely satisfactory developments until the fall of 1917, when it was decided to go out to sea off Cape Cod for more thorogoing tests.

The sea was clear of craft as far as the eye could see—yet the operator with his ear to the detector distinctly heard a vessel approaching—nearer—nearer—nearer. The captain from the bridge eagerly scanned the horizon with the ship's glasses—nothing in sight.

"Send a man aloft with powerful glasses," he commanded. "The detector has picked up a craft 3 points on our starboard bow."

The sailor returned. "Nothing in sight, sir."

"I'll go aloft myself. That boat sounds as if it were very near. Why, we can hear her engine as clearly as if she were alongside."

Puzzled, the captain returned from the masthead after a disappointing vision of a calm and perfectly clear sea.

"How's she coming?" shouted the first lieutenant down the hatchway.

"Heading straight for us, sir. Sound getting louder every minute."

There was nothing to do but wait.

The captain pulled out his watch and sat down. Fifteen minutes—half an hour—an hour—ticked on!

(*Continued on page* 167)

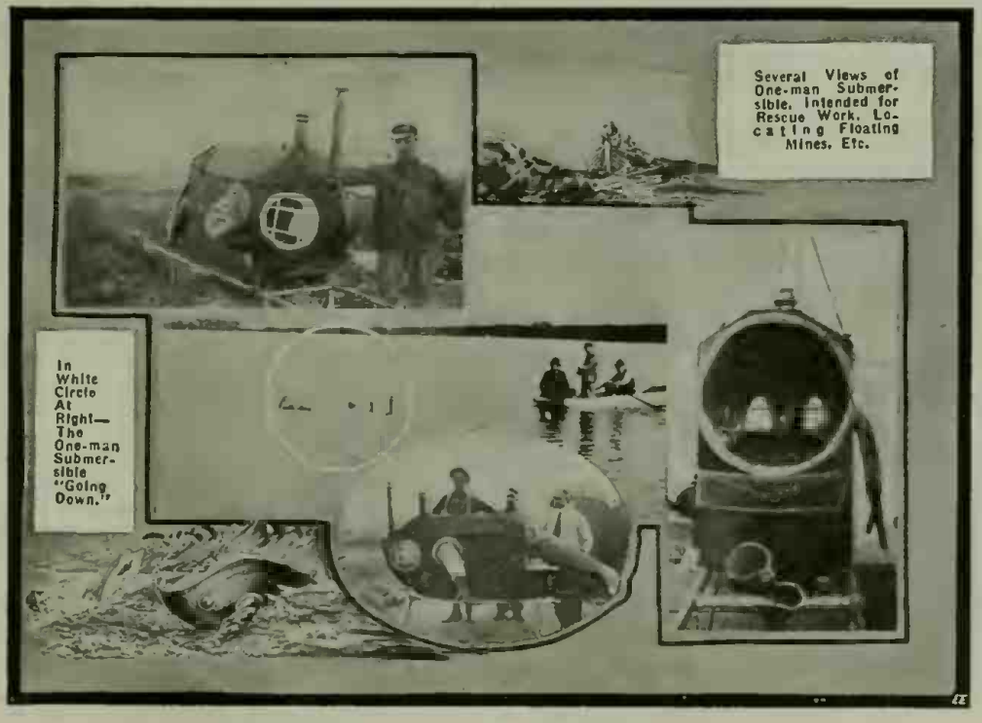
* Another very interesting point is that when mounting microphones on each side of a vessel, the *loudness* of the incoming sound is equal in both telephone receivers, i. e., if a submarine is on the starboard side of the ship, it will be heard just as loud from the port side. But, the difference can be readily detected and very accurately too, by the *phase difference* as heard in the 'phones. In other words, the sound will be heard a fraction of a second earlier in one ear than in the other. Small as this difference is, even a green operator will detect it at once.

—*Excerpt from Mr. H. Gernsback's editorial in the October, 1917 issue of this journal.*

That One-Man Submersible

IN the March issue of this journal there appeared an illustrated article describing a newly invented, one-man submersible boat, intended for purposes of life saving, locating floating mines and other purposes. At the time the article was prepared, the Editors only had the inventor's patent to guide them in its preparation, and the illustration was prepared by one of the staff artists. But behold! This strange animal of the deep really lives, as the accompanying photographs of the actual working device prove. The inventor of the one-man submersible is W. R. Barringer, of Denver, Col., which is a long way from the sea, and it puzzled the Editors how a rank land-lubber such as the inventor appeared to be, could have the heart to work out a complete submarine or anything akin to that device. But now the secret is out, for it appears that the inventor, who was formerly in the United States Army, had gained considerable experience while in foreign lands, and he evolved the principles underlying his submersible boat while observing the methods of pearl and sponge divers in the far-distant Sulu Archipelago.

The makers of the Barringer one-man submersible, claim, among other things, that, due to its peculiar construction, no pressure is required to offset the tremendous external pressure of the water, even when submerged to such depths as 350 feet, for which this submersible is practicable. It is interesting in this connection to mention that the maximum depth reached by U. S. Naval divers in especially constructed diving suits and bells, is less than 300 feet. Moreover, in the ordinary diving suit the tremendous internal pressure of 130 pounds per square inch is necessary to remain at a 350-foot depth for any length of time. This new submersible diving outfit requires but the normal pressure of 15 pounds per square inch, regardless of depth attained. The inventor also claims that no strain is occasioned on the operator, even after a long period under water. The operator rests on a heavy air cushion and suffers no ill effects while below the water's surface. Further, the ascent and descent of the boat need not be done gradually, as in the case of the ordinary diving suit or bell, in order to accustom the body to the changing water pressure. On the contrary, so he claims, ascent may be made rapidly, and the operator's time is, therefore not wasted in slow sinking or rising.



As pointed out in the previous article, there are many interesting electrical features incorporated in this device, including electrical propelling and steering means, an electric searchlight and many other novel devices.

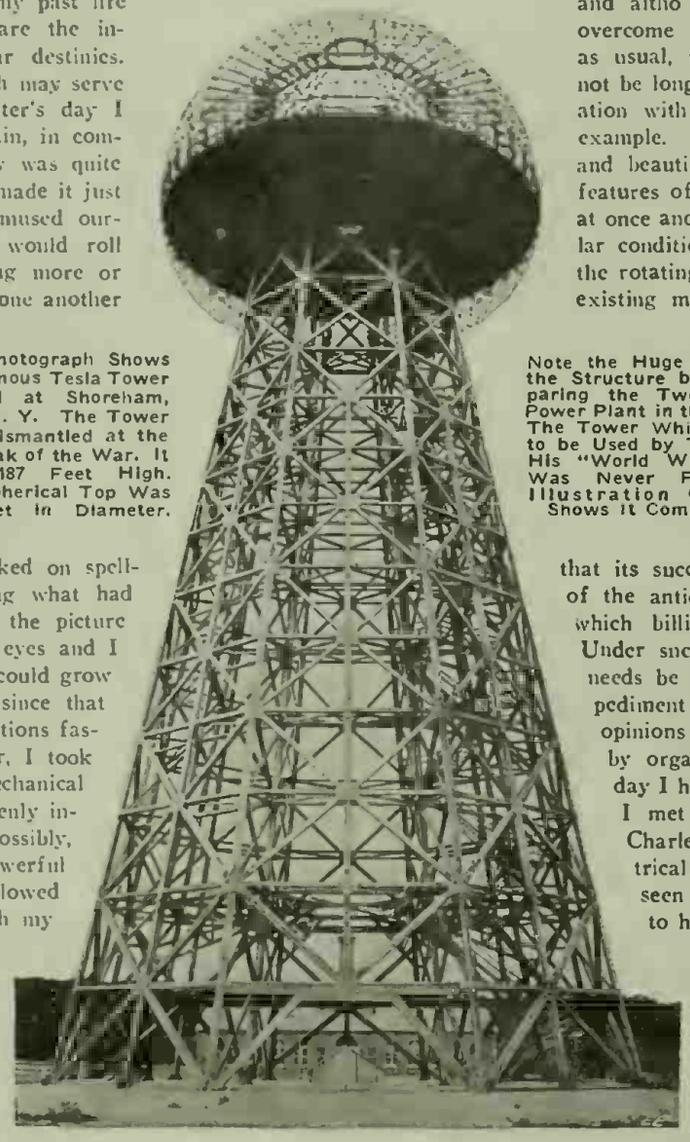
www.americanradiohistory.com

My Inventions

By Nikola Tesla

V. The Magnifying Transmitter

AS I review the events of my past life I realize how subtle are the influences that shape our destinies. An incident of my youth may serve to illustrate. One winter's day I managed to climb a steep mountain, in company with other boys. The snow was quite deep and a warm southerly wind made it just suitable for our purpose. We amused ourselves by throwing balls which would roll down a certain distance, gathering more or less snow, and we tried to outdo one another in this exciting sport. Suddenly a ball was seen to go beyond the limit, swelling to enormous proportions until it became as big as a house and plunged thundering into the valley below with a force that made the ground tremble. I looked on spellbound, incapable of understanding what had happened. For weeks afterward the picture of the avalanche was before my eyes and I wondered how anything so small could grow to such an immense size. Ever since that time the magnification of feeble actions fascinated me, and when, years later, I took up the experimental study of mechanical and electrical resonance, I was keenly interested from the very start. Possibly, had it not been for that early powerful impression, I might not have followed up the little spark I obtained with my coil and never developed my best invention, the true history of which I will tell here for the first time.



This Photograph Shows the Famous Tesla Tower Erected at Shoreham, L. I., N. Y. The Tower Was Dismantled at the Outbreak of the War. It Was 187 Feet High. The Spherical Top Was 68 Feet in Diameter.

Note the Huge Size of the Structure by Comparing the Two-story Power Plant in the Rear. The Tower Which Was to be Used by Tesla in His "World Wireless," Was Never Finished. Illustration Opposite Shows it Completed.

Scrapping the World's Engines.

"Lionhunters" have often asked me which of my discoveries I prize most. This depends on the point of view. Not a few technical men, very able in their special departments, but dominated by a pedantic spirit and near-sighted, have asserted that excepting the induction motor I have given to the world little of practical use. This is a grievous mistake. A new idea must not be judged by its immediate results. My alternating system of power transmission came at a psychological moment, as a long-sought answer to pressing industrial questions, and altho considerable resistance had to be overcome and opposing interests reconciled, as usual, the commercial introduction could not be long delayed. Now, compare this situation with that confronting my turbine, for example. One should think that so simple and beautiful an invention, possessing many features of an ideal motor, should be adopted at once and, undoubtedly, it would under similar conditions. But the prospective effect of the rotating field was not to render worthless existing machinery; on the contrary, it was to give it additional value. The system lent itself to new enterprise as well as to improvement of the old. My turbine is an advance of a character entirely different. It is a radical departure in the sense that its success would mean the abandonment of the antiquated types of prime movers on which billions of dollars have been spent. Under such circumstances the progress must needs be slow and perhaps the greatest impediment is encountered in the prejudicial opinions created in the minds of experts by organized opposition. Only the other day I had a disheartening experience when I met my friend and former assistant, Charles F. Scott, now professor of Electrical Engineering at Yale. I had not seen him for a long time and was glad to have an opportunity for a little chat at my office. Our conversation naturally enough drifted on my turbine and I became heated to a high degree. "Scott," I exclaimed, carried away by the vision of a glorious future, "my turbine will scrap all the heat-engines in the world." Scott stroked his chin and looked away thoughtfully, as though making a mental calculation. "That will make quite a pile of scrap," he said, and left without another word!

IMAGINE a man a century ago, bold enough to design and actually build a huge tower with which to transmit the human voice, music, pictures, press news and even power, thru the earth to any distance whatever without wires! He probably would have been hung or burnt at the stake. So when Tesla built his famous tower on Long Island he was a hundred years ahead of his time. And foolish ridicule by our latter day arm-chair "savants," does not in the least mar Tesla's greatness.

The titanic brain of Tesla has hardly produced a more amazing wonder than this "magnifying transmitter." Contrary to popular belief his tower was not built to radiate Hertzian waves into the ether. Tesla's system sends out thousands of horsepower thru the earth—he has shown experimentally how power can be sent without wires over distances from a central point. Nor is there any mystery about it how he accomplishes the result. His historic U. S. patents and articles describe the method used. Tesla's Magnifying Transmitter is truly a modern lamp of Aladdin.

EDITOR.

"Aladdin's Lamp".

These and other inventions of mine, however, were nothing more than steps forward in certain directions. In evolving them I simply followed the inborn instinct to improve the present devices without

(*Continued on page* 148)

Copyright, 1919, by E. P. Co. All rights reserved

Mr. Tesla's articles started in our February issue

www.americanradiohistory.com



Copyright, 1919, by E. E. Co.

THIS PHOTOGRAPH OF A MODEL SHOWS HOW THE TESLA TOWER BUILT ON LONG ISLAND, EIGHTEEN YEARS AGO, WOULD HAVE LOOKED COMPLETED. FROM ITS APPEARANCE NOBODY WOULD INFER THAT IT WAS TO BE USED FOR THE GREAT PURPOSES WHICH ARE SET FORTH IN HIS ACCOMPANYING ARTICLE.

www.americanradiohistory.com

Filming "Talking Movies" in Glass Houses

By H. WINFIELD SECOR

YOU probably remember the old adage about "people who live in glass houses, should"—etc.—but the latest is the filming of talking motion pictures in all-glass houses or studios, and the process has been invented by one —David O. Royster of St. Louis, Mo., the "show-me" state. Mr. Royster's scheme covers an improved method and apparatus for synchronously making motion pictures and sound records.

As the inventor points out, it has heretofore been very difficult, if not indeed impossible, to make talking motion pictures which would bear a perfect synchronous relation to each other when reproduced, for the reason that the camera used in taking the motion pictures must necessarily be located a certain distance away from the object to be photographed, and being that the sound recording device is located adjacent to the camera in order to operate in synchronism with it, the distance between the receiver on the sound recording apparatus, and the actors being photographed, is such that the sound waves in traveling from the object to the recorder, do not reach the latter for an appreciable length of time. As a result the recorded sounds are not exactly synchronous with the pictures, when these sounds and pictures are later reproduced in the theater projector. And besides, with such an arrangement the sound waves are insufficient in volume to make a clear and strong record on the disc or cylinder of the talking machine.

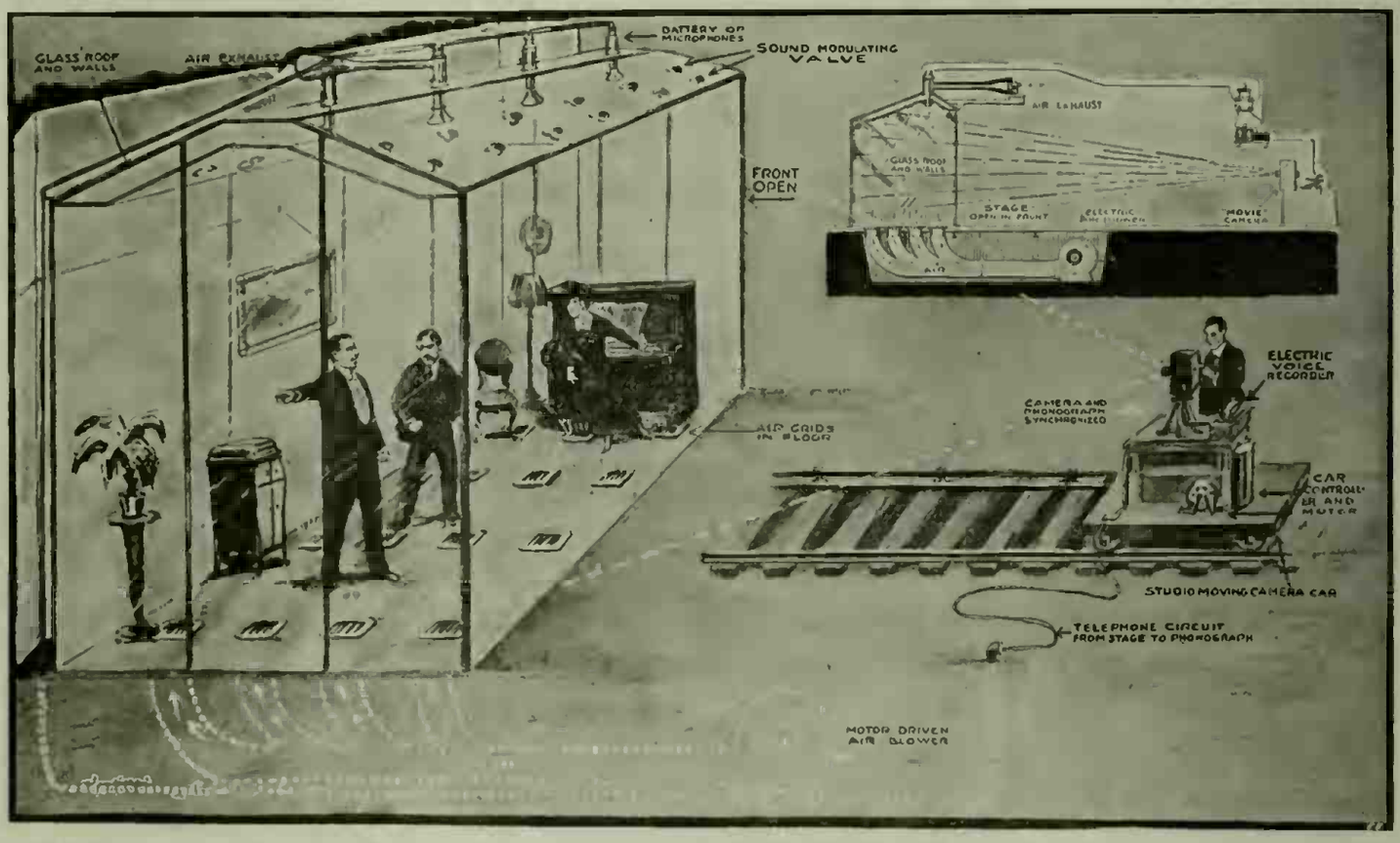
Mr. Royster, in his scheme, provides a transparent *glass studio stage*, or *all-glass house*, if the scene requires it, which is occupied by the objects to be photographed. Thus motion pictures can be made by natural light; means are also provided for concentrating the sounds produced by the speakers, which sounds are telephonically transmitted to the sound recording device, such as a phonograph, located adjacent to and operated synchronously with the motion picture camera.

As is the practise in all of the larger studios, the camera and other appurtenances, such as the sound recording phonograph, etc., are mounted on a wheeled truck, which may be moved along a track, or set of tracks, so as to take either "close-ups" or normal focus pictures, as desired, also to make changes quickly. Some studios utilize a small electric car fitted with a motor and controller, so that the camera man or his assistant can readily move the camera toward or away from the stage, as the occasion may demand. You have probably seen at one time or another a motion picture where the objects came up rapidly toward you, until the actress' face, for instance, was as big as the entire screen. This effect is obtained very easily by moving the car toward the scene. Scenes or settings which fade away, causing the objects to become smaller, are taken in the reverse manner, i. e., by moving the camera away from the stage while the picture is being taken.

There is provided in the present scheme a powerful motor-driven electric blower under the studio floor, which projects a strong draft of air upward thru a series of gratings in the stage floor, and the powerful upward vertical movement of the air thru a series of openings in the glass roof carries the sounds of the voices upward, toward the microphones or sound detectors, which effect is intensified by an electric exhaust fan at the top of the glass-enclosed stage, as shown in the diagram and illustration herewith. The battery of microphones which pick up the sounds at the ceiling of the stage are connected up with a telephone line which leads to the electric recorder on the phonograph beside the "movie" camera, there being a rigid mechanical connection between the camera and the phonograph to ensure synchronism.

Owing to the peculiar and unusual lighting arrangements with this form of all-glass stage, the "setting" or other scenery is placed back of the stage, so as to allow the daylight to pass over it and thru the glass to illuminate the stage proper. Some props and furniture can of course be placed directly on the stage. It is understood that where the light is not sufficiently strong for the taking of motion pictures, the stage can be lighted artificially. The degree of sound transmitted by the microphones fitted over the stage may be modulated by means of adjustable valves placed in front of the microphone, and also by opening more or less of the by-pass valves in the glass inner ceiling, which permits some of the air-conducted sound waves to pass between the two ceilings and out thru the fan chamber.

The apparatus as here described is comparatively simple, can be easily operated, does not require artificial light, and motion pictures and sound records of absolute synchronism can be readily made at any distance from the object within the focal length of the camera, claims the inventor. All things considered, it would seem to presents a new and successful "Movie" idea.



The Secret of Perfect "Talking Motion Pictures" Lies in the Proper Synchronism Between the "Pictures" and the "Voice," and Also in the Clarity and Even Tone of the Speech Reproduction. All Three of These Problems Have Been Solved by the Invention of the Glass Enclosed Stage Here Illustrated.

www.americanradiohistory.com



This Portable Wireless Telephone Was Perfected by W. W. Macfarlane, of Philadelphia. Photos Show Mr. Macfarlane with His Invention and Stove-pipe Aerial. With This Two Persons May Hear the Conversation Being Carried on Fifty Yards Away.

Photos by Int. Film Service

Call Up Wifey on the "Stove-Pipe" Radio

A MAN with a box slung over his shoulder and holding in one hand three pieces of stove pipe placed side by side on a board climbed into an automobile on East Country Road, Elkins Park, Pa.

As he settled in the machine he picked up a telephone transmitter, set on a short handle, and said:

"We are going to run down the road. Can you hear me?"

Other passengers in the automobile, all wearing telephone receivers, heard a woman's voice answering: "Yes, perfectly. Where are you?"

By this time the machine was several hundred yards down the road and the voice in the garage was distinctly heard.

This was one of the incidents in the first demonstration of the portable wireless telephone outfit invented by W. W. Macfarlane, of Philadelphia.

Mrs. Macfarlane, sitting in the garage back of the Macfarlane home, was talking thru the wireless telephone to her husband, seated comfortably in a moving automobile 500 yards away.

The occupants of the car were a chauffeur, a reporter and a photographer. All wore the telephone receivers and could hear everything Mrs. Macfarlane was saying. The chauffeur had no other apparatus than the receiver with the usual telephone cord attached by a metal clip to his steering wheel.

Lying beside Mr. Macfarlane was the foot-square box, the only "secret" in the whole demonstration. What is in the box is the inventor's mystery. This box weighs about twelve pounds. The other machinery used consisted only of the usual telephone transmitter and receivers and the three pieces of stovepipe standing erect on a plain piece of board. This forms the *aërial* of the apparatus.

Before starting on the automobile demonstration of his wireless telephone Mr. Macfarlane stood in the garage and directed the movements of a soldier in a field more than 200 yards away from him. This soldier assisiant had a pair of telephone receivers over his head, connected by a wire with two metal clasps to his rifle (see photo herewith). He marched and halted and about-faced and left shouldered arms out there in the field the instant Mr. Macfarlane gave the order thru his little hand wireless 'phone in the garage.

The "July" Number of the Electrical Experimenter

"Hello Europe"—via Radio. Complete story of How Secretary of the Navy Daniels talked via the New Brunswick Radio Station to President Wilson in France, by Charles M. Ripley.

"My Inventions"—Part VI—by Dr. Nikola Tesla, himself. Besides a big feature surprise article by the world's master inventor.

Interesting Facts About the Electron—How big are atoms and electrons? by L. R. Jewett.

Faradic Currents and How to Apply Them. Including rheumatism, nervous complaints, and other ailments. Treatment with apparatus described in the present issue.

A Rattling Good Electric Story—"How 'Don' flashed the 'S.O.S.' ", by Mabel M. Davis.

New Electric Detector Net for Submarines.

Loop Aerials—Description of Actual Results obtained over 200 mile distances, by Prof. Lloyd M. Knoll.

Tree Wireless—How living trees receive radio messages across the ocean. The wonderful work of General George O. Squier, Chief Signal Officer, U. S. Army.

Storage Battery Testing—Practical Technique in simple language, by Harold R. Adams, storage battery engineer.

Audions operated on Alternating Current—Both Filament and Plate Circuits. Every radio man will want to read this authentic article, by Elliott A. White, formerly Instructor in Radio, Air Service School, Carnegie Institute of Technology.

Mr. Macfarlane said he would make no fanciful predictions as to what his simple, portable wireless telephone might do.

"There are all kinds of possibilities in it," he continued. "If this could have been ready for use in the war, think of the value it would have had. A whole regiment equipt with the telephone receivers, with only their rifles as aërials, could advance a mile and each would be instantly in touch with the commanding officer. No runners would be needed. There could be no such thing as a 'lost battalion.'

"No high power is necessary to operate this wireless. I am using one-tenth of an ampere in this experiment here and the results you see are so good that the voice carries as well as on the usual wire telephone. The telephone system uses about one-fourth of an ampere.

"I am working on a new theory in electricity, and in wireless. I think the accepted principle of the waves is only part of the story. There is something else. It is that something else that I am utilizing. There is no supplementary current in this system as in the usual wireless operation. There is no static and no interruption."

An umbrella, Mr. Macfarlane explains, will serve as well as a rifle for an aërial. "A plain citizen carrying a small handbag containing the compact wireless outfit and with his umbrella held aloft can walk along the street talking with friend wife at the house at the other end of the city," he said.

"How costly would this outfit be?" he was asked.

"Nothing new is used," he explained. "All the apparatus fits in with existing devices. Everything needed for the outfit could be bought for probably $15."

"My apparatus here is rather crude and not all the quality of current is obtained that I can get," he continued. "But it is no wild dream to say that a man riding on a train to New York can telephone his wife about bringing a friend home for dinner by using this device. It will be perfected thus far before very long. This apparatus here needs improvement, but it demonstrates the practicability of the thing. Even now I can connect up the end of the wireless in the house with the existing telephone system and thus can talk from my automobile with any person in the city."

www.americanradiohistory.com

Tin-Can Models—A New Art

By GEORGE HOLMES



IMAGINE if you can on one side a scene, wildly confusing, resembling a rubbish heap of every conceivable sort of tin-can, from the tomato to dainty tin-boxes which once upon a time held My-Lady's peach and cream complexion.

Picture, on the other hand, a scene with beautiful, splendid and practical toys, such as money could not buy, all evolved from these same tin-cans and boxes, with a little touch of imagination, inventiveness and mechanical knack, plus a pair of pliers, a soldering iron and the transformation is complete.

The originator and "wizard" of the tin-can toys is Mr. Edward Thatcher, of Teachers' College, Columbia University. It was he who hit upon the novel plan of utilizing waste tin-cans and from them making amusing, decorative and instructive playthings. He gave an inkling of this new art to his classes at Columbia and the students took it up with such zeal that these models were eligible for the recently successful public exhibition at the Art Alliance Galleries.

As his bit in the war, Mr. Thatcher was successful in having this artcraft introduced in the hospitals both here and abroad; and so helped the wounded soldiers to find a remunerative and amusing pastime which greatly aided in keeping their minds off their troubles. Even such men as were suffering from shell shock took to the tin-can toys; it would seem at first impression that they could not stand the noise of the hammering on the cans, but the reverse proved the rule. In cases where they would jump if a match box were dropt, they seemed not in the least inconvenienced by the sound of the constant tinkering of the tin-can artists and would work all day in the "toy-shops."

The possibilities of this new artcraft are practically unlimited. Where heretofore the wounded have occupied their time in the making of these toy models, the art is spreading the country o'er and will be one of the subjects taught in many schools. Some of the models here shown have been duplicated by ten-year-old boys at the Edgewater Manual Training School.

Most interesting of all is the composite view showing a toy *Army Truck*—"before and after." All the various forms of cans necessary to construct this truck are shown on the left, while on the right may be seen the completed model. The body of the truck was made from the side of a "Wesson" oil can, the wheels were made from evaporated milk cans, the seat from a cocoa box and the hood and radiator from an olive oil can. The indentations for the radiator, to resemble the cooling tubes, were faithfully reproduced by punching many hundreds of holes so as to give it that "corrugated" appearance; I think that would be the proper word, still not envying the long and tedious task it must have been to put all those holes into (or should we say "out of") existence. The radiator cap came from the top of a tooth paste tube and the side lamps and tail-light from screw caps of various olive oil cans.

Drifting back to our war atmosphere we have the steam tractor pulling a "Giant" gun. The tractor was brought to life from these various items: The fire-box and platform from a much abused sardine box, the boiler from another olive oil can, the steam whistle from the top of a "Lyons Tooth Powder" can, wheels from evaporated milk cans and the roof from the side of a square tin. The dummy driving wheels are made from the top covers of "Crisco" cans, soldered together so as to make a sort of pulley face for the driving cord. The long-range gun was built from a shaving-stick box, with the evaporated milk cans again doing duty as wheels.

These model toys are not self-propelling but could easily be made so. It would seem that Mr. Thatcher was born to the model business. He has constructed many real "live" models that work by themselves, notable amongst these being a large-size model of one of the Pacific Coast "mallet type" locomotives, that runs under its own power. The author also had the pleasure of seeing a model "tractor," built along the lines of the one constructed from tin-cans, only this one was made of brass and ran under its own steam.

Mr. Thatcher has found it advisable to write a book on this interesting subject which undoubtedly will find a great demand when it comes off the press. And so we see this new "rage" equally successful with the younger classes as well as at the Teachers' College at Columbia, where, among society folks, they call it "occupational therapy."

(*The Editor will be pleased to receive good photos of tin-can models of electrical things. To mention a few that our readers can readily construct: Telephone, electric generator, electric locomotive, radio sets, airships, etc.*—Editor.)

www.americanradiohistory.com

Making a Practical Electrician

THE world has never before witnest the vast opportunities that at the present moment lie before the people of the United States. Europe, with its shell torn territories and completely exhausted stocks of raw and finished materials, turns to the one country in the whole world fitted to rehabilitate its wastes and reconstruct its shattered industries.

America has a gigantic task before it—not only to feed practically the whole world, but to rebuild a great portion of it. The real business men, the men of creative genius and untiring skill, realize the enormity of the job they must undertake. They know that if the U. S. meets the test, a period of wonderful prosperity is open at its door. The one problem that confronts the business executive to-day is that of labor—*skilled* labor. Can we turn out enough trained men to meet the tremendous demand?

In no other field is the need of thoroly trained men more apparent than in the electrical world. On every side comes the cry for the trained electrician, the man of action, with vim and vigor and the "knowledge of how to do things." Daily we read of the marvelous accomplishments of the wonder of the age—ELECTRICITY. This power in the business life of to-day will play a leading rôle in the world's reconstruction. The United States is rapidly developing its own natural resources and enlarging its field of endeavor—to say nothing of the vast power houses, the new electrified railroads, and the thousands of other electrical needs of Europe. It is to the young man of to-day who is now considering what vocation to take up and who will be the worker of to-morrow, that we look with expectant eyes.

Dr. Charles P. Steinmetz, Chief Consulting Engineer of the General Electric Company, has said that, "The world needs men who know something of electricity, of the operations and control of electrical power. It needs men more every year, its very existence depends on the electrician."

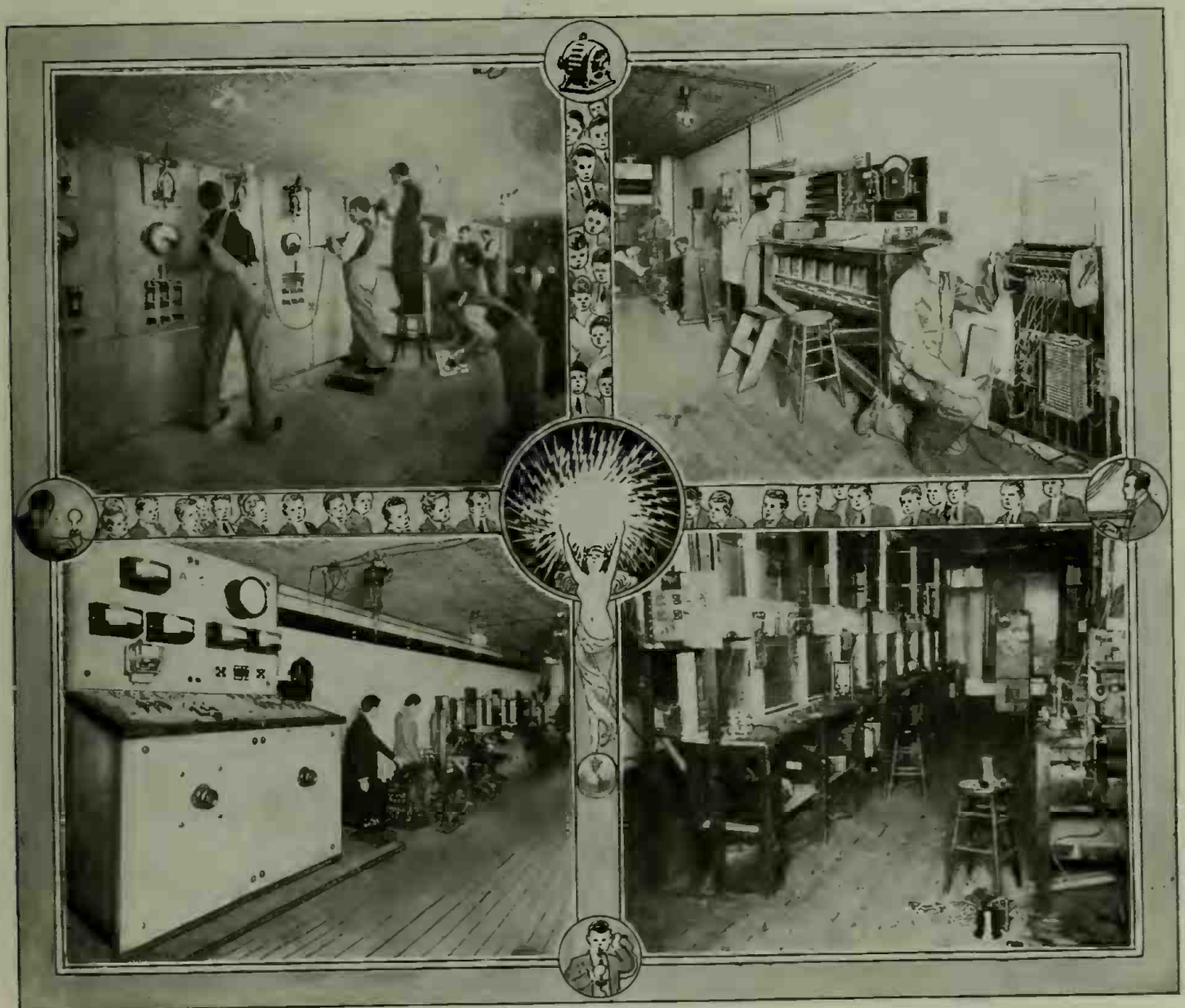
In the greatest city of the United States, in its very heart is located a school, whose aims and purposes are to teach men, both young and old and from every walk of life, the How and Why of electricity by the greatest teacher known—that of getting knowledge by actual experience.

A trained man is the finished product, one who understands the problems coupled with a broad experience in electrical engineering.

Theory is a necessity, but this busy world of ours wants more than theorists. He who is able to supplement his theoretical knowledge with the proper proportion of practical, do-it-yourself-knowledge, is the man who will get most of the world's rewards.

The school which has thus revolutionized educational methods has struck the happy medium of combining enough theory with practical work to turn out first-class electricians in the shortest possible time.

(*Continued on page* 153)



In the Top Left Photo We See the Prospective Electrician Learning the Art of Switchboard Construction. He Takes Apart, Puts Together and Connects These Boards, by Bus-bars and Other Wiring Methods. In Our Lower Left View We See These Same Men Being Initiated Into the Mysteries of Generators, Motors and All Forms of A. C. and D. C. Machines. Top Right Shows Our Men Grasping the Details of Modern Electric Vehicles. The Men Assemble, Connect and Run Complete Systems and Also Take Care of the Storage Batteries. Lower Right Shows Where the Embryo Electrician Starts on His Upward Climb in the Mysterious Art of Electricity. Here He Learns How to Connect Batteries, Bells, Buzzers, Telegraph, Telephone and Fire Alarms as Well as Many Other Systems of Inter-communication.

www.americanradiohistory.com

Close-Ups of New Scientific Movies

By GEORGE VANDERBILT

THESE up-to-date crooks had the best of everything, including a regularly equipt radio set, but ere they could use it to decoy ships to disaster, big and powerful "Reggie" had the strangle hold on our pirate Wireless Operator. Tho there were no women present, curls were in vogue in the radio shack, as can be seen in the accompanying photograph, showing the artistic hook-up of the set.

Whatever else may have happened to him, he had brawn and muscle! That, and that alone, saved Reginald Jones in the new Fox Film, "Never Say Quit," when he ran afoul of a gang of crooks on board a ship in search of sunken treasures.

The "JINX" was his constant "pal." It started by his being born on a Friday, and the thirteenth to boot, and so together some one had made a big mistake. From the very first he was in trouble, his childhood was one nightmare. As he grew older it only made matters worse.

The Rôle of Electricity and Science in the Modern Photoplay

As the gay and dashing Lothario he goes to a ball, and gets into a scrap over a girl and has to exit via the house-tops to escape the "Bulls."

Good luck seems to beckon when a rich aunt dies and leaves him a fortune. But not for Reginald! He must come to her funeral in order to get the money, and the jinx sees to it that he never gets there. On his way he is robbed by pickpockets, his eyes are blackened, and he is bruised and walloped until he thinks his head is in his shoes. He misses his train after many harrowing adventures, and so the fortune goes to charity.

To replenish his empty wallet, Reginald sets out on a voyage after sunken treasure. Adventures befall him again, for the crew turns out to be a gang of crooks. They are bent on robbing a millionaire and his daughter, who are on board.

Reginald saves the millionaire and his daughter from the dire fate the crew has in store for them. He wins the girl's hand, heart and soul, and in matrimony he believes he has conquered the jinx at last. But a year later Reginald and his wife are blest with triplets, and Reggie, superstitious cuss, ventures to believe that the jinx has had something to do with that.

In our next movie we come upon a fair and real live "Radioette." The beautiful daughter of an over-indulgent and elderly millionaire. She is abducted by a band of crooks and taken to a desert island to await the payment of a fabulous ransom by her father—or on his failing to pay it, to forfeit her life. BUT—she knew "Wireless," or, as us "hams" now call it, "Radio," and thru this knowledge outwitted the desperadoes' well-laid plans, gaining a hubby thereby, as can be seen in Metro's latest photo-

(*Continued on page* 161)



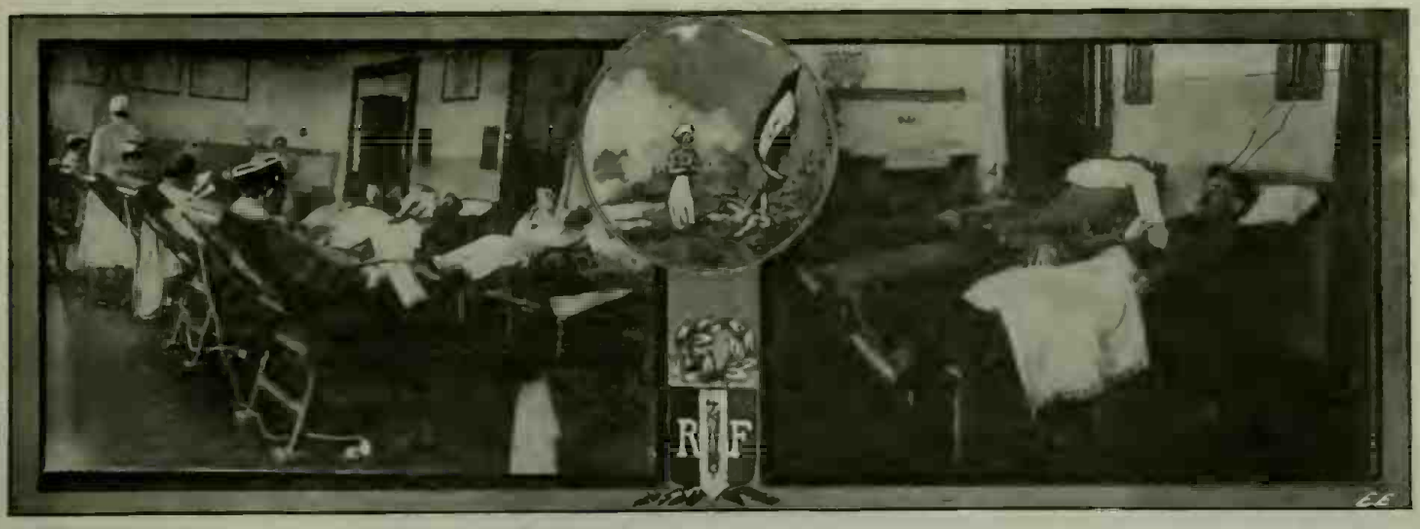
The Well Muscled George Walsh in the Fox Film "Never Say Quit" Putting an End to the Bold Crook's Machinations. Note the Radio Outfit.

We Look Pretty May Allison Over, in Metro's "Island of Intrigue" at the "Wireless Piano". Added to That the Automatic Is Most Annoying to the Villain's Optic Nerve.

One of the "Wolves of Kultur" Rendered Senseless in Pathe's New Series. The Introduction of the Large Radio Direction Finder Is of Special Interest.

Another of the "Wolves of Kultur" Ready to Send Off the Death-Dealing Radio Torpedo and Slowly Counting the Seconds. He Is Perhaps Unaware That a Police Whistle Is "Passe" by Most Villains.

www.americanradiohistory.com



Electro-Therapeutic Ward at Bordeaux, France, Showing the Application of Intensified Rhythmic Faradization by Professor Bergonié. Altho Muscles Are Contracted Violently During This Faradization, the Patient Feels Hardly Anything.

A Wounded Soldier With a Fractured Leg Undergoing Intensified Faradization In Order to Reconstituate the Muscles of the Calf of His Leg. He Was Able to Walk Without a Cane Within Fifteen Days After the Treatment Started.

Paris Letter

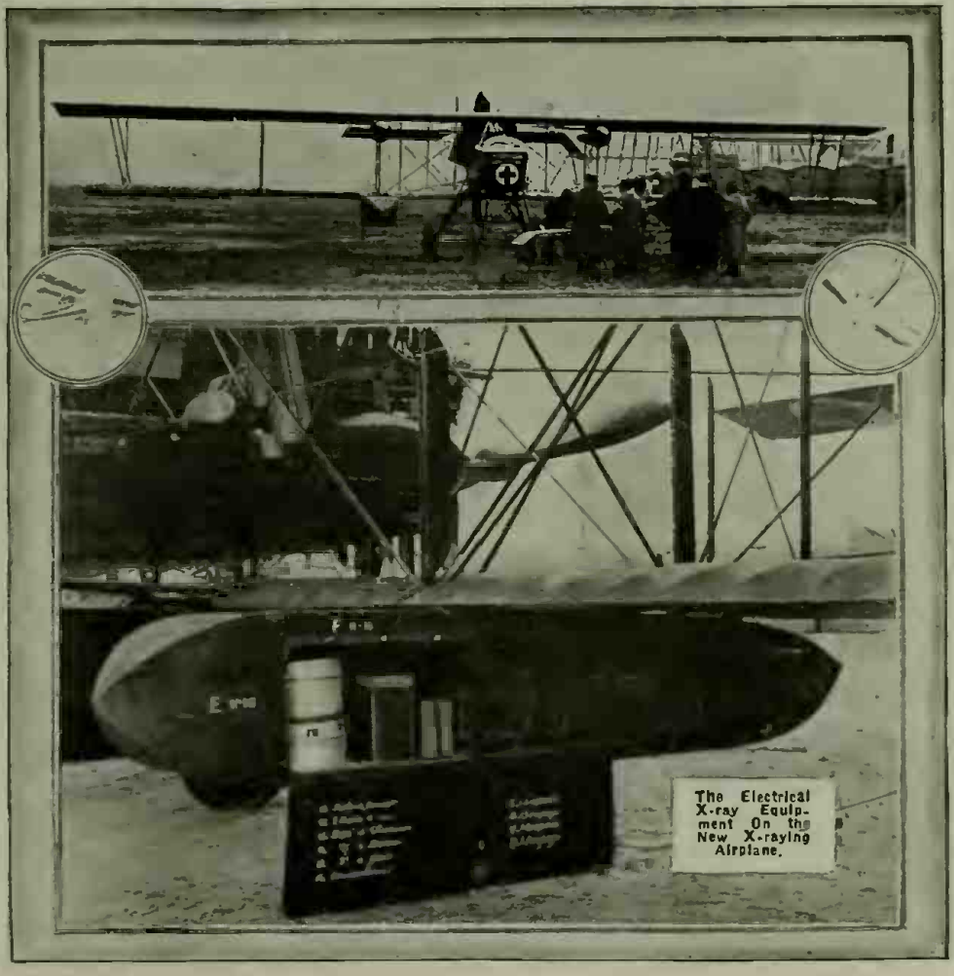
By JACQUES BOYER
Paris Correspondent, ELECTRICAL EXPERIMENTER

Paris, April, 1919.

X-RAYING AIRPLANE.

MANY great personalities of the aeronautical world have recently witnest the baptism of the "Aérochir" (from aëro and chirurgeon) at Issy-Les-Moulineaux, near Paris, at the trial of an airplane used for X-raying chirurgical purposes.

The new machine came thru the air from Ville-Coublay, having been in the air for over an hour. This flying ambulance, which can bring medical aid rapidly to the wounded, was designed by MM. Nemirovsky and Tilant and is painted with the conventional Red Cross. It carries all the chirurgical material such as instruments for operating, sterilization, etc., all X-ray machinery, such as a spark coil, transformer, X-ray tubes, fluoroscope, as well as the personnel capable of putting the apparatus to work immediately. The attendants comprise a pilot, chirurgeon and a professional X-ray man. The entire apparatus does not weigh more than 700 kilograms. In peace times a machine of this kind may be used with great success in case of catastrophes, railroad accidents, explosions, etc., which may take place in an isolated spot. In the colonies the "Aérochir" will find large application; colonies naturally not being well populated and having few doctors, located in widely separated points, it will be an easy matter to bring quick aid to patients by means of the "Aérochir," to which distances are immaterial.



The Electrical X-ray Equipment On the New X-raying Airplane.

DR. BERGONIÉ'S NEW RHYTHMIC FARADIZATION.

Many wounded soldiers in the war have seemingly recovered, with the exception of certain muscles which refuse to resume their normal work. Formerly the best method to make these muscles return to normal conditions would be by means of continuous muscular work, as suggested by Dr. Bergonié. One method required professional work or agricultural occupations every day for an indefinite time of the affected members in order to reconstruct the muscles and put them on a normal basis once more. Unhappily, it is not always possible to do this, be it on account of nervous fatigue which sets in rapidly; be it by unseasonable weather, or also where the muscles are so situated that bodily work will not profit them greatly.

For that reason, Dr. Bergonié has brought into being what he calls an *intensified Rhythmic Forodization*, which makes it possible for the wounded to develop their muscles in a remarkably short time. Moreover, such treatment gives the muscles a very strenuous involuntary exercise produced directly by the electrical current.

From the electrical standpoint, the alternating rhythmic faradization utilizes very sharp waves of a frequency giving rise to a moderate convulsing action (50 to 55 per second). The current is produced by a special coil with a well-regulated vibrator, the coil itself giving no sparks. The waves under pressure of between 12 and 14 volts maximum have a periodicity of 15. By means of a standard metronome the current is dis-

(*Cont. on page* 151)

www.americanradiohistory.com

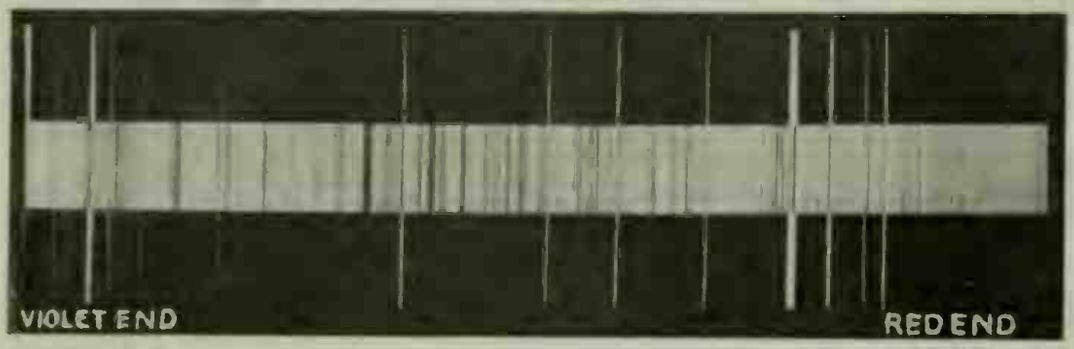
Popular Astronomy

By ISABEL M. LEWIS

of the U. S. Naval Observatory

The Evolution of the Stars

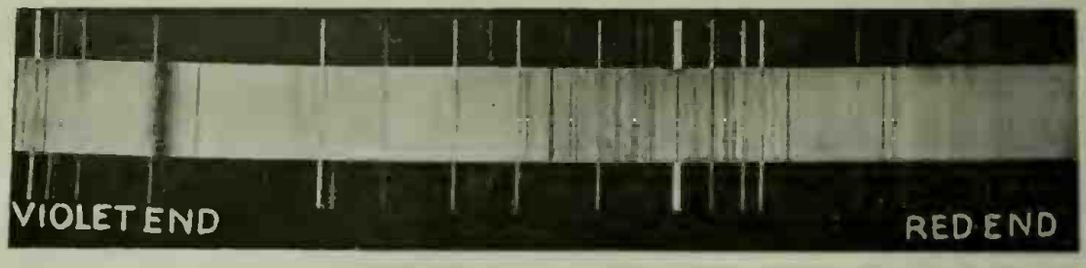
If a ray of white light from the sun is past thru a spectroscope, which consists essentially of a glass prism or cham of prisms, it is broken up into its component rays of different wavelengths which arrange themselves in an orderly band of variegated colors: red, orange, yellow, green, blue, indigo and violet gradually blending one into the other crost by a great number of fine dark lines known as the *Fraunhofer lines* or absorption lines of the solar spectrum. The shortest wave lengths lie in the *violet* and the longest wave lengths in the *red* end of the visible spectrum. Below the red lie the infra-red and beyond the extreme violet the ultra-violet rays, both invisible to the human eye but rendered visible to a certain extent by means of photography and specially dyed plates.



According to the first law of spectrum analysis an incandescent solid or liquid or gas under very high pressure gives a continuous spectrum, that is, an unbroken band of variegated color. If however, cooler gases intervene between us and the source of the continuous spectrum, they will absorb from the light beyond the particular rays of which they themselves consist and as a result the continuous band of color will be crost by a series of dark lines called *absorption lines*, belonging to the cooler intervening gases. To every chemical element belongs its own characteristic lines in this spectrum and no two elements ever have any line or group of lines in common.

Applying these principles to the sun, the central core, consisting either of an incandescent solid or liquid or gas under high pressure (most probably the latter), emits the continuous band of light known as the *continuous spectrum*. The cooler gases of the surrounding solar atmosphere absorb from the light of this central core the particular rays of which they themselves consist and thus produce the multitudinous fine dark lines known as the absorption lines. It is upon the position of these dark lines that we depend for our knowledge of the physical condition of the sun, for obviously, there is nothing in the continuous band of color itself to give us any clue to the nature of the substances from which it originates. If, as sometimes happens, the continuous spectrum is crost by *bright* lines instead of *dark* lines, it shows that the intervening source of light is hotter than the source beyond. An incandescent gas at low pressure, such as incandescent hydrogen, gives a bright-line spectrum or emission spectrum consisting of bright lines upon a dark background. Such a spectrum shows that the body emitting it is a true gas. Nebulae give such a type of spectrum indicating that they are true gases. If, moreover, the central core of the sun could be suddenly blotted out the dark lines of the solar spectrum would immediately appear as bright lines on a dark background, for they belong to incandescent gases, the absorption lines appearing dark by contrast with the more intense light beyond.

2. Eta Leonis—Helium Approaching Solar Type (Harvard Type A0). Hydrogen Lines Have Increased in Intensity. Helium Also Visible But Fainter Than Above and a Few Metallic Lines Begin to Appear.



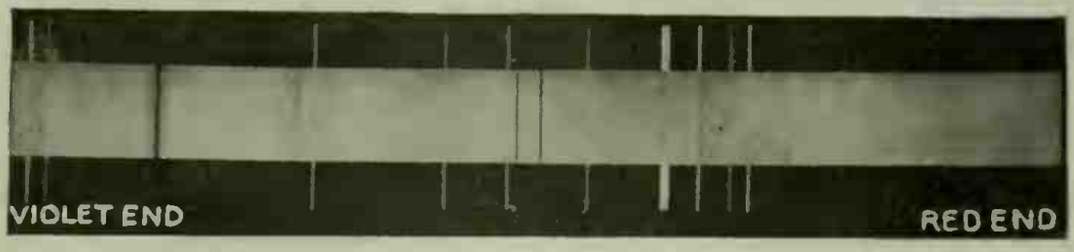
It is upon these principles of spectrum analysis that our knowledge of the physical constitution of the stars depends. The sun is simply one of the stars and the solar spectrum is duplicated almost line for line in a certain type of star known as the *solar stars*. Most of the chemical elements existing in the sun's atmosphere have been identified by comparing the dark absorption lines in the solar spectrum with the lines in the spectra of terrestrial elements produced in our laboratories. It has been found *that all the elements that exist on our own planet occur also in the sun* and the same elements that exist in planet and sun enter into the composition of the stars.

1. Beta Geminorum (Pollux) Solar-type K, Slightly More Advanced in Type Than Our Own Sun Which Belongs to Type G.

By passing a ray of light from a far distant star thru the spectroscope and producing its spectrums, it becomes possible to compare the positions of its characteristic lines with the lines of the same elements in the solar spectrum. It is in this way that we learn the nature of the atmospheric gases of the stars. It must be remembered that it is the *surface* conditions of the stars and their *outer* gaseous envelopes that can be studied by the spectroscope. From the star's deep interior we receive only the continuous band of color.

The first general classification of the stars according to their spectra was made by Father Secchi, the Italian astronomer, and was publisht in 1849. It was the result of a study of the visible portion of the spectrum with a small telescope and only stars showing dark absorption lines were studied. Since that time more elaborate classifications of stellar spectra have been made—chiefly at the Harvard College observatory, where many thousand spectrograms (photographed spectra) have been studied and classified. The Harvard classification of star spectra has now been generally adopted by all astronomers. The importance of the work done along this line at the Harvard Observatory can be judged by the fact that the Henry Draper catalogue of stellar spectra now in process of publication by this observatory *gives the spectra of two hundred thousand stars.*

The first two volumes of the catalogue, which consists of nine volumes in all, are



1. Rigel (Beta Orionis)—A Helium Star Showing Strong Absorption Line of Hydrogen (to Left) and Helium (Near Center) and Absence of the Metallic Lines Characteristic of Solar Type Stars.

www.americanradiohistory.com

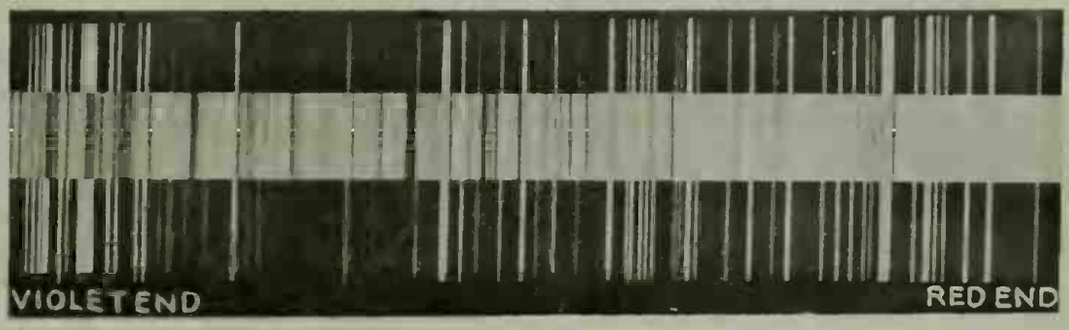
already in print. The great value to astronomy of this monumental work, which was undertaken and completed under the personal direction and supervision of the noted director, Prof. E. C. Pickering, just deceased, can hardly be overestimated. This detailed classification of star spectra shows forcibly that *evolution* is in progress among the stars. As to the exact order in which the evolution is taking place, there is still some doubt, but of the gradual transition from type to type in whatever order the evolution is progressing there can be no doubt. According to the classification of Father Secchi, which is useful for quick and approximate classification, the stars are divided into four classes or types. To Type I belong all the *bluish white or white* helium and hydrogen stars. These stars are believed to be the hottest of all the stars, and their atmospheres consist almost entirely of helium and hydrogen gases. To this class belong the Orion (helium) and Sirian (hydrogen) stars such as Rigel, Sirius and Vega.

Type II consists of the solar stars *yellow or orange* in color, whose spectra are dominated by the absorption lines of hydrogen and the metallic elements. They are generally considered to be lower in temperature than type I stars, and their atmospheres are denser and more extensive and filled with the vapors of many elements. The sun is a star of this type, and to this type also belongs such first-magnitude stars as Capella, Arcturus and Aldebaran. Type III consists of late type stars with banded or fluted spectra due to the presence of metallic compounds, chiefly of titanium oxide which appears to dominate the spectra of stars of this type and indicates a cooler atmosphere than exists in the earlier type stars, since compounds of the elements can only form at comparatively low temperatures. The absorption is strong in the violet end of the spectra of such stars, therefore they are *deeply reddish* in tinge. Antares and Betelgeuse are noted first magnitude stars of this class. Type IV consists of *deep red* stars, whose spectra are also banded or fluted, but the bands are due in this case to compounds of carbon. Their relation to the other types is somewhat uncertain, but they are believed to be connected with solar type stars by a chain of development independent of stars of the third type. That is, some solar stars develop into type III stars, others into type IV stars. Stars of this latter class are all very faint and very distant. It is believed that they are giant stars in absolute magnitude, their faintness being due to great distance.

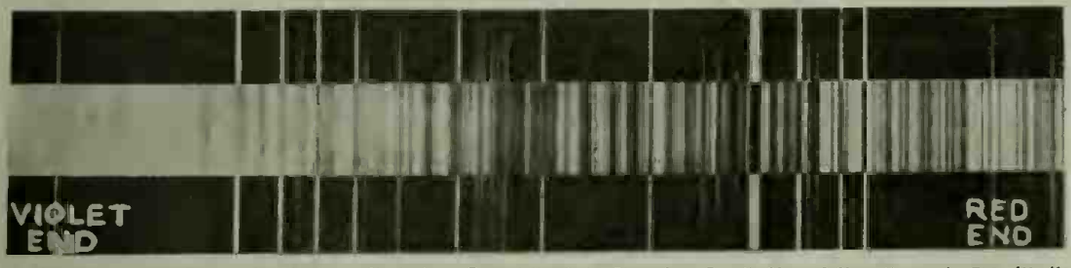
The Harvard classification is much more complete than the above. It rests upon the behavior of certain groups of lines that vary in intensity as the evolution progresses. It also assumes that the evolution of the stars starts from the gaseous nebulae and is in the direction of the late type red stars.

The spectra of the gaseous nebulae consists of bright lines of helium, hydrogen and nebulium upon a dark background. They are therefore true incandescent gases under low pressure. The first link connecting the nebulae with the stars appears to be the bright-line stars not recognized in the Secchi classification. They are referred to as the type O or Wolf Rayet stars in the Harvard notations, and their spectra show a faint continuous background (implying the formation of a central core) crost by a group of bright bands and a series of bright lines, both unknown terrestrially for a long time but finally obtained experimentally by passing a strong condensed discharge thru a mixture of hydrogen and helium in a vacuum tube. The ordinary well known hydrogen series also appears in this type, first as bright lines, but as the type progresses the bright bands and bright lines of both series become dark showing the formation of an atmosphere of cooler hydrogen and helium around the star. With the total disappearance of the bright lines and bands and the strengthening of the dark lines of helium and hydrogen, type O passes over into type B, to which belongs the beautiful blue white helium stars often called Orion stars because so many stars of this constellation are of this type. These stars have the hottest temperature and the rarest atmospheres of all the stars. The only absorption lines prominent are those of helium and hydrogen. There are a number of subdivisions of this type depending upon the relative intensity of the lines of the two gases. Toward the end of the type the hydrogen lines have become more intense than the helium lines, and faint metallic lines have begun to appear until by gradual transitions the hydrogen stars appear known as type A, or Sirian stars, after Sirius, a noted star of this type. The helium lines are now entirely gone and the spectrum of the star is entirely dominated by intense absorption lines of hydrogen. Four strong lines of this element exist in the visible spectrum (see diagram I) and the series extends rythmically far into the ultra-violet. These stars are intense white in color and their atmospheres are composed almost entirely of incandescent hydrogen. As the type progresses the faint metallic lines of the solar spectrum become stronger. The hydrogen lines reach their maximum strength in class A. (See photo of early type stars.) The next type to appear is known as the Calcium or type F group of stars which is characterized by the growing intensity of the lines of the metallic elements, which are now closely packed together in the spectrum, and by the very marked intensity of the calcium bands in the extreme violet and the continued great strength of the hydrogen lines which surpass any of the metallic lines in intensity. (See photo of type F star Procyon). To this class belongs

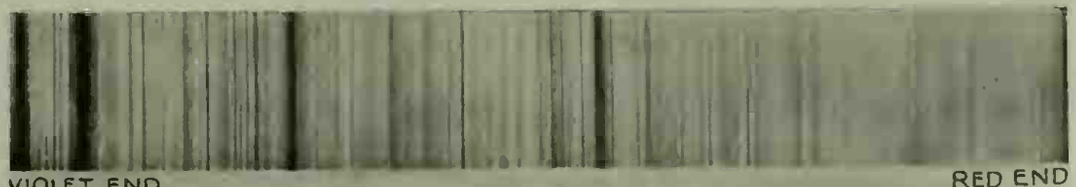
(Continued on page 157)



2. Alpha Tauri (Aldebaran) Advanced Solar-Type K5. Note: The Comparison Spectrum Shown Above is That of Titanium. The Spectrum of the Star is Superimposed Upon the Comparison Spectrum. Note in Above Spectra the Great Intensity of the Lines of the Metallic Elements Which in the More Advanced Types Have Become Stronger Than the Absorption Lines of Hydrogen Which Dominated the Spectra of Earlier Type Stars. As the Absorption Lines of the Metallic Elements Increase in Intensity the Color of the Star Becomes More and More Tinged With Red. Solar Type Stars Are Cooler (Superficially At Least) and Have Denser Atmospheres Than Stars of Type I (Helium and Hydrogen Type Stars).



Secchi's Type III, Harvard Type M Star. This Class Is Divided Into Giant (Type Ma) Stars and Dwarf (Type Mb) Stars—Color, Deep Red. The Spectrum Shown Is That of a Typical Giant (Ma) Star of This Class—Betelgeuse or Alpha Orionis. The Portion of the Spectrum Shown Is in the Blue Region. Note the Heavy Absorption in This Portion of the Spectrum and the Fluted or Banded Appearance Due to the Presence of Compounds of Titanium Oxide (Characteristic Also of Sun Spots and Indicating Comparatively Low Temperature). The Heavy Absorption of the Blue Rays Gives These Stars Their Deep Reddish Color. The Bands or Flutings Are Sharp Toward the Violet and Shade Away Toward the Red. There Is a Fourth Class of Stars Known As Type IV, Harvard Type N or Carbon Stars, In Which the Direction of the Shadings Is Reversed. These Stars Are Also Very Deep Red, Few In Number and Very Distant, the Brightest Known Being Only a Fifth Magnitude Star.



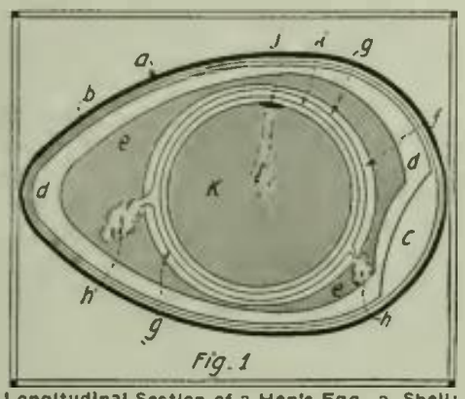
Spectrum of a Calcium or Harvard Type F Star—Alpha Canis Minoris (Procyon) Intermediate Between Secchi's Type I and Type II Stars. Color White Tinged with Yellow. The Portion of the Spectrum shown Runs From the Blue Green At the Right to the Extreme Violet At the Left. The Two Dark Bands At the Extreme Left Are the Strong Absorption Bands of Calcium So Prominent in This Type. The Other Three Dark Lines Are Absorption Lines of Hydrogen. A Fourth Line of Hydrogen Is Also Present So Close to the Second Calcium Band That They Appear Practically As One Band. The Metallic Lines Now Appear Closely Packed Together and of Growing Intensity. This Type of Star Is Dominated by the Absorption Bands of Calcium and the Absorption Lines of Hydrogen Which Are Stronger Than Any of the Metallic Lines.

www.americanradiohistory.com

Practical Chemical Experiments

By ALBERT W. WILSDON

FEW of the millions of people who eat eggs daily are familiar with, and in most cases never concern themselves with the chemical or physiological properties of this form of food. The daily consumption of eggs thruout the world is truly enormous, and the



Longitudinal Section of a Hen's Egg. a, Shell; b, Double Membrane of Shell; c, Air-Chamber; d, Outer, or Fluid Albuminous Layer; e, Thick, Middle Albuminous Layer; f, Inner Albuminous Layer; g, Membrane of the Chalaza; hh, the Chalaza; i, Vitelline Membrane; j, Germ; k, Yolk; l, Latebra. (After Macé.)

present high prices have caused many dealers to preserve eggs till the market is at a high point and then unload them, in many cases with the representation that they are *strictly fresh!* Eggs contain a relatively large proportion of *Proteid* and mineral matter which is used to furnish the salts of the bones, especially calcium phosphate, and also fat, and is one of the most concentrated forms of nutriment.

Proteids serve as a fuel for the body and also provide the important element Nitrogen, which is needed in the case of children for growth, and in the case of both children and grown people, to keep the body in repair.

Strange as it may seem, even eggs, the contents of which are contained in a brittle shell, have had substitutes placed upon the market in the guise of "egg substitutes." Nearly all these are claimed to contain all the ingredients of eggs, but most of them fall far short of these claims. There is a number of so-called *egg powders* offered for making cakes, etc., *which contain no egg at all.* They are composed of other forms of protein matter, usually casein from milk, and colored to resemble the egg in tint.

The average weight of a hen's egg is 60 grams, of which the shell weighs about 6 grams, the white 36 grams, and the yolk 18 grams. Roughly it contains 70% of water, 12% of albumin and 12% of fat.

The substance known as "white of egg" or egg albumin, when separated from the yolk, membrane and shell is a colorless, transparent, thick, sticky fluid, soluble in or miscible with water and is composed almost entirely of albumin, partially dissolved in water.

When the white of an egg is put into boiling water it undergoes a remarkable change, and is said to have *coagulated.* In this state it is insoluble in water and opaque and forms a solid mass, which, however, still contains a large proportion of water. During coagulation it is probable that chemical as well as physical changes have occurred. Thus from the foregoing we see that the white of egg is an extremely unstable and complex substance, its physical properties being so indefinite that it would be almost impossible to say that it was or it was not a definite chemical compound.

Eggs: Their Preservation and Tests

White of egg or egg albumin may, however, be taken as the representative of a group of substances which are classified together as the *Proteids*, or *Albuminoids.* They contain the five elements, Carbon, Hydrogen, Oxygen, Nitrogen and Sulfur.

Egg yolk is composed of albumin, fat, and a phosphorus bearing material of high nutritive value known as *Lecithin.* The yolk of an egg is a much richer food product than the white, containing in addition to the nitrogenous element the fat and mineral bodies necessary to nutrition.

PRESERVATION. Of particular interest to the reader will most likely be the methods of preserving and tests.

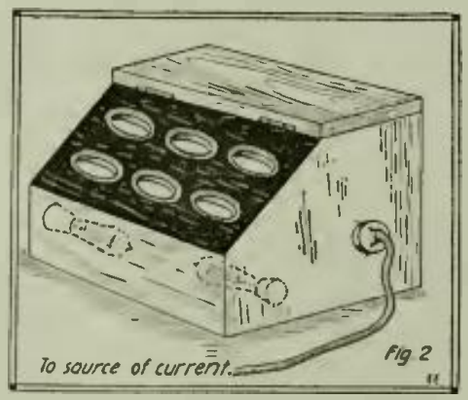
Owing to the porous nature of the shell, the moisture of the contents gradually grows less by evaporation, and the egg loses in weight. Air also passes in thru the shell pores, carrying various microbes, which result in ultimate decomposition and spoiling of the egg. Nature has provided the shell with a thin surface coating of mucilaginous matter, which, however, is easily washed off. This coating tends to partially close the pores, and for best results in keeping should not be removed by washing.

By coating the eggs artificially with a varnish or film of some kind the egg will be rendered impervious to air and water. One of the cheapest, simplest and best of these coatings is *Water-glass.* This is produced by dissolving the substance known as Sodium Silicat (or Silicat of Soda) in water, and applying the same, by dipping the egg into the solution and removing and allowing to dry. The Silicat of Soda which is thus left in a thin film over the surface of the egg penetrates and stops the pores and renders the egg-shell practically impervious both to air and water. This material possesses the property of becoming totally insoluble in water when it has once been dried so that even if the egg is afterwards subjected to contact with water the film is not removed.

One drawback to this method is that eggs so treated break more easily on boiling. This breakage may be prevented by carefully piercing the shell with a strong needle before being put into the water.

Gelatine, vaseline, wax or gum are other substances used for coating or varnishing the egg, tho they are not as efficacious as the water-glass.

Another proposed method is to immerse the eggs in boiling water for twenty seconds with the result that a very thin layer of the egg-white next to the shell becomes

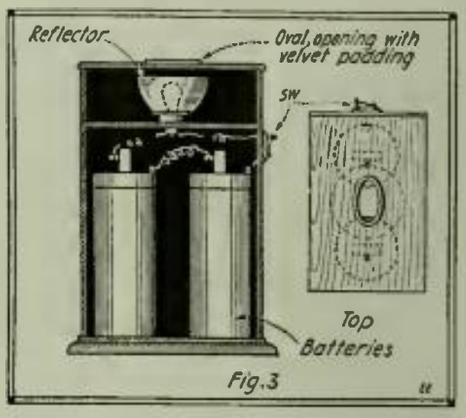


A 110-Volt Two-Lamp Egg Candling Cabinet with a Capacity of Six Eggs. It Can Be Easily Built by Anyone or Purchased as Desired.

coagulated, thus forming an impervious coating *inside the shell.*

PHYSICAL EXAMINATION OF EGGS. Various physical tests have been prescribed for ascertaining the approximate age of an egg.

THE SALT SOLUTION TEST consists of



Battery Type of Egg Candling or Testing Cabinet Which Anyone Handy with Tools Can Easily Construct. The Lamp and Reflector Can be Obtained at Any Supply Store.

placing the egg in a 10% salt solution. **If perfectly fresh, the egg will sink to the bottom. If it remains immersed in the liquid, it is to be considered at least three days old. If it rises to the surface and floats thereon, it is more than five days old.** This test is a rough one, is quickly applied, and will distinguish the really fresh egg from one which is even a few days old, but is useful only for eggs that have been kept in air. Preserved eggs cannot be gaged by these means. It is possible also to apply the sinking and floating tests on a large scale. Salt water tanks of any size may be easily constructed into which hundreds of dozens of eggs may be placed at one time, thus effecting a speedy separation of *sinkers* and *floaters*, and at a minimum expense. There are some instances where a fresh egg will not sink in these circumstances, but such cases are not numerous enough to be of any importance.

CANDLING TEST. The best method of examining eggs for freshness is *"candling,"* the process consisting in placing the egg between a bright light and the eye. **If the egg is fresh it will show a uniform rose-colored tint, without dark spots.** Moreover, there is to be found in the larger end of a fresh egg, between the shell and the lining membrane, a small air cell, occupying *one-twentieth* of the capacity of the egg, which is distinctly transparent. *In an egg which is not perfectly fresh this space, unless the egg is stored with the large end up, becomes filled with egg substances and presents the same appearance as the rest of the egg. If dark spots are found in the egg, it is certain that the egg is not perfectly fresh, and its appearance will be more or less cloudy, being darker as the eggs grow older, becoming in extreme cases opaque.* At the same time the "air chambers" mentioned before grow larger as the age increases. The so-called *"spots"* are eggs which show on "candling" black patches due to fungi.

The best of all tests, however, is to open an egg and examine its general appearance, its mobility, and its odor and taste. Eggs which have been stored some time show a tendency in the white and yolk to run together, and when this phenomenon is observed it may be certain that the egg is not a fresh one, altho no perceptible odor of

(*Continued on page 154*)

www.americanradiohistory.com

Experiments in Radio-Activity

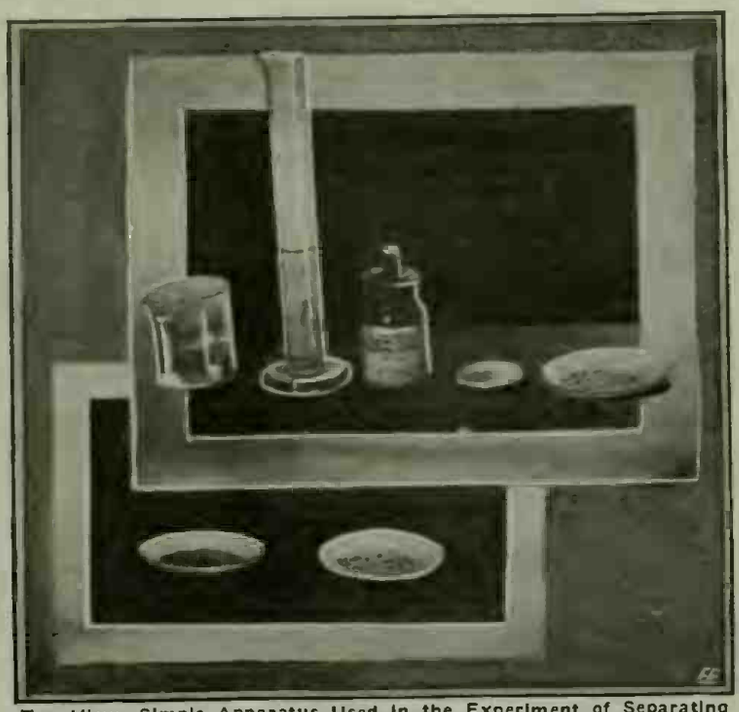
By IVAN CRAWFORD

PART IV (Conclusion)

IN the previous installments of this series the properties of the radiations from radio-active substances have been discust. It is the author's intention in this article to explain the radio-active transformations and to show that in reality *these changes are a transmutation of the elements.* Experiments will be given showing the rise and decay of the active constituents. For a more detailed account the reader is referred to Sir Ernest Rutherford's "Radio-active Substances and Their Radiations."

The disintegration theory was first proposed to account for the continuous production of thorium X from thorium compounds. This change from thorium to thorium X is in reality a breaking down of the thorium atom which has an atomic weight of 232, and the formation of the thorium X atom which has an atomic weight of 224. This is accomplished by the emission of two alpha particles. There are, however, two intermediary products, namely, mesothorium and radiothorium. Radiothorium is, however, chemically inseparable from thorium and mesothorium inseparable from thorium X, and are in reality isotopes. The word isotopes is used to designate two substances which have the same chemical properties, but different atomic weights. The rate of decay of an active substance may be calculated by using the formula given in the second article for the retardation of alpha particles. In this case I_e is the initial activity, I_t is the activity after time t, e is the base of the Naperian logarithms (2.7182), and λ in the case of thorium X is .19 days. Using this equation the decay curve may be plotted. The two assumptions of the disintegration hypothesis as given by Rutherford are: (1) that there is a constant production of fresh radio-active matter by a radio-active substance, and (2) that the activity of the matter so formed decreases according to an exponential law with the time from the moment of its formation.

An experiment proving the disintegration hypothesis will now be given. About 5 grams of thorium nitrat or some other thorium salt are dissolved in water. This solution should be left standing for about 2 days for reasons which will be given later. The thorium nitrat solution is then diluted to about 200 c.c. The solution should be heated and ammonia added in excess. The thorium and some impurities are precipitated as a hydroxid by the ammonia. The thorium X, however, remains in the solution with the mesothorium. The solution is now filtered and the precipitat dried for future use. The filtrate should be boiled down to dryness to remove all traces of the ammonia salts. The residue contains the thorium X. The solution when concentrated should be transferred to a watch-glass and dried upon it to facilitate handling. In the accompanying illustrations the apparatus necessary to perform these separations is clearly shown.



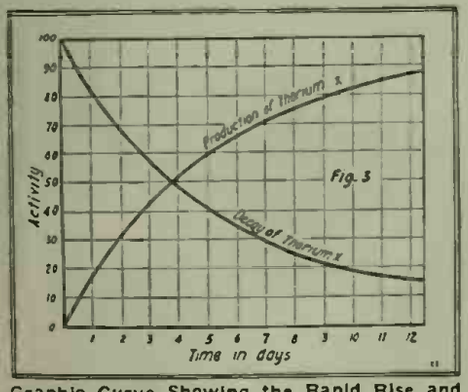
Top View—Simple Apparatus Used in the Experiment of Separating Thorium "X" from Thorium Nitrate. This Experiment Proves the Hypothesis of Radio-active Transformation or the Transmutation of the Elements. Lower View—Watch Glasses Used to Hold Thorium "X."

The reason for letting the thorium nitrat solution stand several days before using had now better be explained. Thorium compounds have been found to give off an active gas known as *thorium emanation.* This emanation when it decays forms an active deposit. In salts this deposit is always present as the emanation is occluded in the solid, and allowed to change into the deposit. This deposit, however, decays in a short time. If the thorium solution were used fresh, the thorium X would contain some of this active deposit, thus causing an initial rise in activity instead of a gradual fall. When the solution is allowed to stand for several days the amount of active deposit remaining is negligible. No more is formed, as the emanation escapes from the open vessel not being held by the solution.

The watch glass or metal plate having the thorium X deposited upon it is now introduced into the radio-active electroscope. The rate of discharge is then noted as outlined in the first article. The activity should then be measured every 12 hours for about 12 days, and the results tabulated. These figures then are the measure of the decay of the thorium X at different periods. These figures may be compared with those calculated by using the equation given in the second article. The results should now be plotted on a graph.

The plotting of the decay curves of active substances is extremely simple, the ordinates represent the activities as determined by means of the ionization current, and the abscissae represent the time in days. In arranging the graph the lower abscissa should be divided into 12 divisions to represent the 12 days in this experiment. The ordinate to the left is divided into 10 parts to represent the change in activity. The initial activity is denoted by 10 and the other activities arranged proportionally on the ordinate. The activity, then, for each half day is marked on the graph by a small circle or dot. A curve joining these circles represents the decay curve of thorium X. Irregularities at the beginning may be caused by the active deposits remaining in the solution.

The thorium nitrat or hydroxid as it is after the chemical reaction can be measured in the same way as the thorium X. It will be found that the thorium hydroxid increases in activity due to the production of thorium X. The curve denoting the rise in activity of the thorium salt is the exact complement of the curve of thorium X. Two such curves are shown in the accompanying graph. They illustrate the theoretical decay and production of thorium X. This experiment shows conclusively that it is possible for one substance to change into another. If this transmutation could be controlled the goal for which alchemists sought would be realized. In this experiment the thorium gives rise to an active substance several thousand times as active, weight for weight, than the thorium from which it was separated.



Graphic Curve Showing the Rapid Rise and Decay Periods of Thorium "X," in Days, as Well as the Relative Activity. The Decay Is Measurable by Means of the Sensitive Electroscope Previously Described.

As the reader goes deeper into the study of radio-activity the question may sometimes occur to him whether or not the property known as radio-activity is limited to a certain group of substances such as have been described here. This question has occurred to several scientists and has been met with various answers. It is, however, merely a subject for speculation, as it is impossible to secure any conclusive experimental evidence. The reason for this is apparent, as the rate at which they would give off rays is so small and their lives so long that they would have to be observed over millions of years to detect any visible change.

Radio-active compounds are being used more and more in modern every-day life. What was at first merely a peculiar phenomena is now an important branch of science. Prominent scientific magazines and institutions are now regarding radio-activity as a separate and distinct science. Large laboratories have been established for the study of this phenomena. Thousands of dollars have been spent in the establishing and equipping of factories for the extraction of uranium and radium from the carnotite. It has found extensive use in large hospitals for the cure and treatment of cancers and skin diseases. This line of research should appeal to every experimenter of the present day. It has given

(*Continued on page* 151)

www.americanradiohistory.com

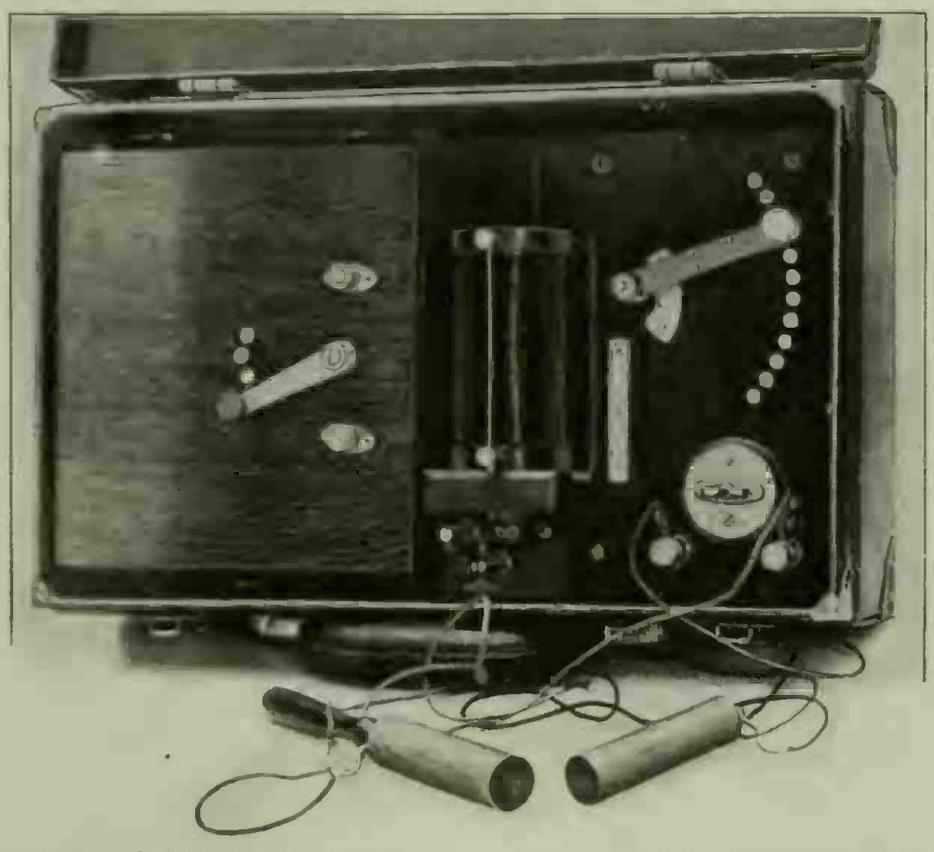


THE CONSTRUCTOR



How to Build an Efficient Medical Coil Set

By H. WINFIELD SECOR



Appearance of Finished Medical Coil Set in Carrying Case as Built by the Writer. This Coil Is Adapted to All Kinds of Testing Work, Besides the Treatment of Various Bodily Ills, Such as Rheumatism. The Primary, Secondary or Tertiary Current and Combinations of Them Are Controlled by a Double-Pole Switch.

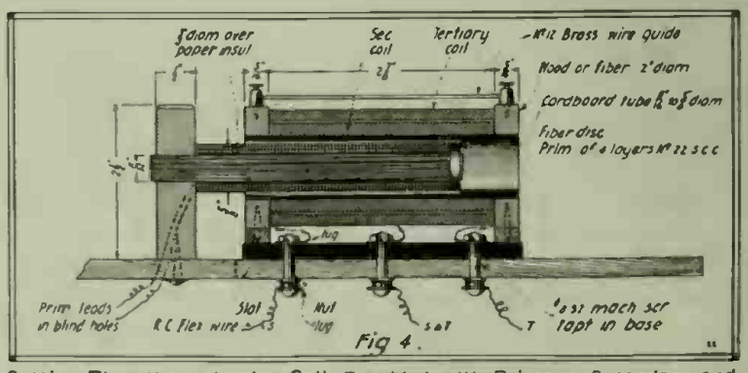
THE aim of this article is to give the constructional details so that anyone interested in shocking or medical coils may build his own apparatus at a slight cost. The outfit will produce equally as good results as any of the commercial apparatus, for all usual requirements. Medical coils are widely used for the treatment of rheumatism and other bodily ills and pains, besides furnishing lots of amusement and fun for the young folks. Not only this, but such a coil as the one here described lends itself very well to many kinds of testing, and it also can be used for telegraphing along railroad tracks for several miles, after the manner of the U. S. Signal Corps buzzer sets. We will take up the construction of the individual parts of the apparatus in detail.

Induction Coil.

The induction coil used in the present apparatus need not be as carefully insulated and constructed as that intended for producing sparks with corresponding high potentials, which constantly tend to break down the insulation between turns and between layers of wire. As the detail drawings show, the usual secondary coil is supplemented by a second fine wire winding, known as the *tertiary*, which is wound exterior to the usual secondary winding. The primary winding and the annealed soft iron wire core is mounted rigidly in a stationary block, made of mahogany or other hard wood, or else it may be cut out from a piece of black fiber, bakelite or hard rubber, whichever may be the handiest material for the builder. This primary supporting block has a hole drilled thru it, having a diameter of 11/32 inch, in which the iron wire core is to be emplaced. To make the core, you will require the softest iron wire you can procure, about No. 22 to 24 gage, measuring about 4 inches in length. The wires should be as straight as possible, and they are mounted in the upright block by placing as many of them thru the block as you can, gradually increasing the number in the hole by sticking some here and there around the outside and in the center, until as many wires are in the bundle as you can push in thru the hole. The core may be finally tightened up by driving a few small brads thru the front end and clipping these off with a pair of pliers. Afterward this core face against which the vibrator is to operate is filed off smooth, but left projecting from the block about ⅛ inch.

The next step is to insulate the long leg of the core projecting from the block, and this is done by winding some thin linen or silk tape along the core, lapping the tape slightly. A daub of glue or a piece of thread will hold the final convolution of tape. The block should previously have had two 1/16-inch holes drilled up from the base with a hand drill or drill press, thru which the two primary leads may pass without being seen. After passing thru one of the primary leads, so as to leave about 6 inches projecting and then coiled out of the way, we may proceed to wind the first layer of the primary. This is wound as evenly as possible, and, in all, four layers of the primary wire (No. 22 S. C. C. or enamel magnet wire) are put on, bringing out the final lead from the fourth layer thru the remaining hole in the upright. This coil may then be immersed in molten paraffin wax, or it may be given a coat of thin orange shellac. To give a finished appearance, a layer of black paper may be glued around it.

The secondary and tertiary coils are wound on the bobbin, as shown in Fig. 4, a wrapping of three layers of paper being placed between them. In winding the layers of these two coils, the length of the layer is made a little shorter than the bobbin, leaving a space of about ⅛ inch at each end, and a layer of thin paper, preferably paraffined paper, is placed between every layer. The size of wire for these two coils is No. 36 B. & S. gage, S. C. C. or enameled insulation. In bringing out the leads from this fine wire, it is the best practise never to rely on a single strand of this small size, which may easily break and cause no end of trouble; therefore several strands of



Section Thru the Induction Coil, Provided with Primary, Secondary and Tertiary Windings. The Tertiary Coil Is Wound Outside the Secondary and Yields a Mild Current, Very Desirable in Electro-Medical Applications.

www.americanradiohistory.com

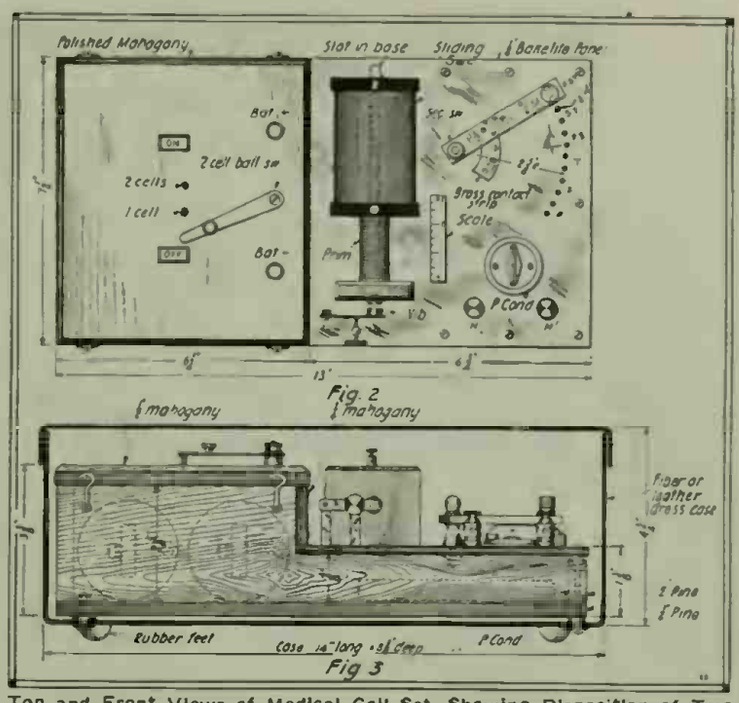
the wire should be doubled up to form a sturdy flexible lead, which should be given one or two wraps around the form and tied with a piece of thread. The fine wire forming the winding is then soldered to this heavier lead. A small winding jig, comprising two wooden uprights mounted on a base together with a piece of heavy iron wire, bent so as to form a handle or crank, and a piece of round wood such as a piece of shade roller, will serve to support the secondary bobbin while it is being wound. Proceed to wind on ten layers of the specified wire for the secondary, insulating each layer from the other by a wrapping of paraffined or other paper (but not newspaper) and when the ten layers have been wound on, the joint or common lead shown in Fig. 1 should then be put in place and the wire soldered to it. After winding three layers of paraffined paper around this coil we may proceed with the winding of the *tertiary*, or third coil, which comprises eight layers of wire, each layer separated by a wrapping of paper between. The third or outer lead, coming from the free end of the tertiary winding, completes this unit, and the coil may be finished with a few wrappings of stiff paper to protect it and give it a smooth cylindrical form. The finishing coat may be a wrapping of thin hard rubber, or simply some black paper, which may be later varnished or coated with some black shellac to correspond with the bobbin ends, as the builder may desire.

The induction coil is clearly illustrated in section by the diagram in Fig. 4, and the method of carrying the three connections from the secondary and tertiary windings is simple and efficient. Instead of the older method of providing sliding shoes and metallic rails, the writer has found it much simpler and more reliable, with no chance of intermittent makes and breaks in the current applied to the patient, to secure the three leads coming from the coils to three 8-32 machine screws threaded thru the fiber or bakelite base of the coil in the manner shown. The secondary unit, as will be perceived, is permitted to slide back and forth by virtue of the slot cut thru the wooden base of the cabinet as disclosed in Fig. 2. Three rubber-covered stranded leads such as lamp cord are firmly soldered to three lugs, clamped against the heads of these machine screws by nuts under the base, as shown. It is well to place a metal washer behind the nut, and the screws are then past thru the slot in the cabinet base and screwed into the bakelite base supporting the coil. The secondary and tertiary leads are preferably soldered to three metal lugs

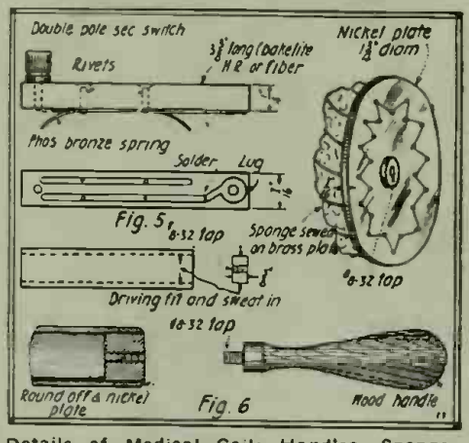
Switch Details.

There are several switches used on this medical coil outfit. (The condenser and switch are optional, and are used mostly for producing a very strong current for shocking purposes.) There are also provided a three-point lever switch for the three positions of "off," "one cell" and "two cells" of dry battery, and a special *bi-polar* secondary switch.

The only special part which needs explanation in detail is the bi-polar secondary switch, and this is illustrated in detail in Fig. 5. The lever of this switch may



Top and Front Views of Medical Coil Set, Showing Disposition of Two Dry Cells. It Works Very Efficiently on One Cell, as Proved by Tests. The Secondary Unit Is Movable.



Details of Medical Coil: Handles, Sponge, Electrode and Bipolar Switch.

be made from a piece of ¼x½-inch bakelite, hard rubber or fiber, preferably black in color. It is not necessary to give here the fractional dimensions for the phosphor bronze contact springs, as their size may be judged from the drawings, and each constructor will make these a little different possibly. They should in any case be approximately ⅛ inch in width and spaced 3/16 inch apart, so as to give as high insulation as possible between them. One of these springs remains flat at the rear, and is soldered to a brass lug, so as to be connected with the central supporting posts of the switch lever in the manner apparent. The second spring bends downward at the rear, and makes contact with an insulated brass segment, shown at Fig. 2, and which forms the second pole of this switch. The necessity of this switch will be evident from the diagram of connections, Fig. 1. The springs on the secondary switch may be of phosphor bronze, German silver, or hard springy brass, and can be quite light.

The secondary current distributing switch gives six different forms of current, namely, primary—secondary—tertiary—primary and secondary—secondary and tertiary—primary, secondary and tertiary—and therefore requires twelve contact points, which are spaced 11/32 inch apart.

Vibrator.

The vibrator is best removed from some cheap medical coil, or else made up by removing the armature spring from a buzzer or bell, which already has a platinum or silver contact mounted in the end of the spring. The vibrator contact screw and spring are supported on two round brass uprights, threaded for machine screws at the base, these uprights being made of about ¼-inch diameter stock. The spring should be about ¼ inch wide and fairly thin. It may be of steel, spring brass, phosphor bronze or German silver. The contact points, that on the spring and the point in the end of the vibrator adjusting screw, are preferably formed of small platinum points, or they may be the new tungsten points. Silver is frequently used, altho it is not very commendable for the purpose. These contact points are generally obtained from old bells or other electrical apparatus. The iron armature on the end of the vibrator spring, for use with this form of coil, should be about 5/16 inch in diameter and ⅛ inch thick. It may be riveted or soldered to the vibrator spring. It should be mounted so that the armature normally is about 3/32 inch from the iron core. (*Continued on page* 150)

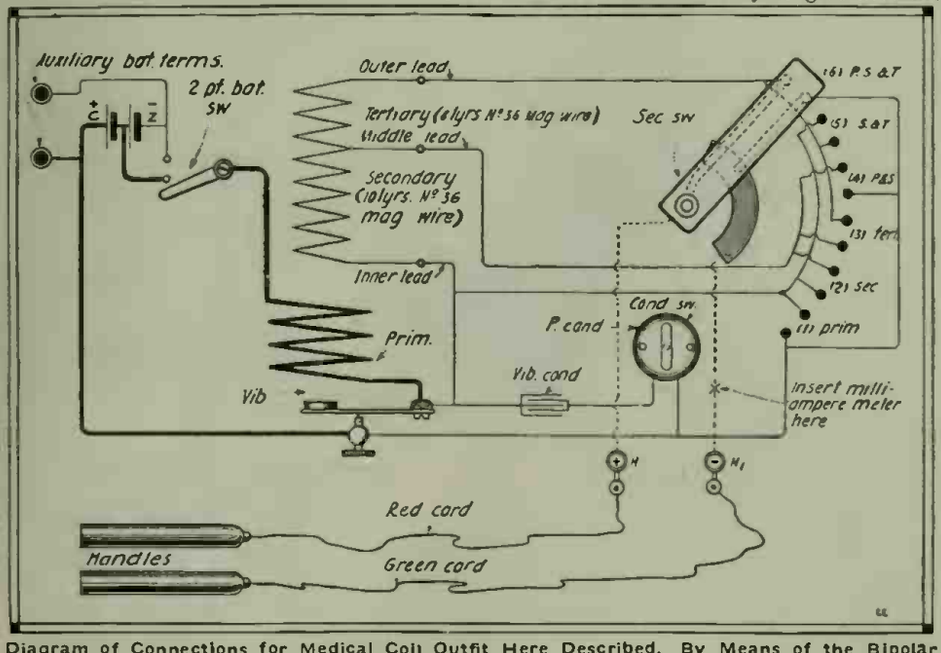
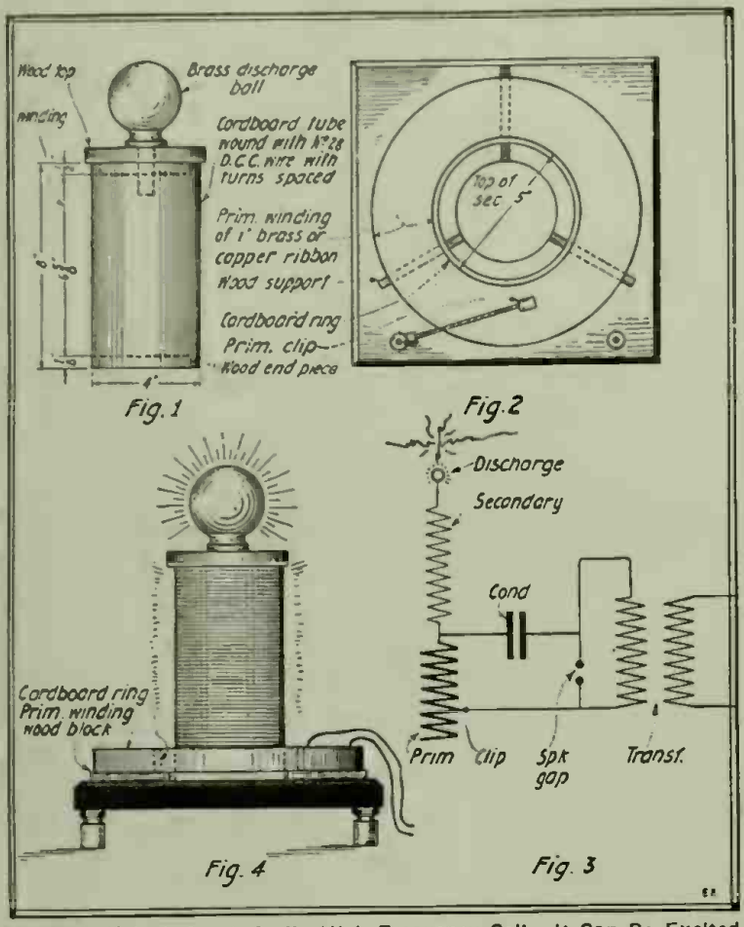


Diagram of Connections for Medical Coil Outfit Here Described. By Means of the Bipolar Current Controller any Modification of Primary, Secondary or Tertiary Current Is at Once Available.

www.americanradiohistory.com

A Small High Frequency "Oudin" Coil



An 8- to 10-Inch Spark Oudin High Frequency Coil. It Can Be Excited by a One-quarter K. W. Step-up Radio Transformer or 6- to 8-Inch Spark Coil.

The high frequency transformer here described is of the *Oudin* type. All that is necessary to use in conjunction with it are a small wireless transformer or spark coil, a high potential condenser, and spark gap. The discharge obtained when the coil is excited by a ¼ K.W. transformer will be from nine to twelve inches in length, while the spray discharges will reach out to still greater lengths. The results obtained with this small coil will thoroly repay the builder for the few hours spent in the construction of this simple, yet intensely interesting piece of apparatus.

The secondary of the transformer is shown in Fig. 1. The cardboard tube, upon which the wire is wound, might well be a round "Quaker Oats" box cut to length. It should be well shellacked inside and out, so as to keep out the moisture. Two wooden ends should be turned or sawed out, and for the sake of appearance should be nicely stained and varnished. A discarded ball from a brass bed will be found to suit very well for a discharger. The wire for the secondary should be numbers 28 to 30 B. & S. D.C.C. or S.S.C. wire. The winding must be done on a lathe or else on a simple winding rig, as it cannot be evenly wound by hand. The turns are separated with a thread wound on with the wire. After the wire and thread are wound, the whole should be given two or three liberal coats of shellac (or better, "armalac"). The upper end of the winding should be fastened to the brass discharge ball. This finishes the secondary coil.

The primary is very easily constructed. It is made of one-inch copper or brass ribbon. The inside turn is taped to a cardboard ring, about 5 in. in diameter, and one inch high. This is shown in Fig. 2. The ribbon should be wound tightly, the turns separated by thin corrugated paper, such as used in packing boxes. The strip of paper should be about ⅝ inch wide, so as to allow sufficient surface of the ribbon exposed to make a variable contact with the helix clip. After nine or ten turns have been wound, the spiral should be tightened and taped on the outside. This makes a quite firm winding. The inside turn is connected to the lowest turn of the secondary, see diagram Fig. 3. Also a wire is led from this connection to one binding post. The clip is connected to the other post by a piece of high tension cable. The primary rests on wood supports, which may be of any convenient size. The base should be of ¾ in. wood, and 11 inches square. The edges should be beveled. Porcelain knobs are glued under the corners by means of wooden dowels inserted into the base, as shown at Fig. 4. The complete hoop-up is shown at Fig. 3. Fig. 4 shows the transformer assembled. In operation, the clip should be moved from turn to turn, until the best discharge is obtained. It might be well to say that the current from the secondary is of such high frequency that it is entirely harmless when taken thru the body, providing the spark is allowed to jump to a piece of metal held in the hand, and not to the skin direct.

Contributed by G. W. COOKE.

An Electro Harp

[*The idea here described and illustrated is the "germ" of the marvelous electrically played "choralcello"—the piano that gives absolutely pure music, owing to the fact that the strings are set into vibration by electro-magnets, not by striking them with mechanical hammers, as in the ordinary piano. With such electrically played instruments it is possible to produce "sustained" notes of wonderful purity. Those interested in this work will find that each string must be vibrated by its own magnet coil, and each coil excited by an alternating or pulsating current having a periodicity corresponding to the natural frequency of the particular string played. A buzzer specially tuned for each string may be experimented with.—Editorial note.*]

Any one possessing a harp or zither and a few odds and ends to be found around any amateur work-shop, may make a most pleasing and interesting instrument.

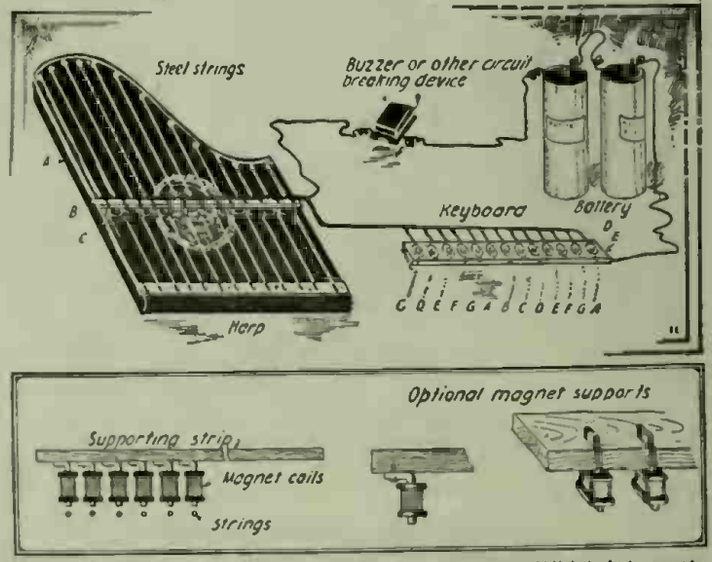
As shown in the accompanying drawing A, is an ordinary harp having steel strings. B is a wood or fiber strip on which the required number of electro-magnets, C are mounted: i. e., as many magnets as there are strings on the harp. These are suspended so as to cover, but *not touch*, the steel strings. Suitable electro-magnets are made from telephone receiver pole-pieces, which can be purchased from any supply house. A corresponding number of push buttons D, are arranged on a separate board E, serving as a key-board. The push buttons D, are lettered according to the strings they control.

The connections are as shown, each magnet being placed in series with its push-button. The other terminals of the magnets and buttons being connected, the main wires are led to a buzzer or other interrupting device F, and batteries G.

It is a good idea to construct a special keyboard, as the push-buttons cannot be played very fast. Pivoted or spring-supported strips arranged side by side can easily be assembled on a base-board, with suitable contact points mounted under each "key" strip. These contacts can be made from silver wire, platinum points off old bells or buzzers, tungsten points, or for that matter just plain brass points or springs. The smooth action of such a hand-made keyboard will really surprise you.

The instrument can be used as an ordinary piano, pressing the buttons as if they were keys.

Contributed by
CARLETON F. MAYLOT (13 years old).



Experimental Electro-Harp Operated by a Buzzer, Which Interrupts the Current Thru a Magnet Coil In Front of Each String.

www.americanradiohistory.com

Experimental Mechanics

By SAMUEL D. COHEN

LESSON XII.

IN the last lesson we considered the theory of twist drills, and having this in mind, we shall now discuss the practical end of the twist drill. It is essential to note that in grinding twist drills it is very important to have the cutting edge

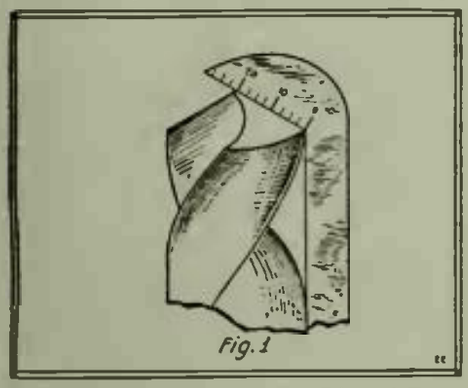


Fig. 1

Using Grinding Gage to Test Edge of Twist Drill When Sharpening It.

at the proper angle, otherwise the drill will not cut—or it may dig into the metal, thus spoiling the same or breaking the drill. The best angle at which the cutting edge should be ground is that of 59 degrees. A gage is usually provided for determining whether the cutting edge is ground to the required angle. Fig. 1 shows the gage being used for that purpose. This gage is a standard tool, and should be found in every experimenter's tool kit.

To acquire knowledge on how to actually grind a drill by reading, is a very difficult matter for the beginner. This is a subject which he must learn by actual practise, thus gaining experience as to the manner in which the drill is held against the abrasive (grindstone or usually an emery wheel), also how to determine whether the drill is ground properly so that it can perform its necessary function.

It is advisable for the beginner to obtain a drill grinder, which can be purchased for a nominal sum. There are two kinds of drill grinders—first, that wherein the drill is controlled by hand, and the grinding of the two cutting edges is performed separately; the second type, wherein the drill is clamped and the grinding is performed automatically. The latter is used extensively in large factories, where considerable quantities of twist drills have to be ground.

The point in favor of the grinding machine is its independence with regard to the ability of the workman; also the grinding is accomplished much faster. Fig. 2 illustrates a hand-controlled, foot-operated grinding machine.

In using twist drills, it is of extreme importance to have the cutting edges properly ground. To illustrate this, the results obtained from careless and inexperienced

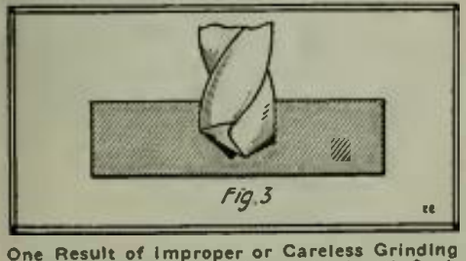


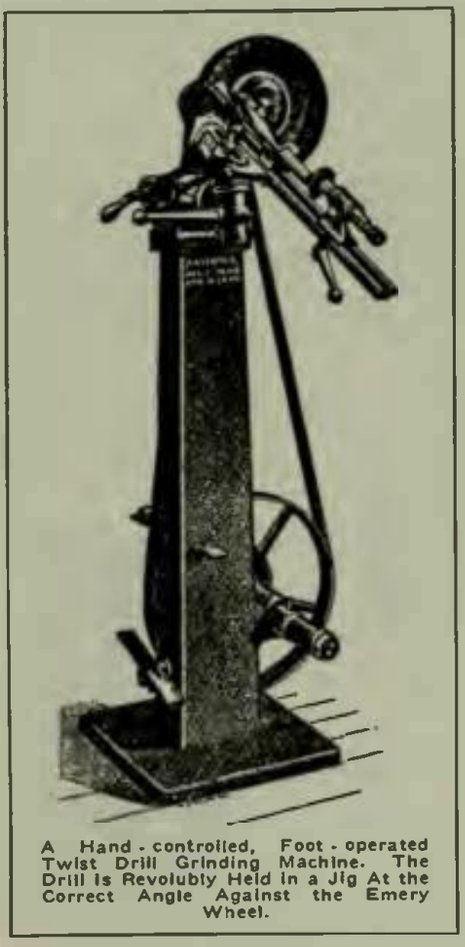
Fig. 3

One Result of Improper or Careless Grinding of a Twist Drill. The Hole Drilled with Such a Twist Drill Tends to be Ragged, Elliptical, and in Fact Most Any Shape But Round.

use of the free-hand twist drill are clearly depicted in Figs. 3, 4 and 5. The subject is of extreme importance, and the novice is strongly advised to procure a machine that will grind his drill to the proper cutting edge angle, thereby saving some important work that he may be engaged on, which might have been destroyed by the poor, hand-ground drill.

If the sharpening is done by a free hand drill, it is advisable to observe the cutting of the metal by the twist drill: first, the chips made by the cutting; second, the size of the hole. If the cutting lips are shaped to a proper clearance, the chips will curl as they start from the cutting edge, but, if the cutting lips lack a proper clearance, the resulting chips have the appearance of being ground off, rather than freely cut. If the cutting lips are of uneven length, the hole will be enlarged over the diameter of the drill.

The next important factor with reference to drills, is their feeding speed. In order to obtain best results with drills and drilling machines, the drill should advance



A Hand-controlled, Foot-operated Twist Drill Grinding Machine. The Drill is Revolubly Held in a Jig At the Correct Angle Against the Emery Wheel.

into the work a definitely regulated amount each revolution. The distance which the drill advances per revolution is termed the *feed*, and must be adjusted to suit the conditions under which the work is being performed. See table at end of article.

These figures are recommended for average conditions. At times they are greatly exceeded, and at others must be greatly reduced. Feeding the drill free hand, if skillfully done, may answer in certain cases, but is less effective than power feeds, with the exception of small wire drills.

The drill speed is another important factor when considering the successful operation of twist drills. This appertains to the surface or peripheral speed of the drill in feet per minute, and is rated at the outer diameter. Under average conditions, the

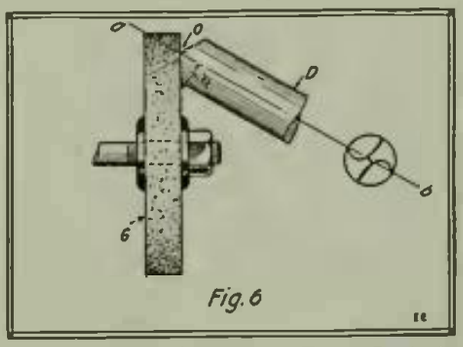


Fig. 6

In Grinding or Sharpening Twist Drills by Hand, Care Should Be Exercised to Keep the Drill Axis At An Angle of 60 Degrees with the Grinding Plane.

peripheral speed recommended for carbon steel drills is thirty to forty feet, and for high-speed drills, seventy to one hundred feet. Working conditions may at times cause a change in these figures. When the extreme outer corners of the cutting edges wear rapidly, it is evidence of too high a surface speed.

In order to grind a drill by hand, it is necessary that the axis of the drill be within 60 degrees of the grinding plane. This can be more clearly understood by referring to Fig. 6, where G is the grinding plane or grindstone, and a-b is the axis of the drill, D, to be ground. The cutting side of the drill should be kept at the required angle, $\Phi = 60$ degrees, with the grindstone surface. If now a revolving movement is made around the axis of its length toward the drill, a straight circular cone will be ground by the grinding wheel at the top, the axis of which coincides with D. If the drill is so ground that the following will be true, the drill will then perform its proper function, namely; that all the cutting lips have the same inclination to the axis of the drill; secondly, that the cutting lips be of exactly equal length; thirdly, a proper lip clearance of the surface back of the cutting edge; fourth, a proper angle of lip clearance.

In order to maintain high cutting speeds, it is necessary to use a lubricant. Those recommended below have stood the test of service.

For hard and refractory steel: Turpentine, kerosene or soda water.

Soft steel and wrought iron drilling: Lard oil or soda water.

Brass cutting: Paraffin oil.

For aluminum: Turpentine, kerosene or soda water.

Cast-iron work: Usually worked dry.

(*Continued on page* 163)

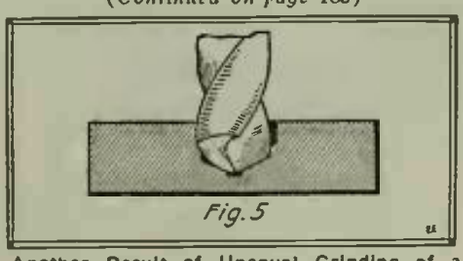


Fig. 5

Another Result of Unequal Grinding of a Twist Drill—and a Very Common Fault Too. The Lips Are of Unequal Lengths.

www.americanradiohistory.com

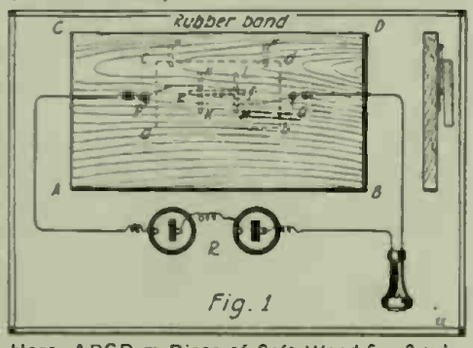
HOW-TO-MAKE-IT

This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 is awarded; for the second best idea a $2.00 prize, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

FIRST PRIZE, $3.00

TELEPHONE TRANSMITTER SENSITIVE AS A DICTAPHONE

A very simple, but wonderfully sensitive telephone transmitter for experimental purposes can easily be made. As shown in the

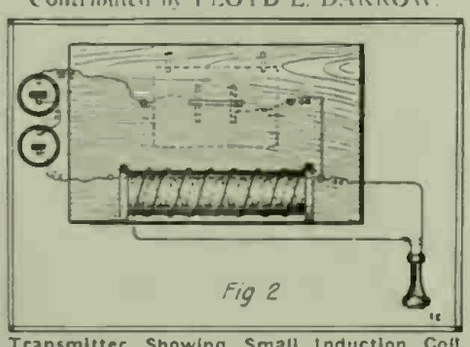


Here, ABCD = Piece of Soft Wood 5 x 3 x ¼ Inches Resting on Wooden Base. abcd = Wooden "Mouthpiece" Hanging on Back of Larger Piece and Carrying a Short Carbon Rod, ef. HK and LM = Carbon Rods Attached to the Larger Piece of Wood. Wires Lead from HK and LM Thru the Posts p and q and Two Dry Cells at R to the Standard 75 Ohm Telephone Receiver.

diagram Fig. 1, it consists of a small piece of thin board mounted on a wooden base and having two vertical carbons about 3/16 of an inch in diameter, attached by claw tacks to the back. Hanging over them is a small, thin piece of light, soft wood carrying a transverse carbon, which lightly touches the vertical ones. This constitutes the "mouthpiece." To the vertical carbons wires are attached which run through the board and connect with two dry cells and a telephone receiver. The transverse carbon resting against the vertical carbons makes a bad contact in the circuit, and the sound vibrations striking upon the *mouthpiece* produce an alternate increase and decrease in pressure, which varies the electrical resistance and current in the circuit.

To secure greater sensitiveness a small induction coil may be mounted on the front, as shown in the second diagram, Fig. 2. A few turns of No. 22 copper wire are used on the primary, and a large number of turns of No. 36 wire on the secondary. With the induction coil inserted the human voice in ordinary conversation, six feet from the transmitter, is easily heard thru the receiver, which may be placed at any distance.

Contributed by FLOYD L. DARROW.



Transmitter Showing Small Induction Coil Mounted on the Front of the Board. The "Mouthpiece" Is In Series with the Primary Winding.

SECOND PRIZE, $2.00

CONTROLLING DISTANT LIGHT WITH A MAGNET.

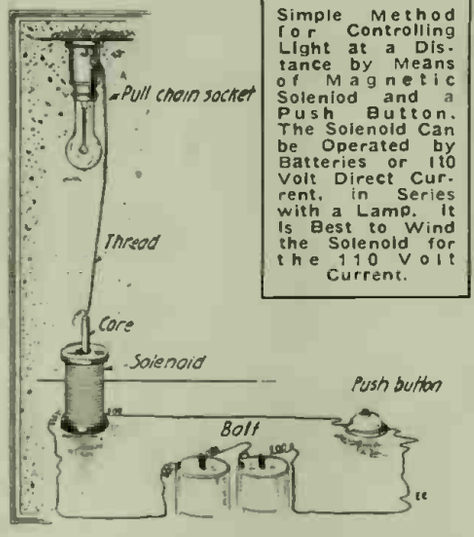
It is often convenient to have a light at the head of the stairs so connected that it may be turned on at the bottom as you go up, and turned off when you reach the top, or vice versa. But it is not always practicable or desirable to have the old wiring taken out and new installed, for this purpose. The same results can be obtained by the use of the scheme herein shown.

A common pull chain socket is used with a thread attached to the end of the chain and to the top of the solenoid core, or the chain may be fastened direct to the core for that matter. The rest of the drawing requires no explanation.

One push can be at the top of the stairs and one at the bottom, and as many others at different places as the experimenter desires. One push of the button turns the light on and another turns it off.

Contributed by

SCOTT EUGENE VANCE.



Simple Method for Controlling Light at a Distance by Means of Magnetic Solenoid and a Push Button. The Solenoid Can be Operated by Batteries or 110 Volt Direct Current, in Series with a Lamp. It Is Best to Wind the Solenoid for the 110 Volt Current.

MAGNETIZED SCREW-DRIVER A HANDY DEVICE.

I magnetized a screw-driver by holding it close to a dynamo for a few minutes, nearly two years ago, and it is still my most valued helper when it is necessary for me to do repair work on my car. It is a great help when working around the car to have this magnetized screw-driver to pick up screws and small pieces of the machinery which drop down inside, out of my reach.

In setting screws it is invaluable; simply pick up the screw by touching the head with the magnetized screw-driver, and it may be instantly set in place with only one hand. It does away entirely with the annoyance of the screw slipping away and getting lost, as it so often does. I always carry it in the tool box, and find the other fellow appreciates it when I find him having car-troubles on some lonely bit of road.

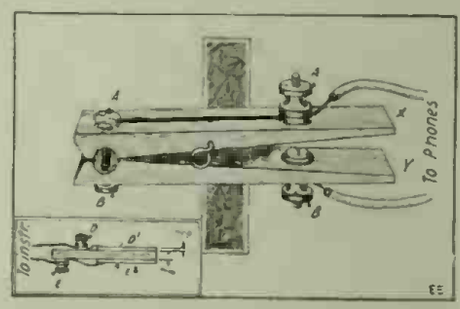
Contributed by ETHEL WEBB

THIRD PRIZE, $1.00

A QUICKLY CONSTRUCTED "PHONE CONNECTOR."

An efficient and handy "Phone Connector" can be made in a few minutes, as follows:

Obtain a spring clothes-pin; bore a hole



A Handy, Simple and Efficient 'Phone Connecting Clip. The Clip Is Clamped, on a Strip of Fiber, Lined on Either Side with Brass Strips as Shown.

thru head where line usually goes, put a battery binding post thru each hole, so that the nut will be on the outside. Then bore two other holes one inch from the opposite end and put two more posts in. Connect the two posts on each side A to A and B to B as indicated.

Next obtain a piece of wood 2" x ⅜" x the width of the clothes-pin; attach two strips of copper ¾" x 1/16" x ⅜" to each side. Mount two binding posts on the opposite side as D and E, then solder wire (or connect in some way) the binding posts E to plate E' and D to D'. Connect D and E with the instruments and A and B with the 'phones, and pressing X and Y together, place on stationary contact blocks so as to make connection in the manner apparent.

Contributed by JOHN W. HOPKINS.

A TIE-CLASP TELEGRAPH KEY.

The telegraph key here shown costs one-tenth as much as one purchased in any store, and is smaller, neater, and just as efficient. It consists of a tie-clasp having a strip of brass, with a hard rubber knob soldered or riveted to it. The whole is then mounted on a base 3½ x 2 inches, with binding posts taken from old batteries. The illustration herewith explains fully.

Contributed by HARRY E. FUCHS.



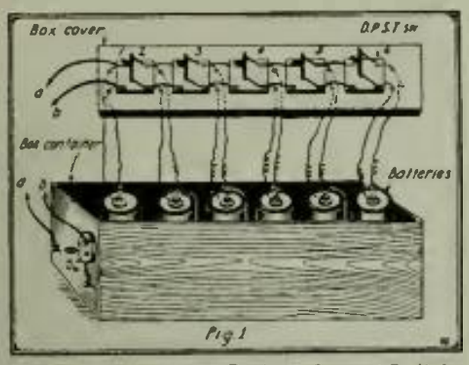
A Masterpiece! Cheap Telegraph Signaling Key Made from Tie Clasp Mounted on Wooden Base. A Brass Screw Serves as the Contact Under the Key Lever.

www.americanradiohistory.com

Connecting Up Dry Cells

By Frederick Von Lichtenow

NEARLY every experimenter who employs Dry Cells or other batteries as the main source of his current supply, keeps these cells, generally speaking, all neatly connected up—often in a dustproof container



A Neat and Effective Battery-Control Switch-Board for Connecting into Circuit Any Number of Cells, from One to Six, on Parallel.

at that—always ready for the biggest job in his laboratory, for instance his "Spark-Coil" or "Tesla Set."

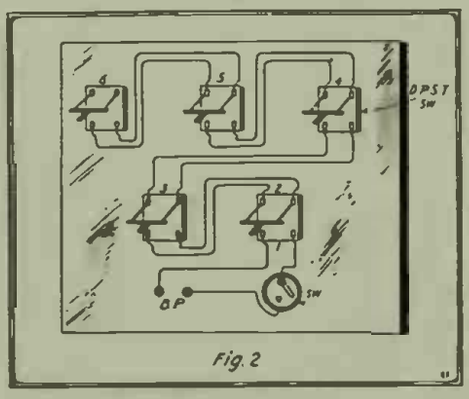
Whenever lesser pieces of apparata, such as a small motor, an electro-magnet, a buzzer, etc., etc., are to be worked, requiring only one or two dry cells, as the case may be, then these cells have to be separated from the rest of the "family", only to be put back and connected up again when the experiment is finished.

This constant disconnecting and connecting is nothing less than a genuine nuisance and does not tend to improve the condition of the connecting links, whatever they are.

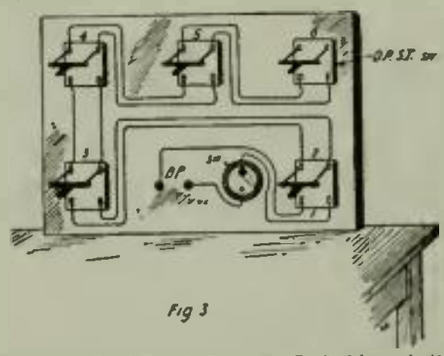
There appear now and then in the technical periodicals schemes, embodying some form of a rotary multi-point switch which are intended to remedy this trouble. To a large extent they are successful in this, but everyone of those, which have come under my observation, was suffering from two other faults, which are nearly as bad as the one above cited: First, the cells were connected up in such a manner that, with only one cell switched-in, this cell was already using energy from the next following one; and this in repetition thru the whole row. Second, as a consequence of the first fault it is impossible to properly test each cell individually without going thru the disconnecting stunt again.

The scheme treated in this article has none of these drawbacks and is the cheapest and simplest one could think of; nothing, so to speak, has to be constructed and the few necessary finished parts are obtainable anywhere at a very slight expense.

As will be seen from the illustrations, this idea of connecting cells lends itself very well to both battery-box and switch-board, whichever one prefers. The cells are arranged as if intended to be connected up in "parallel", which is clearly shown in Fig. 1. Six cells require five (small sizes) D.P.S.T.-Switches, (of which switch No. 1 serves two dry cells) with an additional circuit switch on the one side of the container. There are two binding posts brought out on the same side—one directly connected, the other to the circuit switch, as is self-evident—for the connection of apparatus.



Another Style of Battery Switchboard for Connecting up Any Desired Number of Cells on Parallel.



In this Design of Battery Switchboard the Leads from the Cells Are Brought into the Switches from the back of the Panel.

The diagrams in Figs. 2 and 3 suggest two different ways of connecting the switches, etc., upon boards, with the battery wires running in from the back (not shown in sketches) and connected to their proper places, which are marked by figures, each representing one cell.

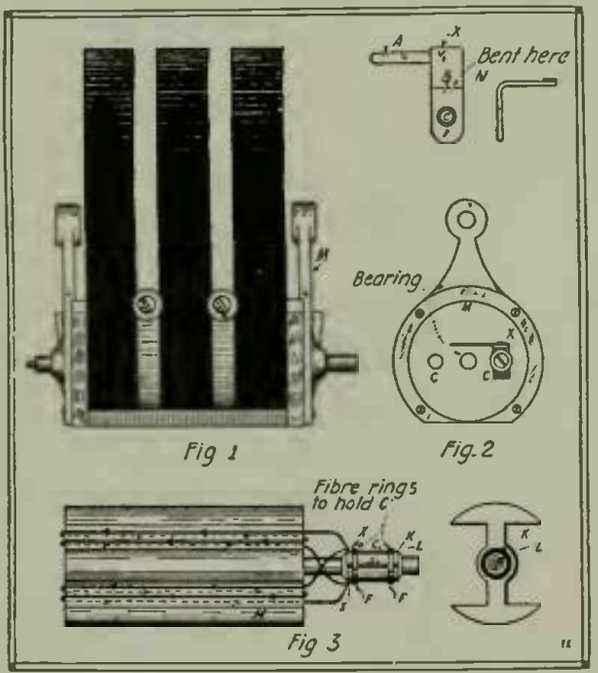
No doubt, there are several ways of eliminating those many switches without disturbing the above arrangement in the least, such as by using taps, switch-points, contact bushings in conjunction with sliding blades or rods, respectively, and other necessary parts, but these have in most cases, to be ordered, if obtainable at all, or made to order in some shop, which involves loss of time and often a respectable amount of money.

The scheme, as it is illustrated and described here, will, after all, be found to be the quickest, simplest and least expensive way of "getting there."

D. C. Dynamo from Magneto

Here is a dynamo-motor that any experimenter can make at practically no cost except a little patience and work. All the material can be purchased for a small sum. The material required are a telephone magneto and two telephone transformer coils, or about ¼ lb. No. 22 magnet wire. Also some pieces of brass, a brass tube, and some fiber and mica. Now, with all the material at hand, remove the two gear wheels on the magneto and take off the contact parts on the other end. The magneto now appears as in Fig. 1. Then take one end plate M off and drill a ¼-inch hole each side of the bearing at cc, midway between the bearing and edge of plate. Next cut two pieces of brass or copper of shape shown at X, Fig. 2. They measure about 1¼ inch. Drill a ¼-inch hole at c in each and solder a piece of spring brass A to the other end at X. Then bend into a right angle at B. These are the brushes, and they fasten to M thru cc with two battery binding posts, which are carefully insulated from the plate M.

Remove the armature of the magneto and cut away the fine wire wound thereon. Next take off about ten of the segments or laminations H, to make room for the commutator. The commutator C is made from a piece of brass tubing ½ inch long, which is slightly larger than the shaft. Now cut the tube in two halves lengthwise, being careful not to bend it. Take a piece of mica and wrap it around the shaft at L until it just fits the brass segments K.



Every Telephone Magneto Can Be Made Over, with Slight Changes, into a First-Rate "Direct-Current" Dynamo. Fine for Auto or Boat Lighting and Experimental Work.

Shellac the mica to the shaft, and then shellac the segments over the mica, taking care to leave a slot S between the segments on both sides. Two short pieces of fiber tubing (rings) F, F, are then slipped tightly over C. A tight fit is necessary. These rings hold the brass pieces C securely. A word of caution here: *Place the slot S just past center as shown.* Then tie securely and put away to dry. When dry wind the armature as tightly as possible with the magnet wire in the manner indicated by arrows. Wind an equal number of turns on each side of the shaft and solder the ends to the segments of the commutator at xx. The diagram shows plainly these operations. When completed, give the windings two coats of shellac and let dry. After it is thoroly dry, place a fiber washer on each end of the shaft and assemble as originally found. Place a small pulley on the end of the shaft that protrudes and all is complete. If directions have been closely followed a nice little machine will result. *It will run either as a dynamo or motor.* As a dynamo I was able to light 4 to 5 small tungsten lamps. On 4 to 6 volts it develops remarkable power. When running as a motor it works better with one of the magnets removed, as this lessens the strength of field so that the armature revolves more freely.

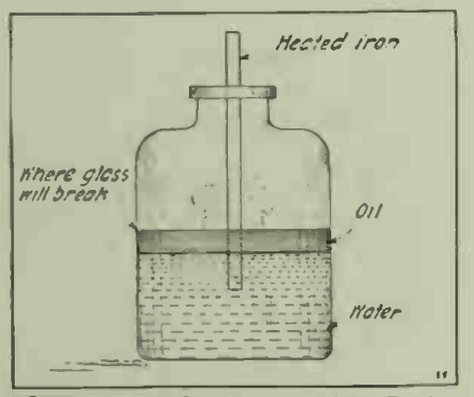
Contributed by W. E. LEACH.

www.americanradiohistory.com



HOW TO CUT LARGE BOTTLES.

I herewith submit a novel way to cut large glass bottles so as to make jars. Procure a large bottle. If the top is not level or tapers it can be cut by the following means: Pour water into bottle within 1 inch of line where you want to cut. Then slowly pour linseed oil in up to the level of proposed cut. Then a red-hot iron



A Simple Way to Cut Off Large Glass Bottles, by Plunging a Red-Hot Iron Into an Oil and Water Solution Filling the Bottle Up to the Line Where the Cut Is to Be Made.

plunged vertically into the oil will cause the glass to crack at the level of the liquid and leave an open top jar.

Contributed by GERRAL EHINGER.

USEFUL LABORATORY INFORMATION.

Rain water may be used as distilled water, provided it is clean.

Baking soda is sodium bicarbonate.

Vinegar contains dilute acetic acid.

Common table salt is sodium chlorid.

Rust from a nail or other iron is ferric oxid.

Tea contains tannic acid.

Blackboard chalk is calcium carbonat.

Epsom salts is magnesium sulfate.

Sugar of lead is lead acetat.

Aqua fortis is nitric acid.

Aqua-regia is a mixture of nitric and hydrochloric acids.

Sal ammoniac is ammonium chlorid.

Sal soda is sodium carbonat.

"Hypo" is sodium thiosulfate.

Denatured alcohol is principally a mixture of wood and grain alcohol.

A porcelain mortar or pestal makes an excellent whet-stone.

Aqua ammonia is ammonium hydroxid.

"Lye" or caustic soda is sodium hydroxid.

Quicklime is calcium oxid; slacked lime is calcium hydroxid.

German silver contains no silver.

Freshly prepared ferric hydroxid is an antidote for arsenic poisoning.

The glue on postage stamps is dextrin.

Quartz is silicon dioxid.

The ruby, saffire and others gems are composed mainly of aluminum oxid.

Borax is sodium borat.

Salt-petre is potassium nitrat.

Copperas is ferrous (iron) sulfate.

Blue-stone is copper sulfate.

Hydrochloric acid and ammonium hydroxid are solutions of a gas in water.

Oxygen is made by heating potassium chlorat with manganese dioxid.

Carbon dioxid is prepared by treating marble chips with strong acid.

Hydrogen is prepared by treating zinc with strong acid.

Chlorin is easily prepared by heating a mixture of hydrochloric acid and manganese dioxid.

Sulfur dioxid is made by burning sulfur in air.

Nitrogen may be prepared by heating ammonium nitrit.

Pure silver may be prepared by treating silver nitrat with copper.

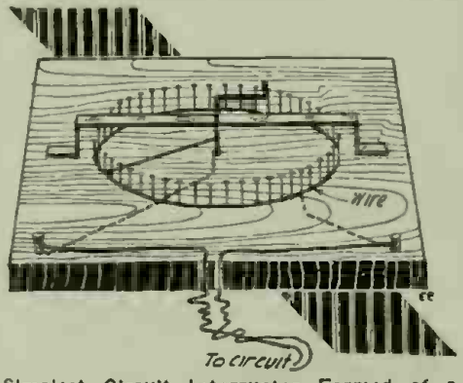
The silver is deposited as a gray powder, and may be collected by fusing into a solid.

Contributed by

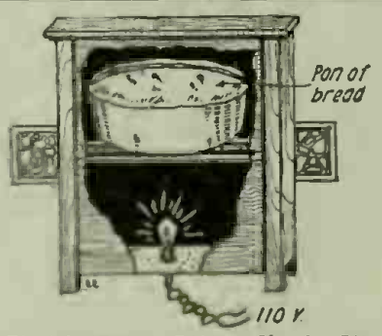
ARTHUR SILVERBERG.

SIMPLE CIRCUIT INTERRUPTER.

Small nails are driven in a board one-half an inch apart and connected together by wire. A crank pivoted in the center has a spring brass strip soldered to it. On turning the crank fast or slow, the circuit is interrupted.



Simplest Circuit Interrupter Formed of a Ring of Nails, Against Which a Brass Spring Mounted on a Crank Is Turned.



An Electric Bread Raiser—Simply Place a 32 C. P. Incandescent Lamp Under the Pan of Bread and Watch the Results.

ELECTRIC BREAD RAISER:—A box of suitable size is fitted with an air tight cover and a 32 candle-power carbon lamp screwed in the bottom of the box. The shelf that the bread rests on is made of slats, spaced about two inches apart. This is done to allow the heat to radiate freely in the box, when the bread is placed in it. The method has worked out well.

Contributed by RICHARD ANDRESS.

EXPLOSIVE GAS APPARATUS.

Having occasion to make hydrogen gas to explode in a gas cannon, I thought of the following idea: I secured an old show-case bulb and broke the tip off. After removing the filament (B), I fused a piece of glass tubing on the bulb, as shown at (A). Then I filled the bulb half full of a

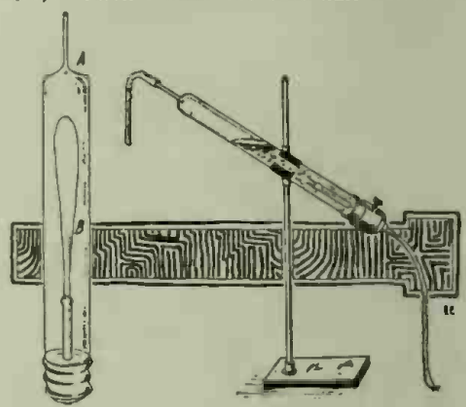


Fig. 1 Fig. 2

Explosive Gas Experimental Apparatus Constructed of Show-case Lamp with Tube Fused on Tip End.

sulfuric acid solution, screwed it in a socket, and clamped the whole on the stand, as in Fig. 2. By running a piece of rubber tubing from the tube to the cannon, I was able to get a good explosion. Care must be taken not to disturb the platinum terminals.

Contributed by

N. KENNETH MEHAFFIE.

SILVER PLATING WITHOUT A BATTERY.

Dissolve about an ounce of silver in two ounces of nitric acid. After the silver is all dissolved throw into it a pint of water and four ounces of common salt. The salt will precipitate a powder which is pure silver. Filter off the water, or if there is no filter paper handy, pour off the water and repeat until all the effects of the salt have disappeared. To this white powder add two ounces of cyanide of potassium* and three ounces of hyposulphate of soda. Now add to all this two quarts of pure rain water and the silver mixture is complete.

The plating is done in the following manner. Hang the article to be plated in the solution at the end of a strip of lead or if more convenient, immerse the article in the solution and boil it for ten or twenty minutes, according to the thickness of the silvering desired. To obtain best results the articles to be plated must be free from grease and oil or dirt.

* This chemical is a deadly poison and must be handled with the most care.

Contributed by DAVID GOODMAN.

IMITATION GOLD.

Take 16 parts of platina, 7 parts copper, 1 part zinc, put in covered crucible, with powdered charcoal and melt together till the whole forms one mass and all are thoroly incorporated. Or take 4 oz. platina, 3 oz. silver and 1 oz. copper.

Contributed by

NORMAN LIVINGSTON.

www.americanradiohistory.com

The RADIO LEAGUE of AMERICA

HONORARY MEMBERS
CAPT. W.H.G. BULLARD, U.S.N. NIKOLA TESLA.
PROF. REGINALD FESSENDEN. DR. LEE DE FOREST.

Manager, H Gernsback

Amateur Radio Restored

By H. GERNSBACK

WINNING one war seems like a great accomplishment, but winning two wars, one after the other, is a historic occurrence for which we have few counterparts.

When on Nov. 11 the glad news came that the great war had been won, the world once more breathed freely, and so did the American Radio Amateur, who had done his "bit" in bringing the war to a successful termination. But hardly was the armistice signed than the spectre of a new war—to the amateur—crept up over the horizon threatening to take away from him the freedom for which we had fought.

A nation may be opprest by a relentless foe if conquered, or it may be opprest in a similar manner by unjust laws which curtail the freedom of its people. Indeed, when it was proposed last winter to take away from the American Radio Amateur the freedom of the ether, which would have deprived the liberties of over 300,000 young men in this country, war was declared once more. This war was to the knife; it was as short as it was decisive. But Right as usual won over Might, and the American Radio Amateur won *his* war, as the Allies won theirs.

And, as the Allies will win the fruits of their victory in the months to come, so will the amateurs reap the fruit of their victory. Indeed, the reaping has already begun. On April 15th the ban on Radio, at least for *receiving*, was officially taken off, and a mighty shout went up when Radio Amateurs were again permitted to use the ether to their hearts' content. Altho the ban for *sending* has not been removed at this time of writing, the chances are that before the next issue is in your hands the freedom of the ether will be once more restored completely.

As soon as the newspapers published the welcome tidings on April 15th that the ban on receiving was off, hundreds of thousands of amateurs began dusting off their sets and aërials blossomed forth over night by the thousands to resume their former activities once more.

And wonders upon wonders! When we put our sets away two years ago we were accustomed to hear nothing but the crisp dots and dashes in flute-like, staccato sounds coming from the high power stations which we all had learned to love. But the war has changed everything—even radio, for now the *radio telephone* has come into its own.

Where formerly there was nothing but the *tah-de-dah* in our phones, the ether is now filled with the human voice flung far and broad over the land—nay, over the oceans—and as the months roll by the dots and dashes will grow less and less, and the human voice will come in over our aërials more and more, which is as it should be.

The writer has always contended that wireless telephony was the logical outcome of radio, and in years to come only the commercial high power stations will operate their dots and dashes with their high speed machines where the voice would not be as reliable. But the future of Radio Amateurism in this country is centered upon the radio telephone. While no doubt many of us will still cling to the dots and dashes, the radio telephone will probably soon be used in overwhelming numbers.

What a wonderful world it will be in one or two years hence! You will step out into the star-lit night and myriads of voices—noiselessly and invisibly—will fill the air all over the continent, flung thru the ether. You will hear nothing and you will see nothing. When you sit on the seashore gazing fascinated at the beauty of the tides, as they follow the moon, all the while the invisible and soundless voices will be all around you—nay, even pass thru your very body. But when you step in the humble little amateur radio station and clasp a pair of receivers onto your ears, the ether will be unlocked and all of these myriads of voices will be made audible to your ears. A perfect Babel of voices will greet you, but by means of your tuning devices you will be able to pick out the very voice you wish to listen to, tuning out all the others.

It is a glorious thought that we are fortunate enough to live in an age where such things are possible, and we must prove worthy of our new-gained liberty, now certain.

And the writer regrets to say that before the war we did not realize how fortunate we were, and we did not show by our actions that we appreciated the freedom of the ether.

There was constant bickering and quarreling on the side of the amateur, among themselves as well as with commercial and government stations. Profane talk took place not infrequently thru the ether, and many of us annoyed the commercial as well as the government operators by "hogging" the ether. Hence, it was not surprising that the government tried to pass laws to curb the amateurs and curtail their liberties.

If Radio Amateurism is to prevail in the new era, the amateurs must stop their former nonsense and must settle down strictly to business. They can and should receive all they want to their hearts' content. They can and will listen very shortly to President Wilson's voice when he speaks to us from the "George Washington," where everybody is free to listen in. Amateurs can listen in to their hearts' delight, whether it be to wireless-telephone or wireless telegraph. But when it comes to sending, we must mend our ways. If we do not, laws will be past sooner or later to curtail our entire liberties, and here the writer desires to make an important suggestion.

There are now a good many Radio Clubs and Associations all over the country. We cannot have too many. The suggestion is that every club and every association should appoint one or a number of expert amateurs to listen in nightly to messages that are violating the common rules, either by profane language, by "hogging" the ether, by Q. R. M. or by wilful interference. The offender should be sought out and promptly warned, and should he repeat his offense a second time, he should be promptly reported to the Radio Inspector of the district, and the various publications catering to the amateurs should be notified. A sworn statement relating the offense should be submitted to the publications, who will pledge themselves to publish the name of the offender.

The ELECTRICAL EXPERIMENTER, for one, will be glad to publish such names regularly, and it is believed that such measures will do more than anything else to increase the prestige of radio amateurism in the United States, and take it out of the school-boy class. There is little doubt that if we follow such procedures Radio Amateurism in the United States will become one of the great institutions of this country. We must show the world that we amateurs are serious-minded and do not use one of the greatest inventions for a

(*Continued on page* 174)

NAVY DEPARTMENT
Naval Communication Service
Office of the Director.
Washington, April 14, 1919.

Editor Electrical Experimenter
Sir:

The Acting Secretary of the Navy authorizes the announcement that effective April 15, 1919, all restrictions are removed on the use of radio receiving stations other than those used for the reception of commercial radio traffic. This applies to amateur stations, technical and experimental stations at schools and colleges, receiving stations maintained by jewelers or others desirous of receiving time signals, receiving stations maintained by manufacturers of radio apparatus, etc.

The restrictions on transmitting stations of all types are still in effect, as are the restrictions on stations operated regularly for the reception of commercial radio traffic. Both of the above classes of stations will be permitted to resume operation as soon as the President proclaims that a state of peace exists.

Attention is invited to the fact that all licenses for transmitting stations have expired, and that it will be necessary, when peace is declared, for the owners of these stations to apply to the Department of Commerce for new licenses.

Very respectfully,

(Signed) E. B. Woodworth,
Commander, U. S. Navy, Assistant Director Naval Communications.

The Above Is the Text of the Official Notification Restoring the Freedom of the Ether Once More. The Ban on Sending Is as Yet not Lifted. When Peace Is Declared, While Technically the Ban for Sending Will be Off, It Should be Remembered That All Sending Licenses Have Been Cancelled During the War and New Licenses Must Be Secured from the Department of Commerce. Address the Office of the Radio Inspector at the Custom House of Your District for Further Particulars.

www.americanradiohistory.com

The Moon's Rotation

By NIKOLA TESLA

In this article Dr. Tesla proves conclusively by theory and experiment that all the kinetic energy of a rotating mass is purely translational and that the moon contains absolutely no rotational energy, in other words, does not rotate on its axis.—EDITOR.

IN revising my article on "The Moon's Rotation", which appeared in the April issue of the ELECTRICAL EXPERIMENTER, I appended a few remarks to the original text in further support and eluci-

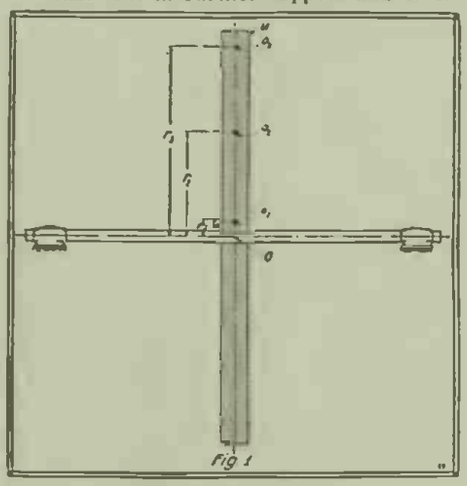


Fig. 1. In Determining the Kinetic Energy of a Rotating Mass, This Figure Shows the Selection of a Number of Points Taken Within the Straight Rod or Mass M, at Successive Distances from the Axis of Rotation O. Knowing These Values and the Speed of Rotation the Kinetic Energy of the Mass Is Readily Computed.

dation of the theory advanced. Due to the printer's error these were lost and, in consequence, I found it necessary to forward another communication which, unfortunately, was received too late for embodiment in the May number. Meanwhile many letters have reached me in which certain phenomena presented by rotating bodies, as the moon's librations of longitude, are cited as evidences of energy due to spinning motion, i. e., proofs of axial rotation of the satellite in the true physical sense. I trust that the following amplified statement will meet all of the objections raised and convert to my views those who are still unconvinced.

The kinetic energy of a rotating mass can be determined in four ways which are illustrated in diagrams, Figs. 1, 2, 3 and 4 and may be found more or less suitable.

Referring to Fig. 1, the method consists in selecting judiciously a number of points as o_1, o_2, o_3, etc., within the straight rod or mass M, respectively at distances r_1, r_2, r_3, etc., from the axis of rotation 0 and calculating the square root of the mean square of these distances. Its value being R_r, denoted radius of gyration, the *effective* velocity of the mass at n revolutions per second will be $V_e = 2\pi R_r n$ and its kinetic energy $E = \frac{1}{2} M V_e^2 = \frac{1}{2} M (2\pi R_r n)^2$.

In Fig. 2 the mass M, rotating n times per second about an axis 0 at right angles to the plane of the paper, is divided into numerous elements or small parts, most conveniently very thin concentric laminae, as l_1, l_2, l_3, etc., at distances r_1, r_2, r_3, etc., from 0. Since the kinetic energy of each part is equal to half the product of its mass and the square of the velocity, the sum of all these elemental energies $E = \frac{1}{2} \Sigma m V^2 = \frac{1}{2} m_1 V_1^2 + \frac{1}{2} m_2 V_2^2 + \frac{1}{2} m_3 V_3^2 + \ldots\ldots = \frac{1}{2} m_1 (2\pi r_1 n)^2 + \frac{1}{2} m_2 (2\pi r_2 n)^2 + \frac{1}{2} m_3 (2\pi r_3 n)^2 + \ldots\ldots$

A different form of expression for the energy of a rotating body may be obtained by determining its moment of inertia. For this purpose the mass M (in Fig. 3), rotating n times per second about an axis 0, is separated into minute parts, as m_1, m_2, m_3, etc., respectively at distances r_1, r_2, r_3, etc., from the same. The sum of the products of all these small masses and the squares of their distances is the moment of inertia I, and then $E = \frac{1}{2} I \omega^2$, $\omega = 2\pi n$ being the angular velocity.

It is obvious that in all these instances many points or elements will be required for great accuracy but, as a rule, very few are sufficient in practice.

Still another way to compute the kinetic energy is illustrated in Fig. 4, in which case the quantity I is given in terms of the moment of inertia I_c about another axis parallel to 0 and passing thru the center of gravity C of mass M. In conformity with this the energy of motion $E = \frac{1}{2} M V^2 + \frac{1}{2} I_c \omega^2$ in which equation V is the velocity of the center of gravity.

The preceding is deemed indispensable as I note that the correspondents, even those who seem thoroly familiar with mechanical principles, fail to make a distinction between theoretical and physical truths which is essential to my argument.

In estimating the kinetic energy of a rotating mass in any of the ways indicated we arrive, thru suitable conceptions and methods of approximation, at expressions which may be made quantitatively precise to any desired degree, but do not truly de-

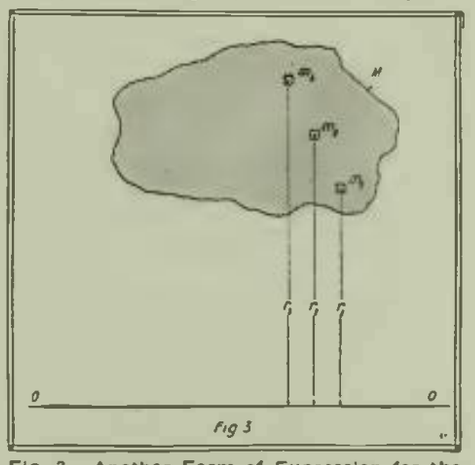


Fig. 3. Another Form of Expression for the Energy of a Rotating Body May Be Obtained by Determining Its Moment of Inertia. Here the Mass M Is Subdivided Into Minute Parts m_1, m_2, m_3, ... etc. The Sum of the Products of These Masses and the Squares of Their Distances Is the Moment of Inertia, Which with the Angular Speed, Gives the Kinetic Energy E.

fine the actual condition of the body. To illustrate, when proceeding according to the plan of Fig. 1, we find a certain hypothetical velocity with which the entire mass should

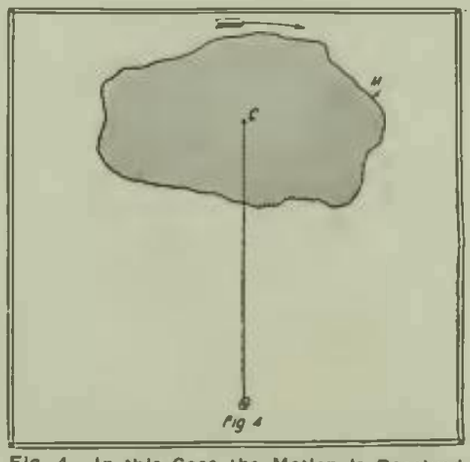


Fig. 4. In this Case the Motion Is Resolved Into Two Separate Components—One Translational About O and the Other Rotational About C. The Total Kinetic Energy of the Mass Equals the Sum of These Two Energies.

move in order to contain the same energy, a state wholly imaginary and irreconcilable with the actual. Only, when *all* particles of the body have the same velocity, does the

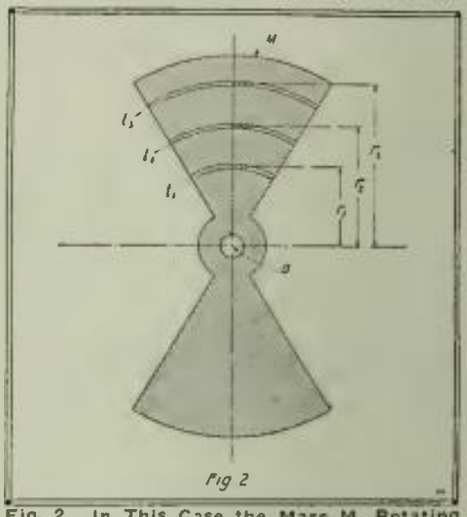


Fig. 2. In This Case the Mass M, Rotating n Times Per Second, About An Axis O, Is Divided Into Numerous Elements or Small Parts at Various Radii from O. Knowing the Kinetic Energy of Each Part, the Whole Kinetic Energy of the Mass Is Easily Determined by Taking a Summation of the Individual Quantities.

product $\frac{1}{2} M V^2$ specify a physical fact and is numerically and descriptively accurate. Still more remote from palpable truth is the equation of motion obtained in the manner indicated in Fig. 4, in which the first term represents the kinetic energy of translation of the body as a whole and the second that of its axial rotation. The former would demand a movement of the mass in a definite path and direction, all particles having the same velocity, the latter its simultaneous motion in another path and direction, the particles having different velocities. This abstract idea of angular motion is chiefly responsible for the illusion of the moon's axial rotation, which I shall endeavor to dispel by additional evidences.

With this object attention is called to Fig. 5 showing a system composed of eight balls M, which are carried on spokes S, radiating from a hub H, rotatable around a central axis 0 in bearings supposed to be frictionless. It is an arrangement similar to that before illustrated with the exception that the balls, instead of forming parts of the spokes, are supported in screw pivots *s*, which are normally loose but can be tightened so as to permit both free turning and rigid fixing as may be desired. To facilitate observation the spokes are provided with radial marks and the lower sides of the balls are shaded. Assume, first, that the drawing depicts the state of rest, the balls being rotatable without friction, and let an angular velocity $\omega = 2\pi n$ be imparted to the system in the clockwise direction as indicated by the long solid arrow. Viewing a ball as M, its successive positions 1, 2, 3—8 in space, and also relatively to the spoke, will be just as drawn, and it is evident from an inspection of the diagram that while moving with the angular velocity ω about 0, in the clockwise direction, the ball turns, with respect to its axis, at the same angular velocity but in the opposition direction, that of the dotted arrow. The combined result of these two motions is a translatory movement of the ball such that all particles are animated with the same velocity V, which is that of its center of gravity. In this case, granted that there is absolutely no friction the

www.americanradiohistory.com

kinetic energy of each ball will be given by the product of ½ M V² not approximately, but with mathematical rigor. If now the pivots are screwed tight and the balls fixt rigidly to the spokes, this angular motion relatively to their axes becomes physically impossible and then it is found that the kinetic energy of each ball is increased, the increment being exactly the energy of rotation of the ball on its axis. This fact, which is borne out both by theory and experiment, is the foundation of the general notion that a gyrating body—in this instance ball M—presenting always the same face towards the center of motion, *actually* rotates upon its axis in the same sense, as indicated by the short full arrow. *But it does not tho to the eye it seems so.* The fallacy will become manifest on further inquiry.

To begin with, observe that when a mass, say the armature of an electric motor, rotating with the angular velocity ω, is reversed, its speed is $-\omega$ and the difference $\omega - (-\omega) = 2\omega$. Now, in fixing the ball to the spoke, the change of angular velocity is only ω; therefore, an additional velocity ω would have to be imparted to it in order to cause a clockwise rotation of the ball on its axis in the true significance of the word. The kinetic energy would then be equal to the sum of the energies of the translatory and axial motions, not merely in the abstract mathematical meaning, but as a physical fact. I am well aware that, according to the prevailing opinion, when the ball is free on the pivots it does not turn on its axis at all and only rotates with the angular velocity of the frame when rigidly attached to the same, but the truth will appear upon a closer examination of this kind of movement.

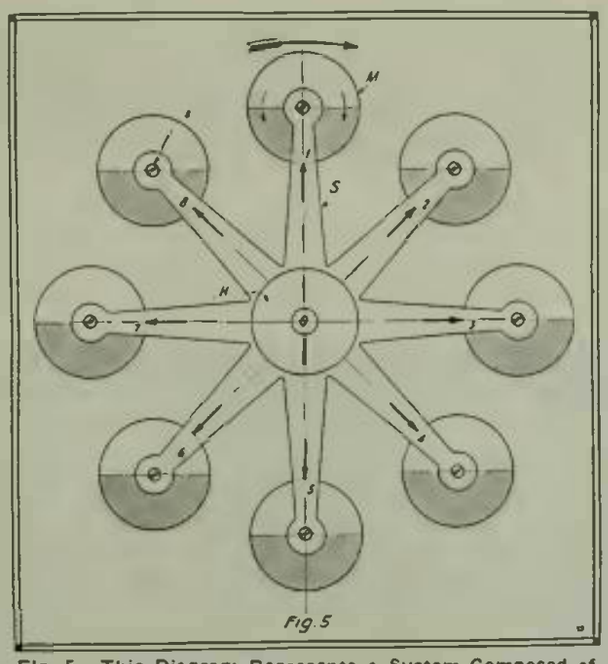


Fig. 5. This Diagram Represents a System Composed of 8 Balls M, Carried on Spokes S, and Rotating Around Center O. The Balls Are Freely Rotatable on Pivots Which Can Be Tightened. With This Model the Fallacy of the Moon's Rotation on Its Axis Is Demonstrable.

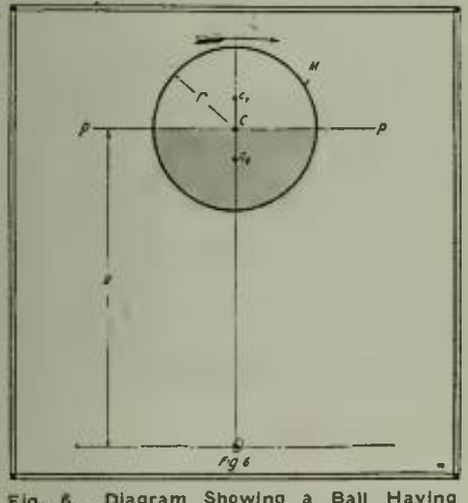


Fig. 6. Diagram Showing a Ball Having Mass M, of Radius r, Rotating About Center O, and Used in the Theoretical Analysis of the Moon's Motion.

Let the system be rotated as first assumed and illustrated, the balls being perfectly free on the pivots, and imagine the latter to be gradually tightened to cause friction slowly reducing and finally preventing the slip. At the outset all particles of each ball have been moving with the speed of its center of gravity, but as the bearing resistance asserts itself more and more the translatory velocity of the particles nearer to the axis 0 will be *diminishing*, while that of the diametrically opposite ones will be *increasing*, until the maxima of these changes are attained when the balls are firmly held. In this operation we have thus deprived those parts of the masses which are nearer to the center of motion, of some kinetic energy of *translation* while adding to the energy of those which are farther and, obviously, the gain was greater than the loss so that the *effective* velocity of each ball as a whole was increased. *Only so* have we augmented the kinetic energy of the system, not by causing *axial rotation* of the balls. The energy E of each of these is *solely* that of translatory movement with an effective velocity V_e as above defined such that $E = \frac{1}{2} M V_e^2$. The axial rotations of the ball in either direction are but apparent; *they have no reality whatever* and call for no mechanical effort. It is merely when an extraneous force acts independently to turn the whirling body on its axis that energy comes into play. Incidentally it should be pointed out that in true axial rotation of a rigid and homogenous mass all symmetrically situated particles contribute equally to the momentum which is not the case here. That there exists not even the slightest tendency to such motion can, however, be readily established.

For this purpose I would refer to Fig. 6 showing a ball M of radius *r*, the center C of which is at a distance R from axis 0 and which is bisected by a tangential plane *pp* as indicated, the lower half sphere being shaded for distinction. The kinetic energy of the ball when whirled *n* times per second about 0 is according to the first form of expression $E = \frac{1}{2} M V_e^2 = \frac{1}{2} M (2\pi R_g n)^2$, M being the mass and R_g the radius of gyration. But, as explained in connection with Fig. 4, we have also $E = \frac{1}{2} M V^2 + \frac{1}{2} I_c \omega^2, V = 2\pi R n$ being the velocity of the center of gravity C and I_c the moment of inertia of the ball, about the parallel axis passing thru C and equal to $\frac{2}{5} M i^2$ so that $E = \frac{1}{2} M (2\pi R n)^2 + \frac{1}{5} M r^2 (2\pi n)^2$. Neither of these two expressions for E describes the actual state of the body but the first is certainly preferable conveying, as it does, the idea of a single motion instead of two, one of which moreover is devoid of existence. I shall first undertake to demonstrate that there is no torque or rotary effort about center C and that the kinetic energy of the supposed axial rotation of the ball is mathematically equal to zero. This makes it necessary to consider the two halves separated by the tangential plane *pp* wholly independent from one another. Let c_1 and c_2 be their centers of gravity, then $Cc_1 = Cc_2 = \frac{3}{8} r$. In order to ascertain the kinetic energy of the hemispheres we have to find their radii of gyration which can be done by determining the moments of inertia Ic_1 and Ic_2 about parallel axes passing thru c_1 and c_2. Complex calculation will be avoided by remembering that the moment of inertia of either one of the half spheres about an axis thru C is $I_C = \frac{1}{2} \times \frac{2}{5} M r^2, = \frac{1}{5} M r^2$, and since $M = 2$ m, $I_C = \frac{2}{5}$ m r^2. This can be expres in terms of the moments Ic_1 and Ic_2; namely, $I_C = Ic_1 + m (\frac{3}{8} r)^2 = Ic_2 + m (\frac{3}{8} r)^2$. Hence $Ic_1 = Ic_2 = I_C - m (\frac{3}{8} r)^2 = \frac{2}{5}$ m $r^2 - 9/64$ m $r^2 = 83/320$ m r^2. Following the same rule the moments of inertia of the half spheres about the axis passing thru the center of motion 0 can be found. Designating the moments for the upper and lower halves of the ball, respectively, I_{O1} and I_{O2} we have $I_{O1} = m (R + \frac{3}{8} r)^2 + Ic_1 = m (R + \frac{3}{8} r)^2 + 83/320$ m r^2 and $I_{O2} = m (R - \frac{3}{8} r)^2 + Ic_2 = m (R - \frac{3}{8} r)^2 + 83/320$ m r^2. Thus for the upper half sphere the radius of gyration $R_{g1} =$

$$\sqrt{\frac{I_{O1}}{m}} = \sqrt{(R + \tfrac{3}{8} r)^2 + 83/320\ r^2}$$

and for the lower one $R_{g2} =$

$$\sqrt{\frac{I_{O2}}{m}} = \sqrt{(R - \tfrac{3}{8} r)^2 + 83/320\ r^2}$$

These are the distances from center 0, at which the masses of the half spheres may be concentrated and then the algebraic sum of their energies—which are wholly translatory those of axial rotation being nil—will be exactly equal to the total kinetic energy of the ball as a unit. The

(*Continued on page* 156)

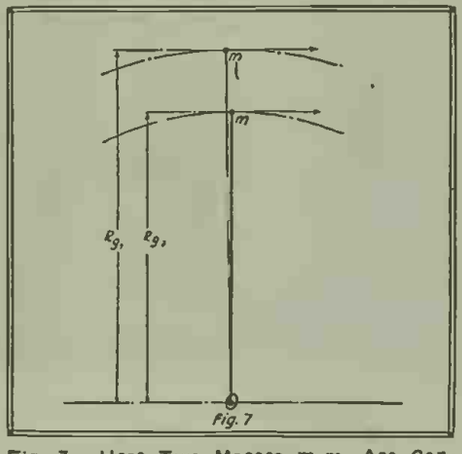


Fig. 7. Here Two Masses m-m, Are Considered as Condensed Into Points, Attached to Weightless Strings of Different Radii. If Both Strings Are Cut, and the Masses Considered as Joined, Then There Will Be No Rotation About the Common Center of Gravity.

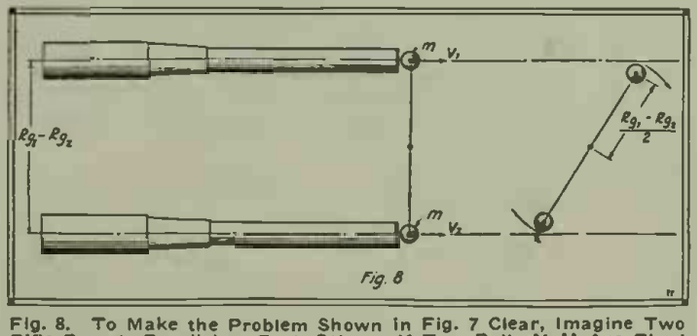
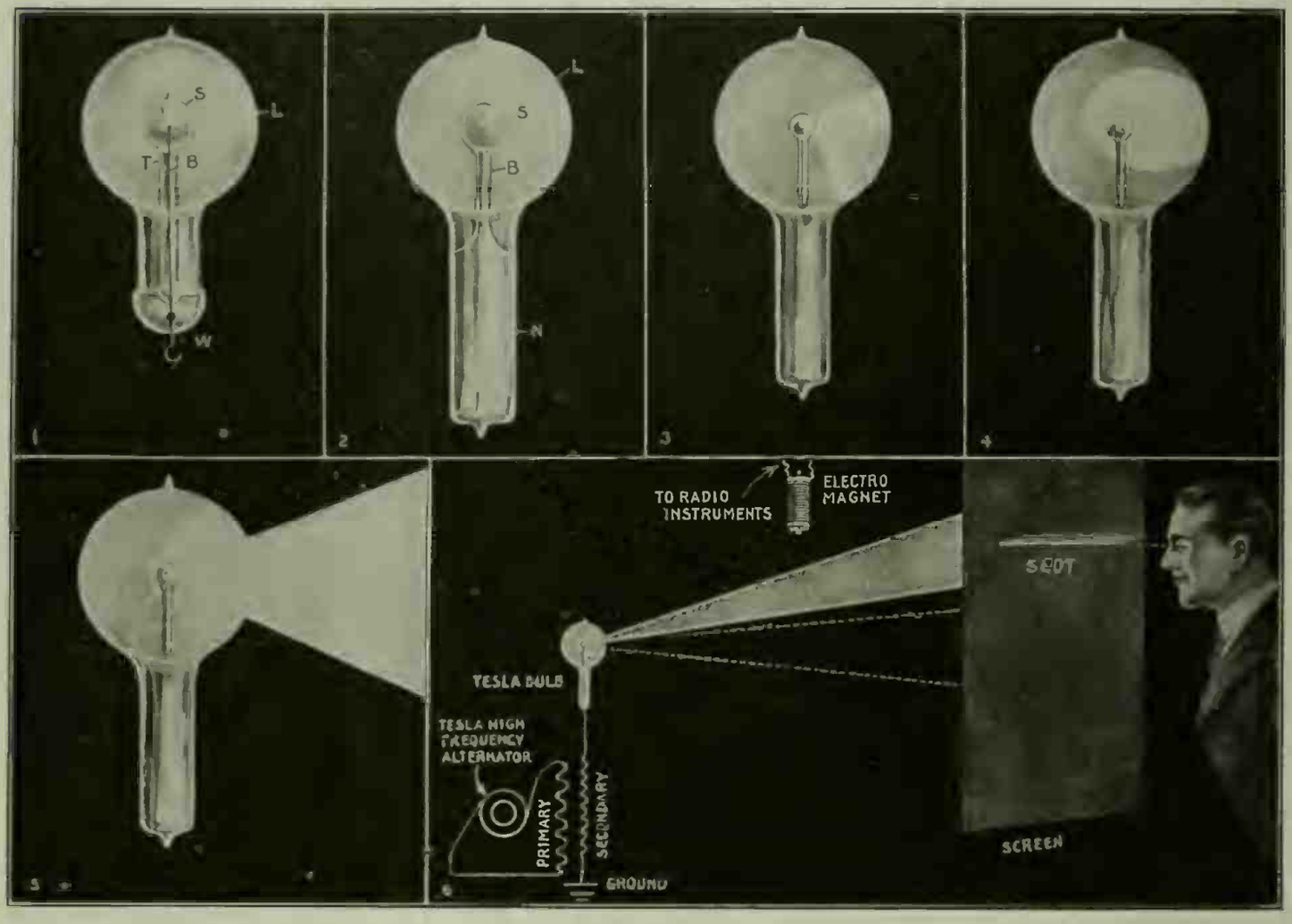


Fig. 8. To Make the Problem Shown in Fig. 7 Clear, Imagine Two Rifle Barrels Parallel to Each Other. If Two Balls M-M Are Fired Simultaneously, Joined by a Theoretical Bond, They Will Revolve About Their Common Center of Gravity, Proving That the Moon Possesses Only Kinetic Energy of Translation.

www.americanradiohistory.com

RADIO DEPARTMENT

Tesla Bulbs



Early in Nikola Tesla's Researches—In Fact as Far Back as 1892—He Discovered a Most Peculiar and Wonderful Vacuum Bulb Phenomena. The Effect was That, Under Certain Critical Conditions, This Bulb Would Cause a Ray to Be Shot off in the Manner Shown, Which Ray Would Revolve or Oscillate Under the Influence of a High-Frequency Current and in Synchrony with It. By Utilizing This Principle, Dr. Tesla Believes It Is Possible to Produce a Radio Detector More Sensitive Than the Audion or Fleming Valve.

IN the May issue in his article, "True Wireless," Nikola Tesla mentions the forerunner of the Audion, a Vacuum Bulb, which he used in his earlier experiments.

We have been in receipt of numerous letters from many individuals interested in this bulb who desire further particulars as to its operation, etc.

Accordingly, we publish herewith some excerpts from a lecture by Dr. Tesla delivered before the Institution of Electrical Engineers and Royal Institution, London, February, 1892.

"I think it best at this juncture to bring before you a phenomenon, observed by me some time ago, which to the purely scientific investigator may perhaps appear more interesting than any of the results which I have the privilege to present to you this evening.

"It may be quite properly ranked among the brush phenomena—in fact, it is a brush, formed at, or near, a single terminal in high vacuum.

"In bulbs provided with a conducting terminal, tho it be of aluminum, the brush has but an ephemeral existence, and cannot, unfortunately, be indefinitely preserved in its most sensitive state, even in a bulb devoid of any conducting electrode. In studying the phenomenon, by all means a bulb having no leading-in wire should be used. I have found it best to use bulbs constructed as indicated in Figs. 1 and 2.

"In Fig. 1 the bulb comprises an incandescent lamp globe L, in the neck of which is sealed a barometer tube b, the end of which is blown out to form a small sphere *s*. This sphere should be sealed as closely as possible in the center of the large globe. Before sealing, a thin tube *t*, of aluminum sheet, may be slipt in the barometer tube, but it is not important to employ it.

"The small hollow sphere *s* is filled with some conducting powder, and a wire *w* is cemented in the neck for the purpose of connecting the conducting powder with the generator.

"The construction shown in Fig. 2 was chosen in order to remove from the brush any conducting body which might possibly affect it. The bulb consists in this case of a lamp globe L, which has a neck *n*, provided with a tube *b* and small sphere *s*, sealed to it, so that two entirely independent compartments are formed, as indicated in the drawing. When the bulb is in use the neck *n* is provided with a tinfoil coating, which is connected to the generator and acts inductively upon the moderately rarefied and highly conducting gas inclosed in the neck. From there the current passes thru the tube *b* into the small sphere *s*, to act by induction upon the gas contained in the globe L.

"It is of advantage to make the tube *t* very thick, the hole thru it very small, and to blow the sphere *s* very thin. It is of the greatest importance that the sphere *s* be placed in the center of the globe L.

"Figs. 3, 4, 5, indicate different forms, or stages, of the brush. Fig. 1 shows the brush as it first appears in a bulb provided with a conducting terminal; but, as in such a bulb it very soon disappears—often after a few minutes—I will confine myself to the de-

(*Continued on page* 179)

www.americanradiohistory.com

Alexanderson's "Barrage" Receiver

The Highly Perfected Tuning Device That Riddled the German "Radio Barrage"

E F. W. ALEXANDERSON, consulting engineer and radio expert, related before a large gathering of leading American radio experts, at the April meeting of the Institute of Radio Engineers held in New York City, how Yankee ingenuity overcame German efficiency in the battle to control the air by wireless during the war. As in the fighting on land and sea, the Americans won!

The Germans installed powerful wireless apparatus at strategic points, and blocked communication with a barrage of meaningless messages that interfered with the sending and receiving of important messages. Something had to be done, and when the American Navy unfurled its battle flag in foreign seas it overcame the German interference with the wireless, and so made a remarkable stride in the science of aërial communication.

Mr. Alexanderson was one of the engineers who perfected the barrage receiver, as the device is termed. This invention permits an operator to tune out the powerful messages sent from points near at hand, and pick out of the clashing of radio waves the message sent from greater distances. In a word, he can isolate all messages except the one he desires to hear.

The problem of combating the barrages of senseless messages became serious as the war wore along. It was rather disconcerting to an Allied operator receiving an important message to have something like this break in on him—"Don't eat apple pie on Thursday. Yours till the watch on the Rhine stops. Gott mit Uns," yet it was just such messages that literally flooded the air when the wireless of the Allies was working.

Mr. Alexanderson explained two new devices at this lecture—the first, the "bridge receiver," which permits the speaker in a radiotelephone communication to break in on the second party at any time, and the wonderfully clever radio "barrage receptor."



Alexanderson Radio Receiver—"Barrage" Section.

The first invention, the "bridge receptor," gives to wireless telephony the same efficiency as the ordinary telephone. It enables the user to interrupt the person he is talking with without manipulating any apparatus. It will make it possible in the early future for a subscriber to converse with another subscriber in Europe while using the ordinary telephone installed in his home. He also will be able to speak to friends on ships in midocean.

The object of this development was briefly to provide means for neutralizing the overwhelming intensity of the transmitted signal so as to make the receiving set sensitive to the faint impulses of the distant signal. Popularly speaking, the corresponding equivalent in sound waves would be to have an ear which could be so adjusted that a person could stand close to a steam whistle without hearing the whistle, but listen to a person speaking from a distance of a few hundred feet (about a hundred meters). A successful solution of this problem was found as described. This method of reception which is characterized by a static bridge neutralization may be properly classified as the "bridge receiver."

The Barrage Receiver.

During the war the same problem presented itself again in a form which called for a new solution. Distances are only relative, and a steam whistle located in Germany might make such a noise that it would completely drown out both in England and France the sound of the voice calling from America. To find a way to counteract such a continuance was seriously considered by the Inter-Allied conference in February, 1918; and appeals for a solution were conveyed to the author by the French representative in this country, Lieut. Paternot. The solution to this problem, which was adopted by the American as well as the French government after the first demonstration, has become known as the "barrage receiver." This name appears appropriate because the word "barrage" has not only the military mean-

(*Continued on page* 171)

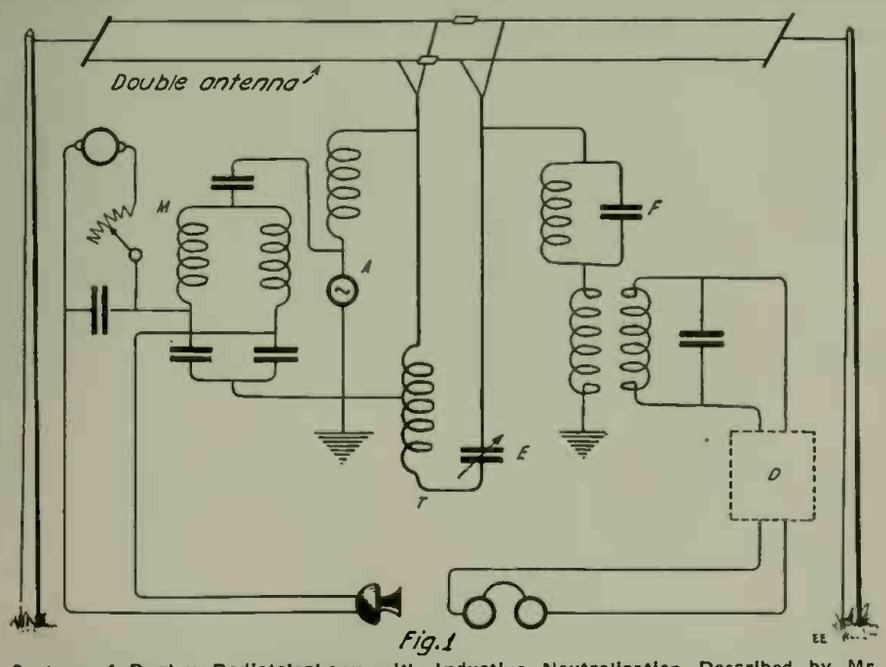
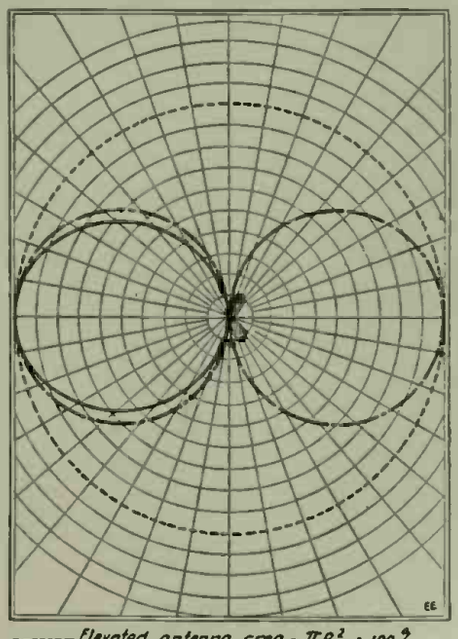


Fig. 1

System of Duplex Radiotelephony with Inductive Neutralization Described by Mr. Alexanderson Before the Institute of Radio Engineers. M—Magnetic Amplifier; A—Alternator; T—Neutralization Transformer; E—Exposure Condenser; F—Frequency Trap; D—Detector.



------ Elevated antenna area = $\pi R^2 \cdot 100\%$
—·— Magnetic loop area = $\frac{\pi R^2}{2} \cdot 50\%$
—— Barrage receiver area = $\frac{7\pi R^2}{32} \cdot 22\%$

Fig. 3. Relative Directive Reception with Different Types of Receiving Systems.

www.americanradiohistory.com

The Rogers Underground Aërial for Amateurs

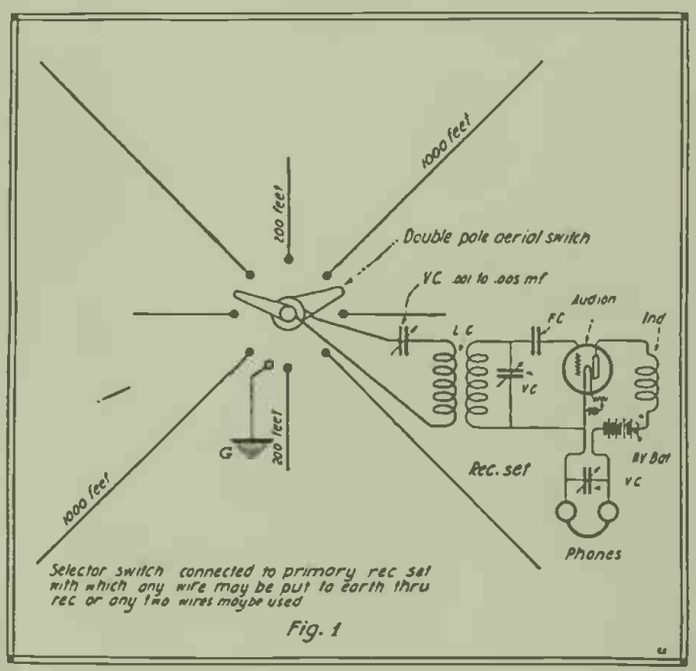
Specially Prepared with the Collaboration of Mr. James Harris Rogers

SINCE the publication of the original article on the Rogers Underground Wireless System, published in the March, 1919, issue of the ELECTRICAL EXPERIMENTER, the Editors have been literally besieged by hundreds and thousands of letters from radio experimenters in all parts of the world, asking for data on the construction of *Rogers underground aërials* suited to the requirements of the Wireless Amateur. The original article contained a great deal of valuable data, which should be carefully read and digested by every radio man, whether he be a student or a professional. In the present article an effort has been made to answer some of the questions which have seemed to annoy the average radio "bug" considerably, — especially those residing in cities where it is difficult and frequently impossible to bury an aërial longer than a few feet. We may say right here, that for those experimenters so situated, there is a solution, or in fact, two solutions, namely—to use a *spiral antenna*, such as has been tried out successfully in U. S. Naval tests on the Rogers System, and which spirals may be buried in the ground a few feet, or placed in a well or other body of water; and secondly, for the experimenter who is not allowed to disfigure an apartment house or other pretentious dwelling with an ugly looking aërial, there is the newly developed *loop antenna*, which can be used right in the radio room. Indoor aërials have been greatly perfected during the war, and now by means of greatly improved and highly sensitive wireless receiving instruments and amplifiers available, particularly those using audions as detectors and amplifiers, they are excellent, and satisfactory results are obtainable by means of a concentrated loop or spiral antenna, small enough to be placed in the radio laboratory.

For the present, we will listen to the sound advice given by our mutual friend, Mr. James Harris Rogers, on some of the practical outstanding features of his underground system, used in conjunction with straight-away single wire underground aërials, as well as loop aërials. Among other things, Mr. Rogers has the following to say regarding the installation of simple underground aërials:

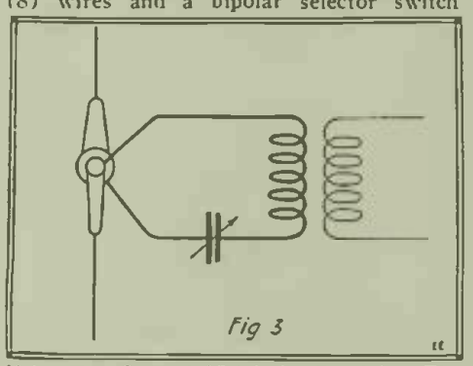
Mr. Rogers Talks to the Amateurs.

"The first installation of my underground antenna was made in the woods about a mile from my laboratory and consisted in burying wires in the earth; the wires radiated from the station as the spokes of a wheel,—*some wire bare* and *some insulated:* their lengths varied from 200 to 1,000 feet. (See Fig. 1).



Rogers Underground Aërial System for General Requirements, Showing Bipolar Selector Switch Connected to Primary Circuit of Receiving Set. Any Aërial Wire May Be Grounded Thru the "Set," or Any Two Wires May Be Used as Desired.

"It is obvious that a number of persons can receive at the same time, one operator to each wire. There is no interference, one with another. Figure 1 shows eight (8) wires and a bipolar selector switch connected to the primary receiving circuit. With this switch any individual wire may be *grounded*, or any *two wires* may be used. *Bare wires give the loudest signals but static is more pronounced.* The deeper the wires are buried, the better the signals, with a corresponding reduction of static. Short wires show a remarkable degree of directivity; long ones to a less degree and in proportion to their length. (See Figs. 2 and 3).



Using Two Ground Aërials for Receiving. The Aërials Should Lie in the Plane of the Station Being Received.

"When using two wires at right angles to each other, signals are heard from any direction. (Fig. 4).

"*The system works best in fresh water or very wet earth.* The primary circuit should have a variable condenser (.001 m.f. or higher capacity) in series. When insulated wires are covered with metal, lead, iron, etc., some remarkable results are obtained. These wires may be entirely enclosed in an iron gas pipe, for instance, (Fig. 5), or the joints may be connected by rubber hose. (Fig. 6).

"Here are some measurements taken with this last form of aërial:

Audibilities with *one bulb* only, on "Nauen" station, Germany:

Length Antenna	*When signals are weak*	*When better*	*When best*
2,000 feet..	15	25	50
2,500 " ..	30	50	100
3,000 " ..	60	100	200
3,500 " ..	120	200	400
4,000 " ..	240	400	800

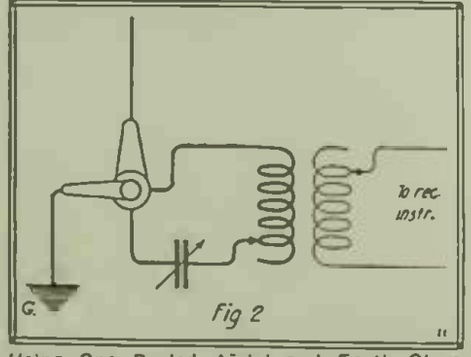
"Regarding the tests with loops I will state briefly that I have successfully tried different forms and sizes.

"I first had a well bailed out and lowered a loop antenna into it; the well was 50 feet deep. (See Fig. 7). The signals were as loud at the bottom as when above the earth. I next had the well filled with water and the results were the same, excepting that the note of the sending station became higher and higher as it was lowered. Upon revolving it I found the directional characteristics were the same in the water as when out. These tests were made about two years ago, and I at once realized that *loops* or *cages* could be used in the dugouts of France, or on submarines when submerged.

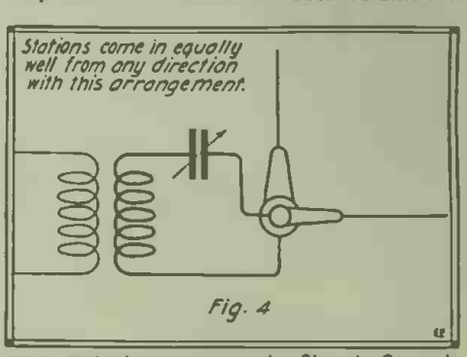
Regarding the dimensions of loop antennae used on submarines, these coils measure about 3 feet square in some instances. The wires are very heavily insulated and placed in a box filled with pitch, the connections are lead below and the coil can be revolved for directional observations."

Kind of Wire Used for Underground Aërials.

Most of the inquiries from Radio Experimenters and those intending to install experimental stations, and wishing to make use of the "static-proof" Rogers underground antenna, on which signals may be received *even thru a thunderstorm*, indicate that the greatest problem to solve seems to be the size and the kind of wire to be used, and how it shall be buried. Some very excellent results have been obtained in

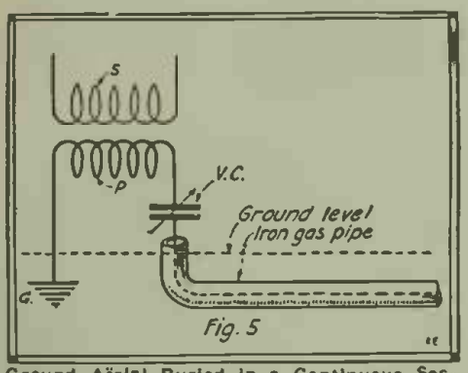


Using One Buried Aërial and Earth Gives Same "Directivity" as When Two Wires Are Used.



With This Arrangement the Signals Came In Equally Well from Any Direction. A Good "Stand-by" Hook-up.

www.americanradiohistory.com



Ground Aërial Buried in a Continuous Section of Iron Pipe. Excellent Results Have Been Obtained with This Scheme.

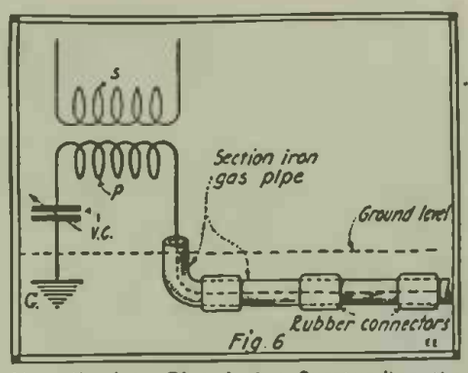
experimental work carried on at one of the leading American universities with aërial conductors laid on the ground, and where the experimenter has the time and space to try this out, he may gain some useful and valuable knowledge by experimenting in this direction. Ordinarily the wire, of whatever kind it may be, as used when installing the Rogers underground aërial, is buried about three feet deep in the earth. For most Amateur requirements, the wire only need be about 100 to 200 feet long, and so the digging of the ditch is not such a great problem; in fact, it can be plowed open, at least part of the depth, and where rivers, brooks or ponds are available the insulated wire can be placed in them directly and allowed to rest on the bed.

Regarding the choice of wire to be used, it becomes evident that even bare copper or other wire may be utilized when desired, as Mr. Rogers has pointed out in the above contribution. The size of this wire should be about No. 12 or 14 B. & S. gage, the heavier the better.

The official U. S. Navy reports of tests on the Rogers Underground System mention that no increased efficiency is obtained by using more than one wire, and that this may be a No. 12 or 14 B. & S. gage, weather-proof or rubber-covered copper conductor. In any case, the free end of the wire should be well taped, and preferably covered with some rubber cement, so as to keep it insulated. Experiments have been tried both by Mr. Rogers at his Hyattsville, Md., laboratory, and also by the Navy Department, with underground aërials placed in terra cotta pipes, but this construction is rather expensive, and the results obtained do not justify its use.

Other forms of wire used both by Mr. Rogers and the Navy Department experts include lead-covered telephone cable, which is, of course, thoroly damp-proof, while a conductor holding considerable favor with the inventor is the heavy rubber-covered, high-tension, auto ignition cable. This is highly efficient for aerial requirements, as it is stranded and therefore of low high frequency resistance.

In any case, a little common sense and logic will give the answer to many of the simple problems arising in connection with the installation of these aërials, such as, for instance, the length of aërial to be used for a certain range of wave lengths. It is manifest that the longer the antenna, the longer the wave length to which it will properly respond. Considering that an antenna is used having a length of, say, 150 to 200 feet, then practically all the shorter wave lengths up to 600 meters and more should be readily picked up on this antenna, especially with the variable condenser hooked up in series with the primary of the loose coupler, as shown in the accompanying diagrams. Naturally the wire buried in the ground has a higher electrostatic capacity than the old-style antenna wires, elevated 40 to 50 feet above the ground, and we can reduce this capacity as desired, so as to tune any certain wave lengths, by connecting another capacity in series with it; in exactly the same manner as short wave lengths are tuned in on the regular elevated aërials, by connecting a variable capacity in series with the antenna circuit, and the primary of the loose coupler. Long wave lengths are tunable by using large condensers and loose couplers preferably.



Here the Iron Pipe Jacket Surrounding the Buried Aërial is Divided up into 20-Foot Sections by Means of Rubber-Hose Connectors; a Later Development.

AUDIONS ON ALTERNATING CURRENT

Well, "Radio-Bugs," the very latest thing in Audion circuits is to cut out the expensive high voltage batteries, which are forever deteriorating and necessitating the purchase of new ones, or else the use of messy miniature storage batteries, and to operate your Audions, both filament and plate circuits, with ALTERNATING CURRENT. Sounds impossible, doesn't it? But it is a fact, nevertheless. Don't miss this important article, which will be worth many dollars to you, to appear in the next issue of the ELECTRICAL EXPERIMENTER. Read this special article entitled "Operate Your Audion Receiving Set on A.C." by Elliott A. White, formerly instructor in Radio at the Carnegie Institute of Technology, with diagrams and complete data on the building of the transformer, and other details. This is but one of the big feature Experimental Radio Engineering articles we have in preparation for the July number. It is the greatest revelation you ever read in Radio literature. Don't miss it, "Radio-Bugs"!

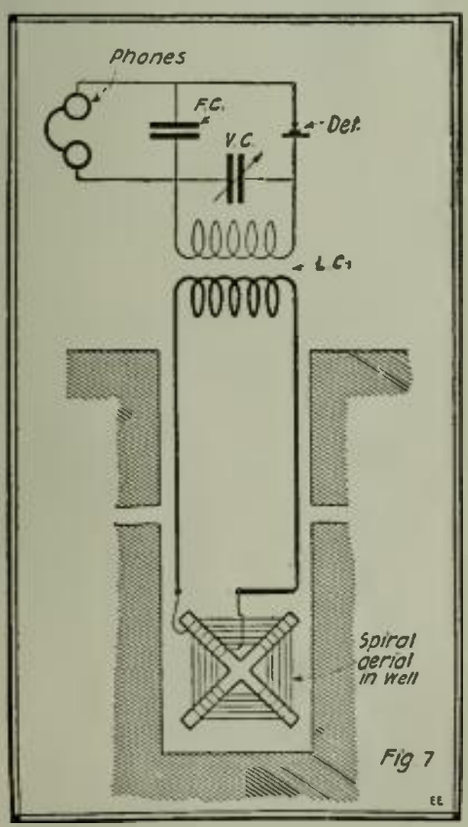
Spiral or Loop Aerials.

As shown in the diagram, Fig. 7, interesting results were obtained with a spiral antenna, composed of a dozen or so turns of insulated wire, such as high tension cable or No. 14 R. C. solid conductor lowered into a well, both with and without water in it.

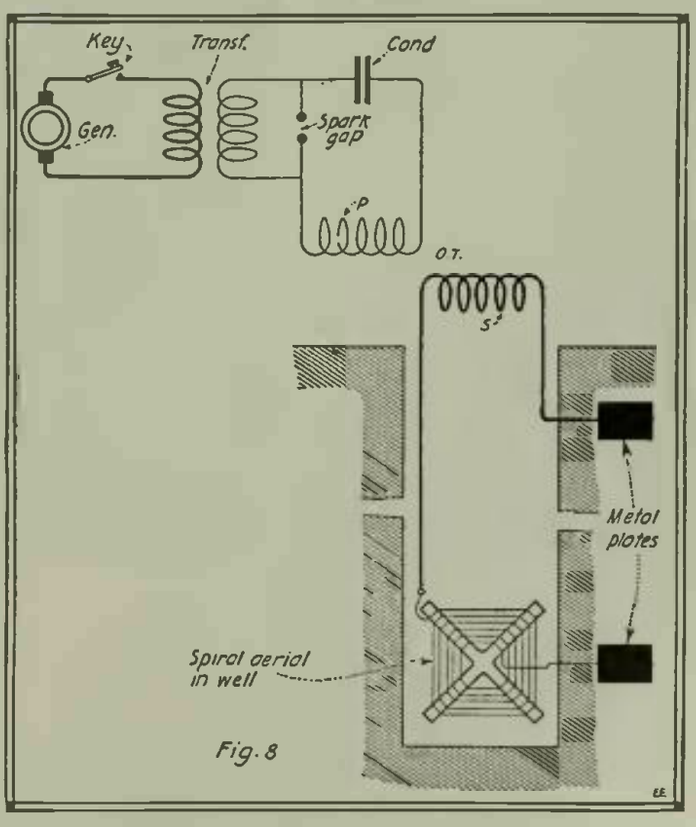
As pointed out in the original article on the Rogers underground system in the March issue, very promising results have been obtained in transmitting with the underground antenna, and Fig. 8 shows how a small transmitting set was operated with such an aërial, coupling the exciting or spark gap circuit with the antenna oscillatory circuit by means of a two-coil oscillation transformer, L, C. In this case two metal plates, about one yard square, are placed in the earth adjacent to the well, one of which connects with the secondary, S, of the oscillation transformer, while the other plate connects with the free end of the spiral antenna.

If the spiral antenna is used, it should be mounted so as to be revolvable on its vertical axis, and it should be placed in the vertical plane as shown in Figs. 7 and 8. Excellent results have been and should be obtained in transmitting with the underground antenna, with the usual insulation incident to the form of conductor above

(*Continued on page* 187)



Some Very Surprising Results Were Obtained in Receiving with a Spiral Antenna Lowered into a Dry Well. Slightly Different Results Were Noticed with Water in the Well.



Distances up to Fifty Miles Have Been Covered Very Successfully in Transmitting with the Rogers Underground Aërial. In This "Transmitter," the Spiral Antenna Is Placed Down in a Well, Metal Ground Plates Being Connected as Shown.

www.americanradiohistory.com

Learning the Code

By HOWARD D. WILDMAN

IN the June, 1918, "E. E.," page 101, there was an article by Mr. Rockwood, relating to Thomas Reed's idea in the January issue, about a new scheme for learning the Continental code. Mr. Rockwood says he tried the scheme himself, but found he often accented in the wrong place and so got the wrong letter. I foresaw this possibility before I tried out the idea and hunted up one substitute word—L—"lo-*cal*-ity." The others I found O. K. Mr. Rockwood says the catchword for "J" is "Jerusalem." It isn't. It is "Ja-*pan-nese-ness*," and I have found that you can't get it wrong.

Now as to my experience—before I read Mr. Reed's article I knew only two or three letters—e, i, t. I read the article and memorized the catchwords.

Before this I had tried several times to learn the code, but I was apt to get .—.. for .—. or ..—. for ——.— After memorizing the catchwords, in an hour or so, I could write a sentence and then rewrite it correctly in dots and dashes. At that time I had no key, receiver or anything but an A. C. toy transformer, a rheostat and a few other instruments. I made a key and receiver and practised sending to myself. A friend of mine learned the code meanwhile by memorizing the dots and dashes—a long process, during which time I learned to recognize the sound in the receivers. To this day he occasionally, when sending, shouts to me, "Hey, what's 'P'", or something similar, and I can always tell him.

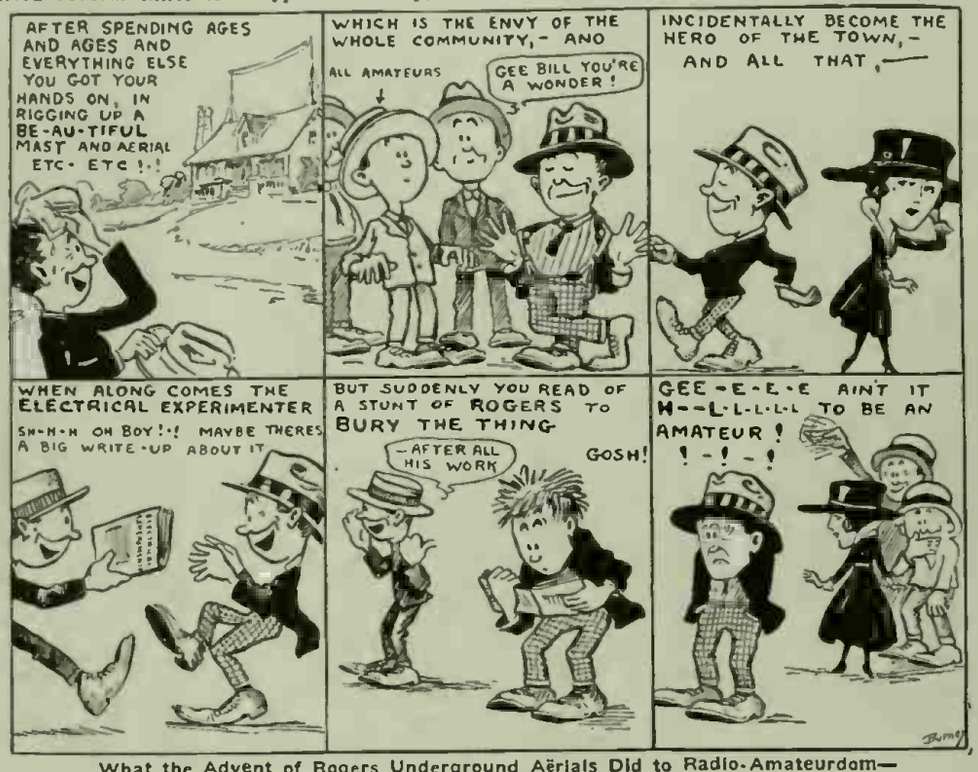
Mr. Rockwood says one must by this method learn the system and then *unlearn* it. This is not quite true. One *gradually* gets to send without using the catchword. Finally one gets to the point where one sends or receives as Mr. Rockwood says it should be done. This comes of itself without effort, after a little familiarity. My friend will sometimes take .—— to be "U," etc. My experience proves that if he had learned by catchwords, this would not happen. I don't confuse ..—. with .—.. or .— with —. The catchword positively prevents mistakes in sending, as you wouldn't send —. for "away," nor ..—. for "lo-*cal*-it-y."

For receiving, the catchword is useless. This can be readily seen as .—. would not readily call to mind "fi-li-*pi*-no.". But by using the catchword to send to one's self you learn to recognize ..—. as "F." After some practise, when you want to send "F," you do not think "fi-li-*pi*-no," or ..—. but send it without thinking.

You say—"Of what use then, is the catchword? It is learned only to be discarded again." The catchword serves to teach the code, so that the student can send to himself and teach himself to receive.

Thus we see the catchword is of no help in receiving. But at first it is a great help in sending, as it prevents confusion.

Briefly then, the idea is to be able to send so as to teach one's self to recognize .—.. as "L," etc.

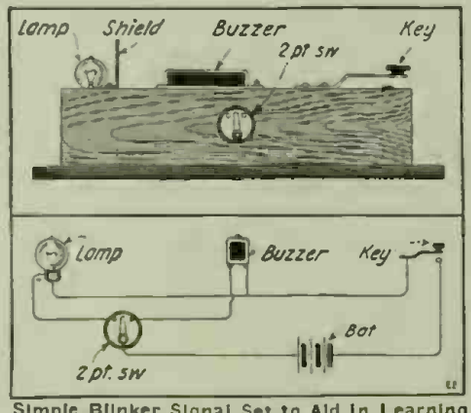


What the Advent of Rogers Underground Aërials Did to Radio-Amateurdom—By H. B. Burney.

A BLINKER SIGNAL SET.

This device consists of a key, dry-cell buzzer, 2 point switch and lamp. The lamp is used for signaling at night, the key being used to make the dots and dashes which the lamp flashes. The buzzer is used when it is impractical to use the lamp.

First procure or make a wooden (small cigar box), just large enough to contain a dry (or flashlight) cell. On top of this box a strap key made from a strip of brass and with a poker chip for a knob is placed. A flat-headed screw serves as a contact point. In the center of the box is placed a box-type buzzer, and near the end opposite the key, a hole is drilled just large enough so that the lamp will fit snugly. A piece of tin is bent to the shape shown and serves as a shield to the operator's eyes. This also acts as a reflector. By using the hook-up shown, either the lamp or buzzer may be put in circuit by using the 2 pt. switch screwed to the side of the box.



Simple Blinker Signal Set to Aid In Learning the Code, with Lamp and Buzzer.

Contributed by P. J. FAULKNER, JR.

RADIO IN THE NAVY.

THE development of wireless by the Navy Department during the war has been so remarkable in many phases that it is almost unbelievable. Apparatus known before the war to only a few scientists and perhaps a few of the more progressive amateurs has been developed by the Navy and placed in practical use to such an extent that it has entirely revolutionized radio operation and will eventually be so applied in commercial work as to greatly increase the scope of radio communication. The work of the radio operator will be so broadened that he will rank as a highly skilled technical specialist.

The development of the radio telephone, radio compass, direction finder, submarine listener devices, etc., have depended largely upon the development of the "audion" and its application to radio communication. The use of the various methods for the elimination of static have permitted the employment of extremely sensitive audion receiving sets employing a number of steps of amplification. This depends, of course, upon the application of the audion. All of these things have so complicated the art of operation as to require a very much broader and technical course of instruction than has heretofore been found necessary.

The Navy Department has approved plans for the centralization of all instruction in radio work in one of the great training stations in the Middle West where they are now organizing a school comprising a course of instruction to cover all these modern phases of radio practise, together with a thoro course in practical electricity.

The development of radio during the war has so interested scientists and others in the many advantages to be obtained from its various applications that it is certain that it will never return to the comparatively limited field which it formerly occupied.

The future in store for those possessing thoro acquaintance of the modern phases of radio work is unlimited. The entire Navy personnel is now, practically, in the course of reconstruction and offers an exceptional opportunity for men interested in electrical and scientific lines. The Naval service has need of, and promises rapid advancement to anyone willing to put forth the same effort in the service as would be necessary for him to make a success in civil life. The opportunity to secure a training in the most modern phases of radio work cannot be duplicated elsewhere.

Those interested in the service may apply to the nearest recruiting officer and request from him information concerning enlistment as "Apprentice Seaman for Radio" or, should further information be required, write to the Officer in Charge of the Radio School, Great Lakes, Illinois.

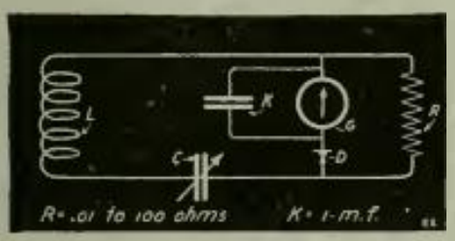
www.americanradiohistory.com

USE OF CONTACT DETECTORS IN RADIO MEASUREMENTS

By Dr. L. W. Austin,
U. S. Naval Radio Laboratory.

For many measurements in radiotelegraphy it is necessary to use a radio frequency-current indicator of known resistance. If the current to be measured is small it is generally customary to use a thermoelement and galvanometer. The most sensitive thermoelements are either of the vacuum type or the welded tellurium type. The vacuum thermoelements can be obtained of any desired resistance and are very sensitive, but are slow in action and frequently show a bad zero drift. In addition, the deflection usually shows considerable divergence from the current-square law. The tellurium platinum elements are quick acting and follow the current-square deflection law with sufficient accuracy for all practical purposes. They are, however, so fragile and difficult to manufacture and transport that no manufacturer has yet undertaken to supply them commercially. It is also impossible to make the contact resistance much less than 10 ohms. It is to be noted that the resistance in both the vacuum and tellurium types changes considerably with the amount of current flowing.

On account of the difficulties mentioned, the sensitive thermoelements in our laboratory have been replaced, for the most part, by a shunted contact detector circuit arranged as shown in figure 1. Here *LC* is any oscillating circuit having inductance and capacity, *D* is a contact detector, *G* a high resistance galvanometer, *K* a paper



Owing to Several Difficulties Experienced with Sensitive Thermoelements in the Radio Laboratory, the U. S. Naval Radio Laboratory Utilizes Instead the Unique Arrangement Here Shown. This Scheme Comprises a Shunted Detector Circuit, where L-C is Any Oscillating Circuit Having Inductance and Capacity; D is a Contact Detector; G a High Resistance Galvanometer; K a Tin Foil and Paper Condenser of One Microfarad Capacity, and R a Resistance Which May Have Any Value from 0.1 to 100 Ohms. The Greater Part of the Radio-Frequency Current Passes Thru R, While a Small Portion is Shunted Thru the Condenser K and the Detector. The D. C. from the Detector After Passing Thru the Galvanometer Returns Thru R. The Sensibility of this Arrangement is Much Greater Than That of the Best Vacuum Thermoelements of Equivalent Resistance.

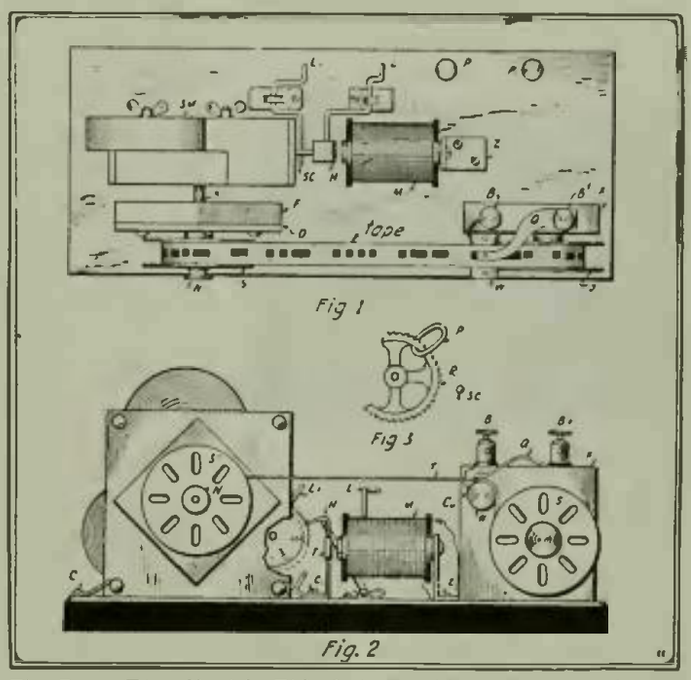
condenser of one microfarad capacity, and *R* a resistance which may have any value from 0.1 to 100 ohms. The greater part of the radio-frequency current passes thru *R*, while a small portion is shunted thru the condenser *K* and the detector. The direct current from the detector after passing thru the galvanometer returns thru R. On account of the high resistance of the detector, the total resistance of the detecting system is practically identical with *R*, as has been experimentally tested between 0.1 and 100 ohms.

The sensibility of this arrangement is much greater than that of the best vacuum thermoelements of equivalent resistance.

In the case of most of the well-known detectors the proportionality between deflection and current-square is excellent. Galena, while the most sensitive of any of the detectors tried, shows a slight deviation from the square law. For absolute current measurements the system must of course be calibrated by comparison with a known thermoelement at the time of experiment.—*Journal Washington Academy of Sciences.*

Automatic Code Transmitter

I present herewith design of an automatic tape transmitter that I constructed and which runs very well. Details: Motor —This is an alarm clock which had "given up its ghost." I pulled it out of its case, removed the balance wheel, hair spring and the little lever—whatever its name is—and also the ratchet wheel, which I kept. I also removed the face, both hands and the driving mechanism for the hour hand. I then drove on the minute hand shaft a block of wood 2 inches by 2 inches by ½ inch, so that the shaft did not come quite thru the block (Fig. 1). On F I screwed a block of thin wood 2 inches by 2 inches with an 8/32 bolt 1 inch long thru the center of it, and a nut on the bolt (Fig. 1, K); on this bolt I put an empty typewriter spool, S, which I held on by bolt and nut (Fig. 1, N). Light spools for the purpose can easily be made up by the experimenter from fibre and brass odds and ends.



The Paper Tape Used In This Code Teaching Instrument Can Be Cut from the Border of a Newspaper, and the Dots and Dashes Punched in It With a Conductor's Ticket Punch.

Transmitter—On the base I fastened (Fig. 1, X) a wooden upright 2½ inches by 2½ inches by ½-inch in line with (Fig. 1, F). The peg, W, covered with copper sheet, Cn, is inserted in a hole in the wood; in W are inserted two small brads to keep the paper tape in proper alignment. Cu is connected to B and a fine brass brush, Q, bears on the tape and connects with Cu when an opening appears. S is another typewriter ribbon spool running on a headless wire nail.

Regulating Devices—Speed—The ratchet wheel aforementioned is treated by cutting out about one-third of it, Fig. 3, and also an oval of wire, P, is fastened loosely around the rim of the wheel (R); this ring hits on Sc, Fig. 1, which is a wire held in a spring binding post so it can be regulated. This regulator and the cut ratchet wheel are used to keep the spring motor from running away with itself.

Brake and Release—Consists of a thin copper spring, H, Fig. 2, fastened in common with one of the two clips which hold the motor down, H, has some sheet iron wound around it at T to form an armature, so that the electro-magnet, M, fastened on support, Z, can act on it.

The auxiliary release, L, is a bent copper wire (No. 14 B. & S. gage), which swivels on a spring post to release the brake H.

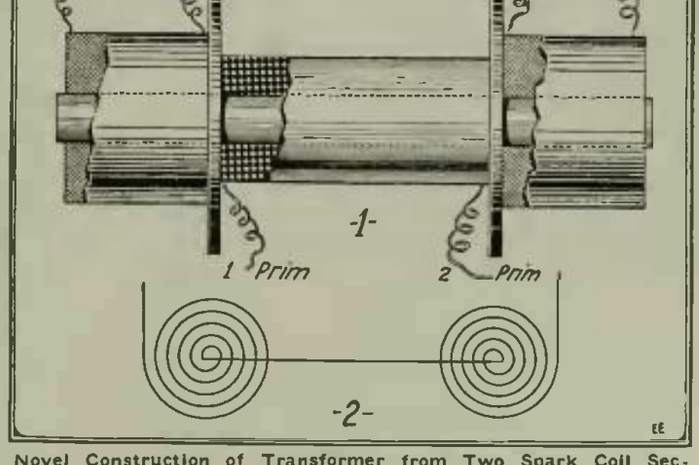
The electro-magnet is connected to binding posts, P and P, and is wound full of No. 28 B. & S. gage magnet wire.

Contributed by
GEORGE HARRINGTON.

A New Type of Transformer

A great many experimenters are in the position of having outgrown the "spark-coil" stage, but do not have the necessary funds to buy or construct a transformer using the 110 volt A. C. They are then burdened with a spark coil, which they usually attempt to use by means of an electrolytic interrupter, which will use an excessive amount of current without a very high degree of efficiency. In some cases the spark coil has been taken apart and an attempt made to use the secondaries. But it is easy to see that this cannot be done on the usual type of open-core transformer, for after winding three or four layers of heavy wire on a core about two inches in diameter, the total size is too great to permit the secondaries to be slipt on over the coil.

A plan that has given very good results is shown in the diagram. As will be noted, the primary is wound in the center of the core, *and a secondary slipt on each end.*



Novel Construction of Transformer from Two Spark Coil Secondaries, with the Primary Coil Placed Between Them.

The core is constructed of soft iron wire

(*Continued on page* 174)

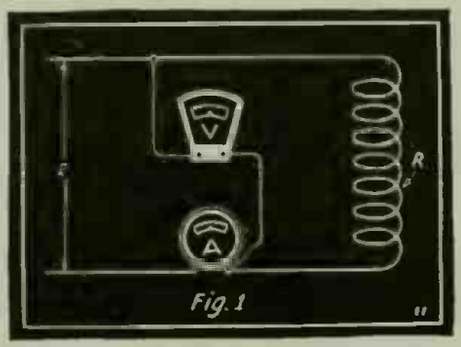
www.americanradiohistory.com

Choke Coils--Theory and Design

By F. E. AUSTIN

Professor of Electrical Engineering, Thayer School of Engineering, Dartmouth College, Hanover, N. H.

THE writer who is constantly in receipt of inquiries from those desiring to know how to construct choke coils to meet certain requirements, takes this opportunity to explain somewhat briefly the theory underlying the



When a Coil of Magnet Wire Is Connected to an A. C. Circuit, the Current Is Measured by an Ammeter and the Potential by a Voltmeter. The Current Absorbed Depends upon the Number of Turns and Kind of Core Used in the Coil.

construction of choke coils, and to give directions for the construction and operation of such coils.

Choke coils are simply coils of insulated copper wire thru which alternating currents are allowed to pass and by means of which the *amount* of the alternating currents may be regulated as desired. The regulation is effected by the action of the counter-electromotive-force induced in such coils due to the continuously varying magnetic field set up by the varying alternating currents. The consideration of the variation of counter-electromotive-force is therefore the important question in the building and operation of all choke coils.

When a coil, formed by winding a number of turns and layers of double cotton covered copper magnet wire about an insulating tube of say hard fiber or cardboard has an alternating pressure applied to its terminals, as indicated in Fig. 1, an alternating current flows thru the wire of the coil according to the well known equation:

$$I_{ac} = \frac{E}{\sqrt{R^2 + (2\pi f L)^2}},$$ in which I_{ac}

denotes the current in amperes, indicated by an ammeter connected with the coil as indicated in the figure; E denotes the applied alternating pressure in volts, indicated by a voltmeter at V in the figure; R denotes the resistance of the coil in ohms, which may be measured by experiment, using a voltmeter and an ammeter with *direct current* or by the use of a Wheatstone bridge testing set, or which value may be *calculated* from the size of the wire and its length; f denotes the frequency of the applied pressure in cycles per second, and L denotes the so-called coefficient of inductance of the coil. Should a direct current pressure be applied to the terminals of the coil, the current would be exprest simply by Ohm's law as:

$$I_{dc} = \frac{E}{R}$$

It is evident by comparing the two equations, if the applied pressure *A. C.* and the applied pressure *D. C.* should have the same numerical value in volts, there would be much less resulting current according to the first equation than from the second, if the term exprest by $(2\pi f L)^2$ has any considerable numerical value. This of course depends upon the value of f and of L. The value of f is fixt by the value of the ordinary commercial frequencies of power circuits, ranging from 40 to 100 cycles per second, with 60 cycles as a very common frequency. The value of L depends upon the square of the number of turns on the coil, and very largely upon the material that is inserted into the coil to serve as a core.

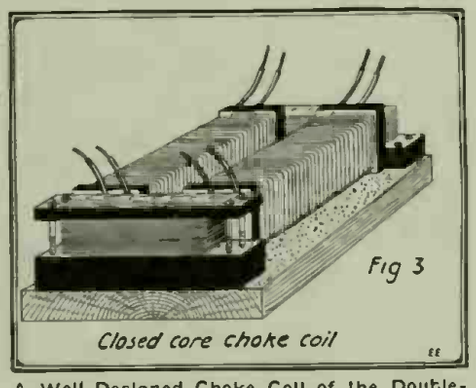
The value of L is exprest by a unit called the *henry*, may be very easily and quickly ascertained by experiment for any coil, and may be quite accurately calculated from the number of turns wound on the coil, the area of cross-section of the central hole thru the coil and the length of the coil, when there is no iron or other magnetic material near the coil.

Let us examine somewhat carefully the first equation. First, suppose the value of f is O; then $2\pi f L = O$ and the equation becomes:

$$I_{ac} = \frac{E}{\sqrt{R^2}} = \frac{E}{R}$$ or Ohm's law.

When $f = 0$, the current is a direct current, and Ohm's law should be applicable. Next suppose $L = 0$; then also will

$$I_{ac} = \frac{E}{\sqrt{R^2}} = \frac{E}{R}$$ and Ohm's law again ap-



A Well-Designed Choke Coil of the Double-Pole, Closed-Core Type. One-half of the Winding Is Placed on Each Leg of the Laminated Sheet Iron Core.

plies. The value of L can be 0 only when the wire constituting the coil is not wound in the form of a coil; that is only when it is *straight*. The *A. C.* current in a straight wire is the same as the *D. C.* current if the numerical value of the *A. C.* pressure is the same as the numerical value of the *D. C.* pressure.

For illustration, suppose the value of L is, first, 1 *henry* and that $f = 60$. The numerical value of the term $(2\pi f L)^2$ becomes $(2\pi \times 60 \times 1)^2 = 377^2$; (very nearly). It may readily be appreciated that the $2\pi f L$ term has a very important bearing on the numerical value of I_{ac} when the values of E and R are fixt. The value of E is always fixt by the pressure of supply, the value of R is of course fixt when the coil is wound. Usually the frequency is also fixt by the frequency of the supply, which leaves L as the only variable quantity remaining that allows a variation in the current denoted by I_{ac}. After a coil is wound, the value of L is not variable unless the windings on the coil may be varied. This of course is not feasible except within rather narrow limits. The coil may be wound in sections, with taps, arranged for connecting with apparatus, thus allowing a variation in a comparatively few steps.

If the coil is provided with a movable iron core consisting of varnished iron wires, the means are provided for not only giving a very wide variation to L, but for making the variation absolutely gradual,

Suppose, for example, that a coil has an ohmic resistance of 5 ohms and a coefficient of inductance of .0162 *henry*. Find the current in the coil when an alternating pressure of 110 volts at 60 cycles is applied to the terminals of the coil? Making the proper numerical substitutions in the fundamental equation gives:

$$I_{ac} = \frac{110}{\sqrt{(5)^2 + (2\pi \times 60 \times .0162)^2}}$$

$$= \frac{110}{\sqrt{25 + (377 \times .0162)^2}} = \frac{110}{\sqrt{62.7}}$$

$$= 13.9 \text{ amperes.}$$

With an applied direct-current pressure of 110 volts the current in the same coil will be found from:

$$I_{dc} = \frac{110}{5} = 22 \text{ amperes.}$$

The coiling of the wire, therefore, accounted for $22 - 13.9 = 8.1$ amperes.

In order to reduce the current to 13.9 amperes on a direct current circuit, it will be necessary to introduce a resistance in series with the coil having a value of

$$R_x = \frac{110 - 69.5}{13.9} = 2.9 \text{ ohms.}$$ This may

be understood better by consulting figure 2, which represents the coil connected in series with an auxiliary resistance R_x across a 110 volt circuit.

The current in this arrangement may be exprest by:

$$I_{dc} = \frac{E}{R + R_x};$$

and if the proper numerical values are substituted in this equation the result will be:

$$13.9 = \frac{110}{5 \times R_x},$$ from which

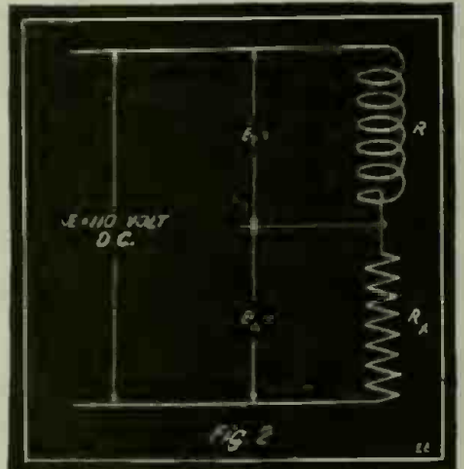
$$(5 + R_x)\ 13.9 = 110;$$

$$5 \times 13.9 + 13.9\ R_x = 110$$

$$13.9\ R_x = 110 - 5 \times 13.9$$

$$R_x = \frac{110 - 5 \times 13.9}{13.9} = 2.9 \text{ ohms.}$$

(*Continued on page* 185)



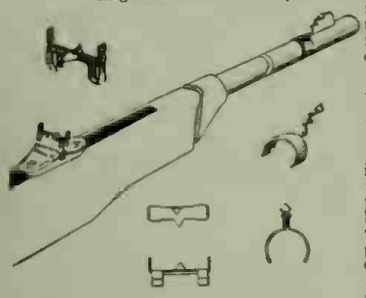
Experiment with Choke Coil Designed for A. C. Circuit Connected to D. C. Circuit, Showing the Effect of Inductance or Impedance on the Current Consumed.

www.americanradiohistory.com

LATEST PATENTS

Luminous Attachment for Gun-Sights.

(No. 1,292,211, issued to Harold S. Young and F. H. Ihde.)

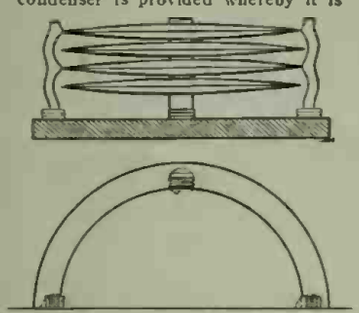


The sighting plate mounted on the front end of the firearm is coated with a covering of luminous paint, or some such other light-radiating pigment, which can be easily discerned at night. The benefit of this improvement in sights is that the marksman looking thru his rear sight can easily discern his forward point or sight due to the fact that the same is covered with this radium paint.

Electrical Condenser.

(No. 1,292,589, issued to R. F. Darmezen du Rousset and Chas. E. Brandt.)

It is a generally accepted fact that in electrical condensers formed of flat conducting surfaces separated by some dielectric the charge is unequally distributed from the center to the edges, its density being greater toward the perifery where the ruptures are always produced. In this new form of invention a condenser is provided whereby it is

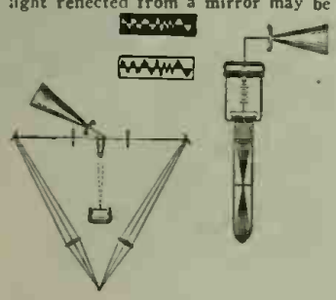


possible to localize the maximum tension at the central point of the system, and also increase the capacity for a given diameter. It consists of a number of discs arranged in the form of a quenched gap, wherein metal plates with concave surfaces are used, and between these various plates insulating discs are placed.

Photographic Phonograph.

(No. 1,291,702, issued to Frank W. Adsit.)

One of the principal points in this new invention is the providing of means for registering on a film the graphic representation of sound. Another object is to provide a means in connection with this film whereby a light reflected from a mirror may be



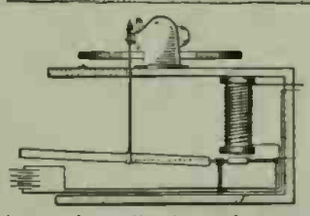
registered on either one side or the other of a center line down the film or on both sides of this simultaneously. It is also possible by special means to reproduce these graphic representations registered on the film, so that musical sounds or voice currents may be reproduced.

Automatic Record Stop for Phonographs.

(No. 1,291,985, issued to D. M. Manson.)

The principal innovation in this invention is an electrical means, whereby after a record has been played the needle will be carried back to the starting point, so that the playing of the record may be repeated. The invention as a whole consists essentially of an arm secured at one end to the sound box crook, magnetic means being provided for drawing down the opposite end of the arm, thereby raising the sound





box and needle from the record. Also a means is provided for counterbalancing the weight of the sound box during its return or downward movement. An ingenious scheme is devised whereby the tapered tube, by means of an adjustable stop, can be designed to be turned in any position to correspond with the starting point of the record, and a spring connected to the tapered tube and bracket, whereby the taper tube can be turned from the center of the record when the needle is out of contact with the record and brought back to the starting position.

System for Amplifying Variable Currents.

(No. 1,297,188, issued to Irving Langmuir.)

This invention is merely a means devised for utilizing an electron discharge and comprises several novel systems of connections whereby the weak currents can be reproduced as stronger currents. Taken as a whole, it is merely a modifica-

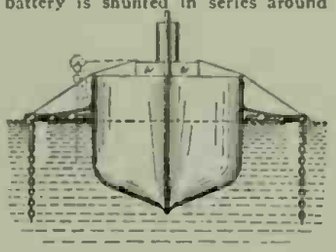


tion of the several step amplifier, as has appeared heretofore. In general it has some new points of interest, but taken as a whole, the invention boils down to the fact that it consists of a number of electron discharge devices connected in cascade for the amplification of currents. The bulb itself is made of quartz previous to an ultra-violet light, and into which are sealed in the usual manner an electron-emitting cathode and anode. The cathode of this particular bulb consists of potassium or sodium, which will emit electrons when illuminated by a source of light.

Magnetic Protector for Ships.

(No. 1,293,539, issued to John and Sophie Pies.)

The principal device is a form of arm extending from the ship on each side attached to an electro-magnet with a flexible chain hanging in the water, and arranged with a number of floats to depend from these extending arms. One circuit is formed in series with these magnets to a large generator, and the battery is shunted in series around

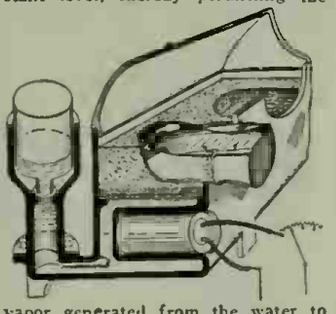


the two chains that hang from either side of the ship. The apparatus is arranged to detect submerged torpedoes, mines, etc., due to the fact that their presence would increase the conductivity between these two chains and cause the circuit to be closed and ring the bell.

Electrically-Heated Apparatus for Moistening Shoes.

(No. 1,294,533, issued to W. W. Reed.)

It has been found that much of the cracking and breaking of shoes incident to the lasting operation can be avoided by preliminarily treating with a hot vapor. A tank is provided which will maintain the water automatically at a constant level, and an electrical heating unit arranged to heat the water. A layer of absorbent material is placed on top of the heated water, and an automatic means provided for maintaining the upper surface at a constant level, thereby permitting the

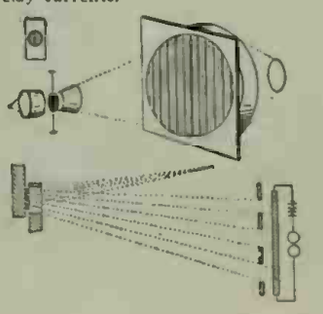


vapor generated from the water to be diffused equally around all portions of the shoe.

Selenium Relay.

(No. 1,293,098, issued to A. N. Hovland.)

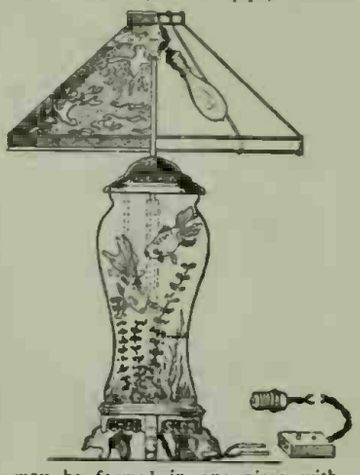
This new form of relay is built on the principle that a conducting wire placed in a magnetic field will be displaced laterally when an electric current is past thru the same. This fact is made use of, for instance, in wire galvanometers and in light-writing apparatus, also that the magnetic field is used to produce a very sensitive relay, utilizing one or more photo-electric cells on the general type of a selenium cell. A shutter means is provided for decreasing and increasing the resistance of the cell, and by such means it is possible to relay currents.



Illuminated Aquarium.

(No. 1,297,254, issued to Natsuo Sato.)

A novel and attractive improvement on the usual form of aquarium, which consists of a bowl which is permanently illuminated from above by electric lamps, and which are concealed in the lamp, and intended for use in drawing rooms. It consists of a metallic tube which runs up centrally thru the apparatus, and thru which tube also is run electric wires to operate the bulbs under the lamp shade. Were this tube to be in actual contact with the water, it might possibly cause some chemical reaction, which would be detrimental to the fish in the bowl. The inventor overcomes this by using a glass tube over the metal pipe, which

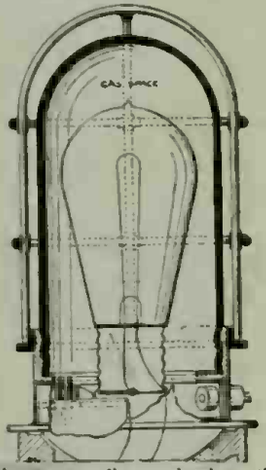


may be formed in one piece with the bowl or may be separate and cemented together in order to prevent leakage. The bottom of the bowl is arranged to present a pleasing appearance with a bed of sand.

Electric Gas-Detecting Safety Lamp.

(No. 1,294,806, issued to C. G. Hunt and John H. Coyle.)

The main feature of the invention consists of a lamp and a sealed chamber, with a source of light in said chamber. A means is provided whereby a gas pressure inside the

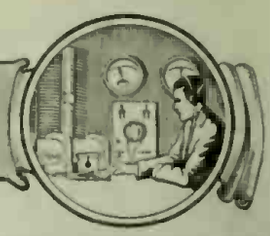


chamber normally maintains the light, but if fumes are present on the outside, this external pressure will cause the light to be extinguished. It operates on the principle that the internal pressure of the gas will normally maintain the light, but should the gas pressure in the chamber be brought to an inferior or superior pressure to that without the chamber, then the light will be extinguished.

www.americanradiohistory.com



WITH the AMATEURS



Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light-toned ones. We pay $3.00 each month for the best photos. Address the Editor, "With the Amateurs" Dept.

"Amateur Electrical Laboratory" Contest

THIS MONTH'S $3.00 PRIZE WINNER—J. CARROLL TOBIAS

I AM an appreciative reader of your magazine and wait anxiously for it to arrive from month to month. I find lots of enjoyment in looking over the photos of Amateur "Labs", and so am sending a "shot" of my own little workshop.

In this room many interesting and educational experiments are performed in chemistry, electricity, metallurgy and electro-chemistry. I have apparatus for both qualitative and quantitative analysis, electric furnace analysis of iron, steel and carbon compounds and for the analysis of coal gas and by-products. A complete bacteriological outfit is also one of my valued possessions and by its means microscopic examinations of water are conducted. This about completes the chemical end.

In the electrical division I have motors, a generator (A.C., 60 volt, 60 cycle), a 50 watt D.C. generator, step-down and step-up transformers, high frequency alternator, high-frequency high-voltage transformer, Oudin coils, Tesla coils and spark coils. I have an electric arc furnace by means of which I conduct small experiments in the production of synthetic gems, electrolytic rectifier, electrolysis apparatus and "bunches" of other "junk". At present I have under construction an A.C.-D.C. switchboard, also a three-step audion amplifier and two long wave loading coils. When the "Lab" is drest out in all its new furniture, I will send you another series of photos.

Another photo shows my radio set which has just been unsealed and which I know is just "hankering" to have the old oscillations flowing once more thru its coils. Another view shows my battery switchboard and electrical work bench with spark coils, Tesla coil, Oudin coil and other "stuff".—J. Carroll Tobias, 106 N. High St., Bethlehem, Pa.

HONORABLE MENTION (One Year's Subscription to the ELECTRICAL EXPERIMENTER) —CHESTER A. WRIGHT

Herewith are photos of my radio station. I have been a steady reader of the ELECTRICAL EXPERIMENTER for some time and get many good ideas and hook-ups. My apparatus is mostly home-made, consisting of a condenser made of heavy plate glass with aluminum sheets. The rotary spark gap is made of a 1700 R.P.M. fan, and the disc of an Edison disc record. It gives a very good tone. My oscillation transformer is made of heavy brass ribbon and is very easy to adjust. I use a Clapp-Eastham 1 K.W. transformer. My receiving apparatus consists of home-made couplers from which some very close tuning can be had. I use an audion and galena non-jarable detector, both with great results. I also have Murdock variable condensers, and two sets of Brandes' phones.—Chester A Wright, 611 Green St., Greensburg, Pa.



www.americanradiohistory.com

Science in Slang

By EMERSON EASTERLING



"A FUNNY thing happened the other day," laughed Punk Loomis. Stokes looked up from the telephone directory. "A guy," continued Punk, "was standing under a belt in the factory. The fellow had on rubber boots. He was talking to his wife, and when she started to leave—you see, they were newlyweds—he reached over to kiss her. WOW! You ought to have seen them! One of them got it in the nose—the other on the lips—and it cracked like a young bolt of lightning. You see, the rubber boots made a Leyden jar out of the man—a human condenser. That kiss sure had a kick."

"I guess that was about as funny to them as it was to the lady who was cleaning clothes and set the rag, saturated with gasoline, on fire in her hand by drawing a spark from the friction of the wool and silk. Both were static, you know." Here he turned and walked to the telephone and asked for long distance. In a few minutes he returned.

"Quite a commodity, this telephone. In the old days when the citizens thought it proper to run in marathons in the 'altogether,' if I should happened to have been let loose at that time, and happened to have gotten word to a guy the same distance as the present case here, I should had to have waited for at least a week—with the best runner that the country had, to tell the adjoining country to go to hades—for the answer."

"Can you reel off another sentence like that without stopping for air again?" asked Bender.

"Jumping over such improvements as Paul Revere and the pony express brought about, we land up at the chapter in scientific history where a bird by the name of Morse, with three other names before it, two of them Sam and Finley—I don't know the other—it don't make much difference anyway. What we are driving at is the fact that after muttering, 'If the presence of electricity can be made visible in any part of the circuit, I see no reason why intelligence may not be transmitted by electricity,' he rigged up a couple of magnets and an arm and anvil—behold! We have the *telegraph sounder*. Then the next thing was to contrive a series of dots, dashes and spaces to convey that intelligence he was speaking of. It took a lot of salesmanship for Sam to get his trick across, but perseverance wins out in the finale—so, first act in the comedy of the telegram.



Sam Finley Morse, the Dash and Dot Kid, Also the Ancestor of the Telegraph Messenger.

Keeping the Wires Hot

"Then another guy—you've heard of him, Bell, Alexander Graham, Proff. in vocal hygiene or physiology—drops in on us. This student of the art and mechanics of the first cause for conversation got down into the throat of the matter and found out a lot about the reason why some men leave home. While trying to make the telegraph do more work for the number of wires used, it is related that this gentleman was alleged to have developed the *telephone*—but none would recognize in the original article any resemblance to the present instrument of long-distance chatter.

"Another duck—Prof. Elisha Gray—would have landed the fish if it had not been that Bell got his draftings in the patent office (no, not the Phoney Patent Offizz) and beat the dear old chap out of the glory. Which all goes to show that some great minds do run in the same channel. But Gray should worry. He is guilty for the *telautograph* being on the market. No, he is not Elisha of the fiery chariot.

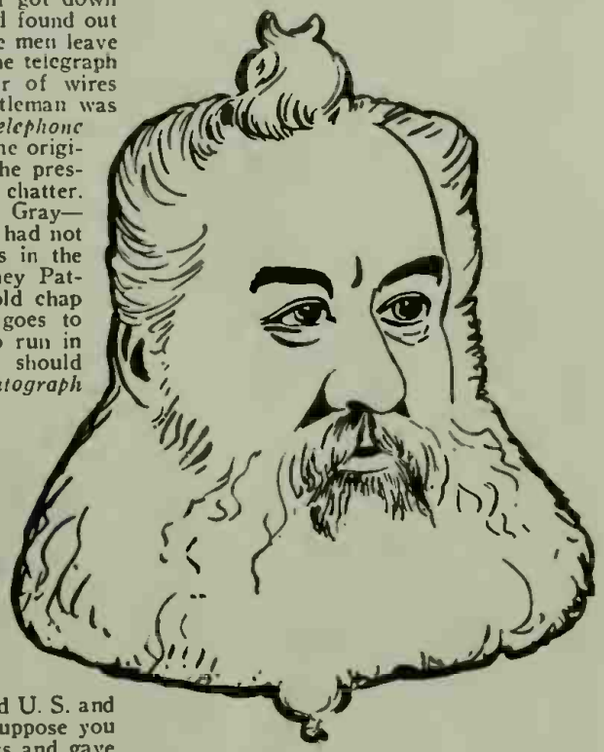
"Europe was a long way off until Cyrus Field succeeded in stringing an *undersea cable* between the two continents in one piece. That made him get in rich with Congress, and he got a medal to show his friends for the stunt, too. It was in 1858—the time that George Washington was fighting the battle of Waterloo—that the cable had one end in the good old U. S. and the other in Europe. I don't suppose you care, but Cyrus gave a few kicks and gave up in the city of New York, 1892.

"You know of Nick Tesla (his picture is on one of the other pages), the fellow that pulled one over on Columbus in the egg stunt. Well, he just had to do something for the telephone and invented a *repeater* for it. Then Tom—who? Edison—improved it a lot. And a gob of other guys boosted the proposition along. Some wise guy hops along and steps on two circuits, and sticks another to work on the same lines—Hoovering on wire. It was on the same order that Bell tried to do with the telegraph, only different. They dubbed it the *phantom circuit*, altho it is not as mysterious as the name implies. Then along comes the *multiplex system*, words and music by Major General Georgie Owen Squier, Chief Signal Officer of the United States Army, and right away he goes the phantom circuit one better by letting five talkers in on the line simultaneous together and at the same time. Not only that, but it lets a crowd of 'brass pounders' in on the circuit at the self-same operation, *tout de suite*.

"De Forest, in his wireless experiments, slipt them the pass to get in on that stunt by creating the *Audion*. That is why the system is referred to as the *wired wireless*.

"By combining wireless and the lines together, we get some pretty long distances covered by the voice. Not so long ago when some notable English guy listened to both oceans at the same time over the telephone we thought it was grand. To-day that's commonplace. Now, if the guys around the player stop coughing, and they have good conditions and sensitive instruments, it is possible to hear Hawaiian hula players do their song and dance in New York City over the wire and wireless.

"I doubt if Sam Morse knew what he really did when he constructed his first telegraph instrument. Just think of the



Prof. Alexander Graham Bell, the Glnk Who Invented the Hello Girls.

war and sporting (accent on the sporting) wires! What would we do without them? Take the business as a whole. We would feel like we were lost without 'phones and 'wires.'

"When the real thing marches in, a load of by-products comes out on the next section. When Edison called up over a 'phone and instead of saying 'Are you there?' or 'Is this you?' he said 'Hello!' That took like 'Over the top,' 'Lay on, McDuff' and such slogans, saws, or what-you-call-'ems. Now we would think a boob crazy were he to say 'I am talking—is there anybody on the other end of the line?' 'Hello' is good anywhere, China, Africa, or Chile, but not in France, where it is 'Alloh.'

"Now, if we can only get rid of the central station," said Punk Loomis, "and replace the live hello-girl with an automatic one that will not get tired or angry when the customers cuss over the 'phone, then we will have it down pat."

"You're 'way behind the times," came back Stokes with an impatient gesture of his head. "What you want to do is to take a flying trip to Chicago and give their automatic telephone rinktum the once over. And, believe me, it is some contraption. Of course, Windy City citizens have the regular Bell 'phone also, so when they get tired of cussing the hello-girls they can switch to the automatic, which is some indoor sport. The two systems necessitate the use of two telephones in one office, and on any Monday morning you can see your Windy citizens doing the hula-hula trying to talk into two phones and to two cus-

(*Continued on page* 155)

www.americanradiohistory.com



THE ORACLE

The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions address to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

ROTATING MAGNETIC FIELD QUERY AND ROGER'S RADIO SYSTEM.

(1004) J. M. McDonald, St. Louis, Mo., writes:

Q. 1. Asking several questions about the rotating magnetic field and Tesla "electric egg" apparatus.

A. 1. We give you the following suggestions in answer to your questions. The rotating magnetic field is very clearly explained in the April number of the ELECTRICAL EXPERIMENTER, containing an article by Dr. Nikola Tesla on his induction motor and how it works, which we are sure will make the matter plain to you, as a clear hydraulic analogy is given therewith.

In connection with the "electric egg" apparatus, we would advise that the two opposite coils are connected so as to give North and South poles respectively.

Elsewhere in the present issue you will find a special article on the "Rogers' Underground Wireless System for Amateurs." This will answer many questions such as the one you ask concerning the length of aerial, etc., and briefly we might say that for short wave lengths of about 200 to 300 meters, a wire (rubber covered auto-cable) about 300 feet in length could be used. When the free end of the wire is grounded, the signal strength is reduced. Generally speaking, and for ordinary amateur and even commercial requirements, but one wire is found necessary.

VALUE OF THE "SOLAR CONSTANT."

(1005) Emmanuel Bellon, Peoria, Ill., writes this department:

Q. 1. About the value of the mean "solar constant."

A. 1. There seems to be indeed much promise in the development of an efficient solar energy plant, and while little has been done along this line in a commercial way of late, yet some very interesting work has been accomplished by a number of scientists, who have worked on the problem. It is a most interesting and valuable field to work in.

The result of nearly seven hundred tests conducted by the Smithsonian Institute of Washington and in various parts of the world, has resulted in accepting 1.93 *calories per square centimeter per minute*, as the mean "solar constant." This is equivalent to 7.12 British thermal units per square foot per minute. The best body for the conservation of the radiant energy into heat energy is a dead black one.

RADIO QUERIES ON MIGNON RECEIVING SET.

(1006) A. S. ———., Chicago, Ill., inquires of the Oracle:

Q. 1. What is the coil around the Audion used for in the Mignon receiving set, and also what is the object of the metal coupler core?

A. 1. Concerning the Mignon type R. W. No. 3 radio receiver, would advise as follows:

Regarding the two specific points you mention first, about the coil around the Audion tube, this is hooked up with one of the tuned oscillatory circuits, so that the oscillating magnetic field created within it, would act electromagnetically on the electron stream within the detector, somewhat in the same manner as is the case where a permanent steel magnet is placed in proximity to a vacuum tube detector to improve its operation. The effect on the electron stream is to either concentrate it or spread it, thus making the path from grid to plate either more conductive or less conductive, depending upon the polarity and position of the magnetic field.

To Our "Oracle" Friends

Do you realize that not one day passes when we do not receive from 150 to 250 letters address to "The Oracle"? If we were to publish all the questions and their answers we would require a monthly magazine five or six times the size of the ELECTRICAL EXPERIMENTER, with no other matter but questions and answers. Of late the influx of letters has become so heavy that several of our associates have been forced to discontinue important editorial work, in order to answer the mail. This we are certain you do not wish. You do not want your magazine to lower its present high standard. You want the best, the very best, and you know we never have failed you yet.

Moreover the multitude of letters are wholly unnecessary. Most of the questions Readers ask every day have been answered before in "The Oracle." Therefore, ere you sit down to write us, look over your back numbers, and nine times out of ten you will find the answer.

We strive hard to publish only such matter as has not appeared before in our columns, and for that reason, only a small fraction of the queries received by us are actually publisht.

Your magazine is steadily coming to the fore as the greatest publication in the scientific world. To keep up its present high standard and to make it a better and bigger magazine requires a tremendous amount of untiring effort on the part of the Editors. Therefore, in the future, we CANNOT in your own interest, answer questions by mail, free of charge.

For questions requiring an immediate answer our fee is 25 cents for the first three ordinary questions, and 25 cents for each additional question. We will gladly advise fee for special questions entailing considerable research work or calculations.

Stamped and addrest envelope should be enclosed with the queries, and moreover, any sketches accompanying them should be drawn in ink on separate sheets. Write plain and, PLEASE, PLEASE BE BRIEF.

Editor of "The Oracle."

Concerning the disc core transformer in the Mignon coupler, so far as we understand, this disc core was either of iron or some other alloy of a ferrous nature. Apparently the designer aimed to or tried to give the impression that this form of transformer would be much more efficient than the standard radio coupler, owing to the presence of the ferrous core, which of course would give a much higher permeability, or flux carrying power.

We refer you to the March, 1917, issue of the ELECTRICAL EXPERIMENTER, page 811, where you will find complete diagrams and explanation of the Mignon adjustable disc core receiving transformer and circuits, written by Mr. Ernest Mignon, the inventor, himself.

RECORDING RADIO SIGNALS

(1007) W. T. Smith, Stockton, Kansas, wishes to know:

Q. 1. Of methods in use for recording radio-telegraphic signals.

With reference to apparatus sufficiently sensitive to record wireless signals at considerable distances, would suggest that you look over the article entitled, "Radio Amplifiers," which appeared in the November, 1918, issue of the ELECTRICAL EXPERIMENTER. A great number of different types of amplifiers are there described, and data is also given on their make-up.

Finally, we would suggest that there are two methods now in use commercially for recording wireless signals. The first one, which is employed at the Marconi Trans-Atlantic Radio Stations, utilizes two to three stage vacuum valve amplifiers, and the signals are recorded on a phonograph or "Dictaphone." The second method is that which has been used by the De Forest engineers, and this system of recording wireless messages or signals, utilizes two, three, or higher Audion amplifiers to boost the signals to a sufficient strength to operate a polarized relay. This, in turn, actuates a Morse register or tape recorder. The De Forest people have also successfully employed a Poulsen *telegraphone* for recording the signals after amplification by an Audion amplifier.

It might interest you to know that the De Forest experts have perfected a six-stage Audion amplifier with an *amplifying capacity of one million times.*

DESIGN OF PHONOGRAPH HORNS.

(1008) Howard L. Quick, Jr., Brooklyn, N. Y., wants data as follows:

Q. 1. How a large phonograph sound chamber or horn should be built?

A. 1. Relative to construction of phonograph sound box or horn, which in every case should be of some hard wood, an eminent sound authority, Prof. Dayton C. Miller, gives data as follows: The horn is best constructed of some hard wood such as maple, mahogany, hollywood or oak. The

(*Continued on page* 146)

www.americanradiohistory.com

Learn Electricity



In the Great Shops of COYNE IN 3½ MONTHS

Thousands of Electrical experts are needed to help rebuild the world. Come to Chicago to the great shops of Coyne and let us train you quickly by our sure, practical way, backed by twenty years of success. Hundreds of our graduates have become experts in less than four months. *You* can do the same. *Now* is your big opportunity. Come—no previous education necessary.

Earn $125 to $300 a Month

In the Electrical business. Come here where you will be trained in these great $100,000 shops. Experts show you everything and you learn right on the actual apparatus. You work on everything from the simple bell to the mighty motors, generators, electric locomotives, dynamos, switchboards, power plants, everything to make you a master electrician. We have thousands of successful graduates. Just as soon as you have finished we assist you to a good position.

Become an Expert in 3½ Months

No need of taking from 1 to 4 years to become an expert, we have proved this in thousands of cases. The Coyne method of practical training eliminates all books, useless theory and other non-essentials and trains you in just what you need to know to become an expert.

Earn Your Way

Don't tell yourself you haven't got the money to come to Coyne. If you have ambition and the nerve of a real man, that's all you need. Dozens of our students every year work in their spare time and earn their living expenses. Dozens of others work in the day time, earn all their expense and attend our evening school. Our employment department will help you without charge.

Day or Evening Courses

Don't worry about the money. Anyone with ambition can learn here. Our tuition is low with small easy payments if desired. All tools and equipment is furnished free. Our students live in comfortable homes in the best section in Chicago—on the lake—just a few minutes' walk from our school.

Electricity, Drafting Motion Picture Operating Plumbing

We teach all these trades and professions quickly and in such a thorough, practical way that when finished you are ready to step right into a position of responsibility and big pay.

Send Today for Big Free Book

Write today, *now*, for the book. It tells what Coyne graduates have done. What you can do. Fill in the coupon, check the trade you are most interested in or send a postal card, do it *now*.

Learn Drafting

The country is crying for skilled draftsmen in all lines. Thousands of positions open with princely salaries. We give you the advantage of our big shops. No other school can do this. Now is the time to get into this big field. Experts train you under practical working conditions, no books and theory go here. Check drafting on the coupon below and mail it *at once* for full particulars.

BENNETT W. COOKE, *Director*

COYNE TRADE AND ENGINEERING SCHOOLS

Dept. 26 39-51 E. Illinois Street, Chicago, Ill.

MAIL COUPON FOR FREE BOOK NOW!

COYNE TRADE AND ENGINEERING SCHOOLS
Bennett W. Cooke, Director
Dept. 26, 39-51 E. Illinois St.
Chicago, Ill.

Please send at once your big Free Book—I am interested in
[ ] Electricity [ ] Drafting [ ] Plumbing
[ ] Motion Picture Operating
(Check trade interested in)

Name.....

Address.....

www.americanradiohistory.com



Health-Beauty-Power

Treat Yourself in Nature's Way

The Therapeutic White Rays of the Sterling Lamp are a scientific adaptation of the marvelous healing properties of the sun's rays. The warm, soothing, soft, white rays penetrate and vitalize every cell and tissue; new cell growth is stimulated; the body is refreshed and vitalized.

It brings you a clear, unblemished skin, rose-tinted cheeks, bright eyes; quickens the sluggish blood, rebuilds firm new muscle, and clear, new skin.

STERLING THERAPEUTIC LAMP

"The Light That Heals"

Relieves pain without destroying vitality. Absolutely safe; no vibration, shock or pain. Does away with use of harmful drugs. Relief from pain results the moment you snap the electric switch. Rheumatism, neuralgia, sore throat, earache, goitre, headache, nervous conditions, and innumerable other ailments, are instantly eased and relieved. Invaluable in the treatment of skin diseases. Physicians endorse and recommend Therapeutic Light to you.

Send Coupon for Free Book

Nothing vague or mystic in the Sterling Lamp. Our free book tells of its uses and many benefits—deals with the simple, fundamental laws of health and beauty. Tells you how to treat yourself at a few cents in cost, relieving you of pains and ailments and awakening your energy; how others in hospitals, sanitariums and thousands of private homes have benefited. Don't suffer headaches and other pains needlessly—let Nature and Science help you to health, beauty and greater vitality.



STERLING THERAPEUTIC LAMP CO.
Dept. 13, 546 Garfield Ave.
Chicago, Ill.

Use This Coupon

STERLING THERAPEUTIC LAMP CO.,
Dept. 13, 546 Garfield Ave., Chicago, Illinois.

Please send me, without cost or obligation, your fully illustrated booklet describing the Sterling Therapeutic Lamp, its uses and benefits.

Name .....

Street & No. .....

City .....State .....

PHOTO CRAFT

The New Photographic Journal Devoted to the Art of Picture Taking and Nature Work With the Camera.

The only Photographic Magazine devoting a department every month exclusively to Nature Photography.

June Issue Will Contain:

"Bird Photography", by H. T. Middleton.
"Some Strange Things From Australia."
"Nature Work With the Camera."
"Pictures in June."

and many other exclusive pictures and articles. Don't fail to get this issue if you are interested in Pictures. Four Competitions with Cash prizes leading to a fifth. Send 10c today for three months' trial subscription.

Photo Craft Magazine
Ann Arbor - - Michigan

THE ORACLE

(Continued from page 144)

wood for ordinary size horns may be ½ to ¾ inch stock, finished perfectly smooth inside and preferably varnished. Glue the joints and do not nail them. Mahogany is very well suited to the purpose indeed. The wood stock used should be quite thick, as the whole principle of the phonograph sound chamber is to vibrate the column of air within the chamber, and with this object in mind, and as pointed out by some of the highest scientific authorities on acoustics, the walls forming the chamber should not be thin enough to vibrate, but should be *rigid, so that the column of air can vibrate freely, and only this column of air.*

The longer the horn the better, and as the wave length in air of the average voice, such as the *baritone*, is about 4½ feet, the total mean length of the sound chamber from the reproducer should not be less than this value. Providing the sound chamber has at least this length, and that the diafram of the reproducer is large enough, say at least 2½ inches, so as to vibrate at the usual range of frequencies predominant in speech and music reproduction, then you should obtain very good results.

A high authority in the field of acoustics recently mentioned to the Editor of this column that the best phonograph music he ever heard in the laboratory, was that given from a wooden horn seven feet long, which took care of all the longer as well as the shorter wave lengths and frequencies. Very fine results were obtained from a still more rigid horn, constructed of concrete, he stated.

This authority also mentioned that a very slight difference was noted as to whether the sound chamber was made *square* or *round* in cross-section. The lines of its length should expand continually and not be parallel. Furthermore, the general contour or shape of the walls of the horn may be made perfectly straight, and no increased efficiency is obtained by any fancy frills or curves in the horn, as is claimed by many phonograph companies. Also it is a proven fact by laboratory tests, that any form of wooden grill or vane whatsoever placed in the mouth or opening of the sound chamber, only lowers the tonal and acoustic efficiency of the instrument.

With regard to needles, it is also interesting to note that tests have shown where anything softer than a steel, diamond or saffire point is used, that pure and clear sound reproduction is sacrificed, such as when fiber needles are used. Prof. Miller stated the situation very succinctly and correctly, we believe, when he said that "If you use fiber needles and like them, then use them, as they of course effect a saving in the wear on the records." The fact remains however, that any such needle as this absorbs a considerable portion of the vibrations of the music picked up from the record, and dissipates it before it ever reaches the diafram. The same reasoning applies to many other fancy attachments offered to the phonograph public.

A. C. MOTOR STARTING COIL CONNECTIONS.

(1009) G. S. Golden, Harrisburg, Pa., writes:

Q. 1. How do you connect up the starting coils on an A. C. single phase induction motor?

A. 1. We give herewith diagram of connections for the four starting coils on your A. C. motor. The current must flow around the successive poles in an opposite direction,

(Continued on page 148)

Advertising Talks

NUMBER 3

LAST month I showed you how necessary it was to the life and growth of a big magazine like the ELECTRICAL EXPERIMENTER to have a large number of satisfied advertisers, and explained how more advertisers meant a bigger magazine for you and more reading matter. This month I want to give you a few more reasons why it is worth your while to patronize firms who advertise, and especially those who advertise in the EXPERIMENTER.

When you pay your good money for some article, no matter what it is, you want to get the very best quality possible for the money. Advertised articles are always of better quality than unknown, unlabeled, and unbranded goods. This is easily proven. Compare such well-known brands as the Sonora Phonographs, Starrett Tools, Brandes or Murdock Receivers, etc., with similar articles put out by firms who have not the ambition or progressiveness to standardize their merchandise. The comparison always proves the superiority of the advertised article.

There is a good reason why this is so. It costs money to advertise. An inch ad in the ELECTRICAL EXPERIMENTER costs $8.40 for one insertion—a page ad $264.60. An advertiser who is using ten or twelve magazines and spending anywhere from $1,000 to $10,000 a month to tell you about the goods he has for sale, must get his money back by keeping you as a steady customer. It costs too much to make the first sale to drop your friendship then and there. He must make you a strong booster of what he has to sell, and keep you a steady customer if he is to make money. The only way he can do it is by giving you better quality and a cheaper price than possible anywhere else. If he doesn't give you a better article and save you money you won't remain a steady customer and he loses.

Therefore, when an advertiser spends a small fortune each year to build up a reputation, don't think for a single moment that he is going to risk that reputation or run the chance of having his money thrown in the gutter by putting out inferior goods. Far from it! The advertiser lays his cards on the table. He says, "Here's who I am, and what I am and what I have to sell you." He is frank with you. He does not try to "stick" you. He cannot afford to.

When you send your orders to any concern which advertises in the ELECTRICAL EXPERIMENTER you know that you are sending them to a reliable firm (we do not accept advertising orders from any concern except those that we know are reliable.) You will know that the goods which you will get are the best that you could buy for the money. You will know that the advertiser stands back of his goods and is willing to make good if any dissatisfaction should arise.

I have given you only a few reasons why it is a business proposition for an advertiser to give better service, put out a better quality of goods, and offer you more for the money than you would get from a non-advertiser. There are many others. Next month I will take up the matter of costs and prices and show you just how the advertiser can sell goods more cheaply than his competitor.

Advertising Manager.

www.americanradiohistory.com

How to Increase Your Will Power In One Hour

Author of This Article Tells How He Quickly Acquired a Dominating Will Power That Earns Him Between $50,000 and $70,000 a Year

FOUR YEARS ago a man offered me a wonderful bargain. He was hard up for money and wanted to sell me some shares in a young, growing company for $1,000. Based on the earnings of the Company the stock offered me was easily worth $5,000—in fact, the man who finally bought the shares sold them again in five months *at a profit of* $4,300.

The reason I didn't buy the shares was that I could no more raise a thousand dollars than I could hop, skip, and jump across the Atlantic Ocean. A thousand dollars! And my income only twenty-five a week.

The second chapter in my life began a few months later, when another opportunity came to me. It required an investment of $20,000 during the first year. I raised the money easily, paid back every penny I borrowed, and had $30,000 left at the end of the first year! To date in less than four years, my business has paid me a clear profit of over $200,000 and is now earning between $50,000 and $70,000 a year. *Yet for twelve years before, the company had been losing money every year!*

The natural question for my reader to ask is, "How could you borrow $20,000 to invest in a business which had previously been a failure, after being unable to borrow $1,000 for an investment that seemed secure?" It is a fair question. And the answer can be given in two little words—*WILL POWER.*

When the first proposition came to me I passed it by simply because I didn't have the money and couldn't borrow it. I went from one friend to the next and all turned me down. Several refused to talk business with me at all. They all liked me personally, and they asked about the kiddies, but when it came to money matters I hadn't a chance. I was scared stiff every time I talked to one of them. I pleaded with them, almost begged them. But everybody had their "money all tied up in other investments." It was an old excuse, but I accepted it meekly. I called it hard luck. But I know today that it was nothing in the world except my lack of Will Power or rather my weak Will Power, which kept me from getting what I wanted.

Partial List of Contents

The Law of Great Thinking.
The Four Factors on which it depends.
How to develop analytical power.
How to think "all around" any subject.
How to throw the mind into deliberate, controlled, productive thinking.
Detailed directions for Perfect Mind Concentration.
How to acquire the power of Consecutive Thinking, Reasoning, Analysis.
How to acquire the skill of Creative Writing.
How to guard against errors in Thought.
How to drive from the mind all unwelcome thoughts.
How to follow any line of thought with keen, concentrated Powers.
How to develop Reasoning Power.
How to handle the mind in Creative Thinking.
The secret of Building Mind Power.
How the Will is made to act.
How to set your Will.
How a strong Will is Master of Body.
What creates Human Power.
The Six Principles of Will Training.
Definite Methods for developing Will.
The NINETY-NINE METHODS for using Will Power in the Conduct of Life.
Seven Principles of drill in Mental, Physical, Personal Power.
FIFTY-ONE MAXIMS for Applied Power of Perception, Memory, Imagination, Self-Analysis, Control.
How to develop a strong, keen gaze.
How to concentrate the eye upon what is before you—object, person, printed page, work.

These are only a few of the many subjects treated.

When I heard that the man sold those shares at a profit of $4,300, it seemed that my sorrow could not be greater. That profit was just about what my salary amounted to for four years! But instead of grieving over my "hard luck," I decided to find out why I was so easily beaten in everything I tried to accomplish. It must be that there was something vital that made the difference between success and failure. It wasn't lack of education, for many illiterate men become wealthy. What was this vital spark? What was this one thing which successful men had and which I did not have?

I began to read books about psychology and mental power. But everything I read was too general. There was nothing definite—nothing that told me *what to do.*

After several months of discouraging effort, I finally encountered a book called "Power of Will," by Prof. Frank Channing Haddock. The very title came to me as a shock. When I opened the book I was amazed. I realized that will power was the vital spark—the one thing that I lacked. And here in this book were the very rules, lessons and exercises through which anyone could increase their will power. Eagerly I read page after page; including such articles as The Law of Great Thinking; How to Develop Analytical Power; How to Concentrate Perfectly; How to Guard Against Errors in Thought; How to Develop Fearlessness; How to Acquire a Dominating Personality.

An hour after I opened the book I felt like a new person. My sluggish will power was beginning to awaken. There was a new light in my eye, a new spring in my step, a new determination in my soul. I began to see, in my past, the many mistakes I had made, and I knew I would never make them again.

I practiced some of the simple exercises. They were more fascinating than any game of cards or any sport.

Then came an opportunity to acquire the business which had lost money for twelve years, and which I turned into a $50,000 a year money maker. Instead of cringing before the moneyed people, I won them over by my sheer force of will. I would not be denied, and my every act and word since then has been the result of my training in will power.

I am convinced that every man has within himself every essential quality of success except a strong will. Any man who doubts that statement need only analyze the successful men he knows, and he will find himself their equal, or their superior, in every way except in will power. Without a strong will, education counts for little, money counts for nothing, opportunities are useless.

I earnestly recommend Prof. Haddock's great work. "Power of Will," to those who feel that success is just out of reach—to those who lack that something which they cannot define, yet which holds them down to the grind of a small salary.

Never before have business men and women needed this help so badly as in these trying times. Hundreds of real and imaginary obstacles confront us every day, and only those who are masters of themselves and who hold their heads up will succeed. "Power of Will" as never before is an absolute necessity—an investment in self-culture which no one can afford to deny himself.

I am authorized to say that any reader who cares to examine "Power of Will" for five days may do so without sending any money in advance. If after one hour you do not feel that your will power has increased, and if after a week's reading you do not feel that this great book supplies that one faculty you need most to win success, return it and you will owe nothing. Otherwise send only $3, the small sum asked.

Some few doubters will scoff at the idea of will power being the fountain head of wealth, position and everything we are striving for, but the great mass of intelligent men and women will at least investigate for themselves by sending for the book at the publisher's risk. I am sure that any book that has done for me—and for thousands of others—what "Power of Will" has done—is well worth investigating. It is interesting to note that among the 250,000 owners of "Power of Will" are such prominent men as Supreme Court Justice Parker; Wu Ting Fang, Ex-U. S. Chinese Ambassador; Gov. McKelvie, of Nebraska; Assistant Posmaster-General Britt; General Manager Christeson, of Wells-Fargo Express Co.; E. St. Elmo Lewis; Senator Arthur Capper of Kansas and thousands of others. In fact, today "Power of Will" is just as important, and as necessary to a man's or woman's equipment for success, as a dictionary. To try to succeed without Power of Will is like trying to do business without a telephone.

As your first step in will training, I suggest immediate action in this matter before you. It is not even necessary to write a letter. Use the form below, if you prefer, addressing it to the Pelton Publishing Company, 30 K Wilcox Block, Meriden, Conn., and the book will come by return mail. You hold in your hand, this very minute, the beginning of a new era in your life. Over a million dollars has been paid for "Power of Will" by people who sent for it on free examination. Can you, in justice to yourself hesitate about sending in the coupon? Can you douht, blindly, when you can see, without a penny deposit, this wonder-book that will increase your will power in one hour.

The cost of paper, printing and binding has almost doubled during the past three years, in spite of which "Power of Will" has not been increased in price. The publisher feels that so great a work should he kept as low-priced as possible, but in view of the enormous increase in the cost of every manufacturing item, the present edition will be the last sold at the present price. The next edition will cost more. I urge you to send in the coupon now.

PELTON PUBLISHING COMPANY

30-K Wilcox Block. Meriden, Conn.

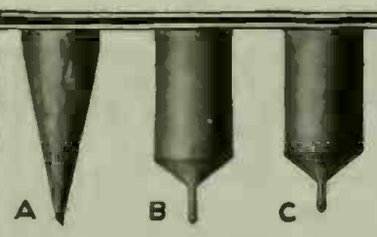
I will examine a copy of "Power of Will" at your risk. I agree to remit $3 or remail book in 5 days.

Name.....

Address.....

City.....State.....

www.americanradiohistory.com



They replace steel phonograph needles!

SONORA Semi-Permanent Silvered Needles are for use on ALL MAKES of steel needle records. They play 50 to 100 times, mellow the tone, are more economical, more convenient, save constant needle changing, and increase the life of the records.

THE INSTRUMENT OF QUALITY
Sonora
CLEAR AS A BELL

Semi-Permanent Silvered
NEEDLES

Study these microphotographs, Fig. A shows an ordinary steel needle after playing one record. Notice that the point is worn off. Fig. B shows Sonora Needle after playing one record. No wear is perceptible. Fig. C shows Sonora Needle after playing over 50 records. Needle has worn down, but is still in splendid playing condition.

3 Grades: Loud—Medium—Soft
30c per card of 5. In Canada 40c.

FREE Sample Sonora Needle will be sent FREE on request. Write for it *today*. Note how many times it plays.

Sonora Phonograph Sales Company, Inc.
GEORGE E. BRIGHTSON, PRESIDENT
279 Broadway, *Dept. G*, New York
Toronto: Ryrie Building
CAUTION! Beware of similarly constructed needles of inferior quality

Send Only 12c
(Stamps or Coin)

And I will send you a copy of my valuable booklet.

"Hints to Music Loving Owners of Talking Machines"

Tells you how to take care of your machine and records, preserve the life of both, and gives many pointers to improve the tone of your instrument and increase your enjoyment of it. Instructs on the care of the motor, cleaning, speed adjustment, care of the needles—in fact every thing you should know. Send 12c today and the booklet will come by return mail.

J. H. ELLIS, Box 882, Milwaukee, Wis.
Patentee & Manufacturer, Ellis Harmonious Reproducer



You Can *RENT* This Phonograph

on our new plan! $10 puts this Young's Superior Phonograph in your home on 30 Days' Trial! Plays all makes of disc records. Cabinet size, 47 ins. high. *Rental applies on purchase.* $125 Value for $62.50. Write for details of greatest phonograph bargain ever offered. Offer Limited. Write Today.
YOUNG'S SUPERIOR PHONOGRAPH
62 W. Madison St. Dept. P26. Chicago, Ill.

Get This Car
And the AGENCY In YOUR Territory

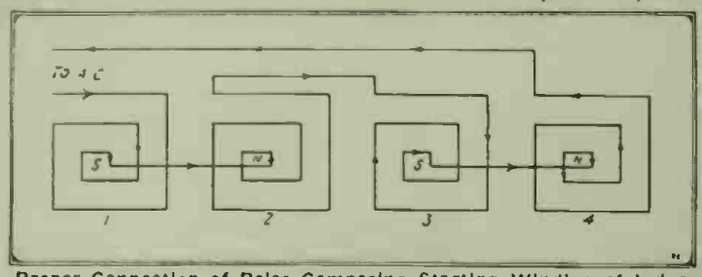


Drive a new 1919 Birch SUPER-FOUR and make good money selling Birch cars to your friends and neighbors. They are fully guaranteed. Prompt shipments. Write quick for full information.
36 h.p.—115 inch W.B.—32x3½ tires
BIRCH MOTOR CARS Dept. 626 61 E. Madison St. CHICAGO • ILLINOIS

The Oracle

(*Continued from page* 146)

as the diagram shows. Those you show in your letter are not correct, for they give like polarity on each pole, which is wrong. We have no data on the starting coil dimensions, but you can arrive at this by experiment, or else by getting in touch with the manufacturers of a similar sized motor.



Proper Connection of Poles Composing Starting Winding of Induction Motor.

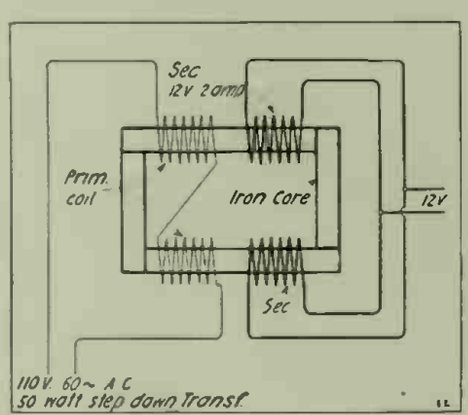
SPECIAL 110 VOLT TO 12 VOLT A. C. TRANSFORMER.

(1010) August Kling, Mobile, Ala., writes:

Q. 1. Asking for data on building a small step-down transformer to give 12 volts at the secondary, which he desires split into two coils. Total output 50 watts.

A. 1. We give herewith data on double wound closed core transformer to step-down 110 volts 60 cycle A. C. to a maximum secondary voltage of 12 volts.

The laminated sheet iron core for this transformer may measure 5 inches wide by 6 inches long, and have a cross-section of 1 inch by ½ inch. At either end of the two longer legs, as the diagram herewith shows, two primary windings may be placed, each of them consisting of 200 turns of No. 18 D. C. C. magnet wire. At either end of the two long legs, the two secondary windings may be placed, as the diagram shows, each of these developing about 12 volts and about 2 amperes, or giving 12 volts and 4 amperes or 50 watts, the total output you request for both secondaries connected in parallel. It is understood that both primaries in this design are to be connected in series on 110 volt 60 cycle A. C. at all times, i.e., whenever the transformer is used. The secondary windings each consist of 45 turns No. 12 B. & S. gage D. C. C. magnet wire, the secondary being wound on either leg beside the primary coil.



Details of 110-Volt to 12-Volt A. C. Transformer. Secondary Coils May Be Connected In Parallel or In Series.

With respect to taking off taps on the secondary for different voltages, you can easily divide up the total number of turns on the secondary yourself by means of a small battery voltmeter. You can readily test the potential by experiment. The voltage in any case is directly proportionate to the number of turns in use.

100-WATT, 32 TO 8-VOLT STEP-DOWN TRANSFORMER.

(1011) Claude Carefoot, Pasqua, Sask., Canada, inquires:

Q. 1. For data on step-down transformer to reduce 32 volts to 8 volts, A. C.

A. 1. We do not of course know how many watts you wish the transformer to carry, but we give you herewith data on a 100-watt transformer. The laminated sheet iron core may be about 8" long by 6" wide and thickness of 1". The core should have a cross-section of 1 square inch. The primary winding, on one leg of the transformer, should consist of 230 turns of No. 11 D.C.C. magnet wire.

The secondary winding should have 58 turns of No. 5 D.C.C. magnet wire.

My Inventions
By Nikola Tesla

(*Continued from page* 112)

any special thought of our far more imperative necessities. The "Magnifying Transmitter" was the product of labors extending through years, having for their chief object the solution of problems which are infinitely more important to mankind than mere industrial development.

If my memory serves me right, it was in November, 1890, that I performed a laboratory experiment which was one of the most extraordinary and spectacular ever recorded in the annals of science. In investigating the behaviour of high frequency currents I had satisfied myself that an electric field of sufficient intensity could be produced in a room to light up electrodeless vacuum tubes. Accordingly, a transformer was built to test the theory and the first trial proved a marvelous success. It is difficult to appreciate what those strange phenomena meant at that time. We crave for new sensations but soon become indifferent to them. The wonders of yesterday are today common occurrences. When my tubes were first publicly exhibited they were viewed with amazement impossible to describe. From all parts of the world I received urgent invitations and numerous honors and other flattering inducements were offered to me, which I declined.

In Faraday's Chair

But in 1892 the demands became irresistible and I went to London where I delivered a lecture before the Institution of Electrical Engineers. It had been my intention to leave immediately for Paris in compliance with a similar obligation, but Sir James Dewar insisted on my appearing before the Royal Institution. I was a man of firm resolve but succumbed easily to the forceful arguments of the great Scotchman. He pushed me into a chair and poured out half a glass of a wonderful brown fluid which sparkled in all sorts of iridescent colors and tasted like nectar. "Now," said he, "you are sitting in Faraday's chair and you are enjoying whiskey he used to drink." In both aspects it was an enviable experience. The next evening I gave a demonstration before that Institution, at the termination of which Lord Rayleigh addressed the audience and his generous words gave me the first start in these endeavors. I fled from London and later from Paris to escape favors

(*Continued on page* 173)

www.americanradiohistory.com



ELECTRICITY

Taught By A Practical Man

and In Your Home.

IT IS UP TO YOU.

I am teaching electricity and drafting to many men, young and old, and wish to interest you sufficiently so that you will send for my catalog which tells the whole story regarding my method of instruction and the good which is being accomplished. It is up to you whether you look into this proposition, but if you are in earnest in your desire to get into the electrical industry, or to become more proficient in that line, you will send for my catalog and not regret the time you give in doing so.

THE PURPOSE OF THE COURSE OF STUDY

I have been designing courses in electrical instruction and teaching electricity, off and on, during the past 17 years, and during that time I have had an unusual opportunity to make a special study of the teaching business, from the standpoint of a practical man. This course has been designed by me with a view of reaching those who do not have a lot of time and money to devote to study work and to give them as thorough a knowledge as possible of electricity as applied to every day practical work. The instruction is given like you were working on various jobs and I tell you what to do and how to do it, giving the necessary explanation for the understanding of the theory covered by the subject under discussion. Another particular feature of my instruction is that I lay particular stress on the unusual conditions which seldom happen in the every day run of electrical work, and this part of the instruction makes the course attractive and valuable to those already engaged in the electrical industry and accounts for the fact that over 60 per cent of my students are practical men.

FIFTY-FIFTY

I work absolutely on a 50-50 basis with my students and my method of handling their instruction and my dealings with them have never been criticised. You pay me the comparatively low price I ask and I give you the instruction and other help as stated in my catalog. No student is permitted to pay cash for his entire course on starting, the course being paid for in small monthly payments as you go along. Students have the privilege of discontinuing the work if they should find that it was not just what they were after and their payments stop at the same time. This is my way of doing business and a part of my 50-50 plan, as I would not want your money when I was not giving you the instruction.

Apparatus, Instruments, Materials, Etc.

Certain electrical apparatus, instruments, materials, charts, drafting materials, etc., as described in the catalog, are included as a part of the course for which there is no extra charge, as it is covered by the regular monthly payments.

Fill Out Coupon Or Drop Me A Postal Card For One Of My Catalogs Which Gives Full Information.

BURGESS ELECTRICAL SCHOOL

745 E. 42d Street **Chicago, Ill.**

YORKE BURGESS,
BURGESS ELECTRICAL SCHOOL.
745 East 42nd Street, Chicago, Illinois.

Gentlemen:—
Send me catalog describing your course in Electricity and Drafting

NAME .....

ADDRESS .....

CITY .....

STATE .....

To Practical Men and Electrical Students:

(See review of this book by Editor in December issue of your Electrical Experimenter, page 568)

I have prepared a pocket-size note book especially for the practical man and those who are taking up the study of electricity. It contains drawings and diagrams of electrical machinery and connections, over two hundred formulas for calculations, and problems worked out showing how the formulas are used. This data is taken from my personal note book, which was made while on different kinds of work, and I am sure it will be found of value to anyone engaged in the electrical business.

The drawings of connections for electrical apparatus include Motor Starters and Starting Boxes, Overload and Underload Release Boxes, Reversible Types, Elevator Controllers, Tank Controllers, Starters for Printing Press Motors, Automatic Controllers, Variable Field Type, Controllers for Mine Locomotives, Street Car Controllers, Connections for reversing Switches, Motor and Dynamo Rules and Rules for Speed Regulation. Also, Connections for Induction Motors and Starters, Delta and Star Connections and Connections for Auto Transformers, and Transformers for Lighting and Power Purposes. The drawings also show all kinds of lighting circuits, including special controls where Three and Four Way Switches are used.

The work on Calculations consists of Simple Electrical Mathematics. Electrical Units, Electrical Connections, Calculating Unknown Resistances, Calculation of Current in Branches of Parallel Circuits, How to Figure Weight of Wire, Wire Gauge Rules, Ohm's Law, Watt's Law, Information regarding Wire used for Electrical Purposes, Wire Calculations, Wiring Calculations, Illumination Calculations, Shunt Instruments and How to Calculate Resistance of Shunts, Power Calculations, Efficiency Calculations, Measuring Unknown Resistances, Dynamo and Dynamo Troubles, Motors and Motor Troubles, and Calculating Size of Pulleys.

Also Alternating Current Calculations in finding Impedance, Reactance, Inductance, Frequency, Alternations, Speed of Alternators and Motors, Number of Poles in Alternators or Motors, Conductance, Susceptance, Admittance, Angle of Lag and Power Factor, and formulas for use with Line Transformers.

The book called the "Burgess Blue Book" is published and sold by the Burgess Engineering Company for one dollar ($1.00) per copy, postpaid. If you wish one of the books, send me your order with a dollar bill, check or money order. I know the value of the book and can guarantee its satisfaction to you by returning your money if you decide not to keep it after having had it for five days.

BURGESS ENGINEERING CO., Yorke Burgess, *Consulting Engineer*
750 East 42nd Street Chicago, Illinois

www.americanradiohistory.com

BOYS



Learn Drafting

Employers everywhere are looking for skilled draftsmen. They are offering good salaries to start with splendid chances for advancement.

Drafting offers exceptional opportunities to a young man because drafting itself not only commands good pay, but it is the first step toward success in Mechanical or Structural Engineering or Architecture. And drafting is just the kind of work a boy likes to do. There is an easy delightful way in which you can learn right at home in spare time. For 27 years the International Correspondence Schools have been giving boys just the training they need for success in Drafting and more than 200 other subjects. Thousands of boys have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon, then mark and mail it. This doesn't obligate you in the least and will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6190, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ MECHANICAL DRAFTING
- ☐ STRUCTURAL DRAFTING
- ☐ SHIP DRAFTING
- ☐ ELECTRICAL DRAFTING
- ☐ ARCHITECTURAL DRAFTING
- ☐ SHEET METAL DRAFTING
- ☐ BOILER MAKER DRAFTING
- ☐ BRIDGE DRAFTING
- ☐ MACHINE DESIGN
- ☐ ELECTRICAL ENGINEER
- ☐ Electric Lighting and Railways
- ☐ Electric Wiring
- ☐ Telegraph Engineer
- ☐ Telephone Work
- ☐ MECHANICAL ENGINEER
- ☐ Machine Shop Practice
- ☐ Gas Engine Operating
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ STATIONARY ENGINEER
- ☐ Marine Engineer
- ☐ ARCHITECT
- ☐ Contractor and Builder
- ☐ Concrete Builder
- ☐ Structural Engineer
- ☐ SALESMANSHIP
- ☐ ADVERTISING
- ☐ Show Card Writer
- ☐ Sign Painter
- ☐ ILLUSTRATING
- ☐ Cartooning
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Public Accountant
- ☐ TRAFFIC MANAGER
- ☐ Railway Accountant
- ☐ GOOD ENGLISH
- ☐ Teacher
- ☐ Common School Subjects
- ☐ Mathematics
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ AUTOMOBILE OPERAT'G
- ☐ Auto Repairing
- ☐ PLUMBING AND HEATING
- ☐ Textile Overseer or Supt.
- ☐ CHEMIST
- ☐ Navigation
- ☐ AGRICULTURE
- ☐ Poultry Raising
- ☐ Spanish
- ☐ French
- ☐ Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____

FREE



$20
Violin, Hawaiian Guitar
Ukulele, Guitar, Mandolin, Cornet or Banjo

Wonderful new system of teaching note music by mail. To first pupils in each locality, we'll give a $20 superb Violin, Mandolin, Ukulele, Guitar, Hawaiian Guitar, Cornet or Banjo absolutely free. Very small charge for lessons only expense. We guarantee success or no charge. Complete outfit free. Write at once—no obligation.

SLINGERLAND SCHOOL OF MUSIC, Dept. 422, CHICAGO, ILL.



GO INTO MOVING PICTURE BUSINESS
Small Capital Starts You
on our easy payment plan. Begin now and get your share. We sell everything. Write today.
Our Catalog FREE. Show you how to earn $25 to $50 per day
Atlas Moving Picture Co.
Dept. 40 5338 S. Dearborn St., Chicago

How to Build an Efficient Medical Coil Set

(*Continued from page* 125)

The tin foil and paraffined paper condenser used with this coil for intensifying the current for shocking purposes, etc., may be composed of about forty sheets of tin foil measuring 3x4 inches, each foil leaf separated with a layer of paraffined paper. Alternate sheets are connected together to form a terminal, and the condenser is finally connected up with the switch, as shown in Fig. 1, so that it can be cut in or out of circuit as desired.

Wooden Cabinet.

The cabinet proper, housing the two dry cells and the medical coil with control switches, in the case of the writer was made of some ¼-inch pine obtained from some old boxes. To further explain, and after considerable experience in building apparatus of this and kindred sorts, experience dictates that it is best not to bother with any elaborate wooden outer cabinets, but to make it more rugged by housing the apparatus and coils in a small dress-suit case. The author purchased one of these for $2.00, which filled the bill perfectly, the case being made of fiber with a good lock and hasp, reinforced corners and leather handle. The case measured 14 inches long by 8¾ inches in width and 4¾ inches in depth. Before building the cabinet, therefore, and providing you intend to enclose the apparatus in a case of this kind, which may be purchased at any trunk and bag store, you should ascertain the dimensions of the case beforehand, so that the cabinet will fit into it properly. As becomes apparent from Fig. 3, the top of the cabinet is the only part that shows when the case is open, and therefore it will be evident that the bottom can be made of pine and given a coat of black shellac or black coach varnish. The battery cover in the author's instrument is made of polished mahogany, being one-half of a mahogany base which originally belonged to an obsolete wireless instrument and a strip of polished mahogany was used for the central upright alongside the induction coil. The main switch panel which supports the coil of the condenser switch and the twelve points, also the secondary switch, is best made of either black fiber, polished hard rubber or bakelite. As the switch contacts are quite close together, and potentials of several hundred volts are carried thru adjacent contacts.

The battery compartment cover is held in place by means of four eye hooks, which can be purchased for a few cents at any hardware store, and as the experimenter has never yet been born, to the writer's mind, who has not wanted to use the battery which he has just locked up in a cabinet, provision is made so that the battery in this cabinet can be used at any time without having to open the compartment. For this purpose two auxiliary battery terminals or binding posts are placed on the side of the battery switch as Figs. 1 and 2 show.

Miscellaneous.

All of the connections under the panel supporting the apparatus as well as the battery connections are best made with rubber-covered flexible conductor about No. 18 B. & S. gage capacity. At Fig. 6 there are shown details for making the two metal handles, as well as a sponge electrode for treatment with saline solutions (salt water). The handles, if they are to be made instead of purchased, are very well composed of two lengths of brass tubing of about ¾-inch outside diameter by 3½ inches long. Each of these handles should be plugged up by a thick brass washer or a piece of ⅜ brass turned to make a driving fit in the tube, and which may be afterward sweated with solder so as to make a smooth tight joint which cannot be noticed, especially when the handles are afterward nickel plated. Thru the center of the plug a No. 8-32 tap hole should be drilled and threaded, into which a binding post may be secured or else a wooden handle as shown in the detail sketch, Fig. 6, may be utilized. This handle is turned up from some hard wood and given a coat of black shellac, and in the smaller end of the handle there is tightly fitted a piece of No. 8-32 screw. A small hole may be drilled crosswise thru the screw near the wood thru which the cord tip may be placed to make connection when it is used.

This wooden handle is very essential when the sponge electrode is employed, when it is screwed into the threaded shoulder in this electrode. To make the sponge electrode you will require a small piece of soft sponge about ½ inch thick which is sewed or laced with some heavy thread to the brass disc shown at Fig. 6. When using this electrode it is dipt into a salt water solution and applied over the part affected, such as a stiff muscle or cord, the patient holding the other handle in the hand, etc. The positive and negative poles of a faradic current as delivered at the binding post terminals, H and H¹, is readily determined by means of a polarity indicator, and the writer has successfully used very often one of the pole test paper indicators available on the market. This paper is dampened when it is to be used for determining polarity. Some of the papers turn red at the negative pole, and others turn red at the positive pole.



Earle Liederman

THE ACME OF PHYSICAL PERFECTION

Send for my latest book
"MUSCULAR DEVELOPMENT"

It will tell you how you can get ROBUST HEALTH, GREAT STRENGTH, ABUNDANCE OF VITALITY and a HIGHLY DEVELOPED BODY. Beautifully illustrated with photographs of myself and of some of the world's strongest men whom I have trained.

Send 10c for a copy TODAY—NOW—while it is on your mind.

EARLE E. LIEDERMAN
Dept. 209, 203 Broadway, New York City

www.americanradiohistory.com

Paris Letter

(*Continued from page* 119)

tributed and is interrupted in a certain rhythmic manner, which thus gives alternating periods of rest and work to the actuated muscles. The application of the current is made by large metallic surfaces, the electrodes covering the entire muscular region under treatment. The method of application of these electrodes is carefully supervised by the physician in order to get the best results. The large surface electrodes overcome to a great extent the high resistance of the skin, and also renders it certain that the patient does not experience any disagreeable sensation.

There is no nervous fatigue. The patient himself is unconscious of this gymnastic, passive *ergotheropy;* he experiences no shocks nor any disagreeable twitching. There is no muscular fatigue; the muscles are strengthened immediately; particularly the abdominal muscles are greatly benefited. The local circulation is highly stimulated. The motor functions of the muscles rapidly emerge from their impotency.

Our photographs were taken at the Grand-Lebrun Hospital at Bordeaux, Prof. Bergonié himself being in charge of the same. One of the photographs shows one of the electro-therapeutic wards while the faradization is taking place. It is interesting to watch the patients while they undergo the treatment. They seem to be unconscious of the effect of the current, but their muscles are working overtime. Our *Poilus* continue reading their newspapers and magazines as if they were actually enjoying a pleasant rest. The treatment extends for two hours in the morning and two in the evening, but in some cases the treatment is decreased or increased as becomes necessary, all depending on the specific cases. In one of our photographs we see a *poilu,* suffering from a fracture of the leg bones and the loss of his calve muscles, who was enabled to walk again without difficulty within fifteen days.

EXPERIMENTS IN RADIO ACTIVITY.

(*Continued from page* 123)

an undisputed footing to the atomic theory and has helped to solve many problems which have been puzzling the scientists for years.

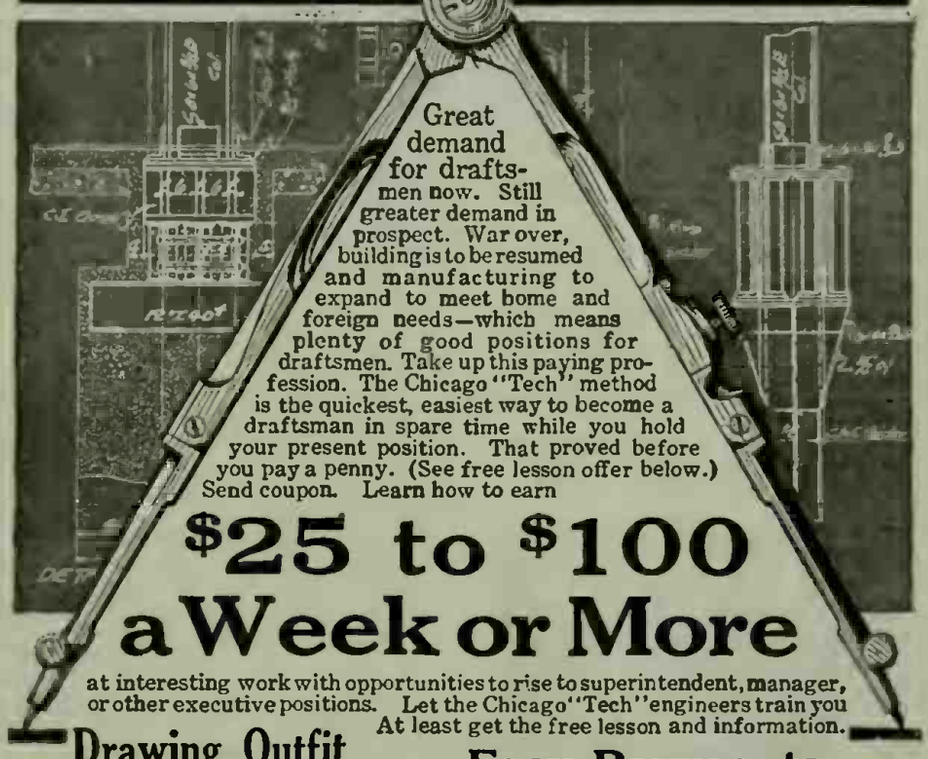
Of course this series is only a beginning and the experimenter wishing to continue should procure a standard work on the subject such as Rutherford's justly famous "Radio-active Substances and Their Radiations." It is hoped by the author that these articles have begot an interest in this far-reaching and fascinating study.

(*Conclusion*)

WIRELESS SIGNALS HEARD THREE-QUARTERS OF A MILE.

As considerable discussion is often heard among radio men, both Professional and Amateur, as to the distance over which an amplified radio signal has been heard, it may be of interest to mention in this connection that Dr. Louis W. Austin of the U. S. Naval Radio-Telegraphic Laboratory states in a recent letter to the Editors that he has often heard incoming radio signals amplified by means of *standard* radio apparatus so as to be audible for from *½ to ¾ mile!* He also states that he believes it possible to amplify phonograph music or speech thru the aid of a standard audion amplifier having several stages and loud talking attachment, so that the music could be heard over a distance of a mile or more.

Make a Bigger Income
Learn Draftsmanship



Great demand for draftsmen now. Still greater demand in prospect. War over, building is to be resumed and manufacturing to expand to meet home and foreign needs—which means plenty of good positions for draftsmen. Take up this paying profession. The Chicago "Tech" method is the quickest, easiest way to become a draftsman in spare time while you hold your present position. That proved before you pay a penny. (See free lesson offer below.) Send coupon. Learn how to earn

$25 to $100 a Week or More

at interesting work with opportunities to rise to superintendent, manager, or other executive positions. Let the Chicago "Tech" engineers train you At least get the free lesson and information.

Drawing Outfit



(*No Extra Charge*)

Every student of the Chicago "Tech" Home Study Course in Draftsmanship receives this drawing outfit—set of instruments in case, drawing board, T square, triangles, scale, curve, drawing paper, pencils, etc., or a cash credit in case he already has an outfit. You use them while learning.—then take them right into your practical work.

NOTE: Enrolled with Chicago "Tech" you have the personal direction of practical engineers, builders and architects who teach you the methods they use in their own work. No useless theories, no time wasted. You are prepared to stand beside old, experienced men. Big advantage to learn from a staff like this—every man a specialist.

Come To the College or TRAIN at HOME

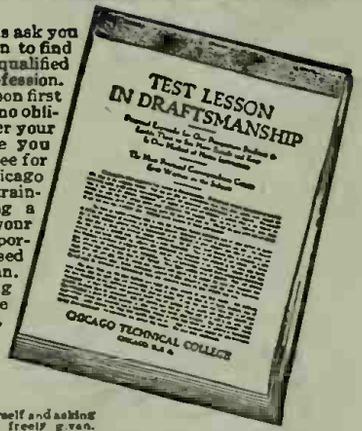
Wherever you are you can have this Chicago "Tech" training. Complete instruction by mail. Exercises, lessons, personal direction of our experts right in your own home if you cannot come to the college for a resident course. Send the coupon and get the facts.

Easy Payments

The fees for Chicago "Tech" courses are very moderate—and you can pay on easy terms. And also—you can obtain in a few months what it would take several years to acquire by ordinary methods. You can get an early start. You are soon ready to take a paying position and to quickly get back the cost of your course.

FREE TEST LESSON

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything. And see for yourself just what Chicago "Tech" offers you in training which will bring a ready market for your services and open opportunities which are closed to the untrained man. The coupon will bring all the facts about the course, the small fee, and the easy terms.



Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Splendid opportunities open now.

Learn All This in Spare Time

All about the Principles of the Automobile.
All about Gasoline Engines.
All about Power Plants and Transmissions.
All about Carburetors and Fuel Supply Systems.
All about Lubrication and Cooling.
All about Batteries.
All about Magneto Ignition.
All about Starting and Lighting Systems.

Know How To Fix Troubles

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men.

Write Send the coupon and get catalog and all information now.

Mark with X the branch you are interested in—or if in doubt about which course to take, write a letter stating facts about yourself and asking our advice, which will be freely given. Mail either the coupon or the letter today.

CHICAGO TECHNICAL COLLEGE,
645 Chicago "Tech" Building, Chicago

Without obligation upon me, send your Catalog on subject indicated below. Also FREE Lesson if inquiry is on Drafting or Plan Reading. Mark X opposite work in which you are especially interested.

- ☐ Architectural Drafting
- ☐ Machine Drafting
- ☐ Electrical Drafting
- ☐ Structural Drafting
- ☐ Sheet Metal Drafting
- ☐ Builders' Course
- ☐ Plan-Reading—Buildings
- ☐ Plan-Reading—Shop Men
- ☐ Estimating
- ☐ Surveying
- ☐ Map Drafting
- ☐ Autos and Gas Engines

Name .....

Address .....

City ..... State .....

College or Home Study? State which .....

www.americanradiohistory.com



You can't build such a Coaster.

The Auto-Wheel Coaster

is designed and built by men who know boys' tastes, and have the materials to build with. For years a favorite because of its strength, speed and grace.

The Auto-Wheel Convertible Roadster

below is a double purpose wagon, changed in a minute from roadster to speedster.

Both types have the durable oval spokes, roller-bearings and steel axles.

FREE FELT PENNANT and Color Catalog for names of three coaster wagon dealers. (Tell which handles the Auto-Wheel).

CAPS FREE—to Auto-Wheel Coaster Club members. Special cap to captain. Organize your Club now, and write for details. Address

THE BUFFALO SLED COMPANY,

In Canada: Preston, Ont. 163 Schenck St., N. Tonawanda, New York.





BOYS
Build and Fly Your Own Training Plane

Train yourself in Aviation. Be an Amateur Aviator with an Aeroplane of your own. Learn how Aeroplanes are built; learn the principles of construction, operation and control. We sell IDEAL Accurate Scale Drawings, and Building and Flying Instructions which show you how to build a perfect Model Aeroplane, 3 ft. size, that will rise from the ground by its own power and fly like a big one. Send now for the Drawings and Instructions for the one you want to build.

Drawings and Instructions for

Curtiss Military Tractor	25c
Sloriot Monoplane	EACH
Nieuport Monoplane	Set of
Taube Monoplane	Seven
Curtiss Flying Boat	$1.50
Wright Biplane	postpaid
Each Pauli Racer	

Ideal Model Aeroplane Catalog 5c—None Free

Tells about Model Aeroplanes, Racing Aeroplanes, Flying Toys, and parts and supplies to build them with. 48 pages. Sent only upon receipt of 5 cents.

IDEAL AIRPLANE & SUPPLY COMPANY
159-161 Wooster St., New York City

MAKE RECORDS
DISC STYLE
On Your Phonograph



Play them on your own
VICTROLA, COLUMBIA
Edison, Brunswick, Sonora, Soulé or any phonograph made

When answering this ad mention the name and style of phonograph you have.

ELECTRO-MECHANICAL PARTS CO.
160 No. Wells Street Chicago, Ill.

What's in a Cover?

WHAT we really should say is, "What's ON a cover?"—but you *did* get the meaning after all. There are covers and covers, or to qualify it better, let us say cover illustrations. Tons of reams could be written about them and still the correct answer as to what constitutes a *good* cover would be as nebulous to you as it is to every other magazine editor. To be sure, the "pretty girl" cover has been proven *the* real seller, but so has the homely baby face, and the ugly bulldog, not to speak of Charlie Chaplin or the playful kitten cover. All of these make good covers and the public buys millions of copies of publications every day on account of them.

But the subject on the cover alone does not always mean that it will prove a big seller. Like as not the color scheme plays just as big a rôle. For if the color is not pleasing, the magazine often does not sell, even if the pretty girl *does* adorn its front. Then there is the "teaser," the "wonder-what-it-is" cover. If gotten up correctly, and if it stirs up sufficient curiosity in a man's breast—every copy will be sold as a rule. For after all, man is curiosity incarnate, and is willing to pay for appeasing it!

Our April cover was of this sort, as indeed it was an all-around ideal type. It had the mysterious element in it; it was startling, and the color combination was right and pleasing.

Some one—an authority on magazines—said that if we did get out a thousand covers, we could never hope to beat the April cover! And if the sales of the April issue is an index, his prophecy probably will come true! Indeed, we had to print an extra edition, and that did not cover the demand.

Of course, adverse criticism was not lacking. A few cranks—the usual monthly crop—were on deck, loudly denouncing us. Their virtuous ego had been shocked profoundly because we dared to show a woman unattired, save for her—skeleton!! These "critics" like as not forget that "to the pure everything is pure." They belong to that fanatic category of men who can't bear to look at the naked truth, because it is—naked!

So we were pleasantly surprised when hundreds of readers from all sections of the country began sending us clippings of the editorial which accompanies this article.

This editorial was written by Arthur Brisbane, the highest paid editorial writer in the world. It was publisht in the New York *Evening Journal*, the Chicago *American*, the Washington *Times*, the Boston *American*, the Atlanta *Georgian*, the San Francisco *Examiner*, and the Los Angeles *Examiner*.

Mr. Brisbane seldom uses illustrations in his editorials. That he picked out our April cover illustration proves that it must have been good. Indeed, we may paraphrase Mr. Brisbane's editorial by asking:

"What is a Cover Illustration? A Backbone." And again:

"While there are many *magazines*, so few of them are vertebrate that you can count them on the fingers of your two hands in the United States."

Ask yourself or your friend, "What *magazine* do you know that you can call a vertebrate? What *magazine covers* have you ever heard anybody discuss?" See how many answers you get.

Today the ELECTRICAL EXPERIMENTER is the most widely quoted scientific publication in this country. Within its covers you will find the last word on Radio, Electricity, Aeronautics, Chemistry, Astronomy, Mechanics and all the allied sciences, written so that the layman as well as the most modern theorist may enlarge his fund of knowledge. Therefore do you wonder that hardly a newspaper worth the name fails to quote the EXPERIMENTER several times a month?

What do *you* think is the reason?

EDITORIAL PAGE OF THE NEW YORK
EVENING JOURNAL

What Is an Editorial?
A Backbone.



Here, reproduced from that interesting scientific journal The Electrical Experimenter, is a picture showing a lady's skeleton photographed by modern methods. You will see the resemblance between these bones and the editorial

On your knees thank kind Providence that we have not X ray eyes, but eyes that see the surface, nothing below.

If like the mysterious penetrating rays we could see THROUGH see the bones, the crinkly skull, with its interesting seams, and all the rest, how gruesome we should look to each other.

Marriages would all be made in heaven, none of them on earth. We should all look too ugly.

But wise Providence limits us to a million directions, giving us what we need to make us useful and efficient here and nothing unnecessary.

We cannot see colors below the red or above the violet. Insects probably see others. We cannot detect sound except within a narrow range. We see the bloom on the cheek, not the bone inside of it. We see the pretty graveyard with the green grass and the flowers, but do not know what happened to the individual who went in there.

We see the baby, just arrived, chewing its fist in the cradle, but don't know whence it came, what it was doing before it got here.

And it is all for the best.

This is written to answer a reader who asks, "What part should you say that the editorial plays in a newspaper?"

This little picture answers the question.

The editorial in a newspaper, if it IS an editorial, which it usually ISN'T, plays in that newspaper the part that the skeleton, and particularly the backbone, plays in the anatomy and the activity of the young lady in this picture.

She doesn't show it, her young man doesn't know it, the world at large doesn't know it, but the most important thing about her, that which makes her stand up and go through life well balanced on her two feet, is the bony structure, and particularly that BACKBONE.

The young man who doesn't know it really admires her for the backbone, admires her because she is a vertebrate, that is to say, one having a spinal column.

Without it she would lie flat on the ground, could not stand up could not walk, could not even crawl along. Beautiful hair and eyes and color would all go for nothing without the backbone.

So, inquiring reader, it is with the newspaper and the editorial column. The editorial column is the spinal column.

If the newspaper has got it, it is a vertebrate. If it hasn't got it—and newspapers usually haven't—it is a mollusk. The mollusk is good to eat, leads a prosperous, cheerful life quite often. But it is a mollusk.

In the newspaper, as in the human being, the backbone, or editorial column, makes the thing stand up and walk and gives it its power.

In this charming young person, as you can see at a glance, the skeleton is by far the least attractive part. It cannot be compared with long, curly hair, pink cheeks, red lips, sparkling eyes. But it is more necessary than those.

The newspaper's backbone, when it happens to be a newspaper with a backbone, is perhaps the least attractive part, the least pleasing. It does not compare with the woman's page, the continued story, the fashion page, the comic page, but it is THE BACKBONE.

While there are many newspapers, so few of them are vertebrates that you can count them on the fingers of your two hands in the United States.

Ask yourself or your friend, "What newspaper do you know that you can call a vertebrate? What newspaper editorial columns have you ever heard anybody discuss?" See how many answers you get.

www.americanradiohistory.com

Making a Practical Electrician

(*Continued from page 117*)

The new student starts at the very beginning, under an instructor that not alone initiates him into the electrical field, but helps to mold the character and general business policy of the future electrician.

In this school no text-books are in evidence! What the student hears and sees, as well as does, is first given to him verbally by his instructor. When he has done the work with his own hands, and made such notes as will be of assistance in the future to refresh his memory, the knowledge he has gained is the only text-book he uses. In the large electrical library of the school the student may at any time refer to any topics that seem hazy or not quite clear to him.

The new man learns the elementaries first, such as the meanings of various symbols and the rudimentary rules applying to electrical calculations, after which he does the practical work at his own table. Next he performs the simple feats of connecting up bells, batteries, telephones, fire-alarms, telegraphs and all sorts of intercommunicating systems.

From here he graduates into the high branch of applied electricity and in a practise building consisting of a ten room apartment he learns how to wire for light, heat and power by all the prevailing systems, such as cleat work, wood and metal moulding, knob and tube work, armored cable, flexible and metallic conduit.

As electrical power is one of the greatest factors of American industry, and its applications many, the electrician finds a great field in his endeavors in this one branch alone. Therefore, at this school every modern power problem is studied minutely. When this part of his course is finished the student is ready to tackle anything that may come his way, be it the installing or building of switchboards to carry enormous currents, the connecting and operating of alternating and direct current motors, dynamos or generators, or the operation or installation of storage battery systems as applied to electrical vehicle propulsion, and every other phase of this branch of electrical science. With his vast storehouse of knowledge gained by actual experience the student is well qualified to enter the field of Electric Traction, the coming achievement of this century, for he will have worked on, installed and run a complete electric trolley and locomotive.

Finally the student learns the biggest bug-a-boo of all, "Armature Winding," which to most people is a science in a class by itself. At this school a complete knowledge is quickly gained in a simple and practical manner. All puzzling details are rapidly grasped and within a short time the student is winding any form of armature, stator, field or motor ever used in actual practise. This and machine shop practise, repairs, electrical drafting, etc., complete the training course.

No specified time is set for a student to complete his studies—everything depends on the individual and the rate at which he can grasp things. No entrance "exams" are needed, one can start at any time. The men hold meetings, at which all new advances in science are discust and many novel features introduced.

When finally graduated the student, diploma in hand, stands ready to meet any phase of the electrical industry. He is able to undertake any job, for he has the confidence that only comes with the knowledge that he has done with his own hands the things he will have to do in actual practise in the business world. *Photos Courtesy N. Y. Electrical School.*



Learn to Fill Bigger Shoes

NO matter what kind of work you are doing now, a set of these great home study books will quickly fit you for a bigger and better paying job. We will send any set you select for one week's FREE examination, and if you want to keep them you pay only the special reduced price—at the rate of 50 cents a week. This is your opportunity to make more money—grasp it NOW. Use these books and a little spare time and LEARN TO FILL BIGGER SHOES.

Carpentry and Contracting
Five volumes, 2138 pages and more than 400 illustrations. Prepares for Contractor, Building Superintendent and Carpenter Foreman. Regular price, $25.00. Special price, $17.80.

Civil Engineering
Nine volumes, 8900 pages and 3000 illustrations, plates and diagrams. Prepares for Civil or Structural Engineer, Transitman, Estimator, Designer or Chief Draftsman. Regular price, $45.00. Special price, $29.80.

Telephony and Telegraphy
Four volumes, 1728 pages and 2000 illustrations, plates and diagrams. Prepares for Telephone Engineer, Wire Chief, Exchange Manager, Trouble Man or Telegrapher. Regular price, $20.00. Special price, $12.80.

Steam and Gas Engineering
Seven volumes, 3300 pages and 2500 illustrations, plates, diagrams, etc. Prepares for Stationary, Marine or Locomotive Engineer or Fireman. Regular price, $35.00. Special price, $21.80.

Law and Practice
(with Reading Course in 25 bound pamphlets). Thirteen volumes, 6000 pages and 24 illustrations. Prepares for all Bar Examinations. A wonderful aid to business men. Regular price, $72.00. Special price, $39.80.

Practical Accounting
Four volumes, 1840 pages and 800 illustrations, plates and diagrams, C. P. A. questions and practical problems. Prepares for Accountant, Bookkeeper or Cost Clerk. Regular price, $20.00. Special price, $12.80.

Pay Raisers

These books are written by well known authorities—the top-notchers in each line. They will help you make more money. You can't fail to understand them, because they are written in plain, everyday language. Thousands of photographs, diagrams, charts, etc., help to make difficult points as simple as A-B-C.

See our Free Examination—no money down offer below



Ask Our Experts

With these books goes free of all charge a $12.00 Consulting Membership in the American Technical Society. If any question puzzles you—write us. Our corps of experts and engineers will solve any problem. Ask all the questions you want for a whole year. This service is absolutely FREE.

Automobile Engineering
Five volumes, 2400 pages and 2000 illustrations. Prepares for Garage Foreman, Automobile Mechanic or Chauffeur. Invaluable to car owners. Regular price, $25.00. Special price, $17.80.

Machine Shop Practice
Six volumes, 2300 pages and 2500 illustrations. Prepares for Machine Shop Superintendent or Foreman, Foundryman, Pattern Maker, Tool Designer or Tool Maker. Regular price, $30.00. Special price. $19.80.

Sanitary, Heating and Ventilating Engin'ring
Four volumes, 1464 pages and more than 1400 illustrations, etc. Prepares for Sanitary Engineer, Heating and Ventilating Engineer, Master Plumber or Plumber. Regular price, $20.00. Special price, $13.80.

Mechanical and Architectural Drawing
Four volumes, 1678 pages and more than one thousand illustrations. Prepares for Architectural or Mechanical Draftsman. Regular price, $20.00. Special price, only $12.80.

Electrical Engineering
Seven volumes, 8000 pages and 2600 illustrations, plates and diagrams. Prepares for Electrical Engineer, Power Plant Superintendent, Substation Operator or Electrician. Regular price, $36.00. Special price, $19.80.

Accountancy and Business Management
Ten volumes, 3630 pages and 1987 illustrations, forms, etc. Prepares for Certified Public Accountant, Auditor, Office Manager, Accountant, Credit Man or Bookkeeper. Regular price, $50.00. Special price, $24.80.

Don't Send Any Money!

Write the name of the books you want on the coupon and mail it today. We will send the books at once, express collect, and you can use them just as if they were your own for a whole week. If you decide you don't want to keep them, send them back at our expense. If you like the books, as thousands of other men have after examination, just send us $2.00. You can send the balance of the special reduced price the same way—$2.00 each month (50 cents a week).

Start right now and learn to fill bigger shoes. There will be a better job looking for you if you do. Be ready to meet it when it comes. *Send the coupon now.*

American Technical Society, Dept. X338A, Chicago, Ill.

American Technical Society, Dept. X338A, Chicago, Illinois

Please send me set of _____ for 7 days' examination, shipping charges collect. I will examine the books thoroughly and, if satisfied, will send $2 within 7 days and $2 each month until I have paid the special price of _____. If I decide not to keep the books, I will return them by express at your expense. Title not to pass to me until the set is fully paid for.

Name _____

Address _____

Reference _____

SEND THE COUPON NOW

www.americanradiohistory.com

Be a Traffic Man-Earn $50 to $150 Weekly

Learn Professional Traffic Management

Unusual Opportunities await trained men in this field. Business institutions everywhere are forced to seek the services of competent Traffic Men. Constantly changing conditions require trained men to understand and solve the problems that arise. Big salaries are paid to men who can overcome these difficulties. YOU can fit yourself to do this pleasant work and command a salary from $3500 to $10,000 yearly.



TRAFFIC MANAGER

Pleasant Work—Easy to Learn

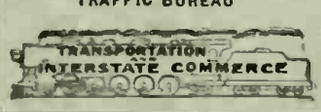
Spare time study—a few hours each week—will soon fit you to fill such a position. The work is easy, the surroundings pleasant and you become a man among big, successful men, with a private office, prestige,—and SUCCESS! Positions are permanent and lead to bigger opportunities constantly.



R. R. TRAFFIC MEN



TRAFFIC BUREAU



Your Success Depends On YOU!

Mere wishing and hoping will not bring results. You must GET ACTION if you would climb. The difference between "wages" and "salary" is in being able to do something the crowd can't do. Success is a matter of preparation.—It doesn't "just happen". The man willing to pay the price of preparation gets the big salary. Get out of the rut! Don't drift. Be a winner, not a wisher—and loser. Give yourself a chance. Only one thing can stop you—that's YOU. A pleasant job at a big salary awaits you as a trained Traffic Man. Our free booklet "Traffic" gives full particulars,—tells HOW you can "learn to earn the big salaries". The first step is to start—NOW! Prove your ambition. Take a step for SUCCESS. Write TODAY!

Our Courses Highly Practical

Entire course of instruction given by practical, experienced, successful traffic men. Their counsel and advice comes from their daily experience. They know the needs and requirements and they know the methods and information necessary to meet them, hence are amply fitted to successfully teach others. Each student gets personal attention. Practical assistance rendered for two years after graduation. An ordinary education, ambition and determination are all you need to win. An established Traffic Department at School furnishes practical experience, also offers opportunity for

Post Graduate Course Free

Students and graduates are privileged to use this feature without extra charge. Gives actual experience in rates, routing, classifications and packing. An exclusive feature not offered elsewhere.

TRAFFIC MANAGERS' salaries range from $3000 to $25,000 yearly.
TRAFFIC BUREAUS earn from $2000 to $10,000 yearly.
TRAFFIC SECRETARIES in Chambers of Commerce earn from $2500 to $10,000 yearly.

Interstate Traffic School, 266 Traffic Building, Ft. Wayne, Ind.

YOU HAVE A BEAUTIFUL FACE

BUT YOUR NOSE?





BEFORE



AFTER

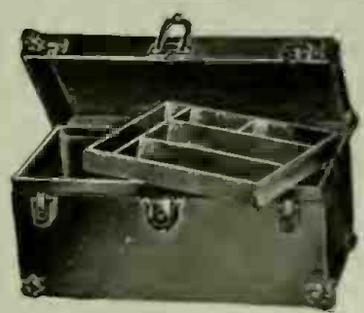


IN THIS DAY AND AGE attention to your appearance is an absolute necessity if you expect to make the most out of life. Not only should you wish to appear as attractive as possible, for your own self-satisfaction, which is alone well worth your efforts, but you will find the world in general judging you greatly, if not wholly, by your "looks," therefore it pays to "look your best" at all times.

Permit no one to see you looking otherwise; it will injure your welfare! Upon the impression you constantly make rests the failure or success of your life. Which is to be your ultimate destiny? My new *Nose-Shaper*, "TRADOS" (Model 24) corrects now ill-shaped noses without operation, quickly, safely and permanently. Is pleasant and does not interfere with one's daily occupation, being worn at night.

Write today for free booklet, which tells you how to correct ill-shaped noses without cost if not satisfactory

M. TRILETY, Face Specialist **1162 Ackerman Bldg., Binghamton, N. Y.**



This is the handiest and most useful Tool Kit to have around the house or Garage.

Fisher's Metal Tool Kits

For Electricians, Wiremen, Plumbers, Tinners, Motorists, Mechanics and Garage Men.

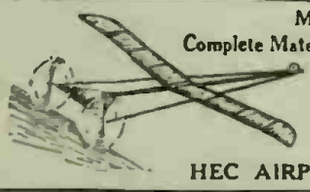
Only the very best of workmanship is used in the construction of all our Tool Kits. Neat in appearance, light in weight, and handy to carry—Dust, Dirt and Water-proof.

The corners, sides and ends are doubly reinforced, giving them the required strength and durability to withstand Knocks, Bumps, and rough usage that the average kit is subject to. The Hinges, Handle, Lock and Catches are all metal, and are of the most substantial and best quality that can be obtained.

The tray is intended to hold small tools, such as Pliers, Drill Bits, Screw Drivers, Chisels, etc.

SPECIAL OFFER: In order to introduce our Tool Kits more thoroughly we will ship your choice of any one of the following sizes, complete with tray, remittance to accompany the order, for $4.25—No. 30, size 18x8x8. No. 32, size 19x9x9. No. 34, size 20x10x10. If a larger or smaller size than the above, or a different style Tray is desired, write for information and prices or send for Booklet. Agents and Dealers wanted in every locality. Address all orders and make all remittances payable to

JOHN C. FISHER & CO. - - - Freedom, Pa.



MANHATTAN RACER—2,000-FOOT FLYER

Complete Materials, Carved Propellers, Assembling Instructions, Ready to Assemble

$3.50 Postpaid in the U. S. A. Working Blue Print only—35c

Bleriot Model—600-Ft. Flyer Complete Parts and Instructions

$3.50 Postpaid in the U. S. A. Blue Print only—35c

HEC AIRPLANE CO., Dept. B, 6 W. 48th St., New York City

MONEY for YOU

Add to your Salary—Make extra Pin Money
Start a lucrative business of your own

Spend an hour each day taking subscriptions for the "Experimenter." We'll pay you well and you'll enjoy the work. *Write for full particulars.*

Circulation Dept. ELECTRICAL EXPERIMENTER, 233 Fulton St., N. Y. City

Practical Chemical Experiments

(Continued from page 122)

decay may be at all noticeable.

COOKING OF EGGS. There is a notion prevalent that hard-boiled eggs are not digestible, and experiments made with eggs in the stomach lead to the same conclusion. Thus eggs slightly boiled have left the stomach in 1¾ hours, and raw in 2¼ hours, and hard-boiled in 3 hours. It should be noted, however, that raw eggs are only partially digested in the stomach, perhaps because they do not fully excite the flow of the gastric juice. The complete digestion is accomplished further along in the alimentary canal.

In cooking eggs, they should be placed in water at 170 to 180 degrees Fahrenheit, and allowed to remain for 10 minutes, when the yolk will be found to be more coagulated than the white, the egg albumin beginning to coagulate at 134 deg. Fahr., and it requires some time to heat the egg thruout.

A convenient method for cooking eggs without the use of a thermometer is to pour a quart or so of boiling water into a bowl, and put two or three eggs into this and allow them to remain for 10 or 12 minutes. The yolk actually cooks more readily than the white, and by this process the eggs are cooked uniformly thruout.

QUESTIONS AND ANSWERS

MIXING MILK AND ACID.

Ques. No. 5. A. J. Karlson, Phenix, Ariz., wants to know if it is possible after milk or cream is mixt with Sulfuric acid, to remove the latter and restore the acid to the same strength as before.

Ans. We do not quite understand your object in mixing the acid with the milk, only to revert back to the same original substances. However, this is not possible, as the acid enters into reaction with the formation of new compounds, which reaction is not reversible.

FIRE EXTINGUISHER.

Ques. No. 6. *Fire Extinguishers.* Mr. Kenneth Gordon, Tulsa, Okla., desires information regarding ingredients and operation of fire extinguishers.



Section Thru a Standard Fire Extinguisher.

Answer: A solution of sodium bicarbonat is contained in a metallic cylinder, having a flexible tube at one of the upper sides. Sulfuric acid is kept in a small container above the bicarbonat as shown in the accompanying illustration. When the extinguisher is inverted, the stopper falls out of the bottle, permitting the sulfuric acid to come in contact with the solution of sodium bicarbonat, with the formation of carbon dioxid, thus:—

$$H_2SO_4 + 2NaHCO_3 = 2H_2O + Na_2SO_4$$

The presence of the carbon dioxid gen-

www.americanradiohistory.com

erated forces the solution out thru the hose.

"Pyrene" extinguishers contain carbon tetrachlorid, a highly volatile liquid, whose vapor does not burn.

In either case the gases liberated so envelop the flame that combustion ceases, due to lack of its supporter, oxygen.

RADIOACTIVE GAS MANTLE.

Question 7. *Welsbach Mantle.* Theodore McGowan, Elmira, New York, wants to know how he can conclusively show that the Welsbach gas mantle contains radioactive substances.

Answer: The most simple and conclusive method is to place a gas mantle upon a box which contains an unexposed photographic plate, wrapt in the usual opaque paper. Set these aside for a week or ten days, and develop as usual. The result will be a photographic reproduction of the mantle, exposed by its own light, liberated by the radioactive ingredients.

FULLER'S EARTH.

Question 8. William W. Staley, Portland, Oregon, desires information as follows: Where he can obtain Fuller's earth as mentioned in the April issue, Experiment No. 3 on Butter Tests; and also the composition of the alcoholic potash solution as mentioned in Experiment No. 4 in the same issue.

Answer: (a) *Fuller's Earth* may be obtained from any chemical supply house dealing in chemicals, and may be ordered under that name.

(b) The *Alcoholic Potash Solution* mentioned is prepared by dissolving 28 grams of caustic potash (in stick form) in 1 litre of alcohol.

Science in Slang

(*Continued from page* 143)

tomers at the same time. At that, the automatic is some little system and the guy who invented it certainly had it thick behind the ears. All you have to do is to move a little disc around the front of the 'phone, having numbers from 1 to 0, and you don't have to wait for a connection, either. If the line is busy you hear the usual busy signal which means, Hang up your receiver.' After a while you try it again and you can cuss and howl all you want if it's still busy. The automatic 'phone exchange doesn't mind it in the least, and take it from me, the system works to a charm."

"That so?" interposed Punk Loomis. "When how comes it that if the system works so charmingly and charmfully, the rest of the universe doesn't adopt it?"

"You see," said Stokes, "it's like this: When a man bumps into you at the corner, almost upsetting you, it does your heart good to come back at him with a long string of verbosity that clears out your venom and makes you feel comfortable again. as soon as it is out of your system. But if you run into a lamp-post, it doesn't do you much good to cuss at it by letting loose a blue streak of hyphenated talk. Same with the automatic outfit. A man wants to have somebody to act as his personal goat once in a while. He wants to tell Central what is the matter with her. Or, if he is not inclined that way and time hangs heavily on his hands, he might want to speak to her about the color of her eyes or the texture of her soul. Never mind if she hangs up on him, that's the complexity of the human mind. So while the automatic is a fine outfit as far as it goes, it is too *inhuman*, for it refuses to be your goat and that is the reason——"

"Stokes!" yelled the steward. "Long distance is answering."

The Man Who *Wouldn't* Stay Down



He was putting in long hours at monotonous unskilled work. His small pay scarcely lasted from one week to the next. Pleasures were few and far between and he couldn't save a cent.

He was down—but he *wouldn't stay there!* He saw other men promoted, and he made up his mind that what they could do *he* could do. Then he found the *reason* they were promoted was because they had special training—an expert knowledge of some one line. So he made up his mind that *he* would get that kind of training.

He marked and mailed to Scranton a coupon like the one below. That was his first step upward. It brought him just the information he was looking for. He found he could get the training he needed right at home in the hours after supper. From that time on he spent part of his spare time studying.

The first reward was not long in coming—an increase in salary. Then came another. Then he was made Foreman. Now he is Superintendent with an income that means independence and all the comforts and pleasures that make life worth living.

It just shows what a man with ambition can do. And this man is only one out of hundreds of thousands who have climbed the same steps to success with the help of the International Correspondence Schools.

What about *you?*

Are you satisfied merely to hang on where you are or would you, too, like to have a real job and real money? It's entirely up to you. You don't *have* to stay down. You *can* climb to the position you want in the work you like best. Yes, you can! The I. C. S. are ready and anxious to come to you, wherever you are, with the very help you need.

Surely when you have an opportunity that means so much, you can't afford to let another priceless hour pass without at least finding out about it. And the way to do that is easy—without cost, without obligating yourself in any way, mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 6189, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

ELECTRICAL ENGINEER	CHEMICAL ENGINEER
Electrician	SALESMANSHIP
Electric Wiring	ADVERTISING MAN
Electric Lighting	Show Card Writer
Electric Car Running	Outdoor Sign Painter
Heavy Electric Traction	RAILROADER
Electrical Draftsman	ILLUSTRATOR
Electric Machine Designer	DESIGNER
Telegraph Expert	BOOKKEEPER
Practical Telephony	Stenographer and Typist
MECHANICAL ENGINEER	Cert. Pub. Accountant
Mechanical Draftsman	Traffic Management
Toolmaker	Commercial Law
Ship Draftsman	GOOD ENGLISH
Machine Shop Practice	Common School Subjects
Gas Engineer	CIVIL SERVICE
CIVIL ENGINEER	Railway Mail Clerk
Surveying and Mapping	STATIONARY ENGINEER
MINE FOREMAN OR ENG'R	Textile Overseer or Supt.
ARCHITECT	AGRICULTURE
Architectural Draftsman	Navigator / Spanish
PLUMBING AND HEATING	Poultry Raising / French
Sheet Metal Worker	Automobiles / Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____

CHARGE YOUR OWN BATTERIES and they are READY WHEN YOU NEED THEM

The highly efficient Full-Wave F-F MAGNETIC RECTIFIER operates from any handy Alternating Current Lamp Socket and enables you to charge your batteries safely at night unattended right in your own home garage and in the case of an automobile, without removing the battery from car or breaking any electrical connections. A full charge is done over night and costs about 6 cents for the average starting and lighting battery.

For operation from Farm Lighting Plants or Direct Current Service you would use the F-F Charging Rheostat.

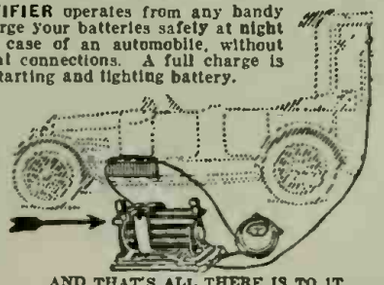
Either style of BATTERY BOOSTER is Portable and furnished complete with Ammeter and Battery Clips.

No electrical knowledge whatever is required to operate the F-F Charging Outfit. You simply screw plug in lamp socket and snap charging wires on battery terminals. That's all there is to it.

The F-F BATTERY BOOSTER means Long Life to your battery, a Hotter Spark, a Quicker Start, Brighter Lights, Vitality to carry overload and work overtime, and that it is READY WHEN YOU NEED IT.

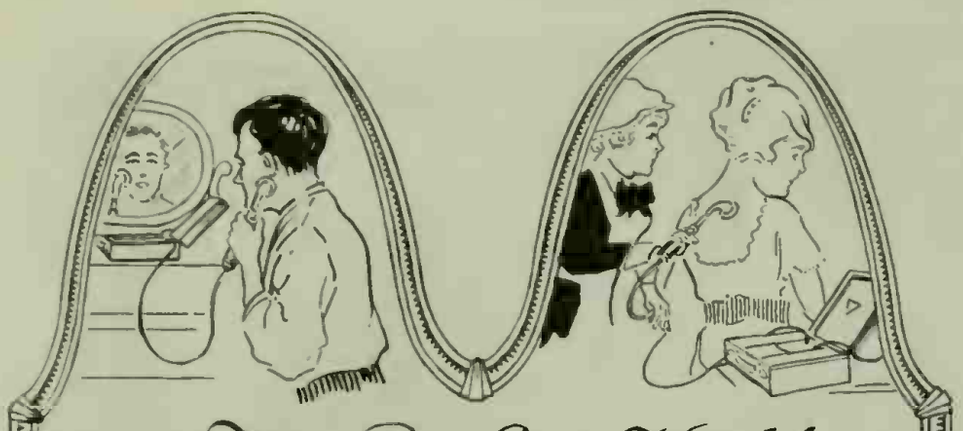
THE FRANCE MANUFACTURING CO. Cleveland, O.

Write for Bulletin No. 12



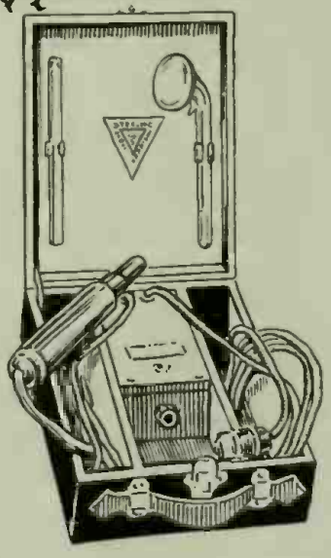
AND THAT'S ALL THERE IS TO IT

www.americanradiohistory.com



For Perfect Health, Strength, Unlimited Vitality & Improved Personal Appearance

The STERLING HIGH FREQUENCY VIOLET RAY



CELEBRATED Physicians and leading Beauty Specialists receive fabulous fees for treating with the Violet Ray. *You* can have a health doctor and beauty specialist right in your own home for your daily service at an average cost of less than a penny stamp.

The Sterling High Frequency Violet Ray was specially designed for home use—fitted to work from the ordinary lamp socket—easy to manipulate—under control at all times—and contains within its covers the Services of a servant, a doctor of medicine, and a nerve and beauty specialist—all in one, ready for instant service.

The Sterling Violet Ray is invaluable in the treatment of diseases of the skin, mouth, throat and lungs, derangements of the liver, kidneys, stomach and intestines—soreness in muscles and joints—tired or "sick" brains or lack of "nerve tone." It strengthens heart action—cleanses the blood—brings the flush of youth to the skin—enlivens the hair—puts a "spring in your step" and creates a clear eye and brain.

Six hundred thousand vibrations per second saturate the entire body with electricity—fill the blood with oxygen—eliminate waste, toxins, and poisons—ALL enemies of youthfulness.

Sterling Violet Ray Generators are the creations of Mr. Anthony Longoria, our Chief Designing Engineer, whose long years of practical experience in the designing and operation of Violet Ray Generators entitle him to the commanding position he holds in their manufacture. They are based upon the original discoveries of Nikola Tesla, first given to the world in May, 1891, but have been developed to the highest state of perfection ever reached in this type of generators.

Book and Valuable Information Free

We want to send you our book and full particulars about the Sterling Violet Ray Machines. Read how you can treat innumerable diseases and ailments, improve your personal charm, add strength and vitality and help yourself in hundreds of ways. Just mail the coupon or drop a postal. Do it now, this minute, before you forget it.

THE STERLING ELECTRICAL CORPORATION

1278 West Third Street **Cleveland Ohio**

STERLING ELECTRICAL SPECIALTIES

MAIL THIS COUPON FOR FREE BOOK

The Sterling Electrical Corporation, 1278 West 3rd St., Cleveland, Ohio.

Gentlemen:—

As per your offer in Electrical Experimenter, please mail me at once, free and postpaid, your book and full information about the Sterling Violet Ray Generators.

NAME .....

ADDRESS .....

CITY ..... STATE .....

The Moon's Rotation

By Nikola Tesla

(*Continued from page* 133)

significance of this will be understood by reference to Fig. 7 in which the two masses, condensed into points, are represented as attached to independent weightless strings of lengths R_{c1} and R_{c2} which are purposely shown as displaced but should be imagined as coincident. It will be readily seen that if both strings are cut in the same instant the masses will fly off in tangents to their circular orbits, the angular movement becoming rectilinear without any transformation of energy occurring. Let us now inquire what will happen if the two masses are rigidly joined, the connection being assumed imponderable. *Here we come to the real bug in the question under discussion.* Evidently, so long as the whirling motion continues, and both the masses have precisely the same angular velocity, this connecting link will be of no effect whatever, not the slightest turning effort about the common center of gravity of the masses or tendency of equalization of energy between them will exist. The moment the strings are broken and they are thrown off they will begin to rotate but, as pointed out before, this motion neither adds to or detracts from the energy stored. **The rotation is, however, not due to an exclusive virtue of angular motion, but to the fact that the tangential velocities of the masses or parts of the body thrown off are different.**

To make this clear and to investigate the effects produced, imagine two rifle barrels, as shown in Fig. 8, placed parallel to each other with their axes separated by a distance $R_{c1} - R_{c2}$ and assume that two balls of same diameter, each having mass m, are discharged with muzzle velocities V_1 and V_2, respectively equal to $2\pi n R_{c1}$ and $2\pi n R_{c2}$ as in the case just considered. If it be further supposed that at the instant of leaving the barrels the balls are joined by a rigid but weightless link they will rotate about their common center of gravity and in accordance with the statement in my previous article above mentioned, the relation will exist $\frac{V_1 - V_2}{2} = \pi n (R_{c1} - R_{c2})$ n being the number of revolutions per second. The equalization of the speeds and kinetic energies of the balls will be, under these circumstances, very rapid but in two heavenly bodies linked by gravitational attraction, the process might require ages. Now, this whirling movement is real and requires energy which, obviously, must be derived from that originally imparted and, consequently, must reduce the velocity of the balls in the direction of flight by an amount which can be easily calculated. At the moment of discharge the total kinetic energy was $E = \frac{1}{2} m V_1^2 + \frac{1}{2} m V_2^2$ which is evidently equal to $m V_3^2$, V_3 being the effective velocity of the common center of gravity, from which follows that $V_3 = \sqrt{\frac{V_1^2 + V_2^2}{2}}$. The speed of revolution of the masses is, of course, $\frac{V_1 - V_2}{2}$ and the rotational energy of both balls, which must be considered as points, is $e = m\left(\frac{V_1 - V_2}{2}\right)^2$ The kinetic energy of translation in the direction of flight is then $\frac{1}{2} m V_1^2 + \frac{1}{2} m V_2^2 - m\left(\frac{V_1 - V_2}{2}\right)^2 = m\left(\frac{V_1 + V_2}{2}\right)^2 = m V_3^2$, $V_3 = \frac{V_1 - V_2}{2}$ being the speed of the

www.americanradiohistory.com

AK TABLETS FOR All Pain

Headaches
Neuralgias
Colds and La Grippe

Women's Aches and Ills
Rheumatic and Sciatic Pains

Ask Your Druggist for A-K Tablets
(If he cannot supply you, write us)

Small Size 10c — **Dozen Size 25c**

Fac-Simile

See Monogram AK on the Genuine

The Antikamnia Remedy Company, St. Louis, Mo.

Write for Free Samples



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle massage. Can be used with or without electric current.

All users of the Lek-Tro-Shav speak well of it

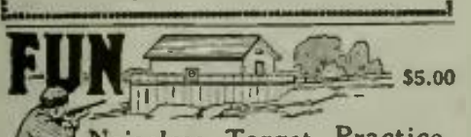
A barber says—"Have shaved for years and have never used any shaving device near its equal."
A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."

No. 1 Made for use from Light Socket.
No. 2 Made for use from Dry Battery.

Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.

VIBRATING ELECTRIC RAZOR CO.
Dept. 122. Omaha, Nebr.

FUN $5.00



Noiseless Target Practice

Fit your .22 with a Maxim Silencer and get no end of fun this summer practicing in your back yard and on your vacation.

MAXIM SILENCER

MAKES YOU A BETTER MARKSMAN

It eliminates recoil and all noise of the report, and steadies your aim. Direct from Dealer or Factory $5.00. Write for Free Book of Stories.

FREE BOOK



MAXIM SILENCER CO.
89 Homestead Ave., Hartford, Conn.

A Cigarette With One Hand

Don't drop everything every time you want a smoke. Let

The "HANDY" Cigarette Case

Hand it to you. Pull the cover down, then up, and the cigarette is ready. Fits the pocket. Full Nickel-Plated. Shipped Post-Paid on receipt of price **50c**

CASE MFG. CO., 241 W. 23rd St., New York

common center of gravity, so that $V_1 - V_1$ is the loss of velocity in the direction of flight owing to the rotation of the two mass points. If instead of these we would deal with the balls as they are, their rotational energy

$$e_1 = e + i\omega_1^2 = m\left(\frac{V_1 + V}{2}\right)^2 + i(2\pi n)^2$$

i being the moment of inertia of each ball about its axis.

As will be seen, we arrive at precisely the same results whether the movement is rectilinear or in a circle. In both cases the total kinetic energy can be divided into two parts, respectively of the same numerical values, *but there is an essential difference.* In angular motion the axial rotation is nothing more than an *abstract conception;* in rectilinear movement it is a *positive event.*

Virtually all satellites rotate in like manner and the probability, that the acceleration or retardation of their axial motions—if they ever existed—should come to a stop precisely at a definite angular velocity, is infinitesimal while it is almost absolutely certain that all movement of this kind would ultimately cease. The most plausible view is that no true moon has ever rotated on its axis, for at the time of its birth there must have been some deformation and displacement of its center of gravity thru the attractive force of the mother planet so as to make its peculiar position in space, relative to the latter, in which it persists irrespective of distance, more or less stable. In explanation of this, suppose that one of the balls as M in Fig 5 is not of homogenous material and that it is similarly supported but on an axis passing thru its center of gravity instead of form. Then, no matter in what position the ball is fixed on the pivots, its kinetic energy and centrifugal pull will be the same. Nevertheless a directive tendency will exist as the two centers do not coincide and there is, consequently, no *dynamic* balance. When permitted to turn freely on the axis of gravity the body, of whatever shape it may be, will tend to place itself so that the line joining the two centers points to O and there may be two positions of stability but, generally, if the center of gravity is not greatly displaced, the heavier side will swing outwardly. Such condition may obtain in the moon if it had solidified before receding from the earth to great distance, when the

(Continued on page 160)

POPULAR ASTRONOMY

The Evolution of the Stars

(Continued from page 121)

Canopus, one of the giants of the universe. The transition of this type into the solar type stars of class G, to which our sun belongs, occurs when the group of iron lines known as group G begins to appear (see diagram I). The lines of calcium and hydrogen still remain more intense than any other lines in the spectrum, but many fine metallic lines now appear in ever-increasing intensity. The transition of this type into the advanced solar type K occurs when some of the metallic lines surpass the hydrogen lines in intensity. The group of iron lines has also greatly increased in intensity until it becomes one of the most conspicuous features of the K type stars. Stars of the solar type such as Capella and the sun are yellow, and stars of the advanced solar type, such as Arcturus and Aldebaran, are orange colored bordering on red. Their atmospheres are filled with dense metallic vapors. (See photos of solar and advanced solar type spectra.)

Class M is divided into giant and dwarf

Drake's Practical Mechanical Books

For Home Study



Pave the way for the big positions—the fat pay-envelopes. Written in non-technical language—easy to read—easy to understand. We will send any book postpaid—keep them five days—if not entirely satisfied return the books and your money will be refunded in full. Order direct from this page. Use the coupon.

Electrical Books

Electric Motor Control Systems and Methods. Leatherette	$1.50
Electrical Tables and Engineering Data. Leatherette	1.50
Motion Picture Operation. Leatherette	1.50
Alternating Current. Leatherette	1.50
Wiring Diagrams and Descriptions. Leatherette	1.50
Armature and Magnet Winding. Leatherette	1.50
Modern Electric Illumination. Leatherette	1.50
Modern Electrical Construction. Leatherette	1.50
Electricians' Operating and Testing Manual. Leatherette	1.50
Drake's Electrical Dictionary. Leatherette	1.50
Electric Motors, D and A. Leatherette	1.50
Electrical Measurements and Meter Testing. Leatherette	1.50
Drake's Telephone Handbook. Leatherette	1.50

Automobile Books



Automobile Ignition. Leatherette. $2.00
Brookes' Automobile Handbook. Leatherette .. $2.00
Automobile Starting and Lighting. Leatherette .. $1.50
Ford Motor Car, Truck and Tractor Attachments. Cloth. $1.00
Ford Motor Car, Truck and Tractor Attachments. Leatherette .. $1.50
Automobile Catechism and Repair Manual. Leatherette $1.25
Gas and Oil Engine Handbook. Cloth ... 1.00
Gas and Oil Engine Handbook. Leatherette 1.50

Modern Language Courses



French Without a Teacher, Spanish Without a Teacher, German Without a Teacher. By Professor Philip Schuyler Allen, University of Chicago. An entirely new home series of modern foreign languages. Simplest, easiest-to-master language method ever devised. French, Spanish or German. Pocket size. Each $1.25

Mail the Coupon NOW

Order on our five day money back plan.

FREDERICK J. DRAKE & CO.,
1009 Michigan Ave., Chicago, Ill.

Enclosed find ($.....), for which please send me prepaid the books checked in this adv. (or list attached). It is agreed that I may return same in 5 days if not entirely satisfied, and money will be refunded in full.

Name .....

Address .....

www.americanradiohistory.com

Let Me train YOU in AVIATION



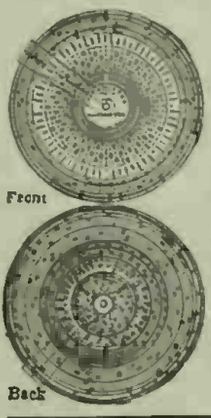
Capt. G. F. Campbell, formerly Third Ace of the Royal Flying Corps.

My advice to you is to start right now to take my

HOME COURSE IN AVIATION

and prepare to fill one of the big jobs later. Wonderful opportunities. Trained men in big demand. Prepare now for big future. Lessons are easy to understand. Write TODAY for my FREE BOOK, "The Science of Aviation," and I will send it and write you a personal letter that will interest you. Address:

CAPT. GEO. F. CAMPBELL, Chief Instructor, National Aero Institute, 916 S. Michigan Ave., Dept. 7446, Chicago



Front

Back

SPECIAL KON-VER-TER SLIDE RULE

The Hamilton Improved circular slide rule has over 3000 graduations and over 1800 figures and letters on it, and is an engineers hand book and slide rule combined. It is 6.4 inches in diameter.

It will subtract, divide, multiply and add fractions or decimals of an inch can be used as a decimal equivalent table, constructed of three disks and double transparent celluloid rider. Decimal equivalents given to six places to figures, gives sines, co-sines tangents, co-tangents, secants, co-secants versed sines, co-versed sines, square, cube and fifth roots with all their powers. Finds the area, circumference and diameter of circles directly.

The Log scale has 1000 graduations. The DE LUXE rule may be bent double without injury, try this with rigid material such as metal. Has no clumsy operating attachments and will work proportions.

The KON-VER-TER is artistic as well as useful. In use all over the U.S., Canada, Mexico, Cuba, Porto Rico, Panama, Bermuda, Hawaii, Philippines, Australia and New Zealand. Instructions with rule.

Beautiful gold embossed black leatherette case, 50c extra. PLAIN UTILITY RULES $1.00. SPECIAL DELUXE RULES white ivory celluloid $2.50 P.P.

J. C. HAMILTON & CO.
Dept. B 7 Water St., Boston, U.S.A.

Delivered TO YOU FREE



Your choice of 44 styles, colors and sizes in the famous line of "RANGER" bicycles, shown in full color in the big new Free Catalog. We pay all the freight charges from Chicago to your town.

30 Days Free Trial allowed on the bicycle you select, actual riding test in your own town for a full month. Do not buy until you get our great new trial offer and low Factory-Direct-To-Rider terms and prices.

TIRES LAMPS, HORNS, pedals, single wheels and repair parts for all makes of bicycles at half usual prices. No one else can offer such values and such terms.

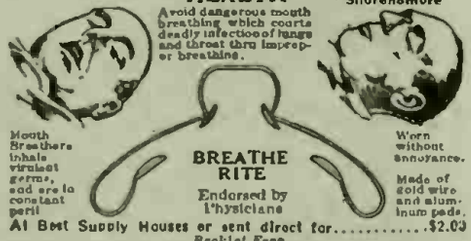
SEND NO MONEY but write today for the big new Catalog. It's free.

Rider Agents Wanted

MEAD CYCLE COMPANY Dept. F107 Chicago

LEARN HOW TO BREATHE-RITE FOR HEALTH

"Snorenomore"



At Best Supply Houses or sent direct for..... $2.00

Booklet Free

BREATHE-RITE CO., Dept. 2, Ann Arbor, Mich.

How to Get Rid of Moles



A simple, safe home treatment—15 years' success in my practice. Moles (also BIG growths) Dry Up.

Ask for Free Booklet of Full Particulars

WM. DAVIS, M.D.
1140 State Street Perth Amboy, N. J.

You can be quickly cured, if you

STAMMER

Send 10 cents coin or stamps for 70-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering for 20 years.

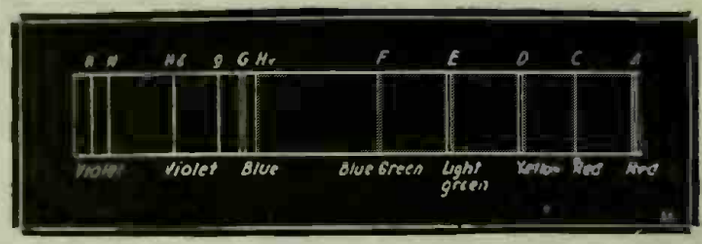
Benjamin N. Bogue, 755 Bogue Building, Indianapolis

Be an Artist

Comics, Cartoons Commercial, Newspaper and Magazine Illustrating. Pastel, Crayon portraits. Poster and Fashions. Earn Big Money. Taught by Mail or Local Classes. Write for illustrated booklet, terms and list of successful pupils

ASSOCIATED ART STUDIOS, 13A Flatiron Bldg., N. Y.

red stars with banded and fluted spectra corresponding to Secchi's type III. Their dense atmosphere are filled with metallic compounds and they are superficially at least much cooler than stars of the other types outlined above. (See spectrum of typical giant type M star.)



The Relative Positions of Certain Lines Prominent in Various Stellar Spectra Are Indicated in the Above Diagram of the Visible Spectrum: K and H Are the Absorption Bands of Calcium in the Extreme Violet End of the Spectrum. The Ultra-Violet Lies Beyond to the Left. Hδ, Hγ, F, and C Are the Characteristic Absorption Lines of Hydrogen Prominent in Type I and Type II Stars. g Is a Line of Calcium in the Violet. G Is a Group of Lines Due to Iron Prominent in Solar Type Stars. E Is a Second Group of Iron Lines. D Is a Pair of Lines in the Yellow Due to Sodium. A Is a Group of Lines in the Extreme Red Originating in Our Own Atmosphere.

Class N corresponds to Secchi's type IV and its characteristics have been mentioned above.

The position of the *Novae* or *Temporary Stars* in this scheme of evolution is somewhat uncertain, if in fact they fit into it at all. At the time of their outburst their spectra are usually rich in violet light and they are therefore to be classed with first type stars. Many sudden and peculiar changes take place in their spectra, but one characteristic is common to all novae, and that is the existence of both bright and dark bands of helium and hydrogen greatly displaced in position, the dark ones being shifted toward the violet and the bright ones toward the red.

Temporary stars usually pass first into bright line stars and later into planetary nebulae, thus reversing the generally accepted order of evolution from nebulas to bright line stars.

Tho a gradual transition from one type of star to the next can be traced, it does not necessarily follow that *all* stars pass from nebula to type M or type N stars thru all the types O, B, A, F, G and K in order and from there on to gradual extinction. It is possible that some stars become extinct or cease to shine without passing thru all of these stages.

The fact that in certain double star systems two stars physically connected and therefore evidently formed at the same time are at different stages of development calls for explanation. Some stars may run thru the course of evolution more rapidly than other stars, and some stars may lose their radiating powers before they have completed the normal course of evolution.

The marked division of the solar and late type stars into dwarf and giant stars also has a direct bearing on the problem of the order of the evolution of the stars. Tho the generally accepted order of evolution is that outlined above, it is possible that the sequence advanced by Prof. H. N. Russell may be the true one in which the evolution begins with giant stars of type M, continues in an order reverse to the one usually accepted thru giants of types K, G and F to the type B helium stars, hence in the normal order thru the *dwarfs* of types F, G, K and M to extinction. This would account for the existence of both giants and dwarfs of the later types. The Orion or Helium stars, which are the hottest of all the stars, would in this case represent the height of stellar development.

Whatever may prove to be the exact sequence in the evolution of the stars, the fact that there is evolution and change going on among the stars is indisputable. Such is the similarity existing among the hundreds of millions of stars of the universe that they can be grouped or classified under one or another of the few distinct types outlined above according to their color and the characteristic lines of their spectra.

(The next installment will appear in an early issue.)

TABLE SHOWING THE ORDER OF THE EVOLUTION OF THE STARS ACCORDING TO THE CLASSIFICATIONS OF SECCHI AND THE HARVARD COLLEGE OBSERVATORY

Type of Star		Typical 1st Mag. Star	Color	Characteristic Lines of Spectra
Secchi	Harvard			
.....	Gaseous Nebulae	.....	Green	Bright lines of helium hydrogen and nebulium.
.....	O (Wolf-Rayet)	....	Blue-White	Bright bands and lines of helium and hydrogen changing later to dark bands and lines.
.....	(Novae)	Nova Persei	....	Bright and dark bands, greatly displaced, of helium and hydrogen.
Type I	B (Helium)	Rigel	Blue-White	Dark absorption lines of helium and hydrogen, but chiefly of helium and a few faint metallic lines.
	A (Hydrogen)	Sirius	White	Intense absorption lines of hydrogen, reaching maximum. Increasing strength of metallic lines.
Type I-II	F (Calcium)	Canopus	White tinged with yellow	Intense bands and line "g" of calcium in violet. Hydrogen lines of great intensity; many strong metallic lines.
Type II	G (Solar)	Capella	Yellow	Increased intensity and number of metallic lines. Strong hydrogen lines still surpassing metallic lines in intensity. Appearance of Group G lines due to iron.
	K (Advanced Solar)	Arcturus	Orange	Decrease in strength of hydrogen lines. Great increase in number and strength of metallic lines and Group G of iron.
Type III	Ma (banded)	Betelgeuse	Red	Appearance of banded spectra due to compounds of titanium oxide.
	Mh (banded)	.....	.....	Marked faintness of violet end of spectrum.
Type IV	N (Carbon)	.....	Red	Banded spectra due to presence of carbon compounds.

NOTE—This latest type does not follow in order after Type M, but is entirely independent of it in its evolution.

The novae also do not fit into the regular chain of evolution, but are placed after the stars they most closely resemble.

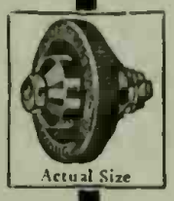
www.americanradiohistory.com

MOST SENSITIVE MICROPHONE

FOR $1.00

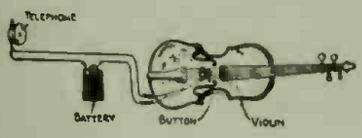
YOU can easily make a highly sensitive detectophone by using a Skinderviken Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive exquipment. Think of the fun you would have with such an instrument! It's very simple, too, and inexpensive.

You can install an outfit in your home and hear the conversation being held all over the house. You can connect up different rooms of a hotel. *Our outfit was used by secret service operatives during the War. It is being used on the stage.*



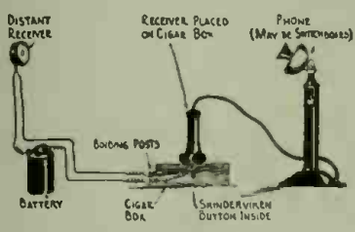
AMONG electrical experimenters the button has created a sensation. It is not uncommon to receive unsolicited letters like these: "I received transmitter button today and I wish to inform you that it works great and is *the best I have ever seen or heard of for the price.* I will certainly recommend it to my friends. I wish to thank you for your good service."

"I have been using one of your transmitter buttons, and it has proved to be worth more than its value in my experimenting." "I received one (Transmitter Button) some time ago, and they



So much for its commercial adaptations! *You* can procure apparatus of the same type.

One of the main advantages of the Skinderviken Transmitter Button lies in its ultra-sensitiveness.



You can place it in any position you like. It is the greatest invention in micro-phones and has won recommendations from men of high standing in the scientific world. It is being used all over the world. You can mount it most anywhere. Card board boxes, stove pipes, stiff calendars and hundreds of other places will suggest themselves to you. The buttons cannot be seen by any one in the room as they are so small and light. Only a small brass nut is exposed to the view.

Full directions for connecting up the button for use as a detectophone are given in booklet No. 4 which is sent with each button.

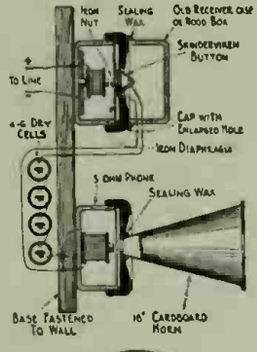
The only instruments needed to complete a detectophone outfit, in addition to a Skinderviken Transmitter Button are a receiver, battery, and, if desired, an induction coil.

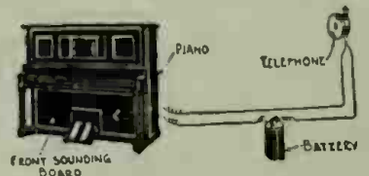
REAL BARGAINS

These prices are very low

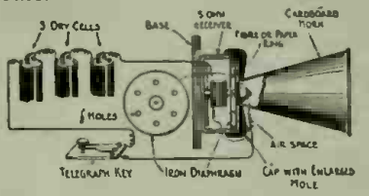
All equipment is GUARANTEED. The apparatus is the same as sold by us to large telepbone companies. 110 volt telephone generators.

3 bar	$1.75	Weight 6½ lbs.	
4 bar	2.25	"	8 lbs.
5 bar	2.75	"	10 lbs.
Ringers 80 ohm	.50	"	1 lb.
" 1000 ohm	.75	"	1 lb.
Silk cords, 6 ft. 3 cond.	.25	"	3 oz.
" " 6 ft. 4 cond.	.28	"	3 oz.
" " 3 ft. 2 cond.	.15	"	1 oz.
Transmitters complete with Steco transmitter button	$1.50		12 oz.
Induction coils	.40		6 oz.
Receivers—Watcb Case 75 ohms	1.25		1 lb.





are just O. K. for experimentary." "I have been using one of your transmitter buttons for experimental work and it certainly lives up to all you say for it *and then some.*"



Mr. H Gernsback, editor of tbis magazine, who is the dean of electrical experimenters, said: "In writer's opinion, obtained by actual elaborate tests, your Transmitter Button is probably most efficient device of its kind on market today, due to its simplicity and other outstanding features. Should have a great future."

The same circuit connections apply to all experiments, regardless of how the transmitter button is mounted.

The Skinderviken Transmitter Button operates on one or two dry cells. It often happens that two cells produce too much current and the sounds are deafening. We recommend either one fresh cell or two worn out cells.

We have the utmost faith in our transmitter button. We guarantee satisfactory service or we will refund the purchase price. Boys—Young and old—send in a dollar bill RIGHT NOW! You can't lose. If you're not satisfied, you receive your dollar back. Isn't that fair?

Send a 3c stamp for a copy of Booklet No. 4.









$1.00 ppd. **Skinderviken Telephone Equip. Co. Inc.**

335 Broadway NEW YORK
2134-36 N. Clark Street CHICAGO

$1.00 ppd.

USE THIS COUPON

STECO: (Use Pencil) E. E. 6-19

Gentlemen:—Please enter an order for

[ ]	Skinderviken transmitter buttons	@ $1.00		prepaid
[ ]	110 volt generators ..... bars	@	Wt.....	lbs.
[ ]	Ringers ..... ohms	@	Wt.....	lbs.
[ ]	Cords ..... conductor ..... ft.	@	Wt.....	lbs.
[ ]	Induction coils	@ .40	Wt.....	lbs.
[ ]	Transmitters with T Button	@ 1.50	Wt.....	lbs.
[ ]	Receivers—Watch Case—75 ohms	@ 1.25	Wt.....	lbs.

Amount Enclosed: Ship via
Enclose sufficient postage for mailing.

Ship to.....

.....

.....

Send Booklet No. 4. [ ]

www.americanradiohistory.com

MY NEW BOOK

"Muscular Development"

will tell you how to get a wonderful muscular development like mine, perfect health, abundance of vitality and great strength as I have.



EARLE E. LIEDERMAN
Why not look as healthy and be as strong as I am?

The results of my system are shown on my own person and that is recommendation enough. To give every one the opportunity to profit by what I have learned, I will mail my book, for a limited time only, on receipt of

10c Stamps or Coin

This wonderful book will help you. It is profusely illustrated and contains pictures of many of the world's strongest men whom I have trained. Send for it to-day. Right now, while it is on your mind.

EARLE LIEDERMAN, Dept. 209, 203 Broadway, N.Y.

RIGHT NOW—You Can Make Big Profits In BATTERY CHARGING

Owners of HB Chargers everywhere are making $100 to $400 *Clear Profit* every month. Business better than ever. YOU can do as well. Don't delay. Get out and get this business with sturdy, dependable HB Equipment.

THIS HB 500 WATT CHARGER WILL PAY $100 to $200 CLEAR PROFIT EACH MONTH

No electrical knowledge required to install or operate. Recharges 7 6-volt batteries at once. Costs 12c to 15c each to recharge, customer pays 75c to $1.50 Big, quick, clean profits—easily made. No burnouts or expensive renewals. Steady service 24 hours a day. Economical to run, requires no attention, save occasional oiling.

$25 Puts This Money-Maker in Your Garage on Money-Back Guarantee

Balance in 9 monthly payments of $20 each. Earnings easily pay for machine. Fill $25 Initial payment check to this ad and send today for trial order. Sold under **HB Absolute Money-Back Guarantee.** Order NOW. Don't delay. Get busy! Get these Profits!

HOBART BROTHERS COMPANY
604 E. Troy, Ohio
Successful Manufacturers Since 1893



Mining Engineering

For Your Profession

A wide and profitable field, not overcrowded, is open to forward-looking young men. The Michigan College of Mines, established 1886, offers a comprehensive four year course which can be completed in three years. Its breadth provides foundation for expert specialization in that field of engineering which most appeals to the student. All phases of technical knowledge and instruction relative to mine development and operation thoroughly presented by constructive methods. Practical experience is there combined with theoretical work in a rare way. *College is located in center of one of the world's greatest copper mining districts.* Close relations are constantly maintained with mines, mills, smelters, electrolytic and power plants which are practically a part of the College equipment and a factor of enormous value in instruction. "M. C. M. Men Make Good." For descriptive book address Administrative officer, Houghton, Mich.

Michigan College of Mines



Send for Free Book

Do You Want to Know

HOW TO DEVELOP

Vitality, Energy, Endurance, Nerve Strength, Muscular Strength, Perfect Physique?

My FREE BOOKS, "The Whys of Exercise" and "The First and Last Law of Physical Culture," tell you if you are weak or underdeveloped, how to grow strong; if strong, how to grow stronger. They explain how to develop the lungs and muscle, the strong heart and vigorous digestion—in short, how to improve health and strength internally as well as externally. SEND TODAY—NOW—for these FREE BOOKS. Enclose 4c in stamps to cover postage.

PROF. H. W. TITUS
76-58 Corner Sq. Dept. 602. New York City



Swing 4 in., 11 in. between centers. 17 in. total length. Shipping weight 13 lbs. Bed of lathe is machined. Workmanship first-class. Equipped with wood turning chuck. Can be fitted with 3 in. face plate and drill chuck as special equipment. Order one today. Price $5.00 cash with order. SYPHER MFG. CO., DEPT. C TOLEDO, OHIO



Learn to PAINT SIGNS and SHOW CARDS

I teach you personally, by mail, in a short time. Oldest and largest School. Big field, work interesting. You can

EARN $18 TO $45 A WEEK

Printer, Minn., wrote: "Did job after first lesson, got $10, profit $7.05." Crawford, B. C., says: "Earned $200.00 while taking course." Get literature, samples, guarantee; all FREE.

DETROIT SCHOOL OF LETTERING
Established 1899. 906 D. S. of L. Bldg., DETROIT, MICH.

The Moon's Rotation

By Nikola Tesla

(Continued from page 157)

arrangement of the masses in its interior became subject to gravitational forces of its own, vastly greater than the terrestrial. It has been suggested that the planet is egg-shaped or ellipsoidal but the departure from spherical form must be inconsiderable. It may even be a perfect sphere with the centers of gravity and symmetry coinciding and still rotate as it does. Whatever be its origin and past history, the fact is, that at present all its parts have the same angular velocity as though it were rigidly connected with the earth. This state must endure forever unless forces from without the luna-terrestrial system bring about different conditions and thus the hope of the star-gazers that its other side may become visible some day must be indefinitely deferred.

A motion of this character, as I have shown, precludes the possibility of axial rotation. The easiest way to free ourselves of this illusion is to conceive the satellite subdivided into minute and entirely independent parts, as dust particles, which have different orbital, but rigorously the same angular, velocities. One must at once recognize that the kinetic energy of such an agglomeration is solely translational, there being absolutely no tendency to axial rotation. This makes it also perfectly clear why the moon, provided its distance does not greatly increase, *must* always turn the same face to us even *without any inherent directive tendency* nor so much as *the slightest effort from the earth.*

Referring to the librations of longitude, I do not see that they have any bearing on this question. In astronomical treatises the axial rotation of the moon is accepted as a material fact and it is thought that its angular velocity is constant while that of the orbital movement is not, this resulting in an apparent oscillation revealing more of its surface to our view. To a degree this may be true, but I hold that the mere change of orbital velocity, as will be evident from what has been stated before could not produce these phenomena, for no matter how fast or slow the gyration, the position of the body relative to the center of attraction remains the same. The real cause of these axial displacements is the changing distance of the moon from the earth owing to which the tangential components of velocity of its parts are varied. In *apogee*, when the planet recedes, the radial component of velocity decreases while the tangential increases but, as the decrement of the former is the same for all parts, this is more pronounced in the regions facing the earth than in those turned away from it, the consequence being an axial displacement exposing more of the eastern side. In *perigee*, on the contrary, the radial component increases and the effect is just the opposite with the result that more of the western side is seen. The moon actually swings on the axis passing thru its center of gravity on which it is supported like a ball on a string. The forces involved in these pendular movements are incomparably smaller than those required to effect changes in orbital velocity. If we estimate the radius of gyration of the satellite at 600 miles and its mean distance from the earth at 240,000 miles, then the energy necessary to rotate it once in a month would be only $\left(\frac{600}{240{,}000}\right)^2 = \frac{1}{160{,}000}$ of the kinetic energy of the orbital movement.



ZIP-ZIP Patented Sept. 3rd, 1918

The Greatest 60 Ct. Article on the Market. Shipped right from the factory the same day we receive your order. The Prong is made of beautiful metal; never break or wear out; scientifically made and best workmanship. The rubbers are elastic and lasting, with plenty of pep and force. Zip-Zip, complete, only 60c prepaid. Be sure the name Zip-Zip and our address appear on the article you buy. Order from us or any Sporting Goods Store in your city. Send Stamps, Coin or Money Order.

AUTOMATIC RUBBER CO.
COLUMBIA, S. C.

Telegraph Pictures
BY ELECTRICITY



Complete sets of two machines of this marvelous equipment at ridiculously low prices. Instructive, mystifying and useful. This picture of President Wilson was telegraphed by these machines. Will transmit pictures, maps, drawings and hand writing. Picture telegraphing is the coming science. Write today.

J. LEISHMAN CO., Dept. T Ogden, Utah

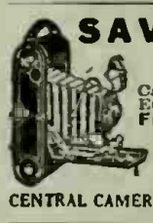
CLEARTONE PHONOGRAPHS
$4.00 to $200.00 Retail



Needles 45c per thousand in lots of 500,000. Motors $1.35 to $14.75 each. Tone Arms and Reproducers $1.30 to $5.75 per set. Main Springs 20c to 90c each. Records, Needles, Sapphire Points and Parts at reasonable prices.

Write for our 84 page catalogue, the only one of its kind in America. Illustrating 33 different styles of Talking Machines and over 500 different Phonographic Parts.

LUCKY 13 PHONOGRAPH COMPANY
Export Dept. 46B E. 12th St., N. Y., U.S.A.



SAVE 25% to 60%
on slightly used
GRAFLEX-KODAKS

Cameras and Lenses of every description. Equal to new. Save money. Write now for **Free Bargain Book and Catalog** listing hundreds of money-saving bargains in slightly used and new cameras and supplies. All goods sold on 10 days' Free Trial. Money back if not satisfied. You take no chances dealing with us. We have been in the photographic business over 16 years. Write now.

CENTRAL CAMERA CO., Dept. 176 124 S. Wabash Ave., Chicago

UMAKEM

Airplane Workchest, containing aircraft work table with adjustable cutting board and length gauge, steel drill, steel hammer, Model Maker's steel square, screwdriver, sandpaper block, 10" scroll saw, together with finest quality reed and bass wood, aluminum, silk, pure rubber, full set of blueprints, directions, and all fittings for building one 36" Bleriot Model flying Monoplane. Price $10.00. Other UmakeM Outfits 50c to $50.

W. A. PRICE, Inc.
No. 2 UmakeM Building, 127 Fifth Avenue, New York

RAISE BELGIAN HARES For U.S.



HUGE PROFITS easily and pleasantly made We furnish stock and pay you $5.00 a pair and express charges for all you raise. Contract and book "Fortunes in Hares", by mail Free.

NATIONAL FOOD & FUR ASSOCIATION
Dept. 24 MILWAUKEE, WISC.

EARN MONEY

Stamping Names on Key Tags. $50 Either sex. Spare time. Some make Send 25c for Tag with your name on and instructions. Returned if required Exp. Key Tag Co., Cohoes, N. Y.

STAMMERER



Send 10 cents for my remarkable book, "How To Stop Stammering." Kill the fear of stammering. Re education the key.

The Hatfield Institute, 109 N. Dearborn St., Chicago, Ill.

TYPEWRITERS



$10 AND UP. ALL MAKES. SAVE $25 TO $50 on rebuilt at the factory by the well-known "Young Process." Sold for low cash—installment or rented. Rental applies on purchase price. Write for full details and guarantee. Free trial. YOUNG TYPEWRITER CO., Dept. 918, Chicago

BE A C.P.A. ACCOUNTANCY

The Highest Paid Profession taught thoroughly in a few months of home study by new system.

FREE BOOK International Accountants Society Dept. 39F, 2628 S. Mich. Ave., Chicago

158 Genuine Foreign Stamps—Mexican War Issues, Venezuela, Salvador and India Service, Guatemala, China, etc., only **10c.** 100 all diff., fine, 15c; 200 all diff., 25c. FINEST APPROVAL SHEETS 60% to 80%. AGENTS WANTED. Big 72-page lists FREE! We Buy Stamps. Est. 25 years. C. E. HUSSMAN STEP CO., Dept. 6 ST. LOUIS, MO.

Learn Watchwork, Jewelrywork and Engraving A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL Department, Bradley Institute, Peoria, Ill., for our latest catalog

www.americanradiohistory.com



This Book Cost $34,000

1200 Authors Contributed

Our Bound Volume No. 6 contains a goldmine of electrical and scientific information. No such value has ever been offered before for so low a price. A marvelous cyclopedia of electricity. A reference book of authentic information not found in any other book in print.

Volume contains twelve numbers of the "Electrical Experimenter" magazine — May, 1918 to April, 1919, inclusive. There are 984 pages, 2,110 complete articles, 1,908 illustrations, 369 questions and answers. Sizes, 12" high; 9" wide; 2" thick.

A world of electrical information; the entire electrical Progress for one year; the greatest reference book on current "Wireless"—all at a price within reach of everybody. Mind you, the book is durably bound in attractive green linen with heavy covers. Letters stamped in gold. You will be proud to have it in your library. We have only 600 copies, therefore be sure and order to-day. Shipping weight 8 lbs. Add a sufficient amount for postage, otherwise we must ship by express.

$3.00

add postage for 8 lbs

Positively the Greatest Electrical book bargain in the World. We ship AT ONCE. Order todoy to ovoid delay.

EXPERIMENTER PUBLISHING COMPANY, Inc.

Book Department

233 Fulton Street - New York, N. Y.

Fill in—Tear out—and Mail

6-19

Gentlemen:

Please send at once your Volume No. 6 as advertised, for which I enclose herewith $.....

I also enclose $.....extra for postage.

.....

.....

Name .....

Address .....

.....

Close-ups of New Scientific Movies

(Continued from page 118)

play starring May Allison in "The Island of Intrigue."

Lawrence Waring, millionaire oil magnate, compelled to go East on business, worries about leaving his daughter Maida alone. The problem is solved by the arrival of a letter from Mrs. Juliet Smith, an old friend, who invites Maida to spend the summer at her country home on Sunset Island.

A woman, who says she is Mrs. Smith, calls later and Maida, who has never met her father's friend, goes aboard a yacht, en route for the island. She meets Maric and Lorna, Mrs. Smith's "son" and "daughter," and a "Count" Pellessier.

A few hours later the Waring house is in a state of alarm when the real Mrs. Smith arrives. It is then that Mr. Waring realizes that his daughter has been abducted.

In the meantime the yacht arrives at the island, but Maida, enjoying her holiday, does not realize that she is a captive. On one of her long walks thru the island she comes upon a camp and meets its owner, Gilbert Spear. She does not mention this to the others, but the meetings, begun as a lark, soon become a habit.

In the meantime the Count, by a wireless apparatus cleverly concealed in a piano, sends a message to Waring demanding fifteen thousand dollars as his daughter's ransom. He gets no answer and decides to force Maida to write of her peril to her father. On finding the true standing of the "Smiths," Maida refuses to write the letter and is at once locked in a room. The band have also discovered the friendship which exists between Maida and Gilbert, and after a fierce struggle he is captured, tied and gagged, and placed in a cave.

A second message is sent to Waring, which is also received at a Naval Station, and in this manner the location of the island is disclosed. A submarine chaser, with Waring aboard, goes to the rescue.

In the meantime Maida escapes from the room and flies to the camp. She finds Gilbert gone, but his dog, frantic with delight at her arrival, leads her to the cave. She soon releases him and together they hasten to his motor boat to escape. They are overtaken by the band and are just about to be taken aboard the yacht when the Naval boat comes upon the scene. The swindlers are captured and Maida introduces Gilbert to her father as the man she loves.

"America, First, Last and Always," is the theme of Pathé's new serial, "Wolves of Kultur," abounding in many thrilling radio scenes, underground and cave laboratories, and radio controlled torpedoes. It is the story of Alice Grayson, a cultured young society lady of wealth and refinement, possest of an ardent patriotism which has been stimulated by the completion of the invention by her uncle of an electrically driven wireless controlled torpedo.

Visiting her uncle's laboratory one day Alice finds he has been foully murdered by alien spies, and the plans and model of his invention stolen. Over his dead body Alice vows vengeance for his murder and for this traitorous act to America. She has learned from her uncle before he dies that "Hartman and Zaremba are guilty of this."

Alice, in her rôle of a Secret Service Agent, has finally located the death-dealing torpedo and the operator awaiting orders.

Before she can interfere the torpedo has been launched and is sent on its deadly mission, against a U. S. troop ship, when Alice, in a most superhuman effort, throws a rock at the operator and knocks him out.

She seizes the wireless apparatus and turns the course of the torpedo against the yacht, aboard which are the plotters.



STRONGFORT
The Perfect Man

ARE YOU SLIPPING?

Are you losing your grip—your ability to DO things, to make any progress in your business or even to make good in your present position? If you wake up in the morning tired before you begin the day, with you back aching, your digestion out of order, your nerves frazzled, you brain befogged, **don't let yourself slip any further:** there's no toboggan slide so rapid as the road down to chronic ill health and the consequent loss of all enjoyment in life.

GET A GRIP ON YOURSELF

Don't wait a single day before taking steps to rid yourself of the ailments or bad habits that will be millstones about your neck as long as you live. If you don't free yourself from them. When a man is on the limited for the scrap heap, every day counts; what is easy today will be a heap harder tomorrow, almost impossible if you wait too long.

YOU CAN DO IT

You can have renewed vitality; health, strength, energy, all that makes life worth living, if you throw away all druggist's dope and take hold of yourself in the right way.

I'LL SHOW YOU HOW

I have shown the way out to thousands of men who knew they were losing their grip on things through indigestion, constipation, biliousness and other ailments; I have shown them how to gain the energy and strength of will to break off bad habits they knew were undermining their constitutions, how to build up and strengthen their vital organs, develop their muscles, and make live, active, red-blooded, forceful MEN of themselves again.

My book, **"Promotion and Conservation of Health, Strength and Mental Energy,"** will show you how they did it: how YOU can do for yourself what they did for themselves, in a simple, easy, natural way. Send for a copy—IT'S FREE. Enclose three 2c stamps to cover postage and packing and I'll mail it to you at once.

LIONEL STRONGFORT

Physical and Health Specialist

937 Strongfort Institute, Newark, N. J.

FREE CONSULTATION COUPON

Mr. Lionel Strongfort, Newark, N. J.—Please send me your book, **"PROMOTION AND CONSERVATION OF HEALTH, STRENGTH AND MENTAL ENERGY,"** for postage of which I enclose three 2-cent stamps. I have marked (X) before the subject in which I am interested. (1937)

. . Colds	. . Insomnia	. . Vital Losses
. . Catarrh	. . Short Wind	. . Impotency
. Asthma	. . Flat Feet	. Gastritis
Obesity	. . Stomach Disorders	. Heartweakness
. . Headache		Poor Circulation
. . Thinness	. Constipation	. . Skin Disorders
. . Rupture	. Biliousness	. Despondency
. Lumbago	. . Torpid Liver	. . Round Shoulders
. Neuritis	. . Indigestion	. . Lung Troubles
. . Neuralgia	. . Nervousness	. . Increased Height
Flat Chest	. Poor Memory	. . Stoop Shoulders
. . Deformity (describe)	. . Rheumatism	Muscular Development
	. . Youthful Errors	

NAME .....

AGE .....OCCUPATION .....

STREET .....

CITY .....STATE .....

Write Plainly

35 Miles per hour

Is Record of this Car



Boys, Build This Car. This nifty little car driven by gasoline motor, can be built by any boy. Parts are furnished by us and are very cheap. Send 25c for building plans and price list of parts showing how to build this lad's car

STPHER MFG. CO.
156 Warran Street
TOLEDO, OHIO.

GENUINE "COLT"

latest, safety model automatic pistols, .25 calibre, 7 shot, brand new, with usual "Colt" guarantee. Regularly retail at $20.00. Our special price $18.00, postpaid to any address. Immediate shipments while they last. Monongahela Novelty Co., Monongahela, Pa.

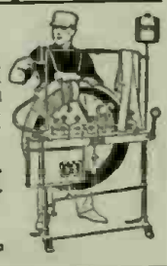
www.americanradiohistory.com

AN EASY WAY TO MAKE MONEY

Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business. One man says "I made $60.00 the first day." Others average $200 to $500 a month. Very little capital needed. Jobs plentiful. Every motorist a possible customer. No experience needed. We teach you.

SHALER Tire Repair Outfit

Improved Wrapped Tread Method
Used by Tire Manufacturers



Does as good work as the big high priced vulcanizing outfits. A boy can use it. It's the only vulcanizer that has Automatic Heat Control, and can't undercure or overcure a tire. Requires no watching or regulating.

FREE Book

"How to Open a Tire Repair Shop." It tells how to make big money. Don't delay. Write quick.

C. A. SHALER CO.
2205 Fourth St. Waupun, Wisconsin

Pocket Tool Chest

9 Tools in 1

Strong Knife — Wire Pliers
Leather Punch — Hoof Hook
Sneaging Awl — Wire Cutter
Screw Driver — Screw Bit
Alligator Wrench



Each a strong, practical tool. As easily carried as a 3-blade knife, and has no more parts. Length, 4 in. Pliers and wire cutters are drop-forged tool steel — cut harbed fence wire as easily as S-inch pliers. Blade is tempered cutlers' steel. Each tool works independently. Once used, always carried by Electricians, Railway Men, Motorists, Mechanics, Horsemen, Sportsmen.

Elican Wunderknife

Sent postpaid in U. S. for $1.75 (add 5c if insured). Highest quality construction, fully guaranteed.

Elican Specialty Co. 874 Merchants Bank Bldg. Indianapolis, Ind.

Chemical Tricks for Boys



Puzzle your friends with mysterious, harmless Chemical tricks. Pour red, white and blue from a glass of water, write secret letters with invisible ink, write with water and have it turn blue, make your own blue oil or ink powder. You can have lots of real fun doing these tricks with "CHEMCRAFT" Junior, complete outfit shown at left. Send for yours right away and get a Free copy of "The Chemcraft Chemist," an interesting magazine for boys.

Amateur Chemist's Catalogue and Hand Book

CHEMCRAFT JUNIOR
25¢
POSTPAID

The Porter Chemical Co.
Arcade Bldg., Hagerstown, Md.

TIRES at WHOLESALE



Not Seconds—Fully Guaranteed

Genuine "Capitol" or the new "Rib-Skid" Beacon Tires $13.60 up. Red Tubes or "Inside Armor" $2.90 up. Write at once for full description, samples of material, and "Direct-To-You" wholesale prices on these absolutely First Quality Fully Guaranteed 5000 mile Tires, Tubes, Armor, etc. Avoid tire trouble, and save one-third your Tire expense by sending size of your tires and name of car today.

MODERN TIRE CO.
659 7th St., Racine, Wis.



Says the Master Mechanic, The Greb Automatic Grip Puller is a One-Man Puller—Quick-acting, strong and simple in the extreme. May be locked in any desired position. A combination of two or three arms. Heavy Duty Size capacity 1" to 18"—Junior size capacity 1" to 7". Two sets of jaws furnished with each size.

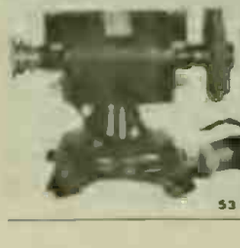
Ten Days' Trial If your dealer or jobber does not have them we will send you one. Try it ten days. If not satisfactory, return to us and we will refund your money. We also make the GREB RIM PUNCH.

THE GREB CO., 230 State Street, BOSTON

Mechanics' Utility

MOTOR GRINDER

A Time-Saver and Money-Maker For Shop, Factory, Garage or Home



Attach to any electric light socket and you have a power unit which will do grinding of all descriptions as well as drive small machinery. Can be furnished with chuck and buff for buffing. Type B—Complete with 3/8 x 1-2" Emery Wheel, $15.50

Order today.

RACINE UNIVERSAL MOTOR CO.
53 W. Jackson Blvd. Chicago, Ill.

Listening to Theater Critics

(*Continued from page 105*)

are usually well patronized, by "between the acts" smokers and thirsty box holders, then phonograph selections are played thru the loud-talking telephones in the horns, and the public generally is pleased—both those that like music and the others, who will enjoy it anyhow. But the psychological moment always arrives, and we have our turn after the show when the horns are "unsuspiciously silent," while the audience files out, homeward bound, chatting among one another about the show, and incidentally handing out several hundred dollars' worth of valuable criticism and suggestions, which any theater manager would almost break his neck to overhear. But even tho his office has a screen door, or if he happens to adorn the passageway with his own graceful and frock-tailed form, he hears but little of real value.

Now, all is changed, however, for, thanks to the dictograph installation, our friend the theater manager can appease his heretofore unsatiated thirst for a knowledge of "what his patrons actually think of the performance" by simply manipulating a switch at his desk, which causes the voices, no matter how low they may be, to be picked up by the respective microphones switched into circuit, and reproduce loudly and clearly thru the loud-talking telephone in his office. In the summer when naturally the office would not be closed up so tightly, the regular head phones, which resemble the telephone operator's headgear or that of the wireless operator, may be used with exactly the same results. The advantage of the loud-speaking telephone for reproducing the conversations is that everyone does not care to be inconvenienced by placing a telephone receiver band on the head, especially when we think of some of our old-time friends—the theater managers, that we have met here and there, who like to, and mostly do, resemble some of our Fifth Avenue millionaires with their sporty neck-ties, spats and a one dollar Perfecto sticking nonchalantly in the southeast corner of their jibs; and then again, who in his wildest theatrical moments can even imagine a "regular" honest-to-goodness theater manager appearing *without* his silk hat, once he has left his hotel. Well, for these poor souls we will suggest that they have available a first-rate secretary who can record the conversation, or better yet, hook up an Edison dictaphone (phonograph) to the horn of the loud-talker and record the various criticisms, so that they can be reproduced later and studied more closely at leisure.

We should imagine that such an arrangement as this will be very valuable indeed to the modern theater, where the movement toward establishing desirable plays, etc., is being brought to more nearly meet the exact wants of the theater-going public. In other words, the American theater manager has for a long time been seeking for every possible opening to gain a more perfect relation between the box office and the patron of the theater, and well this might be so, for if a performance is such that it does not suit the people at the time the play is produced, then there is no use expending additional sums in trying to foist the unwanted play on the theater-going public. Sometimes, however, in the past, and, in fact, it may be said in most cases, one of the chief reasons for the failure of a dramatic or other play, has been that the manager and producers could not quickly enough ascertain the exact feeling or obtain a comprehensive survey of the collective ideas of the audiences viewing the first performance of the play until it was too late.

Earn $35. to $100. WEEKLY



ALL OR SPARE TIME

You can make $35.00 to $100.00 a week, I want hustlers, money-makers, to work with me, to advertise, sell and appoint agents. Biggest thing in years. City conveniences without plumbing. Used in any room. Sells on sight. Demonstrating tub furnished. Folds small, self-emptying, non-leakable. Guaranteed 10 years.

AGENTS MAKE SALES EASILY

Two sales daily means $60.00 a week. Leggett, Ohio, "Worked two hours, took two orders, profit $10.00." Hayhurst, Nebr., "Took 11 orders in 4½ days—profit $55.00, ordered 12 more tubs." Mannlog, Iowa, "Sold 10 tubs in one day—profit $50.00." Dellut, Nebr., "Sold 12 tubs in three days—profit $60.00." And hundreds of others making big money. 70 per cent of homes have no bath tubs. Experience and capital unnecessary. Credit given to the right man. Get full particulars and "special plan" off Pass.

H. S. Robinson, Pres., THE ROBINSON CABINET MFG. CO.
4980 Factories Building TOLEDO, OHIO

THE MIDGET SLIDE RULE



has many exclusive features. It handles three factors at one setting. It has a Log-Log Scale, Polyphase or Inverted Scale, Addition and Subtraction Scale, Square Root Scale, Log. Scale and Binary Scale and the Midget is equivalent to all of these types of straight slide rules. This rule will add and subtract, multiply and divide fractions and mixed numbers without changing them to decimals. Also gives Logarithms, Sines, Tangents, Cosines, Cotangents and the decimal equivalents of fractions. An instruction book, "The Slide Rule Manual," 16 pages, 12 illustrations, is sent with each rule. Diameter of rule, 4 inches. Logarithmic Scale, 12 inches long. Made in two models: Metal (white coated steel), $3.00 each; White Celluloid, $1.25 each. Genuine Leather Carrying Case 50c extra. Circulars Free. Your money back if you are not satisfied.

Gilson Slide Rule Co., Niles, Mich.

Build Your Own PHONOGRAPH, SAVE OVER HALF

It's Easy With Our Help

A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fine profit building phonographs for your friends. Write Today for Our Free Blue Print Offer. Agents wanted for our ready built Chorcleons.



Choraleon Phonograph Co.
706 Monger Bldg., Elkhart, Ind.

NATIONAL TRADE DENTAL SCHOOL

506 S. Wabash Ave., Chicago, Ill.

LEARN MECHANICAL DENTISTRY—DEMAND UNLIMITED

A paying professional trade: You will be a trained dental mechanic and receive our diploma when completed. Students given advantage of thoroughly up to date laboratory, and services of graduate Dental Surgeons on practical cases. No effort spared to place graduates advantageously. No age limit. Day or Evening. Individual instruction. No educational requirements. No book or home study. Easy terms. Highest references. Especially attractive proposition to those who write at once for catalog 11.

EXPERIMENTS

In—Science, Electricity and Invention
256 Pp., by P. Edelman, $1.50 Ppd.

Here is the big illustrated

how to make and do it book you want. Full of stunts, home laboratory wonders, models, etc.

Edelman Publishers, 1802 Hague Ave., St. Paul, Minn.

SIGNAL ENGINEERING



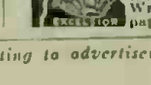
$90 to $250 a Month Free Book Tells How

Write today for this big, new Free Book on

SIGNAL ENGINEERING

Railroads need men for this important work. Big positions open throughout United States. Big Free Book tells all about it—tells how you can get the exact training you need. Write for it—Today—Now! Dept. of Signaling, Room A 179 1810 Wilson Av. Chic.





Printing Cheap

Cards, circulars, labels, book, paper. Press $6. Larger $20 Job press $65 up. Save money. Print for others, big profit. All easy, rules sent. Write factory for press catalog, TYPE cards, paper. THE PRESS CO., O-47 Meriden, Conn.

www.americanradiohistory.com

Experimental Mechanics. Twist Drills

(*Continued from page 127*)

With this information on hand and a little practical experience on the subject, there should be no difficulty for the novice to become thoroly familiar with the handling of twist drills.

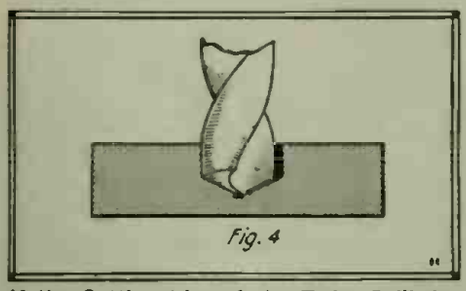


Fig. 4

If the Cutting Lips of the Twist Drill Are Ground of Uneven Length, the Hole Will Be Enlarged Over the Diameter of the Drill.

Average Cutting Speed for Drills In Revolutions Per Minute.

The following table represents the most approved practise in rate of cutting speed for drills ranging from 1/8 inch to 2 inches in diameter:

Diameter of Drills	Speed on Steel	Speed on Cast Iron	Speed on Brass
1/8	1,712	2,383	3,544
5/32	855	1,191	1,772
3/16	571	794	1,181
1/4	397	565	855
5/16	318	452	684
3/8	265	377	570
7/16	227	323	489
1/2	183	267	412
9/16	163	238	367
5/8	147	214	330
11/16	133	194	300
3/4	112	168	265
13/16	103	155	244
7/8	96	144	227
15/16	89	134	212
1	76	115	191
1 1/16	72	106	180
1 1/8	68	102	170
1 3/16	64	97	161
1 1/4	58	89	150
1 5/16	55	84	143
1 3/8	53	81	136
1 7/16	50	77	130
1 1/2	46	74	122
1 9/16	44	71	117
1 5/8	40	66	113
1 11/16	38	63	109
1 3/4	37	61	105
1 13/16	36	59	101
1 7/8	33	55	98
1 13/16	32	53	95
2	31	51	92

(The next article of "Experimental Mechanics" will appear in the July issue)

FRANCE BUYS BIG U. S. BORDEAUX RADIO STATION

Virtual demobilization of all the United States naval establishments in European waters, the sale of the great Lafayette wireless station at Bordeaux to the French government at a price of approximately $4,000,000 and many hitherto unpublished facts of American naval activities in the war, were announced recently by Assistant Secretary Roosevelt.

"The great Lafayette radio station near Bordeaux was intended to insure communication between Washington and the army and navy in case the cable systems were put out of commission or interfered with by German submarines. It has eight towers and could communicate with the United States day and night. It was built by the navy. I arranged with the French government that we shall complete the station, which is two-thirds finished, and they will take it over at what it cost us, about 22,000,000 francs," said Mr. Roosevelt.



SINCE 1880—

For two generations we have been making fine precision instruments—building them to the Starrett standard—not to a price.

Today the name Starrett is recognized the world over as standard for accuracy. Starrett Tools are helping skilled mechanics produce high-quality work.

Write for Catalog No. 21 L E.

THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers.
Manufacturers of Hack Saws Unexcelled.

Athol, 42-901 Mass.

DEPENDABLE KNAPP ELECTRIC SPECIALTIES

Motors and Electrical Specialties Are Best



Knapp Goods have stood the test for 29 years. No detail in construction has been spared to make them the best that money can buy. The complete Knapp line includes Toy and Power Motors, Generators and Dynamos. Specialties and Novelties that amuse and instruct. Fans, Rheostats. Compasses, etc. And Knapp prices are always lowest. Always insist on Knapp Goods.



KNAPP DYNAMO MOTOR

Will electroplate, charge storage batteries, run lamps, motors, train of cars, induction coils,—in fact, the number of experiments it can be used for is unlimited. Runs on 4 to 6 Volts or can be connected to run on 110 Volts through a transformer.

Price, Complete, $7.00

KNAPP "LEARNELECTRICS"

A complete Electrical Laboratory, including a very valuable instruction book by H. P. Gorman, A.I.E.E. Covers all subjects clearly and concisely.
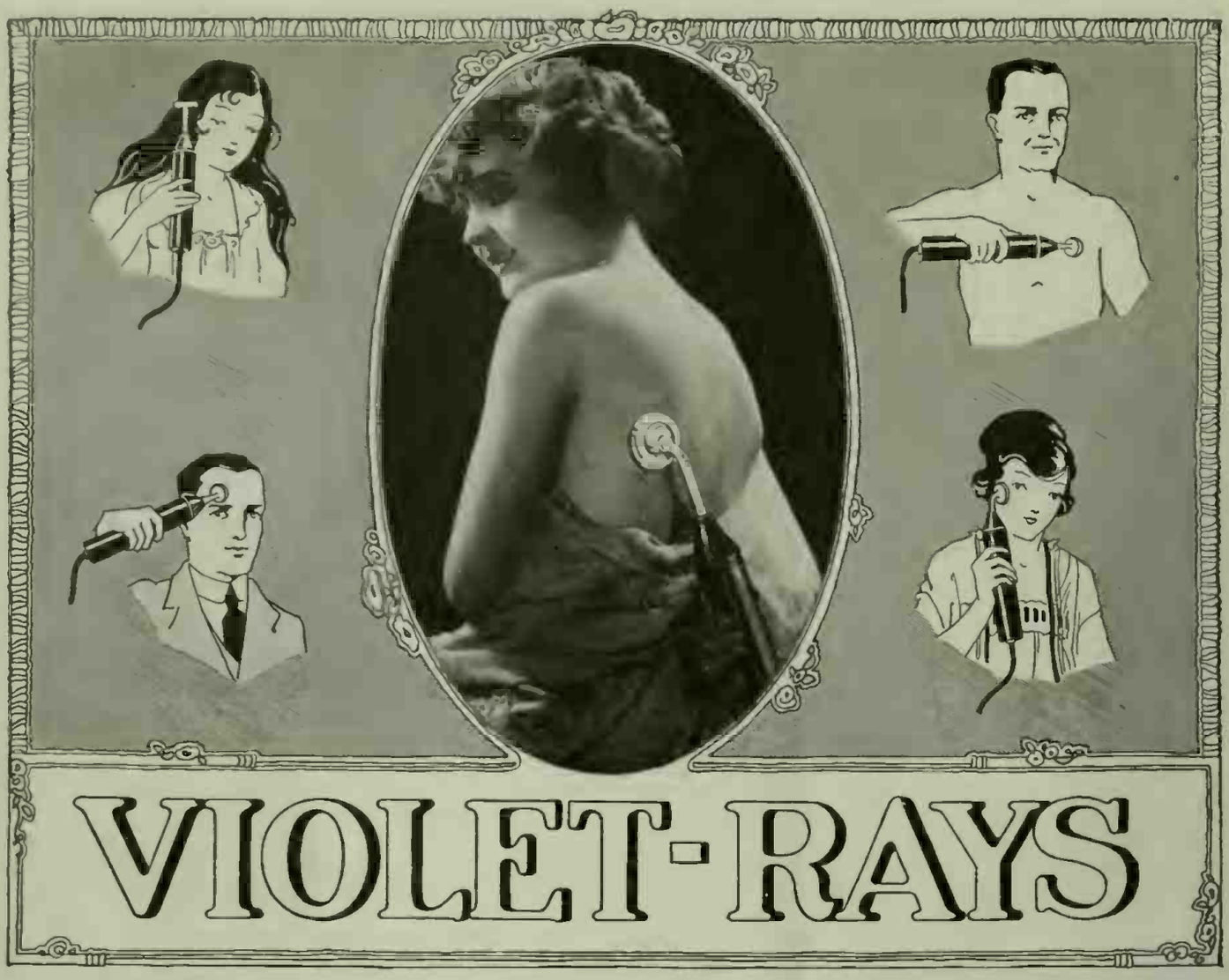
The Laboratory includes a choice collection of instruments, materials and interchangeable parts.

Price, Complete, $3.50

Order to-day. Or your dealer can secure them for you. DESCRIPTIVE CIRCULAR and CATALOG of celebrated Knapp Motors and Electrical Specialties from 10c up mailed FREE on request.

Knapp Electric & Novelty Co. 523 West 51st Street N. Y. City

www.americanradiohistory.com



VIOLET-RAYS

The Magic-like Reliever of Pain. The Marvel of the Age for Rheumatism, Neuralgia, Neuritis, Arteriosclerosis, Hemorrhoids, and Practically Every Other Ailment to Which Flesh is Heir. A Wonderful Beautifier Too! Amazing in the Treatment of Eczema, Blackheads, Wrinkles, Falling Hair, Dandruff, and Every Other Faulty Condition of the Skin and Scalp!

10 DAYS FREE IN YOUR OWN HOME

See for yourself the miracular like results of Violet-Rays. Get the wonderful Violetta Violet-Ray Machine for 10 days' free use in your own home. Give yourself exactly the same Violet-Ray treatments for which eminent physicians and beauty specialists charge big fees. Note the marvelous relief that comes even with the first treatment. See how you can virtually feel the Violet-Rays reaching to the very root and cause of any ailment with the great curative forces of Heat, Light, Electric Energy, and Ozone. See too how Violet-Rays youthilies the skin, purifies the scalp and stimulates hair-growth. Note above all how refreshing the effect of Violet-Rays to mind and body—how invigorating and vitalizing—how much better you work, eat and sleep. Prove all these benefits to yourself without obligation. Try the Violetta for 10 days free, and if you are not more than amazed and delighted, simply send it back.

BLEADON-DUN CO., Dept. 2E.
326 W. Madison St., Chicago, Ill.

Please send me your free book and 10 days' free trial offer on the Violet-Ray Machine. Also full information as to treatment for ailments marked below.

Asthma	Earache	Piles
Barbers' Itch	Eczema	Paralysis
Boils	Eye Diseases	Pimples
Blackheads	Headache	Pyorrhea
Bunions	Hay Fever	Rheumatism
Callous	Goitre	Skin Diseases
Chilblains	Insomnia	Sore Throat
Colds	Lumbago	Sprains
Corns	Nervousness	Tonsilitis
Constipation	Neuralgia	Whooping Cough
Dandruff	Neuritis	Warts and Mole
Deafness	Obesity	

Name .....

Address .....

City ..... State

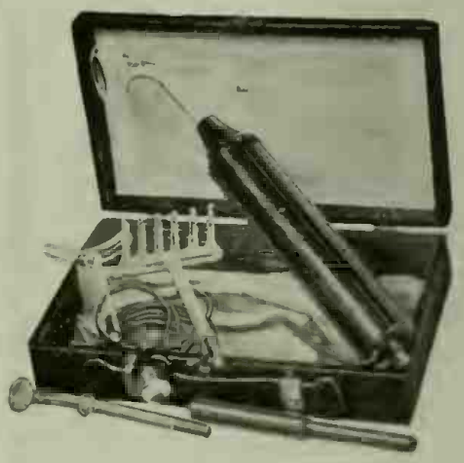
BOOK FREE

Write today without fail. Mail coupon or just a postcard. Let us send you our beautifully illustrated free book, describing the Violetta in detail. Read the amazing phenomena produced by Violet-Ray High frequency current. Why it produces stimulation and sedation. How to give spinal treatments with the Violetta, how to treat various ailments, including nervous troubles, rheumatism, obesity, hay-fever, skin treatments, facial treatments. With the free book we will also send you particulars of our special free trial offer. Mail coupon or postcard now.

BLEADON - DUN CO.

Dept. 2E 326 W. Madison St., Chicago, Ill.

Electrical, Drug and other Jobbers and Dealers Write us today for our Co-operative Selling Plan.



Not a Vibrator

The Violetta is not a machine that contracts the muscles—it does not shock, it does not pound the muscles—it is absolutely painless. Violet Rays administered by the Violetta are wonderful even for infants!

This advertisement copyright 1919, by Bleadon-Dun Co.

www.americanradiohistory.com



In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries address to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are publisht here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

How to Finance and Manufacture a Patent*

By Jay G. Hobson

This article is dedicated to the interest of inventors and people with commercial ideas who are inexperienced in the financing and marketing of commercial products. It tells of a practical plan that made one invention successful. It is written with the intention that it will benefit each reader financially, and will assist him in avoiding the many pitfalls encountered along the road to success.—THE AUTHOR.

MOST people think of inventors as geniuses parturient to some brilliant idea suddenly caught from the air and patent it in workable form. However, this is not the case, for as Thomas Alva Edison, the great inventor, declares: "Genius is one per cent inspiration and ninety-nine per cent perspiration," and "The three essentials to secure anything worth while are, first, hard work; second, stick-to-it-iveness; and, third, common sense."

Edison's inventions have been the result of many experiments, and exacting judgment. He has always sought to produce things that were necessities, which would benefit the masses; consequently, his wonderful success.

The first important step in financing and marketing an invention is, positive conviction that you have discovered something that is practical, not only from a manufacturing point of view, but also from the public's point of view—for it is the co-operation of the public (your eventual customers) that will insure your success. To secure the co-operation of the public, and to sell your invention, be positive you have something to offer that the public needs and demands. Then, after you have made your article commercially practical, prepare it for the market in a convenient form, that will offer the least resistance to the consummation of a sale.

Investors or people with capital (who want to assist you financially in marketing your product) observe your invention and are of the same frame of mind toward it as the public—your ultimate customers. Investors scrutinize the practicability of the commercial side, as well as the production or manufacturing side; however, they are generally more interested in the commercial side of an article, for there is the source of large profits.

Obtaining financial backing for your invention is a serious undertaking. Investors demand facts, proof, conviction, before they will take the business venture necessary for the success of a new idea. Investors are the pessimists, so to speak, while inventors are the optimists. The inventors who succeed with their figments are greater optimists than men with money are pessimists. Conviction, confidence and enthusiasm will convert the most skeptical. Get the confidence of men with money and you will get their assistance.

Men who are successful say that the shortest route to commercial success is thru the example proven by those who have gone before. While modern business necessitates individual plans of operations, yet what one man or firm did to succeed others can duplicate. Therefore, the plan employed to finance and market one invention should help finance another. Experience proves that a patent is as valuable as the inventor or his associates make it—that completing a working model of an invention and securing the patent rights upon same are only the preliminary steps to success. The greatest obstacles lie ahead in the financing, manufacturing and marketing of a new article. It is the commercial wilderness that every new manufactured product must cross before reaching that summit of success desired by all.

It matters not how wonderful or unique an invention may be, it must be serviceably made, intelligently financed and greatly ad-

* Owing to the publication this month of the promised article—"How to Finance and Manufacture a Patent" by Mr. Hobson, the Questions and Answers on Patent Advice are omitted.

U.S. PATENTS



Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them—a post card will do.

LANCASTER & ALLWINE

255 OURAY BLDG.,
WASHINGTON, D. C.

PATENTS

TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
164 Oweo Building, Washington, D. C.
2276-8 Woolworth Bldg., New York City

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE OF CONCEPTION." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention we will give our opinion as to its patentable nature.

Our illustrated Guide Book, HOW TO OBTAIN A PATENT, sent Free on request. Contains full instructions regarding Patents, Trade-Marks, Foreign Patents, Our Methods, Terms and 100 Mechanical Movements illustrated and described. Articles on Patent Practice and Procedure, and Law Points for inventors.

An actual search of United States patents made in all cases before preparing application for patent

Electrical Cases a Specialty Highest References Prompt Attention Reasonable Terms

FREE COUPON!

VICTOR J. EVANS & CO., Patent Attorneys

New York Offices: 1001 to 1007 Woolworth Bldg. Pittsburgh Offices: 514 Empire Bldg. Philadelphia Offices: 135 S. Broad St.
Main Offices: 779 Ninth Street, N. W., Washington, D. C.

Name *Address*

www.americanradiohistory.com

PATENTS COPYRIGHTS TRADE MARKS DESIGNS

U.S.PATENTS

Our facilities for securing patents enable us to give prompt and reliable service at reasonable rates. Inventors are invited to write to us regarding questions appertaining to securing patent protection. All matters receive prompt attention. Send sketch for preliminary examination.

Books free on request

A. M. BUCK & CO.

Patent Attorneys

205 Second National Bank Bldg., Washington, D. C.

PATENTS

LACEY & LACEY

Attorneys-at-Law—Patent Practice Exclusively
Solicitors of
U. S. and Foreign Patents
Trade-Marks, Copyrights

639 F Street, N. W., Washington, D. C.

Write Us for Our Free Inventors' Book
PATENT-SENSE
ESTABLISHED 1869

PATENTS

INVENTORS: Send us sketches or a model of your invention and a description of the device for advice in regard to the best way of obtaining patent protection. Our practical experience covers a period of twenty years. Our hand-book on patents is sent free on request. All communications strictly confidential. Write us today.

TALBERT & TALBERT
Patent Lawyers
4287 Talbert Bldg. Washington, D. C.

Competent Patent Service
By a Former Examining Official of the U. S. Patent Office
NORMAN T. WHITAKER
Lawyer and Engineer
480 Whitaker Bldg. Washington, D. C.
Branch Office, 87 Nassau St., New York City.
INQUIRIES INVITED

Patents Promptly Procured
Send sketch or model for actual search of U. S. Patents. Highest references. Personal service. Moderate fees. Write for Free Patent Book.
GEORGE P. KIMMEL, Patent Lawyer
99-U Loan & Trust Bldg. Washington, D. C.

PATENTS
Inventors Invited to Write for Information and Particulars
Highest References. Best Results.
Promptness Assured.
WATSON E. COLEMAN
Patent Lawyer
624 F Street N. W. Washington, D. C.

vertised to make the inventor money. The public must be educated to the need of a new article before they will buy it. Few inventors appreciate these facts, and are of the opinion that all they need do is to conceive some new, useful improvement, patent it, and their fortune is made; but unfortunately this is not true. It is only the beginning of a difficult undertaking. An inventor should be as good a salesman as he is a mechanic. The public must be convinced before they will invest. The better the salesman, the greater the financial backing. Inventors should sell themselves the merits of their invention before attempting to sell others. With the backing of the convictions that you have a good thing—it will make the convincing of others an easy matter. Confidence and credit in the commercial world are more valuable than gold itself.

Only one who has gone thru a successful patent experience can adequately advise others how to succeed. For the benefit of my readers who may desire to finance a new proposition, I will enumerate the steps thru which I brought my first invention to success. It may help point the way for others.

After I had been granted full protection on my invention for a period of seventeen years, and had settled with my patent attorney for his services, it suddenly dawned upon my elated conscience that my patent certificate, with its big red seal, was not cashable like a Government bond; but, that it was only the foundation and beginning of a steep, rocky road to fame and fortune. I had spent most every cent for my patent rights and a demonstrating model of my invention. I had no money to promote the sale or manufacture of same, but I did possess an abundant confidence in its usefulness and ultimate success, if only I could secure financial backing to put it on the market before the buying public.

As it stood it was absolutely valueless to me. One of two things was necessary for its success. Either I must sell it to some one with money, or raise the capital to manufacture it myself. My friends urgently advised me to sell for any fair profit above my actual cost, saying: "It was better to accept a profit regardless of size than possibly fail in securing sufficient capital for marketing it."

Thru courtesy I listened to all this sincere advice, but was of the same opinion still—that my invention filled a long-felt public want. It was a necessity that could be made easily and profitably. I determined to stick to the first meritorious product of my brain and if possible raise the money that would enable me to place it for sale before the world. I knew that success only waited upon the introduction of my discovery to those for whom it was intended. But how best to accomplish this seemingly impossible task and overcome the colossal obstacles that were in evidence, forced me into quite a quandary.

However, remembering the old adage, "Where there is a will, there is a way," spurred me on to greater hopes for the success of my invention. I decided to tackle this proposition for all it was worth, and reap the benefits that were justly mine.

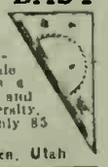
At that time I was a typical amateur in the mysteries of finances. I could not afford to make mistakes and knew few plans to pursue in obtaining the required finances for marketing my invention. Several plans came to my mind, such as borrowing the capital from relatives or friends, giving my patent as security for the loan; organizing a stock company and selling shares of stock to raise the money; or, advertise and sell part interest in my patent to some one, honest and reliable, who would agree to buy only a minority interest, thereby giving me control and protection against loss—for I was determined that I would not be frozen out by a partner.

PATENTS

Hand Books on Patents, Trade Marks, etc., sent free. Our 70 years of experience, efficient service, and fair dealing, assure fullest value and protection to the applicant. The Scientific American should be read by all inventors.

MUNN & CO., 622 Woolworth Bldg., N. Y.
Washington Office, 622 F St., Washington, D. C.

MATHEMATICS MADE EASY



The Arcascope—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 85 cents Postpaid. Order today before you forget.
Dept. J. L. J. LEISHMAN CO., Ogden, Utah



NOW PAID $100 FOR ONE DRAWING

You can become an artist, illustrator or cartoonist even if you now have no talent. Earn $25 to $100 a week. Write for Free Outfit offer and beautiful new book, "HOW TO BECOME AN ARTIST." Address
WASHINGTON SCHOOL OF ART., Inc.
1420 H Street, N.W. Washington, D.C.



CATALOG FREE!

BUILD A $100 PHONOGRAPH

Assemble your own Phonograph
Do it yourself easily. Have the finest machine. Astounding saving. We give you the phonograph secrets. Complete instructions 10 cents.
ELECTRO MECHANICAL PARTS CO.
160 N. Wells St. CHICAGO

Electricians

Get up-to-date in HOUSE WIRING! Save TIME, MONEY, LABOR and MATERIAL by using our 98 GENUINE BLUE PRINT DRAWINGS, containing all the latest diagrams and connections known in house wiring—every diagram and connection up-to-the-minute as used by first class electricians for wiring BELLS, BURGLAR ALARMS, LIGHTS, ANNUNCIATORS, FIRE ALARMS and ELECTRIC GAS LIGHTING. These drawings are bound in the form of a flexible book (8 x 12) for convenience in using on the job. Send for them, and if they don't make you more efficient as a wireman and save you many times their cost as a contractor, return them and money will be refunded—you can't afford to be without them. ONE DOLLAR postpaid. Send for circulars on other sets of drawings.
PATENT SPECIALTY COMPANY
P. O. Box No. 583 San Francisco, Cal.



POPULARITY FOLLOWS THE **UKULELE**



If you play quaint, dreamy Hawaiian music or latest songs on the Ukulele you will be wanted everywhere. We teach by mail 20 simple lessons; give you free a genuine Hawaiian Ukulele, music, everything—no extras. Ask us to send the story of Hawaiian music. You will love it. No obligation—absolutely free.
The Hawaiian Institute of Music
1400 Broadway, Suite 1106, New York

Are You Preparing

for one of the thousands of opportunities waiting for folks who get ready? Develop that "Dormant Talent" in you, to the point where you will see opportunities. Our plan (worth hundreds) costs you $5.00—send Post Office or Express Money Order now.
STUDENT HELP BUREAU Springville, N. Y.

A NEW AND EASY WAY TO PAINT
SIGNS and SHOW CARDS
OUR PATTERNS DO THE WORK

No experience required. Anyone can paint all kinds of signs, banners, cards, etc., on any surface with our new and easy system of lettering. Complete outfit containing eight alphabets of letters, assorted styles and sizes from two to twelve inches high, also four sets of figures, etc., not printed but life size patterns cut out of durable tag board which can be used over and over again for years, also brushes, colors and book of instructions. $7.50
Satisfaction guaranteed. PREPAID
ACME SALES CO., Empire Bldg., Denver, Colo.

MAKE A MOTOR-CYCLE OUT OF YOUR BICYCLE



with a STEFFEY MOTOR. Easy to attach. Fits any wheel. More STEFFEY'S in use than all others. Send stamp for circulars and low factory prices
Agents wanted.
STEFFEY MFG. CO.
Dept. E. 5025 Brown St. Philadelphia, Pa.

STAMPS

50 diff. Belgium (large bi-color), China, Jamaica, Portugal, Venezuela, etc., 10c; 100 diff., nice packet, 20c; 1,000 well mixed, 40c; 100 var. U. S., 50c; 1,000 hinges, 10c; Agts. wanted, 50%. List free. I buy stamps. L. B. Dover, Overlead, Mo.

www.americanradiohistory.com

The first plan had its precipitous faults. Relatives as a rule do not make good creditors and seldom appreciate their kin's abilities in business. The second plan meant immediate cash for incorporation of a company, as well as a long drawn out, expensive stock selling campaign, with capital possibly coming in by dribbles. The third plan appealed to me more favorably. I decided to put forth my best efforts toward this method of placing my invention on the market. How and where to find the investor with the cash who would be willing to invest under the above conditions proved to be my greatest problem. After considerable deliberation, after several demonstrations and interviews with business men whom I knew, I was convinced that the quickest and cheapest way to find *that* person with the idle cash and confident enough to take a legitimate business chance with me, was to advertise in some good newspaper or magazine, under "Business Chance." This I forthwith started and used the following advertisement:

"Wanted, a capable business man with capital to take substantial interest in patented meritorious invention. This is a public necessity that should make fortune for manufacturers. If qualified, address ———, etc."

The above advertisement cost about $1.00 per issue under classified position in a paper having a weekly circulation of upwards of five hundred thousand copies. The first replies were somewhat disappointing. But, believing I was headed right, I continued the advertisement for a few weeks, and one day I received an inquiry from a man who had ready cash, and sufficient optimism to back me up in my great ambition. For $2.000 cash I sold him forty-five per cent interest in my patent right (leaving me fifty-five per cent, or control). With this nest egg in the company's treasury we proceeded to gather all the information that we might need in the manufacturing and marketing of our invention.

First, we decided upon a firm name suitable to the article. Then we arranged with a machinery company to construct the machinery needed for quantity production. We called on the supply houses and secured their lowest prices on material for making our product. We arranged for the printing of circulars, letterheads, envelopes, bill heads, statements, etc., that would be needed for our office. From a bookkeeper friend we learned books required for our business and how to keep them correctly. We called on the wholesale and retail deal-

(*Continued on page* 181)

Hunting Submarines by Sound

(*Continued from page* 111)

"Ship ahoy!" came from the masthead.

"Where away?"

"Two points on the starboard bow, sir. Looks like she was heading this way."

The Ear Beats the Eye.

This vessel had been detected by sound waves traveling thru the water, her course and speed had been accurately charted *and her exact position* within one point of the compass had been determined *more than an hour before the vessel itself had become visible over the horizon.*

"It's almost perfect," said one of the naval engineers in an undertone. The tension under which they had worked for hours suddenly relaxed. The ship's crew gathered in groups to talk it over. There was not a dissenting opinion. The secret of detecting the presence of an unseen vessel had been solved!

DETROIT

the Automobile Center of the World is the Logical Place to

LEARN AUTOMOBILE ELECTRICS



Training for Head and Hand

Auto Electricians are in big demand everywhere. Interesting work—big salaries—exceptional opportunities for advancement. Every garage, factory and service station needs one or more good men. Also splendid opportunities to open electrical service stations and make big money. Cars need constant attention. Nearly all the trouble is electrical. Six million cars now in use—a million and a half new ones will be put in service this year. That means thousands of trained men will be needed. Men trained in Detroit get the preference.

NOT A "ONE MAN SCHOOL"

The M. S. A. S. embodies the best ideas in the Auto Industry No other school offers such an advantage as this school here in Detroit School open all the year, enter classes any day.

KING MOTOR CAR COMPANY

Builders of King Cars — Detroit, U.S.A.

Replying to a recent letter addressed to Mr. Artemas Ward making inquiry as to the reputation of the Michigan State Auto School, will say that as far as we know all Detroit Automobile manufacturers endorse the work they are doing.

It is managed very efficiently and they have been turning out some pretty good men for the automobile industry, and cannot see any reason why you should hesitate about taking a course with this Institution.

Yours very truly
KING MOTOR CAR COMPANY.

MONEY-BACK GUARANTEE

We guarantee to qualify you for a position as chauffeur, repair man, tester, demonstrator, auto electrician, garage man, automobile dealer, Aeroplane motor mechanic or tractor mechanic and operator, paying from $100 to $400 monthly or refund your money.

Be An Auto Electrician
Earn $200 to $500 Monthly

If you are electrically inclined this is your best opportunity. Our complete Auto Course trains you thoroughly in Auto Electrics. You can hold down any job or run a business of your own. You make more money because you can locate trouble quickly, without waste of time. All your time is spent repairing the trouble—not looking for it. Our successful graduates are in every part of the world.

Auto Factories Heartily Endorse Our School

They not only endorse the M. S. A. S. but they also give us hearty co-operation. They employ our students while taking course and after they graduate. We have the latest model chassis for students to work on. In this way our students get best possible training in most practical manner.

"School News" and 176 Page Catalog FREE

Just off the press. Gives complete information. Quotes dozens of letters from students who have actually done what you would like to do. What better proof do you want that YOU can do it? You CAN! — but get busy. "Jump" a train and come to Detroit. Hundreds have done it and made good. Will help you get a job if necessary to pay expenses while taking our course. Get action NOW.



Michigan State Auto School The Old Reliable School
666 Auto Bldg. Detroit, Mich. U. S. A. A. G. ZELLER, Pres.

Earn $35 to $100 a Week



As a Mechanical Draftsman

Thousands of Men Needed

YOU can learn Mechanical Drawing at home in your spare time through our practical Home Study Course and qualify for Big Pay. We have placed hundreds of our students in good paying positions. Government departments and private concerns are continually calling upon us for our graduates. Peace means a bigger demand for draftsmen than ever before. Prepare now and be ready when this demand reaches its height.

Become a Chief Draftsman

and get to the very top in this well-established and rapidly growing profession. The training given by the Columbia School of Drafting will give you just the knowledge you need to make good as a Chief Draftsman. No previous training is necessary. You can begin our course now and make rapid progress from the start by mail under the Personal Instruction of the President of the School, Mr. Claflin. His carefully prepared lessons and personal letters of advice make each step easy and interesting.

Draftsmen Now Getting $35 to $100 a Week

with big chances for better pay as the demand grows. All big engineering, construction and manufacturing projects must first go through the drafting room before the workmen can commence. All such enterprises depend upon large numbers of draftsmen. Salaries are advancing steadily.

Drawing Outfit Free With Our Course

Free As soon as you enroll you will be sent our drawing outfit for your own use throughout the course. This entire outfit will be yours to keep. You are not obliged to return it after completing the course.

We Will Help You Secure a Position

as soon as you complete our course. We have already placed hundreds of our graduates in good paying positions and are constantly in touch with vacancies for which draftsmen are urgently needed.

Illustrated Catalog FREE

Free Simply fill in the coupon below, return it to us and we will send you free a copy of our illustrated catalog which tells all about our practical Home Study Course and how you may secure our instructions at once on easy terms so as to quickly qualify for one of the big positions open.

Send This Coupon Today

COLUMBIA SCHOOL OF DRAFTING.
Dept. 982, 14th and T Sts., Washington, D. C.

Without obligation to me, please send me your illustrated Catalog and tell how I may secure your practical training in Drafting and your help in securing a position as Draftsman.

Name .....
Address .....
City ..... State .....

www.americanradiohistory.com

The ships steered back to Nahant. A long-distance call was put in for the Navy Submarine Base at New London.

"Rush three submarine chasers to Nahant at once."

In due time they appeared. The party started out again, were joined by submarines from the Boston Navy Yard, and anchored off the Massachusetts coast line.

One submarine at a time submerged. The subchasers equipt with detectors followed her every movement, charted her position, reported to each other by special signal devices, and when everything was in readiness rushed to a spot just over the "sub." Dummy depth bombs were dropt. The submarine rose to the surface. *She had been within a few feet of her charted position.*

And now the apparatus was about to demonstrate its most valuable service. A series of practical tests proved beyond the possibility of a doubt that the detector could successfully differentiate between the sounds made by surface craft and the sub. The submarine's noises were distinctly peculiar to itself and the instrument translating this sound to the trained ear brought home the message just as you, when you pick up the long-distance telephone receiver, can identify the voice at the other end of the wire.

The Submarines On the Phonograph.

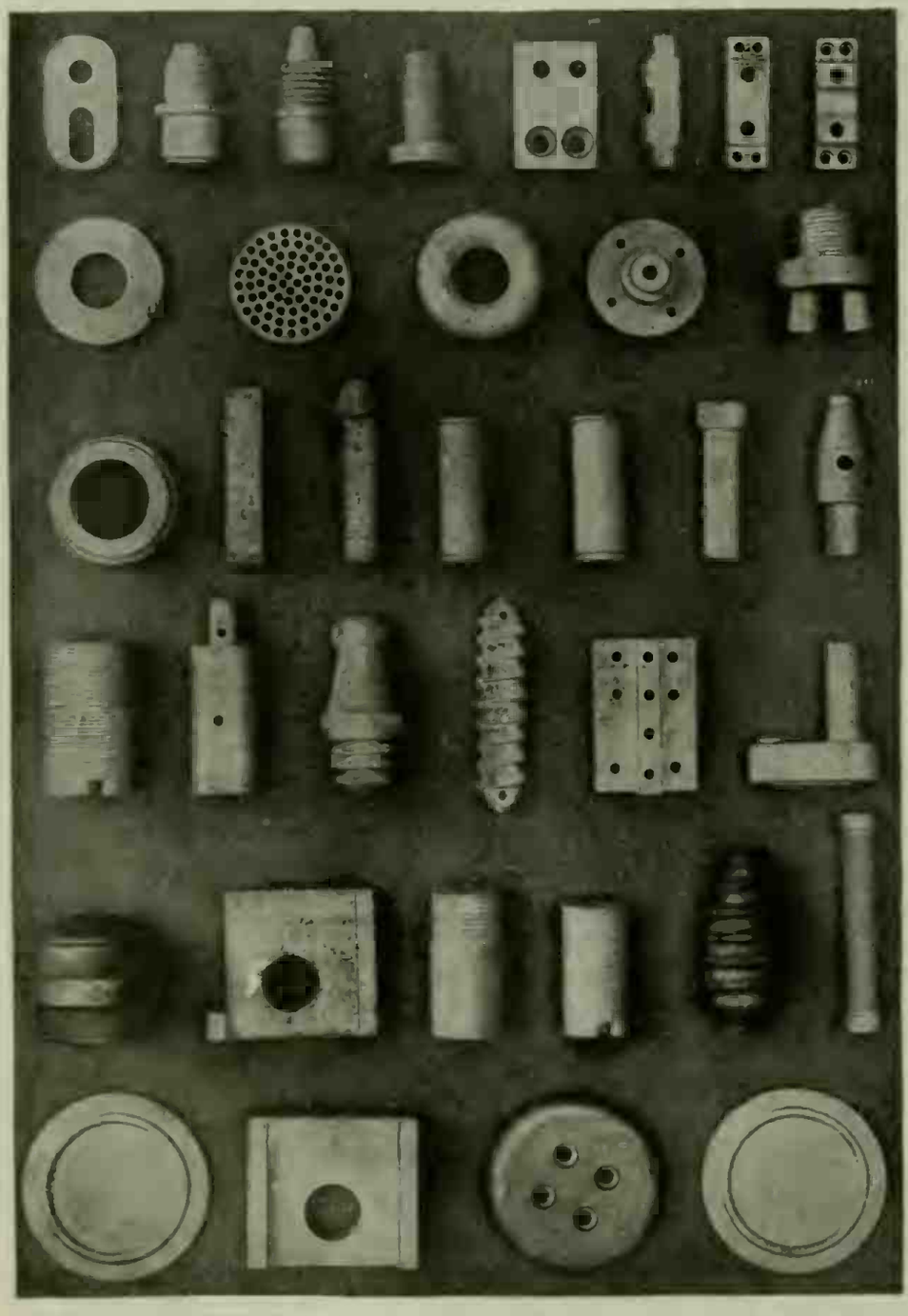
The Victor Talking Machine Company was now called upon for its contribution to the invention. *Phonograph records of the various sounds heard by the observer were made and catalogued*, thus presenting a complete record of the accomplishment of the device. The records were used principally in training students to identify the submarine noises and detect the difference between submarine and surface craft.

Further tests were made. Shore listening stations were set up. During the night trained men sat and listened to vessels going in and out of Boston harbor. The Navy attempted to slip a submarine thru the harbor entrance one night, but the craft was detected at once and a full report of her activities was sent to headquarters a few hours later. Not a ship could enter or leave Boston without being heard. In fact, so sensitive was the instrument that *trained listeners could accurately identify a ship by name*, once having heard her, the engine characteristics of different ships being plainly audible and distinctive.

It was estimated that in December, 1917, *two to five enemy submarines past thru the English Channel daily*. After July 1, 1918, only *one* submarine is known to have done so. In June the Admiralty estimated that *one out of every four submarines was destroyed*. In October the ratio had been increased to five out of every twelve. By this summer British and American naval officers believe three out of every four submarines would have been destroyed. These results were largely due to the perfection of "listening devices."

Hundreds of British craft and most of the American forces were now equipt with the submarine detector. Many French and Italian vessels were also using it. The "submarine hunt" was on in earnest.

About May, 1918, the American ships



Lava Electrical Insulation

Lava Is

the ideal strong, hard, solid fireproof, non-corrosive Insulation. It is machined green, by sawing, lathe turning, milling, drilling and threading to any desired form. Then kiln hardened at 2000° and is unaffected by any subsequent temperature short of that heat.

It will withstand a far greater heat than the conductor which it protects!

Coefficient of expansion being negligible it is of especial value in instruments requiring a fixed relation of their parts under ALL conditions.

Lava Is Not

Molded—no cost or delays for dies or molds.

Glazed or colored. No stock or standard parts—everything being made specially according to design of customers.

Affected by acids or alkali.

Subject to variations in structure or composition (being a natural product).

Ask for P. J. Kruesi's book on "Lava for Mechanical and Electrical Purposes."

AMERICAN LAVA MFG. CORPORATION

Burners all forms for all gases. Heat resisting parts for gas appliances. Electrical Insulation

CHATTANOOGA, TENN.

www.americanradiohistory.com

began to go across with all these devices installed.

Hearing Subs 25 Miles.

Here are some of the outstanding features of the American submarine sound detector:

Under ideal conditions with extraneous noises reduced to a minimum or entirely eliminated *the device was effective at a range of from fifteen to twenty-five miles.*

Trained operators could clearly and invariably distinguish between the sounds made by approaching surface craft and under-water vessels (submarines).

Under average circumstances, the device was good for a range of between *three and eight miles.*

Within five miles the engine characteristics of different vessels was clearly marked even to the point of *identifying by name* certain (unseen) vessels after they had been observed previously for more than one time. (This test was substantiated by a series of night-time experiments at the entrance to Boston harbor in September and October, 1917.)

It was found practical to tell when a submarine changed from her oil engines to electrical drive, which was necessary every time she submerged.

The direction of sound could usually be computed within a very few degrees of its actual location and a good judgment of the distance could generally be made. This was proved to the satisfaction of all concerned following a number of practical tests off Cape Cod, Mass., in the late summer of 1917, in waters adjacent to Boston and in Long Island Sound.

The addition of these listening devices to submarines added the heretofore lacking *sense of hearing* to all the underwater craft and made them at once a much more effective weapon of offense.

An allied submarine on one occasion chased a German U-boat for four hours, while both craft were submerged, without once losing sound contact with the enemy.

The graphic chart publisht herewith will indicate to the reader the ability of submarine chasers to maintain "sound contact" with the enemy and the efficiency of the direction qualities of the device when used in this manner.

The actual battle engagement which it illustrates occurred one early morning in the English Channel. A small squadron of sub-chasers discovered an enemy craft moving slowly up the channel submerged. Forming for the attack they rushed over the spot where their listeners indicated the U-boat to be, dropt a pattern of depth bombs and then withdrew to take observations.

Feverish activity and the sound of hammers ringing against the ship's side was heard. The submarine engines would then start up and stop, start and stop again.

25 Germans Commit Suicide.

Further attacks were delivered and more noise came to the listeners from the hold of the submarine. Evidently the first depth charge had taken good effect and the enemy's crew was making a last desperate effort to reach the surface. Suddenly there was dead silence—then 25 revolver shots rang out—3 followed by 22. *The crew giving up in despair, had committed suicide.* The loss of this submarine was later substantiated by the British Intelligence Department.

When Capt. Leigh and his party went abroad in November, 1917, he requested the Admiralty to loan him two high-speed chasers in which operations could be begun in English waters, but was finally obliged to accept 3 trawlers of 9 to 10 knots speed, because of the then scarcity of higher speed craft.

Equipping these vessels with all of the anti-submarine detecting apparatus they went out in the English Channel on New Year's Day, 1918. Shortly afterwards a wireless message was picked up from an airship giving the position of a submarine which had just been seen to submerge. The channel had been laid out in numbered squares to facilitate the immediate location of enemy craft and the little squadron steamed over, got their devices out and picked up the submarine course.

When believing themselves about over the enemy, depth bombs were discharged and later a trawling instrument was used, which indicated that the submarine had been destroyed. Great quantities of oil rising to the surface also substantiated the success of the attack.

Remaining in English and French waters for several months, where the American devices proved of great value and were highly complimented both by Admiral Sims and British naval officers, another squadron was equipt and sent into the Mediterranean and Adriatic, where at this time submarine activity was at its height.

Because of the deeper water and less interference from surface traffic, listening conditions were unusually good. A "barrage" line of boats was organized across Otranto Straits, between the mainland and the Island of Corfu, to effectively put a stop to the enemy's free entrance to the Mediterranean.

Three of the chasers patrolling in formation abreast one dark night heard a "sub" approaching. The bearings obtained by the two beam vessels pointed directly toward the center boat. The middle boat now heard the submarine approaching from a position dead astern. The enemy came nearer and nearer and finally past right under the sub-chaser so close to the surface that those on board felt a wave of water along the keel of their ship.

When the German had past on and out in front the attack was made in unison, a *pattern** of depth bombs was "let go" and the little fleet halted for further observations. Pretty soon the whirl of the submarine's electric motors was heard—evidently in an effort to reach the surface.

The Germans "Cash In."

Then came a crunching noise not unlike the popping in of a blown-up paper bag. It was apparent that the submarine had been damaged—put out of control—and sunk, and that she had collapsed from the tremendous water pressure at these depths.

Many incidents of this kind occurred during the subsequent operations in foreign waters and several submarines were accounted for thru the direct aid of the American listening devices.

In fact, naval experts who were closely in touch with submarine detection development during the war period state with conviction that if the conflict had continued thru another summer the submarine would literally have been driven from the ocean, the promise of a condition due in a large measure to the perfection of submarine detecting apparatus.

It has also been stated that the noticeable change in naval tactics—from defensive to offensive—which marked this country's entrance into the war was largely caused by the application of American principles to the pursuit and attack of the U-boat, something made possible by the practical use to which it was found the American submarine detector could be put.

* A pattern of depth bombs refers to the plan of dropping them simultaneously in certain prearranged figures, such as squares, circles, etc. The chart herewith shows the pattern scheme quite clearly—notice the black dots at points marked "attack."

Mechanical Engineering



Learn at Home!

THE Government and employers everywhere are looking for men with mechanical ability. Splendid salaries and rapid advancement are offered.

There is an easy, delightful way in which you can learn right at home in spare time. For 27 years the International Correspondence Schools have been giving men and women just the training they need for success in mechanical engineering and more than 200 other subjects. Hundreds of thousands have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6191, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

- ☐ ELECTRICAL ENGINEER
- ☐ Electrician
- ☐ Electric Wiring
- ☐ Electric Lighting
- ☐ Electric Car Running
- ☐ Heavy Electric Traction
- ☐ Electrical Draftsman
- ☐ Electric Machine Designer
- ☐ Telegraph Expert
- ☐ Practical Telephony
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Ship Draftsman
- ☐ Machine Shop Practice
- ☐ Toolmaker
- ☐ Gas Engineer
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MINE FOREM'N OR ENG'R
- ☐ ARCHITECT
- ☐ Architectural Draftsman
- ☐ PLUMBING AND HEATING
- ☐ Sheet Metal Worker
- ☐ CHEMICAL ENGINEER
- ☐ SALESMANSHIP
- ☐ ADVERTISING MAN
- ☐ Window Trimmer
- ☐ Show Card Writer
- ☐ Outdoor Sign Painter
- ☐ RAILROADER
- ☐ ILLUSTRATOR
- ☐ DESIGNER
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Pub. Accountant
- ☐ Traffic Management
- ☐ Commercial Law
- ☐ GOOD ENGLISH
- ☐ STATIONARY ENGINEER
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ Textile Overseer or Supt.
- ☐ AGRICULTURE
- ☐ Navigator
- ☐ Poultry Raising
- ☐ Automobiles
- ☐ Spanish
- ☐ French
- ☐ Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____

ELECTRICAL ENGINEERING training again open to civilians. Over 3000 men trained for electrical industries in experience of more than a quarter of a century. For men of ambition and limited time. Condensed course in Electrical Engineering enables graduates to secure good positions and promotions. Theoretical and Practical Electricity, Mathematics, Steam and Gas Engines, Mechanical Drawing. Students construct dynamos, install wiring and test electrical machinery. Course with diploma, complete.

IN ONE YEAR



Thoroughly equipped fireproof dormitories, dining hall, laboratories, shops. Write for catalog. 27th Year opens October 1, 1919

BLISS ELECTRICAL SCHOOL
260 Takoma Avenue, Washington, D. C.

BE A TOP NOTCHER

Get into the 100% Class. Be Prosperous, Powerful, Happy. Our system has shown thousands HOW. It can show YOU. No guesswork. Proved. A true-to-life Personality Sketch and first lesson on Happier Living for 10c and birthdate. THOMSON-HEYWOOD CO., Dept. 350, Chronicle Bldg., San Francisco, Cal.

www.americanradiohistory.com

AMPLIFY YOUR RADIO SIGNALS

ONE of the greatest drawbacks since the invention of wireless telegraphy is the receiving of weak signals at the receiving station. Many devices were proposed to improve this condition, but without success, on account of the mechanical difficulties encountered in these amplifying devices.

However, this was recently solved by the introduction of an exceedingly sensitive microphone transmitter, which is known to detect sound waves with great accuracy and magnify them through an intermediate telephone circuit.

By the employment of the new DETECTAGRAPH-TRANSMITTER, the amateur can amplify the radio signals to such an intensity that he can hear the signals about his station without the need of the telephone head set.

By the addition of a loud talking telephone he is able to hear the messages many feet away from the instrument. He is also able to demonstrate the operation of his wireless apparatus to his friends.

The super-sensitive DETECTAGRAPH-TRANSMITTER herewith shown is two and three-eighths inches in diameter, five-eighths of an inch thick and weighs less than three ounces. It is the most sensitive sound detecting device ever brought before the public.

The manner in which the amplifying process is attained is by attaching with tape the DETECTAGRAPH - TRANSMITTER to the regular wireless receiver as indicated in the diagram.

SUPER-SENSITIVE

Detectagraph

MICROPHONE DEVICES

Practical Instruments for Commercial and Scientific Purposes.



Our Super-Sensitive Detectagraph Transmitter. Price, $7.00 Complete

Other Uses

Not only is this instrument applicable for amplifying radio signals, but it can be used with equal satisfaction for magnifying other sounds. Phonograph music can be transmitted from one place to another by means of this instrument, and those who are afflicted with deafness will find enormous benefit by using this transmitter.

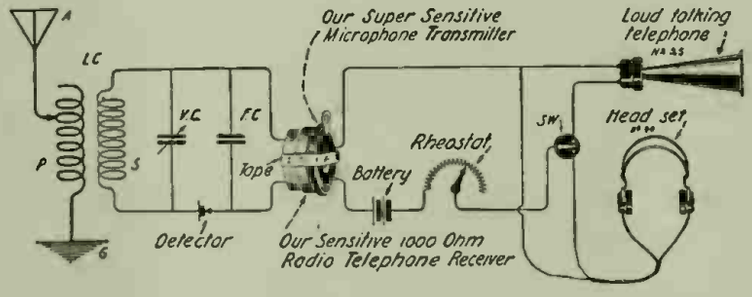
It is the greatest device for building your own loud talking telephone, detectagraph and other devices. Can be used for any purpose where a sensitive detecting instrument is required.



Model "B" Horn, with Loud Talking Receiver, Cord Plugs and Desk Stand Base Price, $10.00 Complete



Our Special No. 25 Loud Talking Receiver Price, $4.00 Complete



DETECTAGRAPHS

FOR THE EXPERIMENTER FOR DETECTIVES FOR THE DEAF

DETECTAGRAPH JUNIOR DEAF-PHONE

A super-sensitive instrument which has been developed to meet the demands for a practical and efficient hearing device at an extremely low price. Equal to any $35.00 instrument made.

The outfit consists of a Super-Sensitive Transmitter, with a cord connector; Super-Sensitive Ear Piece with small black cord; Black Single Headband; Black Case and two small Batteries. The Transmitter is 2¾ inches in diameter, ⅝ of an inch thick, and weighs less than three ounces.



$15.00 Complete

OUR NEW, IMPROVED DETECTAGRAPH

The outfit and case weighs less than two pounds and can be carried in the pocket, yet it is combined with certain features of our famous Detector, which makes it the most powerful and in every way, the most Microphone Detective Device the world has ever known.

Conversations carried on in an ordinary tone and even whispers are taken up by the concealed Detectagraph transmitter, which collects sounds from all directions and are conveyed over the wire to the listening end. This outfit consists of an Improved Sensitive Transmitter with cord connector; 25 feet Black Cord; Sensitive Receiver; Single Headband; Small Carrying Case and Small Battery. The Improved Transmitter is only 2⅝ inches in diameter, ⅝ inch thick, and weighs less than 3 ounces.



$15.00 Complete

Order direct from ad. Or write for free descriptive circular. For your convenience use the coupon.

G. Boissonnault Co., 26 Cortlandt St., N.Y.C.

As per your ad in Electrical Experimenter, please send me free circulars and full particulars about your Detectagraph Devices.

NAME .....

ADDRESS .....

CITY .....

STATE .....

G. BOISSONNAULT COMPANY

26 CORTLANDT STREET NEW YORK CITY

Makers of Super-Sensitive Microphone Devices

www.americanradiohistory.com

Alexanderson's "Barrage" Receiver

(*Continued from page* 135)

ing which has become so familiar, but also the original meaning of toll or stoppage prevention. Thus the barrage receiver may be used not only in time of war to counteract the offensive barrage of an enemy radio station, but it may be used to multiply the number of peaceful communications that may be carried on simultaneously without disturbing each other.

Duplex Radiotelephony.

NEUTRALIZED RECEIVING ANTENNA MOUNTED ON THE SAME MAST AS THE SENDING ANTENNA

If two sets of wires are mounted on the same masts, the radiation from one set to the other is obviously so strong that the overpowering of an ordinary receiving set by the transmitted energy would be almost of the same order of magnitude as if the identical wires were used. The quantitative relations may be better appreciated by mentioning specific figures. In the tests made in Schenectady, the receiving antenna consists of five wires mounted as an umbrella

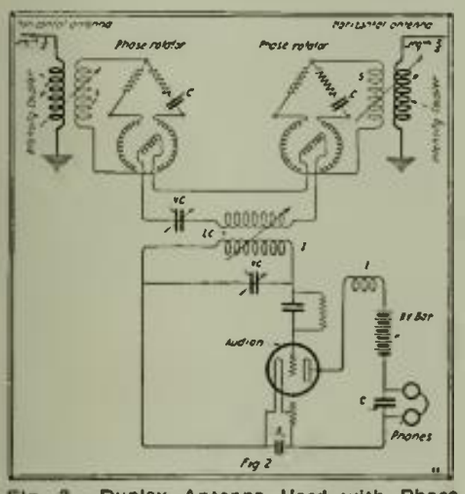


Fig. 2. Duplex Antenna Used with Phase Rotator Units and Regular Receiving Instruments in Alexanderson "Barrage" Receiving Set.

around the main mast, while the sending antenna consists of two wires extending from this mast to another building. The capacity to ground of the sending antenna is 0.003 microfarad, the receiving antenna 0.0011 microfarad, and the mutual capacity such that 10,000 volts on the sending antenna produces 500 volts on the receiving antenna when it is disconnected. While it is obvious that an antenna oscillating with 500 volts continuous waves could not be used with ordinary methods of reception, the system for neutralization which will be described has proven so effective that an ordinary receiving set can be used for receiving signals from such distances as the Pacific coast (2,500 miles or 4,000 km.) without any appreciable interference from continuous wave radiation from the main antenna of 20 amperes and 10,000 volts!

Two methods of neutralization have been used: *inductive* neutralization and *static* (*capacitive*) neutralization. While both methods have been used successfully, the capacitive neutralization is much preferable both on account of accuracy of adjustment and simplicity. A diagram of inductive neutralization is shown at Figure 1. The transformer *T* is used to create a potential of opposite phase to the potential of the sending antenna. The negative potential thus created is transferred to the receiving antenna thru the exposure condenser *E*. The negative potential thus imprest upon the receiving antenna thru the transformer and the exposure condenser is adjusted so as to counterbalance exactly the direct exposure from antenna to antenna, thus leaving the receiving antenna at ground potential. The phase relation of the transformer is, however, not exactly 180°, and a residual potential is left on the receiving antenna which is sufficient in most cases to interfere with reception unless further precautions are taken. If, however, a frequency trap *F* is introduced the neutralization becomes good enough so that an ordinary receiving set can be used.

The arrangement shown in Figure 1 was used to demonstrate duplex radio telephone conversation between Pittsfield and Schenectady (50 miles or 80 km.)

The "Barrage" Radio Receiver.

The barrage receiver is fundamentally a *uni-directional receiver*. The principle of uni-directional reception was first developed by Bellini and Tosi. While the uni-directional Bellini-Tosi receiver has been used as a direction finder, it has, to the knowledge of the author, not been used to any extent for reception of long distance signals. The Bellini-Tosi receiver is based on the principle of receiving the signal thru two antennas of different characteristics and neutralizes the signals received from one direction by a system of balancing.

The uni-directional Bellini-Tosi receiver works on the principle that the *electromagnetic* and *electrostatic* exposures are 90° out of phase. The *barrage receiver* takes advantage of the geographic phase *displacement* in the wave as it travels over the surface of the earth. In the first barrage receivers which have been installed the antennas consist of two insulated wires laid on the ground a distance of two miles (3.2 km.) in each direction from the receiving station. It was originally intended by the author to mount the wires on poles, but the easier procedure of laying the wires on the ground was adopted at the suggestion of Lieutenant-Commander A. Hoyt Taylor, and the arrangement has proven entirely satisfactory. The barrage receiving set, photograph of which is shown herewith, consists of a standard receiving set, combined with a *phase rotator* set. When used as a barrage receiver, a condenser is used in place of the antenna and the standard receiving set is coupled to the aperiodic antenna by the phase rotator set. The diagram of the phase rotator set is shown at Fig. 2. Each antenna is connected to ground thru an intensity coupler, the secondaries of the intensity couplers are connected to the primary of the phase rotators. Each phase rotator is built on the principle of a split phase induction motor or induction regulator. A single phase current introduced in the primary is split into a quarter-phase current which produces the equivalent of a rotating magnetic field inductively related to the secondary. By adjusting the position of the secondary coil the electromotive force induced in it may be made to assume any desired phase relation to the primary voltage. The receiving set proper when used with the barrage receiver has all the normal characteristics of a standard receiving set. A signal originating in any direction whatever may be neutralized by adjustment of the intensity couplers and phase rotators. This adjustment is very easy to perform, even by an inexperienced operator, and is perfectly stable after it has been made.

An experimental barrage receiving set was operated for several months of the

MURDOCK
No. 55

2000 Ohm Double Set $4.00
3000 Ohm Double Set $5.00



Q R K

is the invariable answer of the fellow with "FIFTY-FIVE" fones:—the most sensitive, dependable, and serviceable radio receivers obtainable anywhere at such remarkably low prices. A trial will prove their worth. ORDER A SET TODAY. Use these "fones" for fourteen days. If they are not as good as you want, send them back and get your money. A cheaper set is not worth the bother. A more expensive set is really unnecessary.

Write for your copy of Bulletin 19

WM. J. MURDOCK CO.
55 Carter St.
Chelsea, Mass.

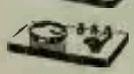
Pacific Coast Representatives:
The Keeler White Co.
221 Second St., San Francisco, Calif.



"The Leader of Them All"
Thordarson's Flexible Wireless Transformer
Thordarson Electric Mfg. Co.
Chicago Ill.



MORSE TELEGRAPH SET
Just as the cut shows it. Fine for learning telegraphy or for a private line. With code and full instructions.....80c



WIRELESS PRACTICE SET
The first need of every wireless amateur. High pitch buzzer and key for learning wireless code. Also for test buzzer, $1.00



BLINKER PRACTICE SET
For learning the visual code.....90c
Any two of above sets may be used for a short line between nearby houses, etc. Send postage for 1 lb. Ask for catalog E.
THE WILCOX LABORATORIES, Lansing, Mich.

www.americanradiohistory.com

WIRELESS BY MAIL
in America's Largest Radio School

NEW plan of profit sharing by which every student taking course is *guaranteed* saving of ten per cent of cost of tuition and an estimated saving of 50 per cent or more.

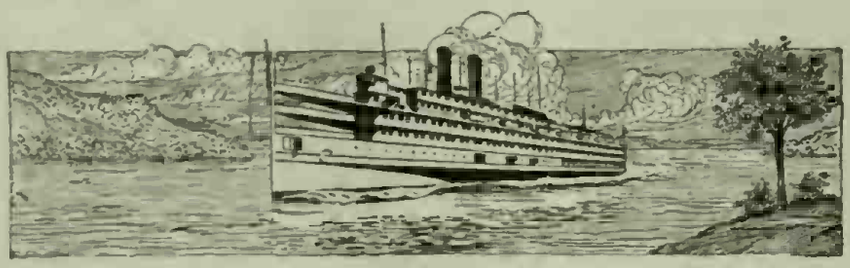
Positions pay $110 per month and living expenses up to $3500 per year.

Qualify in 16 weeks or less. Large staff government licensed instructors, first grade and extra first grade. Wireless practice set and text books free. Full commercial wireless course with free post graduate course of one month in our Washington school to successful students. Very easy terms. Write today for handsomely illustrated catalogue and particulars of profit sharing plan.

SERVICE RADIO SCHOOL
Dept E., 902 Pa. Ave. Washington, D. C.

Free advice to amateurs regarding construction of apparatus on receipt of 3 cents postage, addressed to our Construction and Equipment Department.

HUDSON RIVER NIGHT LINES
NEW YORK - ALBANY TROY



The Luxurious Route to Vacation Land

Leave Pier 32 N. R. Foot Canal St., daily 6 P. M., West 132nd St., 6:30 P. M. Due Albany 6 o'clock following morning. Direct rail connections to all points north, east and west.

Largest River Steamers in the World
Express Freight Service Automobiles Carried
HUDSON NAVIGATION COMPANY

summer and fall of 1918, about three miles from the New Brunswick, N. J., radio station. Records were kept on the reception of European stations during the operation of the New Brunswick station. As the New Brunswick wave is 13,600 meters and the Carnarvon, Wales, wave is 14,200 meters, the reception of Carnarvon was the hardest test to which the set could be put. It was found that in spite of the overwhelming intensity of the New Brunswick signals on an unbalanced receiver, the barrage receiver could be adjusted so that the transmitted wave not only did not interfere with the Carnarvon signals, but the New Brunswick signals could be made entirely inaudible. During these tests it was found that the directive characteristics of the barrage receiver was a material help in reduction of interference by static and strays, as it was found very frequently that solid copy could be obtained by proper directive adjustment, while the signals were practically unreadable with ordinary methods.

The improvement of reception of signals by the use of the barrage receiver depends upon the highly directive qualities of this receiving system. For comparison with other methods of directive reception, a tabulation of directiveness is given in Fig. 3. In this comparison the symmetrical elevated antenna which receives equally from all directions is designated at 100 per cent. The percentages of directivity are calculated from the areas of the corresponding horizontal plane intensity diagrams here shown. If the directivity represented by the intensity diagrams can be taken as relative measure of the average stray-to-signal ratio, we find that the magnetic loop should have 50 per cent. as much strays as the elevated antenna, the differential horizontal antenna (Sayville, Long Island), probably about the same as the magnetic loop, and the barrage receiver 22 per cent. Statistics of reception indicate that these figures are reasonably in agreement with facts, when the strays are evenly distributed. When the strays are directive the improvement is much greater.

A rather surprising characteristic was discovered by the use of the barrage receiver. It was expected that this receiver could be used to neutralize signals from all directions except the direction close to the signal to be received. As a matter of fact it was found that interference could be neutralized by originating in the same direction as the signal. This was first discovered in the New Brunswick installation. Signals from San Diego, Cal., right in line with the transmitting station, could be received without great reduction in intensity, while the set was adjusted so as to neutralize the transmitting station. The explanation for this is the fact that in the case of the nearby station the wave front is curved and the radiation diverging, whereas in the case of the far-away station the radiation is parallel. The receiving antenna covers a space of four miles (6.4 km.), and in this space there is sufficient divergence of the radiation from the nearby station so that an adjustment can be made whereby the diverging and parallel radiation have different effect upon the receiving set. The phenomenon is comparable to the focusing of a field glass on nearby and distant objects. In this case we have a radio field glass of four miles (6.4 km.) in diameter; and, for such dimensions, the focusing effect is sufficient, even at considerable distances, to produce an effective discrimination.

While the barrage receiver was worked out primarily to avoid interference in transoceanic communication, it may be found useful also for the purposes for which the bridge receiver was developed—that is, simultaneous sending and receiving from small shore stations or ship stations. In such cases it has the advantage over the bridge receiver that it can be used not only to neutralize the transmitting station to which it belongs, but can neutralize interference from any other ship or shore station.

www.americanradiohistory.com

My Inventions

By Nikola Tesla

(*Continued from page* 148)

showered upon me, and journeyed to my home where I passed through a most painful ordeal and illness. Upon regaining my health I began to formulate plans for the resumption of work in America. Up to that time I never realized that I possessed any particular gift of discovery but Lord Rayleigh, whom I always considered as an ideal man of science, had said so and if that was the case I felt that I should concentrate on some big idea.

Nature's Trigger.

One day, as I was roaming in the mountains, I sought shelter from an approaching storm. The sky became overhung with heavy clouds but somehow the rain was delayed until, all of a sudden, there was a lightning flash and a few moments after a deluge. This observation set me thinking. It was manifest that the two phenomena were closely related, as cause and effect, and a little reflection led me to the conclusion that the electrical energy involved in the precipitation of the water was inconsiderable, the function of lightning being much like that of a sensitive trigger. Here was a stupendous possibility of achievement. If we could produce electric effects of the required quality, this whole planet and the conditions of existence on it could be transformed. The sun raises the water of the oceans and winds drive it to distant regions where it remains in a state of most delicate balance. If it were in our power to upset it when and wherever desired, this mighty life-sustaining stream could be at will controlled. We could irrigate arid deserts; create lakes and rivers and provide motive power in unlimited amounts. This would be the most efficient way of harnessing the sun to the uses of man. The consummation depended on our ability to develop electric forces of the order of those in nature. It seemed a hopeless undertaking, but I made up my mind to try it and immediately on my return to the United States, in the summer of 1892, work was begun which was to me all the more attractive, because a means of the same kind was necessary for the successful transmission of energy without wires.

Four Million Volts.

The first gratifying result was obtained in the spring of the succeeding year when I reached tensions of about 1,000,000 volts with my conical coil. That was not much in the light of the present art, but it was then considered a feat. Steady progress was made until the destruction of my laboratory by fire in 1895, as may be judged from an article by T. C. Martin which appeared in the April number of the *Century Magazine*. This calamity set me back in many ways and most of that year had to be devoted to planning and reconstruction. However, as soon as circumstances permitted, I returned to the task. Although I knew that higher electro-motive forces were attainable with apparatus of larger dimensions, I had an instinctive perception that the object could be accomplished by the proper design of a comparatively small and compact transformer. In carrying on tests with a *secondary in the form of a flat spiral*, as illustrated in my patents, the absence of streamers surprised me, and it was not long before I discovered that this was due to the position of the turns and their mutual action. Profiting from this observation I resorted to the use of a high tension conductor with turns of considerable diameter sufficiently separated to keep down the distributed capacity, while at the

(*Continued on page* 176)



Brandes "Superior" Head Set, complete with head band, $6. A professional set within the means of every amateur. 2000 ohms.

Uncle Sam Said:

"Go ahead with amateur wireless receiving stations." You will be prepared to get the messages the other fellow misses if you have one of

BRANDES Wireless Headsets

They enable you to "hear with both ears" because Brandes diaphragms are perfectly matched for tone, and both receivers are perfectly tuned together. Handsome, well made, fine quality.

Send for Your Set Today

Your money back if Brandes Headsets don't prove *better* than any you've used in clearness, sensitiveness and range.

Booklet "E" will be sent upon receipt of 4c in stamps.

C. BRANDES, INC.

Wireless Receiver Specialists

ROOM 814 32 UNION SQUARE NEW YORK CITY

Complete line of Brandes receivers for those in Western States and Pacific Coast. Catalogue "E" on request.

Balboa Building FORD KING San Francisco, Cal.

Universal Radio Apparatus

The Universal Radio Manufacturing Corporation has taken over the business previously conducted by the Mignon Wireless Corporation and is prepared to furnish all of the Mignon system instruments, built according to the original Mignon specifications. In addition to these, the Corporation has recently perfected a series of new type instruments which for efficient work and real service have never been equalled.



Regerative Receiver, 200-2500 meters

The Universal complete line of High Quality Radio Apparatus now includes

Cabinet Receiving Sets
Transmission Sets
Loose Couplers
Undamped Wave Receivers
Time Signal Sets
Detectors, etc.

These "Universal" instruments embody the very latest advances in the art of radio communication and are far in advance of other instruments of this type. Every detail in their design has been carefully worked out, and the circuit constants have been computed with scientific accuracy to give maximum results when properly used. Materials and workmanship are of the highest quality.

Every piece of "Universal" apparatus must pass a series of rigid tests before being allowed to leave the factory, and we unconditionally guarantee every piece of "Universal" apparatus to be exactly as represented, and will cheerfully refund the purchase price if the instrument fails to make good for any reason.

Write To-day for Free Catalog

UNIVERSAL RADIO MFG. CORPORATION

SUCCESSOR TO MIGNON WIRELESS CORPORATION

ELMIRA, NEW YORK

www.americanradiohistory.com



De Forest's New Catalog

illustrating and describing the very latest and best in

RADIO APPARATUS

For Discriminating Users

is ready for mailing. Complete information regarding the De Forest "Unit" Set, "Honey Comb" Coils (a radical departure from previous forms of apparatus), variable air and fixed condensers, wavemeters, variometers, detectors, etc., will be sent upon receipt of 10c to defray postage.

De Forest Radio Tel. & Tel. Co.
1391 Sedgwick Ave. New York City

WANTED
Immediately

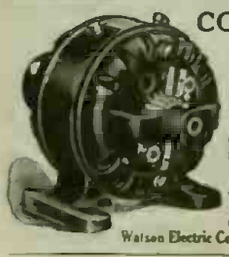
WIRELESS operators are in demand owing to the expansion of our Merchant Marine. Pay has increased to $110 per month plus all expenses.

THE Y. M. C. A. Radio Schools give thorough practical courses with individual instruction. Our graduates fill responsible positions.

THIS is *your* opportunity. Classes now forming. Excellent dormitory facilities. Complete laboratory equipment. Write today for illustrated booklet.

Y. M. C. A.
NEW YORK CITY

Manhattan Branch: 154 East 86th St. Tel. Lenox 6051
Brooklyn Branch: Marcy Ave. Near B'way Tel. W'msburg 3800



COUNTY AGENTS WANTED
for our line of
Electric Farm Lighting Plants

Good money-making proposition. Liberal commission. $300 required. Write for terms.

We also sell Garage Equipment, Storage Batteries, Battery Charging Generators, Motors, Tungar Rectifiers, etc. Catalog free.

Watson Electric Co. Dept. 16, 122 Michigan Av. Chicago

Amateur Radio Restored

(*Continued from page* 131)

plaything only or just a mere hobby.

The ELECTRICAL EXPERIMENTER thru the RADIO LEAGUE OF AMERICA shall be only too glad to publish letters from amateurs suggesting new ways and means to benefit the cause of Radio Amateurism, our columns being open to all worthy suggestions.

While for the present there is nothing to be feared of adverse legislation, still it is impossible to forecast that such legislation will not be attempted in the future. We have won the freedom of the ether due to the splendid coöperation of Radio Amateurs in this country, and if we have won once we will win again.

The RADIO LEAGUE OF AMERICA is a clearing house for all Radio Amateurs in the United States, and today has more members than any other league, but it has not enough members. It wishes to have every amateur as an enrolled member. The membership of the Radio League, established in 1915, is gratuitous. There are no dues or fees to be paid. All the League wants is the name of every amateur and his address, so that first of all, if a national emergency arises, the Government can rely on the amateurs for quick communication. Also in case adverse legislation should be attempted, the League wishes to notify every member immediately, as it did last December when the freedom of the ether was threatened.

We ask every amateur who is not a member of the League to sign the blank appended herewith. It costs nothing but a 3-cent stamp to do so. Every enrolled amateur is entitled to the membership certificate free of charge which is mailed to all members. The membership of the Radio League of America now comprises 21,309 members. If you are not a member at the present time, you should enroll at once by all means.

LONG LIVE THE RADIO AMATEUR!

Application for Membership in the Radio League of America

I, THE UNDERSIGNED, a Radio Amateur, am the owner of a Wireless Station. My station has been in use since..... and I herewith desire to apply for membership in the RADIO LEAGUE OF AMERICA. I understand that the Radio League of America is a National Scientific Organization for the pursuit of the Radio Arts. I will not be called upon to pay membership fees, or dues, and once enrolled I am to share in all the privileges of a regular member.

Upon receipt of this form properly filled out you are to send me your eight-page booklet describing the purpose of the League, rules, etc.

Name.....

City.....

State.....

Date.....191

Mail this blank to Radio League of America, 231 Fulton St., New York City.
6-19

A NEW TYPE OF TRANSFORMER

(*Continued from page* 139)

(Nos. 20 to 30 gage), and is twelve inches long. The exact diameter cannot be given, but it must be slightly smaller than the inside diameter of the secondaries, usually from one to one and one-half inches.

The primary can consist of three pounds No. 16 D. C. C., which when connected in series with an adjustable reactance or rheostat, will give a power range of approximately two to six amperes.

The core is wound with two or three layers of Empire cloth, and then the primary wire is wound on. Between the primary and each secondary should be placed a hard rubber disc about an inch wider than the secondaries, and then the secondaries, covered with Empire cloth, are slipt in place. If a hard rubber disc is not available, three or four layers of the Empire cloth may be used. Great care must be taken with the insulation on account of the peculiar construction, and it is especially necessary that the insulation along the core, between primary and secondaries, be well taken care of. Connections for the secondaries are shown in the diagram (2).

When properly constructed, a thick spark, the length depending on the secondaries used, will be obtained. The transformer has proved especially good in use with a rotary gap.

A transformer constructed along similar lines, using two secondaries from a three-inch spark coil, has been giving me excellent service, and I hope other amateurs will have a similar experience.

Contributed by WM. HOLLADAY.

GERMANS' WIRELESS CODE

Dr. J. A. Fleming, in a lecture on "Electric Wave Telegraphy" at the British Royal Institution, revealed the fact that the Germans had, during the war, conveyed much important information from Tuckerton radio station in America by a code which was dependent on a certain method of "spacing," being otherwise harmless.

"I Would Not Part with it for $10,000"

So writes an enthusiastic, grateful customer. In like manner testify over 100,000 people who have worn it. Conserve your body and life *first*.



The Natural Body Brace

Overcomes WEAKNESS and ORGANIC AILMENTS of WOMEN AND MEN. Develops erect, graceful figure.

Brings restful relief, comfort, ability to do things, health and strength.

Wear It 30 Days Free at Our Expense

For Children Also

Does away with the strain and pain of standing and walking; replaces and supports misplaced internal organs; reduces enlarged abdomen; straightens and strengthens the back; corrects stooping shoulders; develops lungs, chest and bust; relieves backache, curvatures, nervousness, ruptures, constipation. Comfortable and easy to wear.

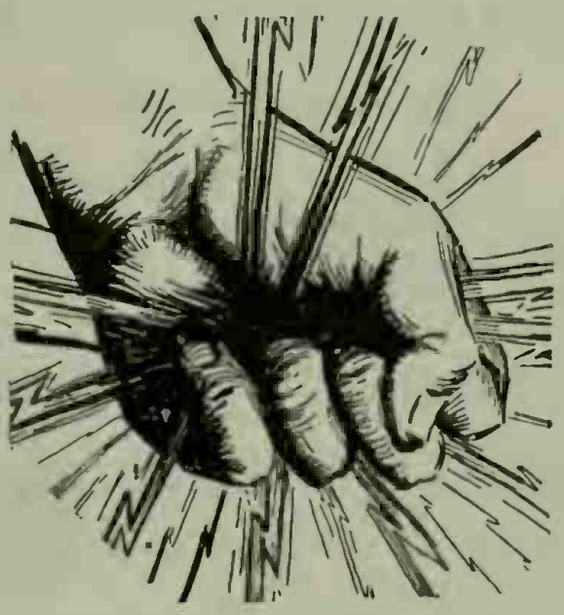
Keep Yourself Fit

Write today for illustrated booklet, measurement blank, etc., and read our very liberal proposition.

HOWARD C. RASH, Pres. Natural Body Brace Co.
286 Rush Building SALINA, KANSAS

www.americanradiohistory.com

Learn WIRELESS —NOW— Enter This New Field of Greatest Opportunity



NOW that peace is here wireless offers the greatest opportunity of the day to the young men of America. The experimental stage has passed. Wireless now equals in importance telegraphy and telephony, and if the present commercial wireless program is carried out, it may supplant them by the end of 1919. It has earned its place among the great commercial industries of the earth. So great has been the development and growth of Wireless in recent years that there is now a tremendous shortage of operators.

Peace Increases Demand For Wireless Operators

Actually thousands upon thousands of Wireless Operators, Inspectors, Mechanics, Electricians, and Radio Draftsmen will be needed for permanent "peace time" wireless positions at bigger salaries than have ever before been paid.

Peace means a bigger demand for men in every branch of wireless and is opening up new fields of Commercial Wireless activity which will fairly revolutionize present methods of communication.

No Previous Experience Necessary

You Can Learn Wireless In Ten Weeks In Your Own Home, through our practical home study wireless course. No previous experience or training is necessary in order to become a Successful Wireless Expert With our help you can quickly qualify for a good position at big pay. Many of our students have secured positions before completing the course. You will make rapid progress from the start because our course is based on actual practice and teaches you what you will need to know to make a big success of Wireless work.

Get Your Instructions From the Nation's Capital

(Our Course is endorsed by U. S. Government Officials.)

The National Radio Institute headed by authorities who have been closely allied with government training of students, was established in 1914 and is the first school in America to successfully teach Wireless by Mail. The work is under the direction of J. E. Smith, E. E., director of the Radio Department, Howard University, and E. R. Haas, formerly of the Radio Division of Yale University.

We now have students throughout the world. Our location in the Nation's Capital together with the standing of our officers and their wide acquaintance among government officials, connected with Wireless activities, place us in position to give our students the best instruction obtainable and to be of the utmost help in assisting them to secure good paying positions.

Travel and See the World

If you want to travel and see the world—go to foreign countries, and increase your knowledge of world affairs, Wireless offers you the chance of a lifetime. However, you are not obliged to travel, but may secure a permanent position at one of the big Land Stations, Railroad, Telegraph, or Steamship companies, if preferred.

Pay as You Go Along With Your Lessons

Our plans of payment bring a wireless education within the reach of anyone who desires to learn. A small payment down on our convenient payment plan, and small following payments, enables you to earn the cost of your tuition while actually learning to be a wireless operator.

Earn up to $250.00 per Month

In the short period of ten weeks we can make of you a wireless operator, a man with a profession, independent, and not subject to the rise and fall of wages in the labor market. Salaries are as high as $250.00 per month. We give you this training at home, by mail, in your spare time. It is not necessary for you to lose any time from your work to take the course. Then when you have received your diploma from us, we help you find a good position.

FREE INSTRUMENTS TO EVERY STUDENT

In addition to text books, lessons and personal instruction, we send you, while taking our course, a Home Practice Set consisting of a standard sending key and buzzer, and a Universal automatic wireless transmitting and receiving set. These instruments are free to every student. No other school can offer you what we do.

Announcement - - Opening of Norfolk School

The demand for our Course has grown to such an extent that we are now preparing to open a school in Norfolk, Va., which will be under the management of Mr. A. H. Van Nostand, Radio Inspector of the Third Radio District.

FREE Our booklet, "WIRELESS, the Opportunity of Today", gives you complete information in regard to our course, the quick and easy methods by which you can master wireless and other important facts you should know. It is free. Just mail the coupon. No obligation whatever on your part.

—MAIL THIS COUPON TODAY—

NATIONAL RADIO INSTITUTE
Department 74, Washington, D. C.

Send me, free of charge, your booklet, "Wireless, the Opportunity of Today," with full particulars regarding your famous 10 weeks Home Study Course, and your Special Free Instrument Offer.

Name .....

Address .....

Town .....

You benefit by mentioning the "Electrical Experimenter" when writing to advertise

www.americanradiohistory.com

Wireless Receiving Ban Raised

MESCO WIRELESS PRACTICE SET



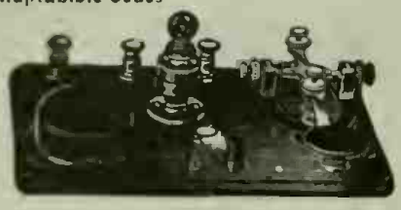
The Practice Set comprises a regular telegraph key, without circuit breaker, a special high pitch buzzer, one red lited Seal Dry Battery, and four feet of green silk covered flexible cord

The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes.

List No. Price
342 Telegraph Practice Set, with Battery and Cord $3.24
Weighs 4 lbs. packed.
Price does not include postage.

MESCO Combination Practice Set for Learning the Morse and Continental Visual and Audible Codes

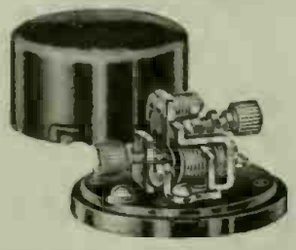
This outfit is the only reliable instrument which will enable students to become proficient operators in the U. S. Naval Service, because it is equipped with a buzzer and miniature lamp enabling the user to master both the visual and audible signals quickly



List No. 52—Practice Set with Red Seal Battery and Cord $4.05

Weighs 4 lbs. packed. Price does not include postage.

MESCO RADIO BUZZER



This buzzer maintains a constant note and is recommended as an exciter for checking wavemeters where pure note and ample energy are required

It consists of practically a closed circuit field of low reluctance, having a steel armature to which is riveted a strap supporting a movable contact. The armature tension is adjustable by means of a screw with a milled head large enough to be easily and permanently adjusted with the fingers. The stationary contact is adjusted by means of a similar screw. The magnet coils are connected in series with a total D. C. resistance of 3.9 ohms. Shunted across these coils is a resistance having a D. C. value of 3 ohms. This shunt eliminates all sparking such as occurs at the break on ordinary radio buzzers and the energy aved thereby is transferred into any oscillating circuit connecten to it, the result being that this buzzer as constructed radiates five times more energy than any other existing type. All connecting wires liable to be broken are eliminated. Contacts are of genuine platinum, which is essential in order to maintain a constant note. The parts are mounted on a Condensate base to insure constancy in operation.

Diameter 2 in., height 1¾ in. The cap is attached to the base by a bayonet joint.

List No. Price
55 Mesco Radio Buzzer $2.05

We carry a Large and Complete Line of Standard Wireless Material Recognized by Experts as such with Competent Experienced Wireless Attendants in Charge

Send for the New Edition of Our Catalog W28

It is pocket size, contains 264 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Wireless Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

Manhattan Electrical Supply Co., Inc.

NEW YORK: 17 Park Place
CHICAGO: 114 S. Wells St.
ST. LOUIS: 1106 Pine St.
San Francisco Office: 604 Mission St.

A New Bulletin of Experimental Radio Apparatus

That embodies the most modern principles of radio engineering and design, backed by the reliability of twelve years experience in the manufacture of Radio Instruments, will be mailed upon request.

CLAPP-EASTHAN COMPANY

143 Main Street Cambridge, Mass.

My Inventions

By Nikola Tesla

(*Continued from page* 173)

same time preventing undue accumulation of the charge at any point. The application of this principle enabled me to produce pressures of 4,000,000 volts, which was about the limit obtainable in my new laboratory at Houston Street, as the discharges extended through a distance of 10 feet. A photograph of this transmitter was published in the *Electrical Review* of November, 1898. In order to advance further along this line I had to go into the open, and in the spring of 1899, having completed preparations for the erection of a wireless plant, I went to Colorado where I remained for more than one year. Here I introduced other improvements and refinements which made it possible to generate currents of any tension that may be desired. Those who are interested will find some information in regard to the experiments I conducted there in my article, "The Problem of Increasing Human Energy" in the *Century Magazine* of June, 1900, to which I have referred on a previous occasion.

The Magnifying Transmitter.

I have been asked by the ELECTRICAL EXPERIMENTER to be quite explicit on this subject so that my young friends among the readers of the magazine will clearly understand the construction and operation of my "Magnifying Transmitter" and the purposes for which it is intended. Well, then, in the first place, it is a *resonant transformer* with a secondary in which the parts, charged to a high potential, are of considerable area and arranged in space along ideal enveloping surfaces of very large radii of curvature, and at proper distances from one another thereby insuring a *small electric surface density everywhere* so that *no leak can occur even if the conductor is bare*. It is suitable for any frequency, from a few to many thousands of cycles per second, and can be used in the production of currents of tremendous volume and moderate pressure, or of smaller amperage and immense electro-motive force. The maximum electric *tension is merely dependent on the curvature of the surfaces* on which the charged elements are situated and the area of the latter.

100 Million Volts Possible.

Judging from my past experience, as much as 100,000,000 volts are perfectly practicable. On the other hand currents of many thousands of amperes may be obtained in the antenna. A plant of but very moderate dimensions is required for such performances. Theoretically, a terminal of less than 90 feet in diameter is sufficient to develop an electro-motive force of that magnitude while for antenna currents of from 2,000-4,000 amperes at the usual frequencies it need not be larger than 30 feet in diameter.

In a more restricted meaning this wireless transmitter is one in which the Hertz-wave radiation is an entirely negligible quantity as compared with the whole energy, under which condition the damping factor is extremely small and an enormous charge is stored in the elevated capacity. Such a circuit may then be excited with impulses of any kind, even of low frequency and it will yield sinusoidal and continuous oscillations like those of an alternator.

Taken in the narrowest significance of the term, however, it is a resonant transformer which, besides possessing these qualities, is accurately proportioned to fit the globe and its electrical constants and properties, by virtue of which design it becomes highly efficient and effective in the

www.americanradiohistory.com

wireless transmission of energy. Distance is then absolutely eliminated, there being *no diminution in the intensity of the transmitted impulses.* It is even possible to make the actions *increase with the distance from the plant* according to an exact mathematical law.

This invention was one of a number comprised in my "World-System" of wireless transmission which I undertook to commercialize on my return to New York in 1900. As to the immediate purposes of my enterprise, they were clearly outlined in a technical statement of that period from which I quote:

"The 'World-System' has resulted from a combination of several original discoveries made by the inventor in the course of long continued research and experimentation. It makes possible not only the instantaneous and precise wireless transmission of any kind of signals, messages or characters, to all parts of the world, but also the inter-connection of the existing telegraph, telephone, and other signal stations without any change in their present equipment. By its means, for instance, a telephone subscriber here may call up and talk to any other subscriber on the Globe. An inexpensive receiver, not bigger than a watch, will enable him to listen anywhere, on land or sea, to a speech delivered or music played in some other place, however distant. These examples are cited merely to give an idea of the possibilities of this great scientific advance, which annihilates distance and makes that perfect natural conductor, the Earth, available for all the innumerable purposes which human ingenuity has found for a line-wire. One far-reaching result of this is that any device capable of being operated thru one or more wires (at a distance obviously restricted) can likewise be actuated, without artificial conductors and with the same facility and accuracy, at distances to which there are no limits other than those imposed by the physical dimensions of the Globe. Thus, not only will entirely new fields for commercial exploitation be opened up by this ideal method of transmission but the old ones vastly extended.

"The 'World-System' is based on the application of the following important inventions and discoveries:

"1. *The 'Tesla Transformer.'* This apparatus is in the production of electrical vibrations as revolutionary as gunpowder was in warfare. Currents many times stronger than any ever generated in the usual ways, and sparks over one hundred feet long, have been produced by the inventor with an instrument of this kind.

"2. *The 'Magnifying Transmitter.'* This is Tesla's best invention—a peculiar transformer specially adapted to excite the Earth, which is in the transmission of electrical energy what the telescope is in astronomical observation. By the use of this marvelous device he has already set up electrical movements of greater intensity than those of lightning and passed a current, sufficient to light more than two hundred incandescent lamps, around the Globe.

"3. *The 'Tesla Wireless System.'* This system comprises a number of improvements and is the only means known for transmitting economically electrical energy to a distance without wires. Careful tests and measurements in connection with an experimental station of great activity, erected by the inventor in Colorado, have demonstrated that power in any desired amount can be conveyed, clear across the Globe if necessary, with a loss not exceeding a few per cent.

"4. *The 'Art of Individualization.'* This invention of Tesla is to primitive 'tuning' what refined language is to unarticulated expression. It makes possible the transmission of signals or messages absolutely secret and exclusive both in the active and passive aspect, that is, non-interfering as well as non-interferable. Each signal is like an individual of unmistakable identity and there is virtually no limit to the number of stations or instruments which can be simultaneously operated without the slightest mutual disturbance.

"5. *The terrestial Stationary Waves.*" This wonderful discovery, popularly explained, means that the Earth is responsive to electrical vibrations of definite pitch just as a tuning fork to certain waves of sound. These particular electrical vibrations, capable of powerfully exciting the Globe, lend themselves to innumerable uses of great importance commercially and in many other respects.

"The first 'World-System' power plant can be put in operation in nine months. With this power plant it will be practicable to attain electrical activities up to ten million horsepower and it is designed to serve for as many technical achievements as are possible without due expense. Among these the following may be mentioned:

"(1) The inter-connection of the existing telegraph exchanges or offices all over the world;

"(2) The establishment of a secret and non-interferable government telegraph service;

"(3) The inter-connection of all the present telephone exchanges or offices on the Globe;

"(4) The universal distribution of general news, by telegraph or telephone, in connection with the Press;

"(5) The establishment of such a 'World-System' of intelligence transmission for exclusive private use;

"(6) The inter-connection and operation of all stock tickers of the world;

$15,000.00
COMPLETE WIRELESS OUTFIT
For Sale

General Description

15 KVA Motor Generator set. Motor is 440 volt, 120 cycle, 4000 R P M type, built to stand heavy overloads for indefinite lengths of time. Generator same specifications. Set is No. 3 phase, complete with all controls, starters, meters, etc.

Three transformers. Discharger of Rotary Type, condenser, etc.

Induction transformer of sufficient size to be used on any wave length up to 2000 meters with a 650 foot antennae.

Capacity of apparatus without extending:—

800 miles at day.
2800 miles at night.

Installed at a cost of over $15,000.00

The equipment comprising this outfit was the very highest type that could be bought; it is complete—ready to erect and operate without the purchase of other apparatus. Was in daily use when ordered sealed for the duration of the war. The outfit has been completely overhauled and is guaranteed to be in first class operating condition.

For further information, price, etc., address

Box 100, care of Electrical Experimenter

YOU can BUILD this PHONOGRAPH easily!
TREMENDOUS SAVING IN COST



You don't need to be a cabinet maker. We have made it an easy and a pleasant job with

Our Simplified Plans

We furnish blue prints, diagrams, motor, and all metal parts complete. You build the cabinet and assemble. A few hours' work, and you will have as fine a type of phonograph as any produced, and at a price away below what you would pay in a store.

Keep the Savings in Your Pocket

Your machine will play all records, will have a wonderful tonal quality, excelled by none. No need now for any family to be without a phonograph because of the cost. THE MAKAFONE solves the problem. BUILD IT YOURSELF AT LESS THAN ONE-FOURTH REGULAR COST, but equal to the high priced cabinet machines. Free Records with each outfit. SEND TODAY FOR FREE CATALOG and full particulars of our wonderful offer. *Many a manufacturer got his start in this way. Why not you? Build machines and sell to your friends. Ask us about this.*

AGENTS ATTENTION

You can make and sell this machine from our plans at a profit of $50 to $75 each. Others are selling two and three a week. Here is your opportunity to make big money and become independent. Pleasant and profitable work. START TODAY.

MODERN PHONOGRAPH SUPPLY CO.
104 Springer Bldg., 313 So. Clinton St., Chicago, Ill.

WRITE TODAY!

MODERN PHONOGRAPH SUPPLY CO.
104 Springer Bldg., 313 So. Clinton St., Chicago, Ill.

Gentlemen: Please send me full particulars of your Makafone proposition, without obligation to me.

Name .....
Street Address .....
City or Town .....

Boys! You Can Make Your Own Electrical Apparatus with the aid of these wonderful books

Home-made Electrical Apparatus

By A. M. Powell



Three wonderful big books, chuck full of just the sort of information you have been looking for and at a price within reach of your pocket book. Each volume is printed on heavy paper, contains 75 pages and over 60 illustrations, complete working drawings for making every sort of electrical apparatus. Written so you can understand them. The price is only 25 cents per copy—practically the cost of publication. See partial table of contents below and order now. The supply is limited.

Vol. I Contains *working drawings* and directions for making all sorts of Static Machines, Static Apparatus, Home-made Batteries, Storage Cells, Transformers, Rectifiers, etc.

Vol. II contains *working drawings* and directions for all sorts of Voltmeters, Ammeters, Galvanometers, Switches, Rheostats, Telegraph Keys, Sounders, Telephones, Shocking Coils, Spark Coils, Experiments, etc., etc.

Vol. III contains *working drawings* and directions for making all sorts of Dynamos, Motors, Electric Engines, Miniature Lighting Plants, Wireless Telegraph Apparatus, Tesla Coils, Wireless Telephone, Electroplating, Experiments, etc., etc.

Any of these wonderful books will be sent to you *postpaid* for 25 cents.

COLE & MORGAN, Inc., *Publishers and Booksellers*
P. O. Box 473, C. H. Sta., New York City

INDEX to ELECTRICAL EXPERIMENTER SCIENCE & INVENTION

For Vol. 1, 2, 3, 4, 5
15c
EXPERIMENTER PUBL. CO.
Book Dept. 231 Fulton St., N.Y.

www.americanradiohistory.com



DUCK'S BIG 300 PP. Wireless & Electrical

Catalog is now as it always has been, the largest and most complete and dependable Wireless Catalog published. Mailed for 12c in stamps or coin which may be deducted on first order of one dollar. Catalog not sent otherwise. This catalog costs us twice the price of other catalogs.

Everything in wireless *worth while* is listed in this catalog. The experienced amateur will tell you to see our catalog before buying. You are thereby insured against an unwise purchase. It is the *Beacon Light* to guide you right in the selection of your wireless apparatus. No bigger or better values are obtainable elsewhere. Send for revised price list. It is yours for the asking.

THE WILLIAM B. DUCK CO., 230-232 Superior St., Toledo, Ohio

RADIO BULLETIN

The great impetus given to radio development during the war is fully symbolized by our new line of high grade radio apparatus. Electrically and mechanically modern and distinctive.

Send for free bulletin

A. H. GREBE & COMPANY

RICHMOND HILL NEW YORK



"BUNNELL" Goods are ALWAYS RELIABLE

Send for our Wireless Manual No. 40 E. *JUST OUT*

The JOVE Is the Best, Cheapest and Most Reliable Detector. Sample by mail for $1.44.

Our Condensers, Transformers, Head Sets, etc., are the acknowledged standard of High Grade Radio Apparatus.

J. H. BUNNELL & Co., Inc., 32 Park Place, New York

→ Radio Amateurs ←

Write us today for a Free Copy of our New Bulletin of latest Radio Apparatus. We handle the products of fifty-three manufacturers of Radio Supplies and can take your order for any piece of Wireless Apparatus on the amateur market. Buying your radio apparatus through us will be as much to your benefit as to our profit. One order and one stamp will cover your entire needs.

Take Advantage of Our Free Information Department

where our Radio Expert is at your service.

Our Bulletins are now ready for Free distribution and supplements will be issued at frequent intervals. A postcard will bring you our Latest Bulletin and put your name on our Mailing List.

NATIONAL RADIO SUPPLY CO.

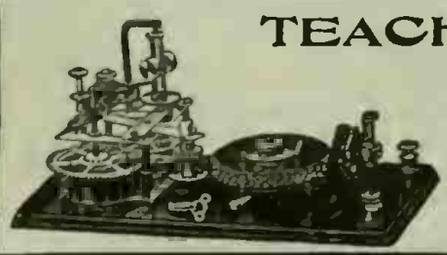
Dept. 100, 1405 U Street :: Washington, D. C.

"THERE'S MONEY IN IT"

LEARN TELEGRAPHY AT HOME AT HOME

MORSE AND WIRELESS

TEACH YOURSELF



In half the usual time, at trifling cost, with the wonderful Automatic Transmitter. THE OMNIGRAPH. Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would.

Adopted by U. S. Gov't. 4 styles. Catalogue free.

OMNIGRAPH MFG. CO.

39L Cortlandt St. New York

"(7) The establishment of a 'World-System' of musical distribution, etc.;

"(8) The universal registration of time by cheap clocks indicating the hour with astronomical precision and requiring no attention whatever;

"(9) The world transmission of typed or hand-written characters, letters, checks, etc.;

"(10) The establishment of a universal marine service enabling the navigators of all ships to steer perfectly without compass, to determine the exact location, hour and speed, to prevent collisions and disasters, etc.;

"(11) The inauguration of a system of world-printing on land and sea;

"(12) The world reproduction of photographic pictures and all kinds of drawings or records."

I also proposed to make demonstrations in the wireless transmission of power on a small scale but sufficient to carry conviction. Besides these I referred to other and incomparably more important applications of my discoveries which will be disclosed at some future date.

A plant was built on Long Island with a tower 187 feet high, having a spherical terminal about 68 feet in diameter. These dimensions were adequate for the transmission of virtually any amount of energy. Originally only from 200 to 300 K.W. were provided but I intended to employ later several thousand horsepower. The transmitter was to emit a wave-complex of special characteristics and I had devised a unique method of telephonic control of any amount of energy.

The tower was destroyed two years ago but my projects are being developed and another one, improved in some features, will be constructed. On this occasion I would contradict the widely circulated report that the structure was demolished by the Government which owing to war conditions, might have created prejudice in the minds of those who may not know that the papers, which thirty years ago conferred upon me the honor of American citizenship, are always kept in a safe, while my orders, diplomas, degrees, gold medals and other distinctions are packed away in old trunks. If this report had a foundation I would have been refunded a large sum of money which I expended in the construction of the tower. On the contrary it was in the interest of the Government to preserve it, particularly as it would have made possible—to mention just one valuable result—the location of a submarine in any part of the world. My plant, services, and all my improvements have always been at the disposal of the officials and ever since the outbreak of the European conflict I have been working at a sacrifice on several inventions of mine relating to aerial navigation, ship propulsion and wireless transmission which are of the greatest importance to the country. Those who are well informed know that my ideas have revolutionized the industries of the United States and I am not aware that there lives an inventor who has been, in this respect, as fortunate as myself especially as regards the use of his improvements in the war. I have refrained from publicly expressing myself on this subject before as it seemed improper to dwell on personal matters while all the world was in dire trouble. I would add further, in view of various rumors which have reached me, that Mr. J. Pierpont Morgan did not interest himself with me in a business way but in the same large spirit in which he has assisted many other pioneers. He carried out his generous promise to the letter and it would have been most unreasonable to expect from him anything more. He had the highest regard for my attainments and gave me every evidence of his complete faith in my ability to ultimately achieve what I had set out to do. I am unwilling to accord to some small-minded and jealous individuals the satisfaction of having thwarted my efforts. These men are to me nothing more than microbes of a nasty disease. My project was retarded by laws of nature. The world was not prepared for it. It was too far ahead of time. But the same laws will prevail in the end and make it a triumphal success.

www.americanradiohistory.com

Experimenters—KNOBS
BASES — INSULATION



Fine black composition base suitable for detector, fixed condenser, etc. The bottom has a cavity 3" x 1½" x ⅜". Over all dimensions 4¼" x 2" x ½". Two holes for binding posts and two for fastening down to table. Post paid.....30c



Knob 1¼ x ¾
Hole through center for mounting.
Post paid 20c



Knob 11/16 x 21/32
With 8/32 brass threaded bushing.
Post paid 20c
Contact points, switch levers, condenser plating, etc.

Bakelite panels, about
9 x 19 x ¼ Black XX.....$4.00
19 x 19 x ¼ Black XX..... 8.00
9 x 19 x 3/16 Black XX..... 3.00
19 x 19 x 3/16 Black XX..... 6.00

A. H. CORWIN & CO.
924 Kinney Building Newark, N. J.

PREPARED!

The lifting of the wireless ban finds the Newman-Stern Co. fully prepared to meet the increased needs of its customers.

Tremendous stocks of apparatus, wires and raw materials, accumulated and reserved for the day when amateur wireless would be resumed, now assure our customers IMMEDIATE Service.

Ninety-nine of every hundred orders will be shipped within twenty-four (24) hours following their receipt.

Present prices are in accordance with price-change schedule effective Feb. 20, 1919, applying to Catalog C-3.

Present prices on any item listed in Catalog B-2 (Handy-Book) will be quoted on request.

The Newman-Stern Co
CLEVELAND, OHIO



CHEMICALS for THE EXPERIMENTER

DON'T PAY FANCY PRICES for chemicals. Buy highest quality for lowest price. Our unique system of standardization guarantees you at all times the most for your money. Send today for interesting free booklet describing the money-saving, value-giving, N-S plan and listing hundreds of chemicals, chemical glass ware, and apparatus.

Send today for FREE Catalogue

THIS RELIABLE MAIL ORDER HOUSE

N-S Co

THE NEWMAN-STERN CO
Department E E CLEVELAND, O.

The Newman-Stern System

Not Toys But Real Apparatus

the same as used by all operating companies. You had better send us your order immediately to insure prompt delivery, as this equipment will not last long at these prices.

110 Volt Hand Generators....	3 bars. each	$3.00
	4 bars. each	4.00
	5 or 6 bars. each	5.00
Telephone transmitters with arms, each..		.75
Good ringers complete with bells, each....		.50
Telephone receivers, each.....		.75
Condensers, ½ to 2 M.F., each.....		.50
Induction coils, each.....		.50
Relays, each		1.50
Repeating coils, each.....		2.00
Real complete C.B. wall type telephone...		4.50
Slightly used dry cells, per dozen.....		1.25

Please send money-order or cash with your order

ELECTRICAL SPECIALTY COMPANY
Dept. E, 48-50 So. Front St., Columbus, Ohio
Dept. E, 128 So. 11th St., Philadelphia, Pa.

Tesla Bulbs

(*Continued from page 134*)

scription of the phenomenon, as seen in a bulb without conducting electrode. It is observed under the following conditions:

"When the globe L (Figs. 1 and 2) is exhausted to a very high degree, generally the bulb is not excited upon connecting the wire *w* (Fig. 1), or the tinfoil coating of the bulb (Fig. 2) to the terminal of the induction coil. To excite it, it is usually sufficient to grasp the globe L with the hand. An intense phosphorescence then spreads at first over the globe, but soon gives place to *a white, misty light.* Shortly afterward one may notice that the luminosity is unevenly distributed in the globe, and after passing the current for some time the bulb appears as in Fig. 4. From this stage the phenomenon will gradually pass to that indicated in Fig. 5, after some minutes, hours, days or weeks, according as the bulb is worked. Warming the bulb or increasing the potential hastens the transit.

"When the brush assumes the form indicated in Fig. 5, it may be brought to a state of *extreme sensitiveness to electrostatic and magnetic influence.* The bulb hanging straight down from a wire, and all objects being remote from it, *the approach of the observer at a few paces from the bulb will cause the brush to fly to the opposite side, and if he walks around the bulb it will always keep on the opposite side.* It may begin to spin around the terminal long before it reaches the sensitive stage. *When it begins to turn around, principally, but also before, it is affected by a magnet,* and at a certain stage it is susceptible to magnetic influence to an astonishing degree. A small permanent magnet, with its poles at a distance of no more than two centimeters, will affect it visibly at a distance of two meters, slowing down or accelerating the rotation according to how it is held relatively to the brush. I think I have observed that at the stage when it is most sensitive to magnetic, it is not most sensitive to electrostatic, influence.

"When the bulb hangs with the globe L down, the rotation is always clockwise. In the southern hemisphere it would occur in the opposite direction, and on the equator the brush should not turn at all. The rotation may be reversed by a magnet kept at some distance. The brush rotates best, seemingly, when it is at right angles to the lines of force of the earth. It very likely rotates, when at its maximum speed, in synchronism with the alternations, say, 10,000 times a second. The rotation can be slowed down or accelerated by the approach or receding of the observer, or any conducting body, but it cannot be reversed by putting the bulb in any position. When it is in the state of the highest sensitiveness and the potential or frequency be varied, the sensitiveness is rapidly diminished. Changing either of these but little will generally stop the rotation. The sensitiveness is likewise affected by the variations of temperature. To attain great sensitiveness it is necessary to have the small sphere *s* in the center of the globe *L*, as otherwise the electrostatic action of the glass of the globe will tend to stop the rotation. The sphere *s* should be small and of uniform thickness; any dissymmetry of course has the effect to diminish the sensitiveness.

"The fact that the brush rotates in a definite direction in a permanent magnetic field seems to show that in alternating currents of very high frequency the positive and negative impulses are *not* equal, but that one always preponderates over the other.

"Of course, this rotation in one direction may be due to the action of the two elements of the same current upon each other, or to the action of the field produced by one of the elements upon the other, as in a



HB 16-Battery Charging Set

CHARGING AUTO BATTERIES
will Pay $150 to $250
Clear Profit Every Month

All you need is HB Equipment. The business is waiting for you—*right now.* More cars are being driven than ever before, with batteries to recharge, and all new Fords are equipped with storage battery. Start NOW to get these big steady profits.

This HB 16-Battery Charger Can Be The Biggest Money-Maker In Your Garage

Recharge 1 to 16-volt batteries or equivalent in 12- or 24-volt batteries at once. Current cost 12 to 15c each. Owner pays 75c to $1.50. Figure those profits. Compare them with other branches of your business! HB Chargers last for years—sturdy, economical, dependable. Finest materials and construction. Long service with *quick, clean, permanent profits.*

$57 Puts This Money-Maker in Your Garage on Money-Back Guarantee

Balance in 10 monthly payments of $23 each. Earnings pay for machine. No electrical knowledge necessary to install or operate. Uses 2 or 3 phase city current. Furnished complete with 2 charging panels capable of charging 1 to 8 batteries each. No burn-outs or expensive renewals. Nothing to wear out or break. Sold on HB Absolute Money-Back Guarantee. Order now—you run no risk. Pin your $57 Check to this ad and mail *today* for trial order.

Hobart Brothers Company, Box 6E, Troy, Ohio
Successful Manufacturers Since 1893.

Commercial
Telegraph Apparatus
Bargains

Standard twenty ohm Telegraph Sounders at $2.00 each

Standard Telegraph Keys at 1.25 each

110 Volt A.C. Dynamos

Three Bar..... 1.75 each
Four Bar..... 2.25 each
Five Bar..... 2.75 each

For other bargains see pages 90 & 91

Skinderviken Telephone Equipment Co.
Abbreviated Address
STECO-2118-2136 N. Clark St. CHICAGO

Send To-day for the
"Electrical Worker's Friend"

An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting A.C. motors. Special at $3.50
Or write for full particulars of this valuable book.

SMITH & SMITH PUBLISHING CO.
1524 LOWRIE ST., N.S., PITTSBURGH, PA.

www.americanradiohistory.com

110-V. TRANSFORMERS

8 Volt Secondary



Consumes so little current will not move ordinary meter.

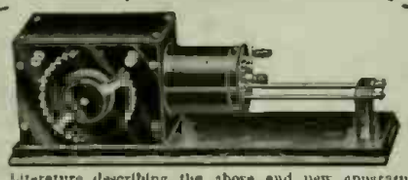
$1.00 Postpaid

Only $1.00

No. 10 gives 3 currents — 6, 12 and 18 volts secondary. Ideal for experimental work. A standard transformer, guaranteed. Complete with plug, $2.00 postpaid. Order from this ad.

NATIONAL TRANSFORMER CO.,
Dept. 13, 3124 No. California Ave., Chicago

Arnold Navy Model Loose Couple



Literature describing the above and new apparatus is now ready. Also shows the line of accessories so much desired by the amateur.

My knobs are of real hard rubber; switch points, binding posts, etc., are perfect, polished and plated.

SPECIAL

Round Dials for Condensers, Variometers, etc., made of hard rubber, the handsomest thing you can put on your set. Send 3c stamp for Bulletin.

J. F. ARNOLD
2082 Lexington Ave. Near 125th St., N. Y.
Established 1910

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 180 Big Pages, 500 illustrations, 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy." 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons, FREE Cyclopedia No. 20 measures 7¾x5¼". Weight ½ lb. Beautiful stiff covers.

WIRELESS

Send 6 cents in stamps or coin for which we will send our latest Cyclopedia Catalog No. 20 as described.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

TELEGRAPHY

Both wire and wireless, and Station Agency taught thoroughly and quickly. BIG WAGES NOW PAID. some of our recent graduates procuring $138.00 per month to start. Great opportunities for advancement. Our school the oldest and largest—annual enrollment 600 students. Endorsed by railway, telegraph, wireless and government officials. Expenses low—chance to earn part. Catalog free. Write.

DODGE' INSTITUTE, 22nd St. Valparaiso, Ind.

WIRELESS IS SIMPLE

when the Summers' theories of wireless are applied to wireless systems, transmitting and receiving apparatus. Will advance the wireless art by leaps and bounds. Get on the right track with your experiments. This booklet should be in every home and school. United States and foreign copyrights. Price $2.00 registered postpaid to any part of the world.

Address FRANK E. SUMMERS, Memphis, Mo.

TELEGRAPHY AND RADIO

DAY AND EVENING CLASSES
SEND FOR PROSPECTUS
IN SUBJECT INTERESTED

EASTERN RADIO INSTITUTE
899-B Boylston St. Boston, Mass.

FRENCH WIRELESS



FROG made of steel with large clicker inside, used to learn telegraphy. GREAT FUN. SEND YOUR FRIENDS WIRELESS MESSAGES. SENT complete with code, and to make a big bundle we will send a Ford joke book, Parlor games, etc. all for 10c 10c

Dept. 72, American Toy Co., Lowell, Mass., U.S.A.

series motor, without necessarily one impulse being stronger than the other. The fact that the brush turns, as far as I could observe, in any position, would account for this theory. In such case it would turn at any point of the earth's surface. But, on the other hand, it is then hard to explain why a permanent magnet should reverse the rotation, and one must assume the preponderance of impulses of one kind.

"As to the causes of the formation of the brush or stream, I think it is due to the electrostatic action of the globe and the dissymmetry of the parts. If the small bulb *s* and the globe L were perfect concentric spheres, and the glass thruout of the same thickness and quality, I think the brush would not form, as the tendency to pass would be equal on all sides. That the formation of the stream is due to an irregularity is apparent from the fact that it has the tendency to remain in one position, and rotation occurs most generally only when it is brought out of this position by electrostatic or magnetic influence. When in an extremely sensitive state it rests in one position, and most curious experiments may be performed with it. For instance, the experimenter may, by selecting a proper position, approach the hand at a certain considerable distance to the bulb, and he may cause the brush to pass off by merely stiffening the muscles of the arm. When it begins to rotate slowly, and the hands are held at a proper distance, it is impossible to make even the slightest motion without producing a visible effect upon the brush. A metal plate connected to the other terminal of the coil affects it at a great distance, slowing down the rotation often to one turn a second.

"I am firmly convinced that such a brush, when we learn how to produce it properly, will prove a valuable aid in the investigation of the nature of the forces acting in an electrostatic or magnetic field. If there is any motion which is measurable going on in the space, such a brush ought to reveal it. It is, so to speak, a beam of light—frictionless, devoid of inertia.

"I think that it may find practical applications in telegraphy. With such a brush it would be possible to send dispatches across the Atlantic, for instance, with any speed, since its sensitiveness may be so great that the slightest changes will affect it. If it were possible to make the stream more intense and very narrow, its deflections could be easily photographed.

"I have been interested to find whether there is a rotation of the stream itself, or whether there is simply a stress traveling around the bulb. For this purpose I mounted a light mica fan so that its vanes were in the path of the brush. If the stream itself was rotating the fan would be spun around. I could produce no distinct rotation of the fan, altho I tried the experiment repeatedly; but as the fan exerted a noticeable influence on the stream, and the apparent rotation of the latter was, in this case, never quite satisfactory, the experiment did not appear to be conclusive.

"I have been unable to produce the phenomenon with the disruptive discharge coil, altho every other form of these phenomena can be well produced by it—many, in fact, much better than with coils operated from an alternator.

"It may be possible to produce the brush by impulses of one direction, or even by a steady potential, in which case it would be still more sensitive to magnetic influence."

Fig. 6 shows a practical application of the Tesla bulb. The bulb itself, as will be seen, is excited by means of a Tesla high frequency alternator which, in turn, is connected to the primary of a transformer. The secondary of the transformer is grounded at one end, while the other end of the transformer connects with the Tesla bulb.

Dr. Tesla, in an interview, stated that

(*Continued on page* 184)

USE HB BALL BEARING ELECTRIC MOTORS

HB Electrical Motors Save Power—Get Ball Bearing equipped HB Motors, as they save you a substantial sum each month on your power bills. Absolutely they are trouble-proof, economical, amply designed, just right for your requirements—one to 15 h.p. They substantially lower your power costs. Easy to install and operate. Require practically no attention.



$20.00 gives you an HB Ball Bearing Motor. The balance on easy terms. Suits your requirements. Let our engineering department advise you. Send in your problems. State kind of machinery you wish to run and type of current available. We can also furnish Battery Charging Outfits, Lighting Generators, etc. Pin this ad to your letterhead and mail for further information today.

HOBART BROTHERS COMPANY
Box 6E Troy, Ohio
Successful Manufacturers Since 1893



SMALL ENGINES

Perfected Gasoline Engines—½, 1 and 1½ h. p.—for Farm and Shop use. Price, $27.50 and up. Also,

WASHING MACHINES

We ship on trial. Send for Booklet and Special Offer.

SIEVERKROPP ENGINE CO.
1401—19th St., Racine, Wis.

STARTER for FORD CARS

Yankee Wireless 50¢

The only dependable wireless set at a low price. It is not a toy and with little practice you can send and receive clear messages anywhere as quick as a flash

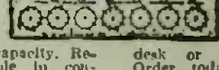


THE YANKEE

is for two complete stations—with Morse code and instructions for operating. We will also include our picture code attachment, which will enable the operator to send and receive pictures and photographs by wireless. The complete Yankee Wireless set can be obtained only from us. All charges paid for 50c money order

A. & B. MFG. CO., 1363 Peoria St., Chicago, Ill.

DOLLAR ADDING MACHINE $1



Adds and multiplies with speed of expensive machines. Seven columns capacity. Remarkably simple in construction. Nothing to get out of order. Weight one ounce. Made of metal and celluloid. The ideal pocket, desk or home machine. Order today. The best way not to forget is to do it now.

L. J. LEISHMAN CO., Dept. 142, Ogden, Utah

MARKO

STORAGE BATTERIES
ARE GOOD—TRY ONE

Paul M. Marko & Co., Inc.
1402-1412 Atlantic Ave.
Brooklyn, N. Y.

SELENIUM CELLS

Guaranteed 99% pure selenium

Made by people who know their business, for the most difficult work, requiring very sensitive, quick acting cells.

Special cells to order.

THE SELENIUM LABORATORIES.
New York Offices, 56 West 45th St.

WIRELESS BOOKS

Send for Catalogue

BUY NOW and Save a Dollar

PRACTICAL WIRELESS TELEGRAPHY
By E. E. Bucher
and THE WIRELESS AGE for one year.
$2.75. *Regular price, $3.75.*

WIRELESS PRESS, INC., 33 ELM ST., NEW YORK.



"BOW LEGS and KNOCK-KNEES" UNSIGHTLY

Send for booklet showing photos of men with and without THE PERFECT LEG FORMS.

PERFECT SALES CO.
140 N. Mayfield Ave., Dept. 50 Chicago, Ill.





INSYDE TYRES Inner Armor for Auto Tires. Double mileage, prevent blowouts and punctures. Easily applied to any tire. Thousands sold. Details free. Agents wanted. Amer. Accessories Co., Dept. 53, Cincinnati

ADVERTISING PAYS

It pays the man who advertises and it pays the man who answers ads. For advertising rates in the E. E., address

Advertising Dept., 233 Fulton St., N. Y.

www.americanradiohistory.com

The Buying Power of a Dollar

When we first launched the four-numbers-for-a-dollar special offer it did just what we expected it to do—proved that readers value

The PHOTO-PLAY WORLD

sufficiently to renew their subscriptions at the regular price—$3.50 a year.

If you are not a regular subscriber a dollar will bring you the next four numbers—just to get acquainted. Add 25 cents in Canada.

DOWNS PUBLISHING COMPANY
Bulletin Building Philadelphia, Pa.

LEARN WATCH REPAIRING



You can learn by our modern and original system of instruction every part of the Watch Repairing Trade at home as good or better than at a shop. You can earn money while learning and secure a well paying position or start in business after completing our course of instruction. Good watch repairers are always in demand and earn from $20 to $35 per week. For particulars apply to the

Milwaukee School of Watchmaking 166 Mason St., Milwaukee, Wis.

MUSIC TAUGHT FREE



In Your Home. Write today for our booklet. It tells how to learn to play Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced pupils. American School of Music, 57 Lakeside Bldg., Chicago

"Hang Your Own Lighting Fixtures"

One Light Bracket $1.05—4 Light Shower $6.15 Semi-Bowls $5.85—Plate & Ball 85c, complete with glassware. Wired. Fine finishes. Send for Photos complete line.

ERIE FIXTURE SUPPLY CO.
Sta. C., Erie, Pa.

Combination [A. C. and D. C.

Eight Inch DESK FAN



detachable plug and 8 ft. of cord. Will operate on A.C. or D.C. current. 100 to 125 volts. 30 to 60 cycles; weight 10 lbs.; black enamel finish; height 11½ in. A real fan—not a toy. Price $6.50. Agents wanted.

THE TEWNO CO.
150 Chambers St., New York

Learn in 6 Evenings



SHORTHAND Simplified
Learn Easily at Home

Practical *K. I. Shorthand;* quickly learned. You attain speed easily. Great saving in time and expense. Guarantee and *10 days' trial* given. Home study. Many endorsements. Used in Government service, in corporations, schools, professional and business offices, private use, etc. Brochure and specimen lesson *FREE.*

"Talk as fast as you like, I am taking it down in K. I. Shorthand."

KING INSTITUTE, ED-300, Station F, New York, N. Y.

Feldman's "Geyser" Electric Water Heater

Instantaneous Hot Water

FELDMAN MFG. CO.
1500 Times Bldg. New York City

"SEXUAL DISASTERS"
which actually happened. Written by one who knows. Does not hint at anything, but says what it means in plain language. Not sold in book-stores. Sent immediately, in plain wrapper, for $2.00. Monongahela Novelty Co., Box B-565, Monongahela, Pa.

How to Finance and Manufacture a Patent

(Continued from page 167)

ers in reference to handling and pushing our goods, when ready for the market (using models of our invention for demonstration) and secured several substantial orders for future delivery. We also consulted an advertising agency about the future advertising of our product.

When the machinery for our little factory was completed we were ready for operation. After a few test runs, everything moved smoothly. In a short time, our factory was busily engaged filling the orders we had secured before starting. Before many months our sales began to mount into large proportions. The public were demanding more and more of our product. Business men began to get interested in our invention and its success. They began to uncover idle money they did not possess when I first asked for their backing. Several offers to buy us out were made from time to time, which we declined. One day the head of a supply company where we obtained the material for making our finished product made us a very attractive offer which we accepted. He knew of our profits better than any one except ourselves. This business man, my partner, not only received his investment, but a handsome profit besides; and I received more money for my patent than would have been possible had I sold it for "Whatever I could get," as my good friends advised.

In conclusion, I wish to suggest the following: If your invention has merit, is a public benefit or necessity, or an attractive novelty, do not sell out for "Whatever you can get," unless it is mighty good. If it is worth your best efforts to originate and perfect, it is also worth further efforts to raise the capital to manufacture it yourself. You might as well receive its full value instead of allowing some one else to do so. However, if you are forced to sell, and feel you cannot command the ability and persistence required to finance it yourself—don't be too anxious to close the deal. Don't accept the first offer made you. Of course, you should not turn it down entirely, consider them all, then decide and you will be sure of getting a fair price.

If your invention is a good one, and investors want it bad enough, they will keep after you until you sell. Fame and fortune come to Inventors who work hard while they are waiting.

RADIOPHONE BETWEEN STORES.

A prominent electrical and radio manufacturing concern of New York City will install, as soon as the ban on sending is lifted, a complete Radio Telephone System between their factory and several branch stores, so as to relieve a greater portion of the land telephone traffic between these units of the organization.

PERPETUAL MOTION?

What promises to be the world's greatest invention, according to a modest inventor hailing from Jersey City, is the "harnessing of gravity" to run a perpetual motion power plant of millions of horsepower, supplying us forever and ever (??) with light, heat and power almost free. ! ! ! In the near future, he expects to give his invention a "showing," and bring it into the light, till then—"We're from Missouri," he'll have to show us. So, beware! fellow experimenters and line your pockets with fish hooks—for Ssh! The inventor has distributed illustrated stock-selling brochures by the millions to get the billions he needs in order to wish this marvelous invention on a long suffering and struggling public.



Men Wanted for Airplane INDUSTRY

Wonderful opportunities—great scope for advancement—and big pay—await you in the airplane industry. This does not mean actual flying, but in any and all of the various branches of the industry. It is the coming profession—the future means of transportation. U. S. Mail is already being carried by airplanes. Factories are springing up everywhere and trained men are in big demand.

Openings in Many Branches You can get into this profession while it is still in its infancy as a mechanic, engineer, repairman, instructor, inspector, builder, contractor, salesman or professional aviator. The minute you understand the science and mechanics of aviation you can step into a high-salaried position.



We Guarantee Our Training

We absolutely and unreservedly guarantee that our Home Training Course will enable you to qualify for a good position as soon as you graduate. The Course itself has been written by noted aeronautical engineers, and covers the entire fundamentals of practical aeronautics. Every lesson is written and illustrated so clearly that you cannot fail to understand it. But see for yourself. Take ten lessons. Then if you are not satisfied you are not out one cent. We guarantee satisfaction.

Prepare Now for a Big Future

Only by specialized instruction can you expect to succeed in aviation or in any line of business. Training alone will fit you for a big job—and NOW is the time to begin. Check and mail the coupon for Big Free Bulletin and Money-Back Guarantee.

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. A F-26 CHICAGO, U. S. A.

TRAINING THE KEY TO SUCCESS

Please send Free Bulletin and explain how I can qualify for the position checked.

....High School Graduate	....Lawyer
....Electrical Engineer	....Business Manager
....Elec. Light & Power Supt.	....Certified Pub. Accountant
....Hydroelectric Engineer	....Accountant and Auditor
....Telephone Engineer	....Bookkeeper
....Telegraph Engineer	....Stenographer
....Wireless Operator	....Fire Insurance Expert
....Architect	....Sanitary Engineer
....Building Contractor	....Master Plumber
....Civil Engineer	....Heating & Vent. Engineer
....Structural Engineer	....Automobile Engineer
....Mechanical Engineer	....Automobile Repairman
....Shop Superintendent	....Airplane Mechanic
....Steam Engineer	....General Education Course
....Draftsman and Designer	....Common School Branches

Name .....

Address .....



WANTED — Railway Mail Clerks

Men-Boys 18 to 35
$1100 to $2000 Year
Common Education Sufficient
Sure pay.
Life job.
Pull unnecessary.

Franklin Institute
Dept. F101
Rochester, N. Y.

COUPON

Sirs: Send me, without charge, (1) sample Railway Mail Clerk Examination questions; (2) schedule showing places of all U. S. Government coming examinations; (3) list of other government jobs now open, and (4) free book describing them.

NAME .....

ADDRESS .....

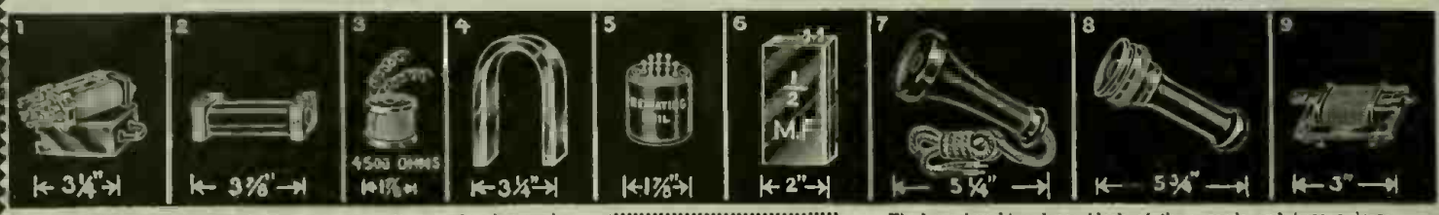
WRITE THE WORDS FOR A SONG

We write music, guarantee publisher's acceptance. Submit poems on patriotism, love or any subject.

CHESTER MUSIC COMPANY
920 S. Michigan Ave., Room 313 Chicago, Illinois

www.americanradiohistory.com

FOR EXPERIMENTERS ONLY!!



WE have in the past held many extraordinary sales, but we believe that the present one eclipses all by the wonderful values we are offering. The goods which we offer on this page are all standard telephone apparatus. Every piece we are offering is equipment that for one reason or another was discontinued by the telephone companies. If you wanted to buy any of the pieces which we offer herewith, from the manufacturers, the price would at least be ten times what we are asking for it. You can readily ascertain this for yourself by looking over our wonderful prices.

RUSH

Cut out and attach to your order. It will leave us within 24 Hours.

We have bought a large block of these goods and have a large quantity of every item on hand. Immediate shipment can be made on all of the goods in practically any quantity within reason. *Shipment within twenty-four hours* will be made if you use the adjoining coupon. This coupon saves you several days and your order will then be considered a rush order. We guarantee every piece to be as represented, and we will refund the money if goods are not exactly as claimed by us.

No. 1 TELEPHONE RELAY, 1500 ohms—has two silver-contact springs and is very sensitive. Can be used wherever a sensitive relay is needed. It is adjustable and can be used for a variety of purposes.
No. 1 Relay—shipping weight, 2 lbs. Price..... **$1.50**

NO. 2 STANDARD TELEPHONE induction Coil, primary 1 ohm, secondary 55 ohms. Used wherever you need a good induction coil. Has primary and secondary and iron wire core; fibre heads.
No. 2 Induction Coil as described—shipping weight, 2 lbs. Price..... **$0.50**

NO. 3 STANDARD RESISTANCE wound with German silver wire—4,500 ohms, can be used as a choke or plain resistance, and has many other uses that readily suggest themselves to the experimenter.
No. 3 Standard Resistance as described—shipping weight, 4 oz. Price..... **$0.40**

NO. 4 HORSESHOE MAGNET, size 3¼ inches wide x 5 inches high. Will lift about 1 lb. Quality such as used on magnetos, which means the best.
No. 4 Horseshoe Magnet — shipping weight, 2 lbs. Price..... **$0.30**

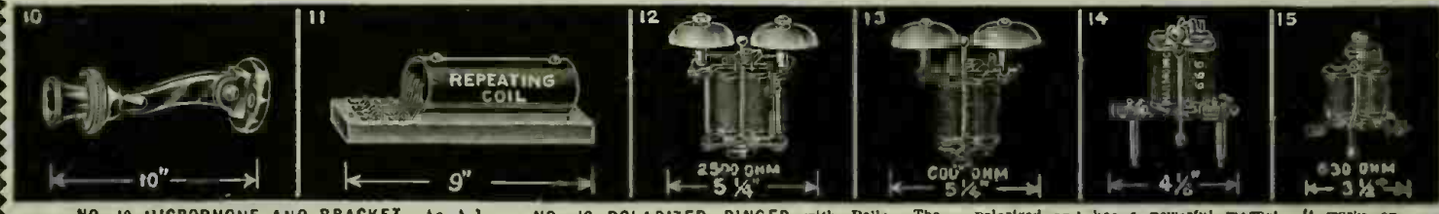
NO. 5 REPEATING COIL (Transformer). This is a standard small repeating coil and is used by all telephone companies. It has 4 different windings and eight contacts. Entirely enclosed in iron. The resistance being respectively 72 and 120 ohms, and 90 and 100 ohms. Diagram is furnished. Can be used for wireless, for boosting signals, etc.
No. 5 Repeating Coil—shipping weight, 2 lbs. Price..... **$0.50**

NO. 6 ½ M.F. CONDENSER. This is a standard telephone condenser and has ½ microfarads. Condenser comes in neat metal casing. This condenser is used in connection with spark coils to absorb the vibrator spark. Invaluable for test buzzers to absorb spark and make the sound of buzzer more steady. Is also used by every experimenter in connection with wireless where a fixed capacity is needed. Several of these condensers should be in every experimenter's laboratory.
No. 6 Condenser, ½ M.F.—shipping weight, 1 lb. Price..... **$0.50**

NO. 7 DOUBLE POLE BELL TELEPHONE RECEIVER—hard rubber casing with 4 ft. cord and tips. Standard 75 ohms—very powerful magnets. This receiver can be used in connection with any ordinary telephone work, and you will even find it sensitive enough for short distance wireless work.
No. 7 Bell Telephone Receiver—shipping weight, 3 lbs. Price..... **$0.80**

NO. 8 STANDARD TELEPHONE RECEIVER with Metal Head. This receiver is made by Stromberg Carlson Co., with genuine hard rubber handle and ear cap. A very good fool-proof as well as sensitive receiver that cannot be put out of order if you try. Used for the same purpose as No. 7 Telephone Receiver.
No. 8 Standard Telephone Receiver—shipping weight, 3 lbs. Price..... **$0.75**

No. 9 IMPEDANCE COIL (Close Core Transformer). This is a very fine little transformer and is used extensively in connection with telephone work. It is in reality an A.C. transformer for which you would pay $5.00 if you had it made to order. The primary has 0.15 ohms, secondary 2000 ohms. It can be used for a variety of purposes that will suggest themselves to every experimenter. Can be used successfully to boost wireless signals. Also in connection with audions, etc. An A-1 instrument. Size 3 x 3 inches.
No. 9 Impedance Coil—shipping weight, 2 lbs. Price..... **$0.65**



NO. 10 MICROPHONE AND BRACKET. An A-1 sensitive microphone of the carbon grain type. Has hard rubber mouthpiece and enamel steel bracket, the instrument being 10 inches long. This microphone, in connection with our No. 7 or 8 Receiver, will constitute a complete telephone outfit, good to speak 50 miles or more, at a remarkably low price.
No. 10 Microphone and Bracket—shipping weight, 5 lbs. Price..... **$1.00**

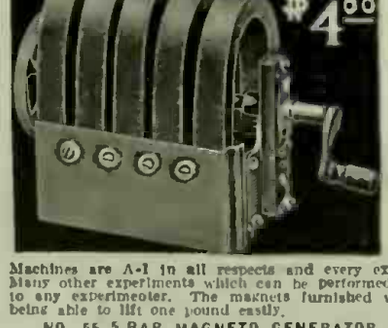
NO. 11 REPEATING COIL (Transformer). A standard repeating coil used for telephonic work. The coil windings are encased in an iron tube 2¾ inches in diameter. There are eight terminals for the four windings to connect to and the instrument is invaluable in connection with radio work to boost up signals, audion work, etc. Many interesting uses will be found for this coil. Resistances are: 100, 120, 145, 175 ohms.
No. 11 Repeating Coil—shipping weight, 8 lbs. Price..... **$2.00**

NO. 12 POLARIZED RINGER with Bells. The resistance of the two coils is 1250 ohms each. The armature is perfectly adjustable. Bell will work on any magneto. We also furnish blue print with ringer showing how a *first class polarized relay* can be made by anyone using only a few pieces of metal and screws.
No. 12 Polarized Ringer with Bells—shipping weight, 2 lbs. Price..... **$1.50**

NO. 13 POLARIZED RINGER with Bells. This is the same kind of ringer as the No. 12, except that it is not adjustable and that the resistance is less. First class in all respects. Blue print furnished with this to make *polarized relay* same as with No. 12. Solenoids on this ringer are worth more than the price we ask for the entire ringer, and do not forget a powerful magnet that goes with it.
No. 13 Polarized Ringer with Bells—shipping weight, 2 lbs. Price..... **$1.00**

NO. 14 HARMONIC RINGER. This ringer is also polarized and has a powerful magnet. It works on 66.6 cycles and any magneto will operate it if run at a certain speed. A very finely built instrument. Resistance of each coil being 200 ohms. Can be converted into a polarized relay by substituting a very fine leaf spring instead of the heavy one furnished. A most interesting instrument with which to experiment.
No. 14 Harmonic Ringer — shipping weight, 4 lbs. Price..... **$1.60**

NO. 15 RINGER without Bells—630 ohms. This also is a polarized ringer and has an adjustable armature. The adjustment is done by means of the top screw. A beautiful little instrument. With this instrument, too, we furnish a blue print showing how a *polarized relay can be built*. You should have several of these beautiful little instruments. They are worth their weight in gold; the powerful magnet alone being worth more than the price we ask for the entire instrument.
No. 15 Ringer—shipping weight, 2 lbs. Price..... **$0.80**



No. 55 5-bar magneto, 110 Volt A. C. Generator

This is one of the most powerful magnetos ever built, when manufacturers could afford to put good stuff into them; equipt with transmission, make and break, etc. Transmission wheels are all brass, crank handle furnished. This magneto, as well as the other ones listed below, will light a 110-volt lamp merely by turning the crank handle slowly. While this magneto gives alternating current only, it can be rewound so it will light up a number of four, six and 10-volt lamps, all depending upon the thickness of the wire you wind on the armature. As we furnish these magnetos, they will give a powerful alternating current and you will not be able to stand the current when grasping hold of the terminals. This makes an ideal shocking machine. All our generators can be transformed into a direct current machine by equipping it with a home-made commutator. Machines are A-1 in all respects and every experimenter should have one of them in his shop. Many other experiments which can be performed with this machine will readily suggest themselves to any experimenter. The magnets furnished with these generators are very powerful, each one being able to lift one pound easily.

NO. 55 5-BAR MAGNETO GENERATOR as described—shipping weight, 25 lbs. Price..... **$4.00**

NO. 33 3-BAR GENERATOR, same as described above except that it has only 3 bars, and is somewhat smaller.
No. 33 3-bar Generator—shipping weight, 10 lbs. Price..... **$2.00**

NO. 44 4-BAR GENERATOR, same as No. 55 except that it has 4 bars, and is somewhat smaller.
No. 44 4-bar Generator—shipping weight, 15 lbs. Price..... **$3.00**

NO. 66 6-BAR GENERATOR, same as No. 55 except that it has one more magnet and the armature is somewhat larger and more powerful. This is the biggest type made and is extremely powerful.
No. 66 6-bar Generator—shipping weight, 30 lbs. Price..... **$4.50**



Complete Wall Set

This is a complete commercial telephone station. The cabinet is of polished oak, piano finish, within which is contained the powerful magneto, the 300 Ohm polarized ringer, and induction coil. The magneto is exceptionally efficient, being of the two bar type with brass gear transmission. The extra sensitive microphone, mouthpiece and two gongs are mounted on the front of the cabinet, giving the entire instrument that desirable appearance of compactness and efficiency. Guaranteed to work over 20 miles. The telephone receiver is a double poled one, and has a hard rubber case. Seven binding posts are provided for connections. The instrument is one which we can offer with pride to our patrons at a ridiculously low price. It is unobtainable anywhere else at less than $15.00 and is an instrument unequaled in value for the price we ask. Size over all 11" x 10" x 8". Shipping weight, 15 lbs.
No. 26 Long Distance Telephone Set..... **$8.00**

"The Livest Catalog In America"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 176 Big Pages, 400 illustrations, 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy." 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 20 measure 7x5¼". Weight ½ lb. Beautiful stiff covers.

ELECTRO IMPORTING CO., 231 Fulton Street NEW YORK

CARBON GRAIN TRANSMITTER

A special design of transmitter for long distance work. Is used on wireless telephone sets where a steady current of ¾ to 1 ampere is constantly required. Sizes over all 3¼ x 2½ inches. Shipping weight, 3 lbs. No. 6080 Carbon Grain Transmitter as described..... **$1.00**



ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

I enclose herewith 6 cents in stamps or coin, to cover postage, for which please send me your latest Cyclopedia Catalog No. 20 as described.

NAME .....

ADDRESS .....

STATE..... E. E. 6-19

www.americanradiohistory.com

Electric Drive on U. S. S. "New Mexico"

(*Continued from page* 106)

structions from the captain, sent either by loud speaking telephones, by indicators, by lights, or by messenger. Following these instructions, the engineers standing at the switchboard can start the vessel forward, or start it backwards; they can make it go many different speeds in either direction; they can run all four of the motors from one of the power plants, or from the other power plant; they can even split up the load so that one power plant will run two of the motors forward and the other power plant will run the other two "astern." Another combination they can effect is that both power plants can equally share the load of driving the four motors—one to each propeller.

If one of the propellers becomes foul the engineer can disconnect this motor from the circuit, and then all of the power in the two power plants is available for the three remaining motors.

Giant Motor for Each Screw.

Can you imagine a motor twice as high as a six-foot man? Can you imagine *one motor capable of doing the work of* 30,000 *horses working at three eight-hour shifts?* If so, then you can appreciate the picture which these made in their steel compartments. One of these giant motors is provided for each of the four propeller shafts. The screw is at one end of the shaft in the water, and the motor is at the other end of the shaft inside the ship. One reason for their efficiency is the fact that the shaft can be short as the motor can be close to the propeller. There is an additional advantage also, because the turbine generators can be located near the boilers, and this permits of a short steam pipe. These very desirable features are a result of electric drive, because it doesn't make any difference what is located between the power plant and the motors.

No Reversing Turbines.

With electric drive, no reversing turbines are necessary, *the reversing is done electrically.* So with the electric drive, the turbine in the power plant always runs in the *same direction* and at highest efficiency.

Electrical propulsion not only does away with reversing turbines, but also does away with reduction gears. The wonderful simplicity of the arrangement can be appreciated also when you remember that the battleship *Pennsylvania* has ten turbines and the *New Mexico* only two.

Propeller More Efficient.

Electric propulsion has another advantage in making the propeller more efficient. This is because, within limits, the faster a propeller turns, the less efficient it becomes. If it turns too rapidly, it merely churns the water, and therefore does not effectively drive the ship ahead. When turbines are directly connected to the propeller shaft, the turbine rotates too slowly to be at its best efficiency, and the propeller shaft rotates too rapidly to operate at its maximum efficiency. So you can look at electric propulsion as a means of speed reduction; for it permits the turbines to rotate at their normally high speed, where they show the best fuel economy, and also permits the propeller to operate at comparatively low speed, where it gives the best driving economy. Without electric propulsion, there were at many different speeds practically "compromise" arrangements, by which either the turbine was rotating too slowly or the propeller too fast. This is obviated in the *New Mexico*, which is one reason why, with one filling of her oil tanks, she can cruise over 50 per cent. further than with any other equipment. In fact, she can go 7,500 knots at 12 knots speed before it will be necessary to take on any more fuel.

Nearly 100,000 Horse Power.

The *New Mexico* is practically the only 100 per cent. electric boat. This will be seen by glancing over, or, better yet, carefully reading the following table, showing her electrical equipment.

Particular attention is called to the loud speaking telephones, 104 in number, located all over the ship. From three different transmitting stations the bugle calls or other instructions can be sent to all or any one of five different groups of these telephones.

Electrical Equipment

2	main generators	33,000 h.p.
4	motors for propelling	33,000 h.p.
6	dynamos	3,000 h.p.
6	air compressors	400 h.p.
2	vacuum pumps	80 h.p.
20	motor generator sets totaling almost	100 h.p.
4	boat crane motors	220 h.p.
2	anchor motors	250 h.p.
4	winch motors totaling	200 h.p.
20	turret motors	1,300 h.p.
10	ammunition hoists	500 h.p.
2	refrigerator motors	40 h.p.
8	motors in kitchen (Peel potatoes, mix dough and cake, and wash dishes, cut butter, make ice cream, meat grinder, all bread and cakes baked electrically.)	15 h.p.
6	in carpenter shop	20 h.p.
10	in machine shop	30 h.p.
6	in laundry (5 machines use electric heat)	10 h.p.
5	motors in print shop totaling	6 h.p.
14	pumps water	140 h.p.
4	oil pumps	8 h.p.
50	electric air heaters	30 h.p.
12	searchlights	300 h.p.
160	fans, 60 blowers, 6 electric toasters, 1 electric percolator, 15 electric irons, 104 loud speaking telephones, 176 ship service telephones, 170 fire control telephones, 2 Sperry electric gyroscopic compasses, 7 portable electric drills, 2 electric glue pots, 6 electric soldering irons.	

Airplane Speeds 300 Miles an Hour

An airplane with a speed of from 200 to 300 miles an hour which will bring America within a short day's journey of Europe, is the prospect held out by the invention of a French engineer, Auguste Rateau.

At the present time without the invention the higher an airplane mounts the less power does its engine develop on account of the rarefying of the air. The loss at 15,000 feet, for instance, is 50 per cent.

M. Rateau's device is said to be very simple. It consists of an arrangement by which the exhaust from the engine works a small turbine, which compresses the air drawn into the engine to normal pressure so that the engine develops full power no matter what the altitude. As the resistance of an airplane decreases enormously at high altitudes, it follows that the higher a machine fitted with the new device mounts the greater will be its speed. This fact, it is declared, was demonstrated by the famous German long-range gun.

It has been found that a heavy day bombing machine whose speed at 15,000 feet ordinarily did not exceed 80 miles an hour, made 140 miles an hour when fitted with this invention, an increase of 75%.

Typewriter Sensation



FREE TRIAL

Use as You Pay

Only $4.00 a month until the low total price of $53.15 is paid, and the machine is yours.

This is absolutely the most generous typewriter offer ever made. Do not rent a machine when you can pay $4.00 a month and own one. Think of it—Buying a $100.00 machine for $53.15. Cash price, $50.35. Never before has anything like this been attempted.

Standard Visible No. 10 Smith Premier

Perfect machines, Standard size, full 84 character one motion keyboard. The entire line of writing completely visible at all times, has the tabulator, the two-color ribbon, with automatic reverse, the back spacer, ball bearing type bars, ball bearing carriage action, in fact every late style feature and modern operating convenience. Comes to you with everything complete; tools, cover, operating book and instructions, ribbon, practice paper—nothing extra to buy. You cannot imagine the perfection of this beautiful reconstructed typewriter until you have seen it. I have sold several thousand of these perfect latest style Model No. 10 machines at this bargain price and every one of these thousands of satisfied customers had this beautiful, strictly up to date machine on five days' free trial before deciding to buy it. I will send it to you F. O. B. Chicago for five days' free trial. It will sell itself, but if you are not satisfied that this is the greatest typewriter you ever saw, you can return it at my expense. You won't want to return it after you try it—you cannot equal this wonderful value anywhere.

You Take No Risk—Put in Your Order *Now*

When the typewriter arrives deposit with the express agent $9.15 and take the machine for five days' trial. If you are convinced that it is the best typewriter you ever saw, keep it and send me $4.00 a month until our bargain price of $53.15 is paid. If you don't want it, return it to the express agent, receive your $9.15 and return the machine to me. I will pay the return express charges. This machine is guaranteed just as if you paid $100.00 for it. It is standard. Over one hundred thousand people own and use these typewriters and think them the best ever manufactured.

The supply at this price is very limited, the price will probably be raised when my next advertisement appears, so don't delay. Fill in the coupon today—mail to me—the typewriter will be shipped promptly. There is no red tape. I employ no solicitors—no collectors—no chattel mortgage. It is simply understood that I retain title to the machine until the full $53.15 is paid. You cannot lose. It is the greatest typewriter opportunity you will ever have. Do not send me one cent. Get the coupon in the mails today—sure.

Harry A. Smith, 738, 218 N. Wells St., Chicago

H. A. SMITH, 738, 218 N. Wells St., Chicago, Ill.

Ship me a No. 10 Smith Premier F.O.B. Chicago, as described in this advertisement. I will pay you the $44.00 balance of the special $53.15 purchase price, at the rate of $4.00 per month. The title to remain in you until fully paid for. It is understood that I have five days in which to examine and try the typewriter. If I choose not to keep it I will carefully repack it and return it to the express agent. It is understood that you give the standard guarantee for one year.

Name .....

Address .....

.....

READ THE CLASSIFIED ADS. ON PAGES 188-190

www.americanradiohistory.com

"The National Authority on Electric Wiring for Twenty-Five Years"

All You Need to Know About Wiring

is in the Latest Edition of

"Standard Wiring"



THIS year's edition, completely revised to date, is the only accurate book on electric light and power wiring and construction published.

The National Electrical Code, with all its new rules, is explained and illustrated. 52 of the latest and simplest tables which show, at a glance, just what size of wire is needed for any kind and size of lighting or motor installation, for any voltage, current and drop desired for any system. Direct Current, Alternating Current, single, two or three-phase. The latest Code Rules on grounding required on all work.

How to install and operate generators, motors and every kind of wiring device with diagrams of connections. Special chapters on illumination, House Wiring, Electrical Units and their Equivalents. The latest lamp data. Proper symbols to use to indicate outlets, etc., etc.

It Will Make You an Expert Wireman

Leather Cover - Pocket Size - 375 Pages - Price $1.50

Sent to any address, postpaid, on receipt of price

H. C. Cushing, Jr., 10 West 40th St., New York

YOUR OPPORTUNITY

Canceled Government Contracts

We have secured a large quantity of Small Motors, Generators and Charging Outfits. This material is new, still in original cases and carries the full factory guarantee.

This is Your Opportunity to buy new, guaranteed Electrical Apparatus of Standard Manufacture

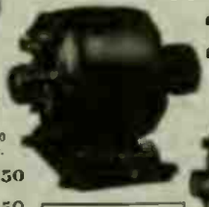


Battery Charging Outfits

For use on 110 volt, A. C., 60 cycle, single phase current only.

60 watts, 6 volts, 10 amperes . $48.50
150 watts, 30 volts, 5 amperes . $68.50
150 watts, 15 volts, 10 amperes . $68.50
300 watts, 30 volts, 10 amperes . $94.50

All outfits complete with switchboard as cut shown



1/2 H. P. INDUCTION MOTOR 110 or 220 volts, A. C. 60 cycle, single phase, 1750 R. P. M. **$32.50**

ALL MOTORS COMPLETE AS CUT

Mail $5.00 cash or Money Order. We will send C. O. D. subject to full examination.

MONEY BACK GUARANTEE



1/4 H. P. 110 volts A. C., 60 cycle, single phase 1750 R. P. M.

WASHING MACHINE MOTOR

Suitable for operating Small Compressors, Coffee Grinders, Bottle Washers, Lathes, Drill Presses etc. **$18.50**

WRITE FOR CATALOGUE. BARGAINS IN MOTORS AND GENERATORS. SPECIAL QUANTITY PRICES

220 volts **POLYPHASE MOTORS** 1750 R.P.M.
60 cycle, 2 or 3 phase. Complete, pulley and base
1 H. P. $59.50 3 H. P. $ 84.50
2 H. P. $72.50 5 H. P. $102.50

NEW MOTORS

110-220 volts **REPULSION MOTORS** 1800 R.P.M.
60 cycle, single phase. Complete with pulley.
1/2 Hp. $44.60 1 Hp. $67.50

MANUFACTURERS' DISTRIBUTER

CHAS. H. JOHNSTON - West End - PITTSBURGH, PA.

What 15c will bring You from the Nation's Capital

Washington, the home of the Pathfinder, is the nerve center of civilization; history is being made at this world capital. The Pathfinder's illustrated weekly review gives you a clear, impartial and correct diagnosis of public affairs during these strenuous, epoch-making days.

The little matter of 15c in stamps or coin will bring you the Pathfinder 13 weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth and only the truth; now in its 26th year. This paper fills the bill without emptying the purse: it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you would appreciate a paper which puts everything clearly, fairly, briefly—here it is. Send 15c to show that you might like such a paper, and we will send the Pathfinder on probation 13 weeks. The 15c does not repay us, but we are glad to invest in new friends. **The Pathfinder, Box 576, Washington, D.C.**

Tesla Bulbs

(*Continued from page 180*)

the best way to use the bulb for such experiments is when the shaft of light is in the position as shown in Figs. 5 and 6, at rest, but in a state of equilibrium inconceivably delicate. This is fully described above in Dr. Tesla's lecture. The inventor states that in such a condition, the shaft of light is marvelously sensitive to magnetic disturbances. Dr. Tesla informs us that a toy permanent horseshoe magnet not longer than ½" and with its poles ⅛" apart could with ease throw the shaft of light out of its normal direction across the whole room. In our illustration, an electromagnet is shown a few inches away from light ray, and we can imagine a slot in a screen in such a way that normally no light falls thru it. If, however, very faint radio-telegraphic impulses surge thru the electromagnet, the light ray will immediately become displaced, and will fall into the slot. Inasmuch as this shaft of light has no inertia, it will follow exactly the dot and dash impulses surging thru the electromagnet, no matter how rapidly they take place. They can then either be read off by the eye, or if desired, can be registered upon a fast moving film. This method will, of course, only be used where the transmission is made at high speed, and where it would be impossible for an operator at the receiving end to follow the dots and dashes with the eye.

The method shown by us in Fig. 6, of course, represents only one. Many others can undoubtedly be evolved to use the Tesla bulb to advantage.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of Electrical Experimenter, published monthly at New York, N. Y., for April 1, 1919.

State of New York, County of New York—ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Hugo Gernsback, who, having been duly sworn according to law, deposes and says that he is the Editor of the Electrical Experimenter, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, The Experimenter Publishing Co., 233 Fulton Street, New York City; Editor, Hugo Gernsback, 233 Fulton Street, New York City; Managing Editor, Harry Winfield Secor, 233 Fulton Street, New York City; Business Manager, Hugo Gernsback, 233 Fulton Street, New York City.

2. That the owners are: Experimenter Publishing Co., 233 Fulton Street, New York City; Hugo Gernsback, 233 Fulton Street, New York City; Sidney Gernsback, 233 Fulton Street, New York City; Mrs. K. Hymes, 233 Fulton Street, New York City; Harry Winfield Secor, 233 Fulton Street, New York City.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but, also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is —(Required only of daily publications.)

(SEAL) H. GERNSBACK.

Sworn to and subscribed before me this 4th day of April, 1919.

BEATRICE K. OWEN.

(My commission expires March 30, 1921.)

www.americanradiohistory.com

Choke Coils: Theory and Design

by Prof. F. E. Austin

(*Continued from page* 140)

It is evident that with a current of 13.9 amperes in a resistance of 2.9 ohms, there will be considerable heating effect, denoted by $R_x I^2_{dc} = 2.9 \times 13.9^2 = 560.3$ watts. If the current passes thru the circuit for one hour, about one-half kilowatt hour of energy will be paid for, which is simply a *heat waste* in the auxiliary resistance R_x.

When connected with a 110 volt alternating current circuit, the current of 13.9 amperes was maintained without this heat loss, simply because of the counter-electromotive-force of induction of the coil itself.

The financial saving effected by the use of a choke coil is therefore very apparent, since the coil reduces the current in the circuit from 22 to 13.9 or 8.1 amperes, at no operating expense for power.

The usual condition governing the use of a choke coil is either the amount of current to be past thru the coil is known, or the amount of pressure reduction is known.

The size of the wire constituting the coil must be large enough to carry the desired current without overheating the coil. The choking effect of any coil depends upon the *square of the number of turns* of wire composing the coil. That is, if the *number of turns* on a coil are *doubled*, its choking effect is increased *four* times.

A very serviceable choke coil for a wide range of choking effect may be made by winding ten pounds of No. 14 double cotton covered copper wire in two sections on a hard fiber tube, measuring 2 inches in outside diameter, and 9½ inches long. The tube should be provided with wooden ends about 4½ inches square and ¾ inch thick, with a middle partition of wood ¾ inch thick. It will be advisable to shellac the insulated wire very thoroly and allow it to dry before using the coil.

An iron core should be made up of about No. 18 iron wire stock, carefully varnished with shellac varnish, and measuring about 14 inches long by 1¼ inches in diameter.

Such a coil will carry as high as 15 amperes for a short time and as high as 5 amperes for a long period without seriously heating.

With both sections in series, without an iron core and with an applied pressure of 110 volts at 60 cycles, the current in the coil will be about 0 amperes. The insertion of an iron core such as described above will reduce the current to less than ½ ampere.

With one section of such a coil, connected across 110 volts at 60 cycles, with no iron core, the current will be nearly 12 amperes, and by inserting the iron core may be gradually reduced from 12 amperes to less than one ampere.

Such a coil may be connected in series with other coils or lamps such as an arc lamp and the desired pressure applied to the apparatus. In using a choke coil always have the iron core inserted in the coil before closing the circuit, so as to have *maximum* choking effect in operation at the *start*.

The effect of the iron core is to greatly increase the coefficient of inductance L, thus increasing the numerical value of the term $2 \pi f L$. The iron core takes the place of a very large number of turns of wire, greatly reducing the expense of construction.

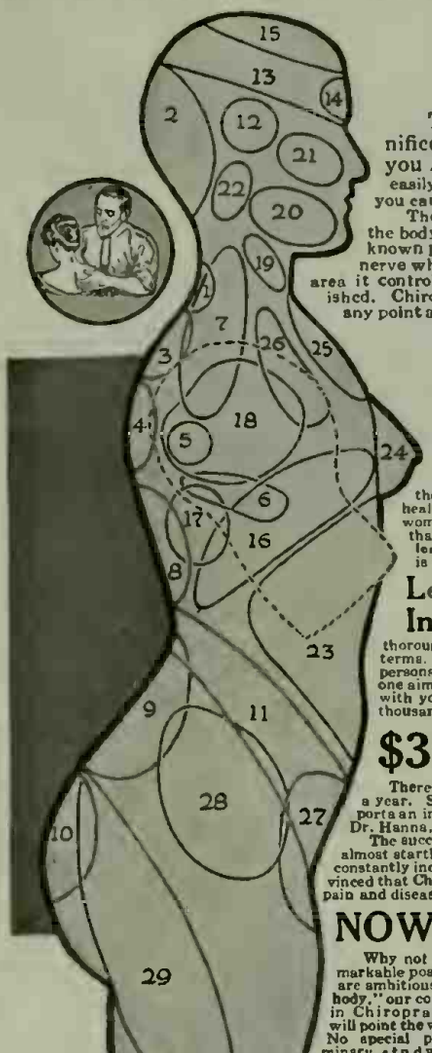
A very useful equation by which choke coils may be designed is as follows:

$$L = \frac{4 \pi n^2 \mu A}{10^9 b};$$

in which L denotes the inductance of a coil in *henries*; n denotes the number of turns on the coil, μ denotes the so-called magnetic permeability of the medium (iron, etc.), in-

(*Continued on page* 187)

Learn to Treat Disease This Way



This is a small reproduction of one of 22 magnificent charts all of which we want to send you ABSOLUTELY FREE, just to show you how easily you can master Chiropractic and bow successfully you can treat disease by this modern drugless healing method. These charts show the different pain and nerve areas of the body. The science of Chiropractic is based upon the well known principle that when there is bone pressure on a trunk nerve where it leaves the spinal column there will be pain in the area it controls: and that by relieving the pressure the pain is banished. Chiropractic teaches you how to locate nerve pressure at any point along the spinal column and how to relieve it.

BE A DOCTOR OF CHIROPRACTIC

Advanced Science of Spinal Adjustment

The great profession that within the past few years has taken the longest forward strides ever known in the history of drugless healing. It has called to its ranks thousands of ambitious men and women from every walk of life. Today it is calling more insistently than ever because the tide has turned strongly in favor of drugless healing. Right now the demand for Doctors of Chiropractic is far greater than the supply.

Learn at Home In Spare Time

The American University method of teaching enables you to study by mail or in class and obtain a complete mastery of Chiropractic in the shortest time consistent with thoroughness, while you hold your position. You can pay on easy terms. From the day you enroll your instruction will be under the personal direction of a splendid faculty of Chiropractic experts. Our one aim will be to make you successful. We will work whole-heartedly with you to advance your interests so that in a short time you, like thousands of Chiropractors, can earn a good income.

$3000 to $5000 a Year

There are many instances of Chiropractors earning from $3000 to $5000 a year. Some upwards of $10,000. Dr. M. D. Moore, of Kentucky, reports an income of $9,000 a year. Dr. L. H. Roche, New Jersey, $5,000; Dr. Hanna, of Kentucky, over $5,000 yearly.

The success of Chiropractors in many cases has come so quickly as to be almost startling. And yet, it is not to be wondered at when you consider the constantly increasing number of intelligent, thinking people who are now convinced that Chiropractic is the common-sense and really scientific way to relieve pain and disease and who, therefore, demand the services of Chiropractors.

NOW—Your Great Opportunity

Why not qualify now for this splendid profession that offers such remarkable possibilities for making you prosperous and independent? If you are ambitious to make money, increase your social standing and be "somebody," our course in Chiropractic will point the way. No special preliminary study required. You graduate with the degree of D. C. (Doctor of Chiropractic), receive handsome diploma, FREE, and are ready at once to open your office.

Get Free Charts offer at once. Regular value of the 22 magnificent charts is $31.50. Many of these charts are handsomely lithographed in life-like colors. Mail coupon and get all the facts. We will send you our beautiful new illustrated book, full particulars regarding course, easy terms, together with free charts offer immediately. Don't put it off—mail coupon or send your name on a postal card—today.

AMERICAN UNIVERSITY
Manierre Bldg., Dept. 490 Chicago, Ill.

AMERICAN UNIVERSITY
Manierre Bldg., Dept. 490 Chicago, Ill.

Without cost or obligation send me by mail, your new illustrated, 72-page book and your Free Charts offer.

Name.....

Street No. or R.F.D.....

City..... State.....

CONCENTRATION SPELLS SUCCESS

When rightly used, but when wrongly used it is sure to bring failure.

Most persons use their Concentration wrongly by concentrating on that which annoys, irritates and makes for failure.

You lock the doors and windows of your home to keep out thieves who would steal your property, but do you lock the doors and windows of your thought world and so keep out the power, ambition and ability?

Concentration when rightly used is a man's greatest asset but when wrongly used becomes his greatest liability.

Do you use your Concentration rightly or wrongly?

Has your Concentration brought you success or failure; happiness or sorrow; health or sickness; brilliancy of mind or loss of memory?

"Concentration—Its Mentology and Psychology"

teaches how to develop and use one's Concentration rightly.

The person who can concentrate rightly for what he wants, when and where he wants to—whether it is for money, health, love, increased business, political power, social position, a better job, good memory or anything else he may desire—has at his command the greatest power in the world—a power which, when he learns to use it rightly gives him the mastery of himself and his environment.

You have this power and can learn to use it rightly by persistently applying the lessons taught in Dr. Sears book.

Take no substitutes; none other "just as good." Price 50c paper; 75c cloth, postpaid. Money back if you want it. For sale at first class book stores or by mail direct from publishers.

CENTRE PUBLISHING COMPANY
Suite 678, 110 W. 34th Street (at Broadway), New York

Note—Dr. F. W. Sears lectures Sundays 11 A. M. in the Criterion Theatre, Broadway at 44th St., New York City



By F. W. SEARS, M. P.
(Master of Psychology)

www.americanradiohistory.com

FREE TO YOU!

Read this Remarkable Offer!



OFFER No. 1

Wireless Course

The most comprehensive Wireless Course ever printed. Contains 160 pages, 350 illustrations. Size of book 6¾"x10". Very fine flexible cloth cover.

FREE with a year's subscription.

Add 5c for postage

OFFER No. 2

Experimental Electricity Course

This masterpiece contains 160 pages, 400 illustrations. Size of book 5"x9". Printed on extra thin paper, so book can be slipped into pocket. Handsome flexible cloth cover.

FREE with a year's subscription. Add 5c postage

OFFER No. 3

How to Make Wireless Sending Apparatus
By 20 Radio Experts

How to Make Wireless Receiving Apparatus
By 20 Radio Constructors

These books are by far the most successful wireless books on the market. Size of each book 5"x7", well bound on good book paper. Covers in two colors. We really cannot praise these books too highly. Each book contains 100 pages and from 88 to 90 illustrations. **BOTH** books **FREE** with a year's subscription. Add 5c for postage

This is a very limited offer. It may be withdrawn at any time, due to the tremendous cost of paper, which IS JUST DOUBLE WHAT IT WAS ONE YEAR AGO. We have only a limited supply of these fine books on hand; after they are gone we cannot reprint the books until conditions become normal again. **Now is your chance.**

The publishers of this journal have earned an enviable reputation of giving more than 100 cents' worth for each dollar spent with them. Profit by this liberal opportunity NOW; it may never be made again.

HERE'S THE OFFER

Subscribe to the ELECTRICAL EXPERIMENTER for one year, at the regular subscription price of $2.00 per year (Canada, foreign and N. Y. C. $2.50) and we will send you either books shown in one of the above offers. If you subscribe for two years, two offers will be given, etc.

If you are a subscriber at present take advantage of this wonderful opportunity anyway. If you do, we will extend your present subscription.

This Offer Limited. *Act Now.*

EXPERIMENTER PUB. CO.
223 FULTON STREET NEW YORK CITY

FILL IN — TEAR OUT — AND MAIL

6-19

Gentlemen: Please enter my subscription to the ELECTRICAL EXPERIMENTER for the term of .... year..for which I enclose herewith $..... You will also send me at once FREE your book..... as per offer No.....

.....

.....

Name.....

Address.....

www.americanradiohistory.com

The Rogers' Underground Aërial for Amateurs

(Continued from page 137)

specified, where the transmitting set is one employing an audion oscillation generator. The voltage in this case will not be extremely high, and special precautions need not be taken to provide extra heavy insulation on the buried antenna. Official tests by the U. S. Navy have shown transmission by radio over 50 miles with the Rogers underground antenna. *The wire in such a case, however, should be especially well insulated* to stand the higher voltage.

Regarding loop aërials in general, it would appear that we can expect a great deal from them, as some of the really remarkable results achieved during the war would seem to point out. The number of turns and the amount of wire to be used in a spiral antenna, such as shown at Figs. 7 and 8, will vary of course for different wave lengths, etc., and here is where the Radio Amateur will have a chance to carry out some original experiments, which may net him some real knowledge, fame and money. Another form of loop antenna, so-called, and which has been tried out several years ago with such success that European stations could be copied in a laboratory located in Florida, is one composing a square form, several feet in height. This was used, as just mentioned, to receive stations using fairly long wave lengths, say from 8,000 to 12,000 meters, W. L. Here the insulating form was wound with a layer comprising several hundred turns of insulated wire, such as ordinary annunciator wire. This antenna was successfully used in some tests made by the Marconi radio engineers at a laboratory in Florida several years ago. Trans-Atlantic radio reception was effected at the radio laboratory of Union College, Schenectady, N. Y., just prior to America's entrance into the world war. This aërial comprised about two dozen turns of No. 14 or 12 bare or R.C. wire, mounted on porcelain knob insulators screwed on the inside wall of the laboratory. The turns were spaced about 3 inches apart. The inside turn was 3 feet square. Flexible leads, fitted with clips, serve to connect as many turns as desired.

Choke Coils: Theory and Design

By Prof. F. E. Austin

(Continued from page 185)

side the coil, A denotes the cross-sectional area in square centimeters of the central hole thru the coil, and b denotes the length of the *coil* (not of the wire) in centimeters. For air the magnetic permeability μ is 1. For an iron core μ varies considerably, according to the kind of iron used. For ordinary iron μ will be between 1,500 and 2,000 which shows how L increases from an air core to an iron core value. Consult any text-book containing a magnetization table, which gives the various permeability values for different flux densities. The flux density in each case depends upon the ampere-turns produced by the coil; this value is found by multiplying the amperes by the number of turns in the coil. Thus it is seen how the value L constantly varies as the core is moved in and out of the coil, or the number of turns varied, as well as any variations of the amperage, which would change the flux and in turn the permeability. It is usual to allow 1,000 circular mils per ampere in designing choke coil or transformer windings; a common core flux density is 25,000 to 30,000 lines per square inch of cross-section.



Learn Public Speaking

10 LESSONS FREE

Write — quick — for particulars of this extraordinary offer; an opportunity you will never forget if you take advantage of it. Ten lessons in effective public speaking absolutely FREE to those who act promptly, to introduce our course in localities where it is not already known.

We teach you by mail to become a powerful and convincing speaker—to influence and dominate the decisions of one man or an audience of a thousand. We have trained hundreds and helped them to increase their earnings and their popularity. Learn, in your spare time at home, how to overcome "stage fright" and conquer fear of others; how to enlarge your vocabulary; how to develop self-confidence and the qualities of leadership; how to RULE others by the power of your speech alone; how to train your memory. Our

WHAT THE COURSE TEACHES YOU.

How to talk before your club or lodge;
How to address board meetings;
How to propose and respond to toasts;
How to make a political speech;
How to tell entertaining stories;
How to make after-dinner speeches;
How to converse interestingly;
How to write better letters;
How to sell more goods;
How to train your memory;
How to enlarge your vocabulary;
How to develop self-confidence;
How to acquire a winning personality;
How to strengthen your will power and ambition;
How to become a clear, accurate thinker;
How to develop your power of concentration;
How to be the master of any situation.

New Easy Method

perfected and taught only by Prof. R. E. Pattison Kline, former Dean of the Public Speaking Department of the Columbia College of Expression, can be learned in 15 minutes a day. Prof. Kline is one of the foremost authorities in the country on public speaking and mental development. Do not let this chance escape you.

Offer Limited

Send This Free Coupon Now

This Special Offer of TEN LESSONS FREE is made strictly for advertising purposes and will be withdrawn without notice. Write now, before it expires, and receive full particulars with enrollment blank by return mail. No obligations of any kind. Just tear off and mail this free coupon—or a postal will do.

FREE LESSONS COUPON

North American Institute,
744A Manhattan Bldg., Chicago

I am interested in your course in Effective Public Speaking and your offer of ten lessons free. Please send full particulars. It is understood that this request places me under no obligation of any kind.

.....

.....

www.americanradiohistory.com

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section seven cents a word for each insertion. No advertisement for less than 50c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the July issue must reach us not later than May 22.

The Circulation of the Experimenter is over 100,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Automobile Accessories.

Auto Motors and Supplies. Buick, Hupp, Franklin, Michigan, Everett, Hudson, Chalmers. Both water and air cooled motors, $40.00 each and up. Bosch Magnetos, $15.00 each and up. Presto Tanks, $5.00. Coils, Carburetors, Head Lamps, Horns, Air Compressors, Generators, Starters. Write for bargain bulletin second-hand Auto accessories. Johnston, West End, Pittsburgh, Pa.

Honeycomb Radiators for Fords. Four times cooling capacity. Built extra heavy to outlast your car. Factory to consumer, eighteen dollars, cash with order. Write Wilson, 44 Riley St., Buffalo, N. Y.

Tite-Loc Khaki Cloth back inner-tube patching stock, with cement and emery cloth, $1.00 package for 75c until July 15th. Walter Clifford, West Spruce St., Shamokin, Pa.

Fords run 34 miles per gallon with our 1919 carburetors. Use cheapest gasoline or half kerosene. Start easy any weather. Increased power. Styles for all motors. Runs slow high gear. Attach yourself. Big profits for agents. Money back guarantee. 30 days trial. Air-Friction Carburetor Co., 270 Madison St., Dayton, Ohio.

Ford power Mechanical Products greatly increase ability Ford Cars, Sedans, Trucks, Tractors, Racers, "4 Speed Forward Auxiliary Transmission"; Double Power, High, Low; Reverse; Powerful Motor Brake descending hills; "Absolute Neutral." Easy winter cranking. "Full-power" "16-Valve Cylinder Head," 20%-64% Power increase, government test. Other Ford Power Devices coming. Opportunity agent, dealer, owner. Send for trial plan K. Victor-Ford Trans. Mfrs., 246-248 W. 54th, New York.

Aeronautics.

Motorcycle Engine with propeller attached, $16. Gerald Willard, Heron Lake, Minn.

Agents Wanted.

Beginners—Complete "Mail Order System." C—Box 1005, Atlantic City.

Easy Pleasant Work for mechanics, shop men, clerks, during spare hours, will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Co., 308 Bar St., Canton, Ohio.

$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Ave. D, Decatur, Ill.

$10.00 to $25.00 a day profit! Biggest summer seller. Concentrated fruit drinks. Just add water. Delicious drink in a jiffy. Six popular flavors. Bestever Products Co., 2426-L6 Polk St., Chicago.

Miracle Motor-Gas amazes motorists. 3c. worth equals gallon gasoline. Eliminates carbon. 300% profit. Isom, Idaho, wires: "Ship 500 packages. Made $70 yesterday." Samples free. Chas. A. Butler, Sec'y, Dept. 70, Toledo, Ohio.

Insyde Tyres, inner armor for automobile tires, double mileage and prevent punctures and blow-out. Quickly applied. Costs little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, O.

Sign letters, foil and specialties for windows. Genuine Gold. Anyone can sell and put up. $50 weekly easily made. Chicago Sign System, 326G River St., Chicago.

Electrical Supplies & Appliances.

New Method of Recharging Dry Cells. No cost. Directions 15c. Scott, Box 465, Dayton, O.

Electrical Tatooing Machine and Supplies—Catalogue stamp. Prof. Temke, Exp., 1019 Vine St., Cincinnati, O.

Die Casting and Molds. Hand casting and molds. Everything in white metal is our line. We can help and save you money. Write us. Schley Metal Crafts, 557-559 W. Quincy St., Chicago, Ill.

Do You Know How to connect or reconnect the winding of the induction motor? Why not learn? 100 induction motor winding diagrams—1, 2 and 3 phase, Star, Delta, 2 to 12 poles inclusive. Postpaid $5. E. Glass, 2108 South Broad St., Philadelphia, Penn.

Electrical Photographic and chemical apparatus, motors, fans, switches, spark plugs. Advise what you want or have for sale. H. C. Hancock, Bogota, N. J.

Help Wanted.

Homeworkers on small scale, Manufacturers on large scale wanted, to make Toy Soldiers, Army, Navy, Marines, Cannons, Machine Guns and other toys and novelties. This new American Industry stands out conspicuously since the war stopped all importation of German toys. Greatest chance for industrious people for an independent business. Some people started small, own factories now. Fortunes are made in toys. Enormous demand and future in "American Made Toys". Millions needed this year. We buy these goods all year, paying fixed prices. Experience or tools not necessary. Hundred and more made complete per hour. Casting form outfits $3.00 up. Booklet and information free. Toy Soldier Manufacturing Company, 32 Union Square, New York.

Wanted—Ambitious Workers to start Collection Bureaus. Be independent—make big income yearly. We train and refer business to you. "Scientific Facts" free. National Collection Bureau, Dept. 20, 65 Maynard, Columbus, O.

Salesmen Wanted to Sell Our West Virginia Grown Nursery Stock. Fine canvassing outfit free. Cash commission paid weekly. Write for terms. Our Nurseries were grown in Ohio for more than 40 years, and much of our stock is grown and sold there now. The Gold Nursery Co., Mason City, Mason County, West Virginia.

Wanted Immediately. Men-boys, 18 or over. Hundreds Government Jobs, now obtainable. $1000-1100 first year. Quick raise. Common education sufficient. List positions free. Write Franklin Institute, Dept F 26, Rochester, N. Y.

Make Die-castings. Sketch, Sample, Booklet and Proposition, 12c. Byrd & Blair, Box 227F, Erie, Pa.

Wanted—Electrical engineer and designer for English works. Young man well up in designing electrical units for heating and cooking apparatus. Address Box 80, giving complete experience, salary expected and earliest date available.

Wide Awake Man to Take Charge of our local trade. $4 to $5 a day; steady. No experience required. Pay starts at once. Write today. American Products Co., 1285 American Bldg., Cincinnati, O.

Wanted Men—Be automobile experts. $35 week. Learn while earning. Franklin Institute, Dept. F 806, Rochester, N. Y.

For Men.

Dredge's Necktie Valet removes wrinkles (without ironing) from neckties. Sample 25c. 190 Pilgrim, Highland Park, Mich.

I Teach Men to be Interesting. Send today. Complete course $2. Alice Barrett, Idahel, Okla. Box 45.

Telegraphy.

Telegraphy (both Morse and wireless) and Railway Accounting taught thoroughly and quickly. Big salaries now paid. Great opportunities. Oldest and Largest School—est. 45 years. Catalog free. Dodges Institute, 7th St., Valparaiso, Ind.

Scenery for Hire.

Collapsible Scenery for All Plays. Amelia Grain, Philadelphia, Penn.

Stammering.

St-Stu-t-t-tering and Stammering cured at home. Instructive booklet free. Walter McDonnell, 105 Potomac Bank Bldg., Washington, D. C.

News Correspondents.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Motion Picture Plays.

Photoplays Wanted Big prices paid. You can write them. We show you how. Free particulars. Rex Publishers, Box 175, E-2 Chicago.

Motion Picture Film.

Motion Picture Films—$3.50 per 1,000 feet. Dramas or comedies. Postage extra, 25c. L. Harrison, 1283 Lakeland Ave., Lakewood, Ohio.

Exchange Ads.

For Sale—Complete, one K. W. sending set and complete receiving set, range four thousand meters, receives one thousand miles. Also miscellaneous electrical articles. R. D. Wylie, 7 Oregon Yacht Club, Milwaukee, Ore.

Exchange—Pair Murdock No. 50 phones, silk cord for good ukulele or mandolin. Write Harold Southwick, 103 Green St., Fall River, Mass.

For Sale—400 watt 110 V. D. C. generator, $32; 1/10 H. P. 220 V. D. C. motor, $12; voltmeter 0-150 volts, $11; crystalloi detector, $5. List for a stamp. "Radio 9," 77 S. Spencer St., Aurora, Ill.

Bargain—Tesla coil complete: transformer, rotary, condenser, terminals, 30 inch spark. Guaranteed. $100. William Peters, 1107 S. 8th St., Burlington, Iowa.

For Sale—Following apparatus formerly used for Xray work: Mercury turbine and electrolytic interrupters and 8, 12, 16-inch induction coils. These can be used for wireless, Xray or experimental work. Write for description. Henry Cole, M-2, Box 380, Indianapolis.

Sell Complete Chemical Laboratory, also chemical correspondence course. N. Michel, 217 South 4th St., St. Charles, Mo.

Sell Motsinger Sparker for Charging. Telephone receiver and coil. Phone headset. Lot $6. A. Lloyd, Canandaigua, N. Y.

A $68 Course in Electricity by A. W. Wicks sell for $20. Address Wm. Ludwikowski, 26 Humboldt Ave., Jamaica, N. Y.

Sale—Type RCL 3S21 Mignon cabinet, $35; Brandes superior phones, $3.75; ¼ K. W. Clapp-Eastham transformer, mounted, $11; $3.60 spark gap, $2.50; $5 helix, $3.50; $7.50 antenna switch, marble base, $5; five plate condenser, $1. Sam Keefer, Danville, Penn.

For Sale—22 Savage repeating rifle, octagon barrel; fine condition, $14. Small 110 volt motor, suitable for spark gaps, $5. Set Hawkins' Guides, $8. R. S. Johnston, Jr., East Bellevue, Pittsburgh, Penn.

Wanted—Five sections Murdock moulded condenser in good condition. State price. Burle R. Jones, Muskogee, Okla.

Rotary Quenched Gap, $10; induction motor, $5; Packard ½ K. W. transformer, quartered oak case, $12; mahogany audion box, regenerative and undamped circuits, $6; 5-cell Edison storage battery, 80 A. H., $25. R. C. Hitchcock, Box 550, Middletown, Conn.

Sell—½ K.W. Packard Transformer $8, new Crystaloi detector, oscillation transformer, Murdock 'phones, 600 v. lightning and antenna switches, oil condenser, antenna wire (copper) and insulators, vibrating rectifier, accordeon. List free. Lowell P. Hoyt, Presque Isle, Maine.

Radio Apparatus for Sale—Lightning switch, oil condenser, 30-foot iron pipe masts, complete, 6-60 storage batteries, wall telephones, receivers, condensers etc. George Holmes, Box 666, Electrical Experimenter.

Bargain—New $50 phonograph, $30. C. Gillespie, 72 Woodward, Buffalo, N. Y.

Sell—Omnigraph, key, sounder, buzzer and phone. Without records, $12. Harry Feingold, 737 Prairie Ave., South Bend, Ind.

Sell or Trade—Howard good wireless receiving apparatus, Westinghouse A. C. ammeter 0-200 amperes and bushar. Ladies violin, $45. Duncan Eader, Shelby, Mich.

Radio Amateurs! Attention!—Bargain in De-Forest receiving set; excellent condition; wave length 150 to 1,200 meters; must be seen to be appreciated. Write or call 1311 Pugsley Ave., Westchester, N. Y.

For Sale—Amplifying set, loose coupler, condenser and double receiving phones. Calm, 182 Pulaski St., Brooklyn, N. Y.

Sell—Complete electrical chemical photography outfit. Send stamp. Clifton Bennett, New Milford, Penna. Route 1.

Typewriter—Like new. For sale or exchange. John Galbreath, Rogers, Ohio.

Sell or Trade—Wireless apparatus. List for stamp. Perry Crawford, 13 Ten Broeck St., Albany, N. Y.

Wanted—Motor Generator, ¼ or ½ K. W. D. C. to A. C. Exchange regenerative receiver, audion bulb, phones. John Di Blasi, 227 East 75th St., N. Y. C.

For Quick Sale or Trade—Telegraph transmitter, ½" spark coil and gap, Multi-Audi-Fone. Want, loose coupler, Baldwin Fones, prism binoculars, variable condenser. C. F. Allen, Box 1504, Providence, R. I.

www.americanradiohistory.com

Exchange—Cont'd

Selling Out at half cost my wireless outfit including ½ K. W. open core transformer, bronze wire, phones, Xray tube, books (including Fleming) and back numbers of this magazine. Goddard, 33 East 50th St., New York.

Wanted—Typewriter. Have 215½ feet plain and 370 feet plated ½-inch copper ribbon, condenser, three sectioned condenser, detector. Harold Miller, 4016 Austin Ave., Chicago, Ill.

L. C. Smith No. 5 in almost new condition. Price $50. Goddard, 33 East 50th St., New York.

Radio Instruments—Cheap. Write. E. Flynn, Collegeville, Minn.

For Sale—Oliver typewriter and two cell medical battery. Earl Brown, Martinsburg, W. Va.

Sale—Fifteen dollars takes new Leishman phototelegraph machine. Good condition. Archie Blackburn, Clarksville, Ark.

Exchange—Chemistry outfit, wireless cabinet for $50 bond. Barkey, 39 West 118th St., New York.

For Sale—Clapp-Eastham type E, 5 K. W transformer, slightly damaged but in good working condition, $1. Brandes trans-Atlantic phones, N-1 condition, $8. K. M. Briggs, 26 Albemarle St., Rochester, N. Y.

Trade—Electrical apparatus for 4,000 coupler. Navy preferred and variables. Edward Brown, East Marion, L. I., N. Y.

For Sale—Dynamo, water motor and chemical and electrical apparatus. Elmer Baseman, 252 N. Porter, Elgin, Ill.

For Sale—All kinds books, magazines, courses, disc-records, theatrical supplies, 1,000 feet films. Send 3c. stamp. Glenn Newton, Pulaski, N. Y.

For Sale—Complete audion receiving cabinet, oscillation transformers, antenna switch, 1-inch spark coil, step-down transformer, wireless key, microscope. A. Alger, 214 Arizona Ave., Lorain, Ohio.

Exchange—7-foot airplane propeller, good shape $10; 5-drawer tool cabinet and 150 miscellaneous tools, $15. Arnold, 2082 Lexington Ave., New York.

For Sale—15 K. W. high voltage transformer, with rheostat and switches. Will consider screw cutting lathe or Thordarson as part payment. Harry Cole, 1515 Linwood Blvd., Okla. City, Okla.

Phonographs.

Build Your Phonograph. "Perfection" high-quality spring and electric motors, tone arms, reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Ind.

Build Your Own Phonographs and manufacture them for profit. Drawing instructions, parts, price list, blue prints, etc., complete, sent free upon request. Write today. Associated Phonograph Co., Dept. E-1, Cincinnati, Ohio.

Formulas.

500 Formulas, resilvering mirrors, renewing dry batteries, luminous paint, mechanics' soap, 25c. Catalogue 2c. Ideal, 5501-E North Robey, Chicago, Ill.

Agents—Sell egg substitute. Big profits formula, $1. W. Smith, 61 Sumpter St., Brooklyn, N. Y.

Invisible Inks—30 formulas, 15c. Horton P. Jones, Perry, Ia.

Formulas, resilvering mirrors, fish bait, how to make a hectograph, 10c. Each list 2c. W. Clifford, 634 W. Spruce St., Shamokin, Penn.

New Substitute for Eggs. Formula 25c. Walker, Box 465, Dayton, Ohio.

20,000 Formulas, $1 postpaid. List 4c. Oscar C. Hanson, Mentor, Minn.

20,000 Formulas and Trade Secrets, only $1 postpaid. 1,000 for 25c., other offers for stamp. Clifford Camp Co., Claremont, N. H.

Letter Specialists.

Letters That Land Orders and Money Orders written for $4; three for $10. Guaranteed. Criterion Service, Dept. 3, West New York, New Jersey.

Emerson J. Poag, 708 Brandywine, Schenectady, N. Y., writes powerful letters, folders, booklets. He prepared several automobile campaigns. Moderate fees. Free suggestions on sales problems. Better chance $1 on 10 letters which netted thousands on automobiles and clothing. Write him. Today!

Novelties.

Waitley's Antique Shop—Large collection "Alaska" Indian relics. Write for list. Worthington, O.

Personal.

Are You Self-Conscious, embarrassed in company, lacking in self-control? These troubles overcome. C. E. Veritas, 1400 Broadway, New York City, N. Y.

Business Opportunities.

Enter a new business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks at small expense; no further capital required; no goods to buy; job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston, Mass.

$30.00 a week evenings. I made it with a small mail order business; continued my regular job daytime. Free Booklet tells how, 2 cents postage. Albert W. Scott, Cohoes, N. Y.

$150.00 per month or more on a $10.00 investment plus 6 hours hustle daily, no canvassing. Brewer, 1510 St. Emanuel, Houston, Texas.

$1 does it. Bank references furnished. Investigate us thoroughly, that's all we ask. Results count. Our plan $1 down, $2 monthly few months gives you Warranty Deed to land. May pay profits $200 or more monthly. Maps, reports, established facts free. Address, Sourlake Texas Oil Co., 867 DeMenil, St. Louis, Mo.

Patents for sale. To buy or sell patents address Patent News-11, Washington, D. C., only inventors' newspaper published.

Start a profitable business manufacturing "Puffed Crisp". Delicious confection. Whirlwind money-maker. Machine, Instructions complete $6.50. Samples 10c. Bestever Products Co., 2426-E6 Polk St., Chicago.

Make Die-castings. Sketch, Sample. Booklet and Proposition, 12c. Byrd & Blair, Box 227-F, Erie, Pa.

Build Up an Income in Oil—Others are doing it—Why not you? Today is the opportunity. Join our easy monthly payment plan now—it may mean hundreds in profits. Write for information. National Oil Drilling Co., Dept. K, Houston, Texas.

Start a Vacuum Clothes and Carpet Cleaning business. $150.00 for machinery required. Write today. General Compressed Air & Vacuum Machinery Co., Dept. E, St. Louis.

Dollars Yearly in Your Back Yard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. Metz, 313 East 89, New York.

Victory—Mechanical Toy Soldier window attraction. 30 inches high. Salutes, turns head, points with finger, etc., as set. Well made, nicely dressed officers, privates, Uncle Sam, etc. Electrically operated. Does some stunt every half minute or oftener as set and will salute soldier and pay no attention to other if desired. Representative wanted in each city and town. Write for prices. The John M. Biggs Co., Box 324, Chattanooga, Tenn.

Chiropractic—The New Profession. You can learn and earn your way. Practitioners earning $3,000.00 a year and upwards. Proficiency quickly acquired. Send card for information. Howard College, 515-25 S. Ashland Blvd., Chicago.

$10.00 a Day for Amateur Photographers. Ten cents brings the plan which has been successfully operated. J. W. Bilodeau, Lydonville, Vt., Dept. 86.

Iceless Refrigerators easily, cheaply built. Instructions, Blueprints; 4 different types $1.00. Bachman, Box 57, Fullerton, Pa.

Name, address on a swell knife $1.00, on key ring 25c, agents wanted. W. Wooley, Peoria, Ill.

Motors, Engines and Dynamos.

Small Motors and Generators from bankruptcy and receivers' sales. Motors for all phases of current. Immediate delivery. Less than one-half regular prices. See display ad on page 150. Johnston, West End, Pittsburgh, Penn.

500 Watt Motors—Modern, efficient; cost me $10. Investigate! Duplicate! Clark, Barnes Road, Newton, Mass.

Gas Engines—Marine and stationary, rebuilt and guaranteed. Don't fail to get our price list before buying. Prices 50 per cent. lower than others. Write. United Motor Repair & Supply Company, 305-309 Broadway, New York.

Wanted—Small gasoline and steam engines, small lathes, drill presses and other light machinery. Will pay high cash prices for good material. Johnston, West End, Pittsburgh, Pa.

For Advertisers.

It Pays to Advertise when Jacobus prepares the copy. Sales letter $1. Jacobus Advertising Service, 1073 Sanford Ave., Irvington, N. J.

"Quick-Action Advertising—How It Is Building Business for the Progressive Advertisers of America"; A little story of results told by the advertisers themselves—not the publishers. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th St., New York.

Patent Attorneys.

Inventora—Send sketch of your invention for advice regarding patent protection. Twenty years' experience. Handbook on patents sent free. Talbert & Talbert, Patent Lawyers, 482 Talbert Bldg., Washington, D. C.

Patents Procured Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C., or 2278-T Woolworth Bldg., New York.

John M. McLachlen, Atty. at Law, Patents, Trade Marks, Copyrights, 410 McLachlen Bldg., Washington, D. C.

M. F. Miller, Ouray Bldg., Washington, D. C., Patent Attorney, mechanical and electrical expert. Best quality of work and results. Moderate charges. Advice free.

Patent Attorney Electrical engineer, mechanical expert; thorough personal service. Frank Ledermann, 21 Park Row, New York.

James N. Lyles—Patents, trade marks, copyrights. 734-D Eighth St., N. W., Washington, D. C.

Patent Your Own Inventions—Save attorney's fees; we prepare applications; furnish full instructions and give satisfaction. Free information. Carl Larsen Co., Park Row Bldg., New York City.

Protect Your Rights—Write for "Record of Invention" which contains forms to establish evidence of conception of your invention. Prompt personal service. Preliminary advice without charge. J. Reaney Kelly, 732-C Woodward Bldg., Washington, D. C.

Inventions Patented, trade marks registered, labels, prints and publications copyrighted, reasonable fees, correspondence solicited, detailed information free, booklets. Jaynes & Jaynes, 702 Kellogg, Washington, D. C.

Patents—My fee payable in monthly installments. Send sketch for advice. Booklet free. Frank Fuller, Washington, D. C.

Millions Spent Annually for Ideas!—Hundreds now wanted! Patent yours and profit! Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. 212 Patent Dept., American Industries, Inc., Washington, D. C.

Patents and Trade Marks Promptly Secured. Lowest fee. If not familiar with particulars, write immediately. Alberto Mendoza, Attorney, Box 251, Panama, Republic of Panama.

For Inventors.

600 Mechanical Movements, also illustrations and explanations of 50 perpetual motions. My book, Inventors' Universal Educator, 4th edition, tells how to procure and sell a patent for your new invention. Government and other costs. Covers the matter from A to Z. 140 pages elegantly bound. Contains noted Court decisions on Patent cases. Mechanical Movements greatly assist inventors—suggest new ideas that might prove of great aid in perfecting inventions. Tells how to select an attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers. Price $1. Postage free. Fred G. Dieterich, 603 Ouray Bldg., Washington, D. C.

Inventions Commercialized—Cash or royalty. Adam Fisher Mfg. Co., 205 St. Louis, Mo.

Inventors join National Institute of Inventors, World Building, New York City; membership society 1,900 strong; will help protect, develop, finance and market your invention. Absolutely no charge. Write for booklet.

Save Money—I will work out your complete patent application, including drawings, for $25. Ready for filing. H. E. Serner, Consulting Engineer, Patent Expert, 1431 Broadway, New York.

Inventors—Protect yourselves. Record your idea before exposing it to anyone, even to us. Write or call. Inventor's Patent Service, 21 Park Row, New York City.

Sell or Finance Inventions—Send dime for sample copy of Money-Talks Magazine. 70-B Park Place, Newark, N. J.

Health.

Tobacco or Snuff Habit Cured or no pay; $1 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

Pyorrhea—H. E. Kelty, D. D. S., M. D., pyorrhea specialist for 15 years, has developed a successful home treatment for pyorrhea. Purifying, healing, preventative. Full month's treatment and booklet $1. Circular free. Dr. H. E. Kelty, 106 Gladwin Ave., Leonia, N. J.

Cigarette, pipe or chewing habit conquered. Nature's method. Guaranteed. Write for free brochure. Edw. J. Woods, TA-300, Station F, New York.

Instruction

Over 100 Branches thoroughly taught by mail. For "Free Tuition," apply Carnegie College, Rogers, Ohio.

Continued on page 190

www.americanradiohistory.com

Tricks, Puzzles and Games.

100 Kinds Wire and Steel Puzzles—Catalog and leader, 10c.; postpaid. Western Puzzle Works, St. Paul, Minn.

Tricks, Puzzles, Jokes, toys, games, novelties, doll and cane racks, plays, wigs, stage supplies, escapes and illusions. Large 1917 catalogue free. Oakes Magical Co., Dept. 549, Oshkosh, Wis.

Black Art Hindoo experiments. 1919 edition, 25c. Invisible ink. Free trick. Catalogue each order. Linhorst Magic X Shop, St. Louis.

1000 Stage Tricks with 500 illustrations. Catalogue, 10c.; small catalogue free. Hornmann Magic Co., Sta. 6, 170 Eighth Ave., New York.

Magic—Entertain at home. Tricks, puzzles, novelties. Big Catalogue A 25c. Martinka & Co., Inc., Harry Houdini, President, 493 Sixth Ave., New York City.

Magic—Card Tricks—Sensational escapes, jokes Novelties. Everything in the amusement line. Large illustrated catalogue of a thousand tricks free. Write today. Largest amusement goods manufacturers in the world. Heaney Magic Co., Desk 200, Berlin, Wis.

All Magicians are reading the leading magical magazine. You'll like it, too! Send 25c. for three months' trial. Sample copy, 15c.; one year, $1. The Eagle Magician, Dept. EE, Minneapolis, Minn.

Send Stamp for Trick and Lists. W. Wooley, Peoria, Ill.

Printing

100 Engraved style visiting cards, 50c.; 100 emblem cards, 70c. H. Gregory, Warwick, N. Y.

Chemicals

Rare Elements and their salts. We have the metal and salts of Caesium, Arium, Lithium, Palladium, Rubidium, Thallium, Strantium, Tungsten, Titanium, Thorium, Vanadium, Vranium, Ythrium, Zircanium. Rare Hugars and Organic compounds such as Furfurol, Arabinose, Dulcit, Insulin, Lactane, Maltose, Mannose, Dextrose, Levulose, Xylose, Raffinose. For Analysis we have a fine grade of Perchloric Acid at $9.25 per pound; also Osmic Acid at $3.25 per grain. Write for particulars. Ziegler Experimental Laboratory, Rochester, N. Y.

100 Chemicals—Young Man $6—Complete chemical laboratory. 100 chemicals, as mercury, iodine, silver, molybdenum, together with 96 others, generous quantities, also chemical glassware, blowpipe, etc. Prepaid anywhere $6. C.O.D. terms accepted. Full list on request. Borough Chemical Co., Successors to the Swimmer Chemical Co., 1904 Park Place, Brooklyn, N. Y.

Chemicals—Amateurs and experimenters buy your chemicals from us and save money. Prices 25 to 50 lower than others ask. Write for our price list and be surprised. Jos. Simpson, 3880 Windsor Pl., St. Louis, Mo.

Standard Chemicals and laboratory apparatus, cheap and reliable. June list, 5c. Frane, Eureka, Ill.

Chemicals in sets, $11.50 to $46. Write for particulars. Ziegler Experimental Laboratory, Rochester, N. Y.

Miscellaneous.

Big Money—Raise rabbits for us. Belgian, New Zealand, Flemish Giants. We sell stock and pay $7 pair. Express all rabbits raised from our pure bred stock at our expense. Contract and literature 10c. None free. United Fur & Produce Co., Inc., Dept. 63, 3017 Wilson Ave., Chicago.

Marvelous! Send for our time-saving multiplication table. Products of any amounts readily calculated. Handy pocket size card. Price 10c. (coin) by mail. Remittance with orders. Tabulated Information Card Co., 2040 Chestnut St., Philadelphia, Penn.

Closing Out Sale—Get one of our Dollar Adding Machines. 75c. while they last. Smith & Gates Co., East Troy, Wis.

Typewriting—Neatly and correctly done. Manuscripts a specialty. Essays, speeches and letters prepared for all occasions. John H. Owens, 536 East 41st St., Chicago, Ill.

For Sale—Young New Zealand Red Rabbits. Winner four silver cups this season. Per trio $35. White, black, chocolate mice, four pairs $2. Extra female 30c., males 25c. Natural Bridge Rabbitry, 4464 Natural Bridge, St. Louis, Mo.

Start a profitable business manufacturing "Puffed Crisp." Delicious confection. Whirlwind money-maker. Machine, instructions complete $6.50. Samples 10c. Bestever Products Co., 2426—E4, Polk St., Chicago.

For the Hair.

I was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have good hair-growing results. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E. 32nd St., BA-300. New York.

Books.

Books for Real Live People. Lists free. J. E. Sheridan, 417 E. 151st St., New York.

What Every Draftsman Should Know. Very useful booklet. Price 12c postpaid. Wack Booklet Co., 1943 Patten St., Philadelphia, Pa.

Dear Reader—If Occult, New-Thought and Scientific books appeal to you, send for my catalog, it's free. I have books on Personal Magnetism, Concentration, Spiritualism, Clairvoyance, Seership, Will, Mind, Hypnotism, Mesmerism, Character Reading, Healing, Mysticism, Success, Salesmanship, Mechanics, Entertainment, etc. A. W. Martens, J-49, Burlington, Iowa.

World-Romic System, Masterkey to All Languages. Six Textbooks, $1.44. French Chart, 37c; Spanish, 37c; Aviation Dictionary, $1.50. French-English Aviation Dictionary, 61c. Languages, 143 West 47th, New York.

Applied Electricity. Electroplating, motors X-Ray, wireless telegraphy, 350 pages, 214 illustrations. 60c. Ask descriptive circular. T. Perez, 729 McKinley St., Elizabeth, N. J.

Be Healthy! Succeed! Read "Success Words," 1919 Wonder. Original, Practical. 20c postpaid. Success, 1943 Patton St., Philadelphia, Pa.

Nature Laws every married and engaged person should know. Two volumes complete, 50c. Over 200 Practical Suggestions for starting your own business, 50c. Central Company, 599 Ninth Ave., New York.

To Get Better Pictures: Read the Amateur Photographers' Weekly; illustrated; weekly prize competitions; print criticisms; many unique features; $1.50 per year; three months' trial subscription 25c. Abel Publishing Company, 401 Caxton Bldg., Cleveland, Ohio.

Old E. E. Back Numbers: We have some valuable old E. E. back numbers on hand as follows: 1915—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec., price each 35c. 1916—Jan., Feb., March, May, June, Nov., Dec., price each 35c. 1917—Jan., April, May, June, Aug., Nov., Dec., each 35c. 1918—Mar., May, June, 35c. July, Aug., Sept., Oct., Nov., Dec., each 20c. 1919—Jan., Feb., Mar., Apr., May, 20c. We can fill orders at once upon receipt of your remittance, and if you have not these numbers already, now is your chance to get them, as they probably will be snapped up very quickly. Experimenter Publishing Co., 233 Fulton St., New York City.

Blueprints.

All Audion Circuits—See Wireless. Address "Radio," Post Box 346, Yonkers, N. Y.

Blue Prints—½ H. P. gas engine, 30c.; ¾ H. P. steam engine, 50c.; ½ H. P. boiler and engine, 70c.; all 3 for $1. Circulars on castings and engines for stamp. Universal Gas Motor Co., 364 Monadnock, Chicago.

Amateurs—Blue prints furnishing wiring diagram and all data necessary for construction of (Paragon RA6) regenerative receiver. Price now $1 postpaid. Radio Research Laboratories, 2148 Fifth Ave., Troy, N. Y.

Stamps and Coins.

Collection of Coins from twelve countries, 50c. Coin Co., Box 465, Dayton, O.

2000 Different Stamps, complete collection, $1. Stamp Co., Box 465, Dayton, O.

California Gold—Quarter size, 27c.; half dollar size, 53c.; dollar size, $1.10; large cent, 1820, and catalogue, 10c. Norman Shultz, Kings City, Mo.

Fortunes in Postage Stamps—Start stamp business of your own. Send 50c. for sample stock, worth $1.50. M. Shedel, 29 Collahie St., Toronto, Canada.

Stamps—61 All Different Free. Postage, 3c. Mention paper. Quaker Stamp Co., Toledo, O.

500 Finely Mixed United States or Foreign stamps 12c. Philatelic Star, Madison, N. Y.

100 Different Stamps 10c., 200, $25. Michaels, 5600 Prairie, Chicago.

Best One-Cent Approvals in America. F. P. Hand, 1117 So. 60th St., Philadelphia, Penn.

Free—Packet valuable stamps to applicants 50 per cent. Approval. Benj. Forbes, 160 Devilliers, Pittsburgh, Penn.

Free Stamps to Approval Applicants. 3c. Harland Burgett, 419 Spring St., Lima, O.

Old Money Wanted.

We Buy and Sell Old Coins. $2 to $500 each paid. Keep All Old Money; you may have valuable coins. Send 10c. for New Illustrated Coin Value Book, 4 x 6. Guaranteed prices. Get posted. Clarke Coin Co., Box 110 Le Roy, N. Y.

Postcards.

Everything in Postcards—Live-wire list free. Worth-while samples 25c. Mention subjects preferred. Mutual Supply Co., Bradford, Penn.

Five Prettiest Women Cards—Hand colored, 25c.; camera bargain list free. Chas. Durso, Dept. 41, 25 Mulberry St., New York City.

Matrimony

"Get Married" Ladies, your description published FREE. Write Cupid's Princess, Lock Box 382, Burlington, Vt.

Wireless.

The Audion Bulb—Its early history and development, electron theory and trigger action, also of blue prints, hook ups for receiving damped signals using both air exhausted and gas bulbs, receiving undamped signals and regenerative circuits, two-step amplifier using same (A) and (B) batteries for both steps, wireless telephony with the audion. How to build a one to one transformer for use in an audion amplifier. Gotten out by a chief electrician (radio) U. S. N. For the amateur. Price $2. Address "Radio," Post Box 346, Yonkers, N. Y.

We Fully Qualify You by Mail for the Government first-grade commercial license as a wireless operator, fitting you for positions in merchant marine or land stations. Positions pay $110 and living expenses, up to $3,500 yearly. Our profit sharing plan guarantees a saving of 10 per cent. on tuition to successful students and estimated saving of 50 per cent. Free post graduate course in our Washington school, the largest in America, where we have daily attendance averaging 200 students, expert Government instructors, and full equipment. Most thorough course. Illustrated catalogue and details of profit sharing plan on request. Service Radio School, Dept. E, 902 Pa. Ave., Washington, D. C.

Now That We're Alive Again, Keep Alive by reading the "Aire News." The "Aire News" is a monthly amateur radio magazine containing many novel departments and sure to please either the novice or expert as it contains live, peppy, simply written articles interesting to both. Yearly subscription $1.50 or three months' trial subscription 25c. Be progressive. Send your subscription, regular or trial, immediately and receive the "Reopening Issue" which will be a rip-roaring success. Delay means your missing much so act now and subscribe today. American Institute of Radio Engineering, Omaha, Neb.

Radio Apparatus of Quality—Manufactured to your own specifications. Radio Engineering Company, Baltimore, Md.

Amateurs!—Special cardboard tubing, impregnated, for receiving transformers. 5 and 5½ inches diameter. 25c. per foot, any length. Postage included. Maier & Company, 335 East 93rd St., New York.

Radio Amateurs—Now is the time to get your stations in readiness. Everything for the amateur. Send purple stamp for circular describing STANDARD apparatus only, at prices that will save you money. Crescent Wireless Supply Co., 1500 Lafayette Ave., Mattoon, Ill.

Switch Points—Binding posts, switch levers, and small parts, send 2c for catalogue describing these and other goods. A. W. Bowman & Co., 23 Church St. (Harvard Square), Cambridge, Mass.

Complete Receiving Sets $8.50, $9.50 and up. Instruments, parts, minerals. Circular for stamp. Inquiries invited. Jenkins, 923 Purchase St., New Bedford, Mass.

Blue Print Code Charts—All codes; fine for laboratory. 13c. each, two for 25c. A. B. "Lab." Co., 1315 E. High St., Davenport, Iowa.

Cameras, Supplies—Photo Developing.

Clean, Neat, Perfect Kodak Finishing at the lowest prices. Work returned the same day received. Send film for sample print and copy of Catalog on Developing, Printing, Enlarging and Hand Coloring, also copy of Photo Craft Magazine, which will help you make better pictures. Photo Craft Co., Box 69, Ann Arbor, Mich.

Mail Us 15c. with any size film for development and 6 velvet prints. Or send 6 negatives any size and 15c. for 6 prints, 8 x 10" mounted enlargements 35c. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke, Va.

Special Trial Offer—Your next Kodak film developed, 5c. Prints 2c. each. Moser & Son, 1919 St. James Ave., Cincinnati, O.

Slightly Used Cameras—Bargains. Send for list. Cameras exchanged and repaired. L. Huber, 1146 Stebbins Ave., Bronx, New York.

Free—Developing, prints 3¼ x 5½ and smaller, 2½c. 8 x 10 enlargements, 25c. Try us. Gem Studio, 462 Wabasha St., St. Paul, Minn.

Any Six or Eight exposure film up to post card size developed and printed, 10c., or enlargement, 8 x 10, your favorite negative, 20c. Special introductory offer to show high quality work. Associated Photo Co., Dept. 12, Cincinnati, Sta. A.

Song Poems Wanted.

Write the Words for a Song—We write music and guarantee acceptance. Submit poems on war, love, or any subject. Chester Music Co., 918 So. Michigan Ave., Room 265, Chicago.

You Write Words for a Song—We write the music, publish and secure a copyright. Submit poems on any subject. The Metropolitan Studios, 914 Michigan Avenue, Room 113, Chicago, Illinois.

Write the Words for a Song—We revise poems, write music and guarantee to secure publication. Submit poems on any subject. Broadway Studios, 1970 Fitzgerald Bldg., New York.

Song Poems Wanted—Send today for valuable information free. Hummel Music Co., Clarence Bldg., Cleveland, Ohio.

Music composed to words. Bauer Bros. (formerly of Sousa's Band), Oshkosh, Wis.

www.americanradiohistory.com

GREATEST TOY SENSATION OF THE DAY!

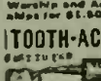
FIGHTING DREADNAUGHT

SENSATIONALLY REALISTIC!!!



Here is a model of Uncle Sam's fighting monsters. Eight big guns, each of which flashes, at correct intervals, from twelve to twenty times. Extra ammunition always obtainable. Absolutely harmless. Can be operated indoors or out. Non-boys! Here's your chance to own a battleship in action, and the best of it is you can OWN the ship and command the fleet yourself! By having two or more Battleships you can arrange EXCITING NAVAL BATTLES in your own home. Price a Warship and Ammunition, 15c, three for 40c, or a fleet of 3 ships for $1.00 postpaid. Extra Ammunition, 5 cents per box.

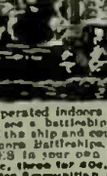
TOOTH-ACHE STOP



Stops the Pain; Stops the Tooth

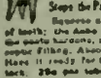
Squeeze a little in hollow of tooth; the Amber Resin instantly fills the cavity, forming an air-tight filling. Absolutely harmless. Have it ready for the next toothache. 25c gas tube, postpaid.

Mysterious Ghost



This is not a pretty object, but there is no limit to the fun it will provide for practical jokers. The Ghost, when hanging in front of a window, darkened room, or dark place, glows with a ghastly cold bluish radiance, very apt to give one a creepy sensation. Even those who know what it is all about, it has a regular starting effect on. Makes the same quite a unique ornament only. A great joke to play on your mother-in-law. Price only 10 cents each, or three for 25 cents.

"SAFETY 1st" PINS



A clever novelty. The word "Safety First" is known the world over as a very popular slogan. Wear one and show your sympathy with the movement. Also handy for wearing at amateur theatricals and the like. Two sizes, No. 1, small gilt head and 1¼ inches long, plated 6c each, two for 10c, postpaid.

INKLESS PEN

WRITES with WATER 500 words every time dipped. Makes its own ink. Writes fashionable violet color. Better and cheaper than fountain pens. Writes a longer letter with one dip to plain water. No trouble—no bother—no mess. A splendid pen. Why bother with ink? Sample holder 10 CENTS, 5 for 25c.

SIMPLEX TYPEWRITER ONLY $2.50



Cheap But Good. So Simple a Child Can Use It. We Guarantee the Writing.

Though so marvelously simple this machine is a thoroughly practical typewriter. Its construction is so perfect that it is guaranteed to last for years. Has all the essentials of the high priced machine. It does not seem possible at the price, but all we need say is look at the work and you will be convinced. Each reasonable letter it will last a lifetime. It is so simple that almost any one can write with it. You can learn all there is to know about it in five minutes, and an hour's practice will make you an expert operator. Every letter looks exactly like the finest pen written, is indistinguishable from and creates the impression that the arm is a mechanical one, so strong and even is the impression. Is a Practical Exponent for all those who have occasion to do their own correspondence, whether it be for business or personal reasons, and to use it both. You should not miss the chance of owning a typewriter. The letters of the Simplex are 3 to 16, and particulars of the machine are so arranged that the letters most used are before the operator most of the time, enabling him to write rapidly. The universal bar, which carries the letters to the paper, is entirely under the control of the writer, moves the ribbon and the paper forward, giving the proper line space. So that the knack is acquired almost instantly, no decrease in the letter returns. Each typewriter packed in a strong box, with full printed instructions for use. Price each only $2.50, postpaid. Extra ribbons, 25c each.

Johnson Smith & Co., Dept. E 8, 3224 N. Halsted St., Chicago

SQUIRT RING



You may have a lot of fun with this Squirting Coin Safety Bank. It consists of a hard-rubber plated ring, attached to a rubber bulb, arranged that the latter is hidden out of view when the ring is in the proper position. Such a attractive looking article that the casual fellow will be sure to be the center of attraction. While the ring is being absorbed in so doing a fit our plan, you just squeeze the bulb and the water will squirt, etc., places a very great surprise. Price 10 CENTS, three for 25c, postpaid. A. G. CO.

Wonderful X-Ray Tube



A wonderful little instrument producing optical illusions both curious and startling. With it you can see what is apparently to be observed in the human body in a lived pencil, the interior opening in a pipe stem, and many other startling effects. A mystery that has long been able to defeat ordinary explain.

Price 10 cents. 3 for 25 cents; a dozen, 75 cents. Postage 2c each, postpaid.

Sneezing Powder



Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real cause, but think they have caught it from each other. Between the laughing and sneezing you may be sure that the time will pass very fast. For parties, public meetings, car rides, or any place at all where there is a gathering of people, it is the greatest joke out. Price 12c a box; 3 for 30c.

By Express only

STAGE MONEY



With a dozen of these bills, it is easy for anyone to create the impression that he is a great prosperous. By flashing a roll of these bills at the proper time will be the cause of a genuine bill of two from the other. Between the laughing and counting you may be sure that the time of your life. For parties, public meetings, car rides, or any place at all where there is a gathering of people, it is the greatest joke out. Price 12c a box; 3 for 30c.

NEW BOOK ON ROPE SPLICING

USEFUL KNOTS, HITCHES, SPLICES, ETC.

Nine Different Knots Are Made and What They Are Used For. Hoists to Use and Hoists to Avoid.



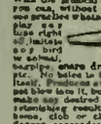
A most practical handbook giving complete and simple directions for making all the most useful knots, hitches, rigging, splices, etc. Over 100 illustrations. All about waterproofs, lashing, blocks, tackles, etc. 37 Heraldic Knots Illustrated. Of great value to mechanics, riggers, campers, boatmen. Price 20c p. p.

Johnson Smith & Co., Dept. E8, CHICAGO

LUMINOUS PAINT

Make Your Watches, Clocks, Etc. Visible by Night The very latest discovery in the scientific world. Electric, non-explosive paint. We have at last succeeded in producing the remarkable LUMINOUS PAINT, which, applied to the surface of any article, emits rays of white light, rendering it perfectly visible in the dark. The Paint Will Last Almost Indefinitely. It Shines Night and Day. Anyone can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the push buttons on switch plates of your electric lights, match boxes, and innumerable other articles, and make your own Luminous Creations. Sufficient to Bottle remaining materials, and articles, Price 20c, Larger sizes 50c and $1 per bottle. Johnson Smith & Co., Dept. E 8.

MUSICAL KAZOO



With the Musical Kazoo you can, without practice, play any one air whatsoever, also play any tune right off hand on any comb (not a comb) harp, guitar, piano, drum, Punch and Judy, etc. No holes to finger. It is simplicity itself. Produces a beautiful tone. You do not blow into it, but sing, speak, laugh or make any desired melody into the end of the instrument, and the most astonishing results of society entertainments, dance, serenade, parties, outings, etc., are yours. Just the thing for choruses and shows in lodge and church clubs, etc. Excellent for vocal or instrumental accompaniments, either with or without other musical instruments. Price 15c, p. p.

MAGIC FLUTE



Wonderfully Sweet Toned and Musical

A marvelous musical instrument. No other instrument produces exactly the same sweet tones as the human voice. It is the joyous notes of a quickstep or the soft and sweet strains of a church hymn—in fact, any class of music can be played upon the Bimaona tone without practice, as it is almost a self-playing instrument. When played with a piano accompaniment, or the other musical instrument, the effect is charming. Full printed instructions for playing sent with each instrument.

Price 15c, p. p.

All the Latest Surprising and Joke Novelties

Chaw's Serpents Eggs, box	10c	Cover the Spot Trick, series, one.	10c
Miniature Water Pistol	10c	2 Kay Nursery	10c
Mystery's Snake Story Booklet	10c	Trick Pencil	10c
Fake Matches (fool your friends)	10c	Rubber Tacks (a good joke)	10c
Hard Nuts Puzzle Catalog	10c	Mesmerized Proof (defies the Sc	
Mysterious Ghost, shines at night	10c	of gravitation)	10c
Rubber Razor (very formidable)	20c	Mysterious Tumbler and Washing Cone Trick	15c
Rubber Dagger (or assassin)	20c	Magic Mirror (looks one peep)	10c
Window Smashers (great joke)	20c	Magic Pocket Flute	10c
Comic Instructions (to be behind you)	10c	Imitation Gold Teeth	6 for 10c
Great Mind Reading Mystery Cde.	10c	Great Surprise Puzzle	10c
Detective's Mysterious Trick Cde.	10c	Wire Puzzles, 10c. 12 different,	$1.00
Fortune Teachers, pair	10c		

JOHNSON SMITH & CO., Dept. E8, 3224, N. Halsted St. CHICAGO

Boys, you can have Movies at your own home with this latest model

MOVING PICTURE MACHINE

Uses Standard Films same as the larger machines. Very easily managed. Simply turn the handle. Good Variety of Films always obtainable

PRICE Complete ONLY **$2.50** Postpaid anywhere Including Two Films

Extra Films, 45c each postpaid



THIS IS A GENUINE MOVING PICTURE MACHINE and the motion pictures are clear, sharp and distinct. The Moving Picture Machine is finely constructed, and carefully put together by skilled workmen. It is made of Russian Metal, has a beautiful finish, and is operated by a finely constructed mechanism. The projecting lenses are carefully ground and adjusted, triple polished, standard double extra reflector, throwing a ray of light many feet, and enlarging the picture on the screen up to three or four feet in area. The light is produced by a safety carbide generator, such as is used on the largest automobiles. This throws a dazzling white light on the screen.

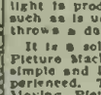
It is a solidly constructed and durable Moving Picture Machine. The mechanism is exceedingly simple and is readily operated by the most inexperienced. The pictures shown by this marvelous Moving Picture Machine are not the common, crude and lifeless Magic Lantern variety, but are life-like photographic reproductions of actual scenes, places, and people which never tire its audiences. This Moving Picture Machine has caused a rousing enthusiasm wherever it was used.

JOHNSON SMITH & CO.

Dept. E 8 3224 N. HALSTED ST., CHICAGO

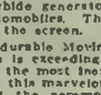


ANARCHIST BOMBS



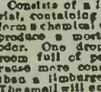
Consists of a little glass vial, containing in liquid form a chemical which will produce a most horrible odor. One dropped in a room full of people will cause more consternation than a limburger cheese. The smell will disappear in a short time. 3 Bonze for 25c, shipped by express only with a Dollar's worth of other merchandise.

ITCHING POWDER



This is another good practical joke: the intense discomfiture of your victims is everyone but themselves is thoroughly enjoyable. All that is necessary to start the ball rolling is to dissemble a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more. 5 Bonze for 25c, sent only by express. (Must order at least One Dollar's worth of other merchandise.)

INVISIBLE INK



The most confidential messages can be written with this ink, for the writing MAKES No MARK. Cannot be seen unless you know the secret. Invaluable for many reasons. Keep your postals and other private memorandums away from prying eyes. Great fun for playing practical jokes. Only 15c bottle.

LOVE LETTER INK

Writing written with this remarkable ink vanishes entirely in a few weeks (sooner if desired), leaving the paper QUITE BLANK. 15c p. pd.

LUMINOUS INK

Writing can be READ ONLY IN THE DARK. Quite invisible in daytime. 3 bottles for 25c, postpaid. Johnson Smith & Co.

MULTIPLYING BILLIARD BALLS

The Best Feat of its Kind

The trick is as effective as it is surprising. The performer rolls the balls around the ball for examination, and immediately it is returned to him has in each of his hands one of the balls, and the third finger and a second ball appears between. There are held in full view of the audience, the tips of the fingers of the left hand, and even while being placed in position, another ball appears between the tips of the fingers. Great is the mystification apparently suffers from some kind of spasm and yet another ball is the result. The feat can thus be repeated, the balls disappearing one after another in an almost endless manner. It is a very interesting trick that is quite easily performed by following the directions that accompany the apparatus. PRICE, 25 CENTS, POSTPAID. JOHNSON SMITH & CO.

GOOD LUCK RING

Gambler and Horse Dealer



A VERY STARTLING and mysterious ring, made of gunmetal, finished in oxidized design, with two brilliant flash or gems resembling fine cut diamond. A never failing object of interest. It is said by many to bring Good Luck, Health and Wealth, so will not guarantee that. It is certainly a very unique ring that you will take a pride in wearing. They were made to sell at 50 cents, but as a special bargain we will supply them to customers at one-half the price, at HALF PRICE, viz., ONLY 25 CENTS, POSTPAID. Johnson Smith & Co.

LOADED CIGARETTES



A box containing ten apparently genuine Cigarettes. They contain a tube which explodes when about one-third smoked.

They are real, and afford a good smoke, unless they are the cause of a great deal of fun. Price, 10c per box, postpaid. Johnson Smith & Co., Dept. E-8

THE "LITTLE GIANT" TYPEWRITER

A First Class Writing Machine For $1.25

A per act little typewriter for all that. There are thousands of persons who would like to own a typewriter but cannot afford the expense it other machines cost. To such persons we confidently recommend our Little Giant. It is strongly made, but simple in construction, so that any one can quickly learn to operate it, and write as rapidly as they would with pen and ink. The letters of the alphabet, numerals, and characters necessary to write a letter, are arranged in one to write rapidly. Use a postcard, 1 to 10, and the punctuation marks listed together. With this machine you can send your best wishes to your friends in less letters, address envelopes, make out bills, and do almost any kind of work not requiring a more expensive machine. With each typewriter we send a tube of ink and full printed instructions for using the machine. Price complete $1.25 by mail postpaid.

SERPENT'S EGGS

Each box contains 12 Eggs, which are no larger than a grain of oats. When lit with a match, however, each one grad-ually hatches itself into a Snake several feet long, which curls and twists about in a most lifelike manner. Price per box 10c, postpaid. Johnson Smith & Co.

MYSTIC SKELETON

A jointed figure of a skeleton 14 inches in height, will dance to music and perform various gymnastic feats when the operator may be any distance from it. The figure may be manipulated by the operator.

When handed back to the operator it is simply placed on a chair or table, when it will seemingly become endowed with life, and begin to dance. As the command of the operator it will sit down, stand up, dance, etc. We send full directions with each Skeleton, by the aid of which anyone can readily make it perform. 10c postpaid.

CIGARETTE ROLLER

Very neat and handy. Rolls less than a quarter of a second. It makes better cigarettes than you can buy and makes them easily and quickly. You can use just the tobacco you prefer and thus have a cigarette smoker's ready made. Sold more of them besides saving about half of your money. Just try one and make your cigarettes just to your own liking. Only 10c or 3 for 25c postpaid, with full instructions for use. JOHNSON SMITH & CO.

MIDGET ILLUSTRATED BIBLE

A Great Curiosity

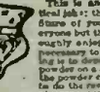
The Smallest Bible in the World

The Midget Bible is a perfect gem, and a credit to art. It is about the size of a postage stamp, and contains TWO RUNG-RED AND FIFTY PAGES of the NEW TESTAMENT, clearly illustrated. The little Bible is a wonder. It is said to bring good luck to the owner. Must be seen to be appreciated. Price, only 12 cents. Three Bibles for 30 cents; one dozen Bibles for $1.00 or 100 for $6.00. Good money can be made selling these Midget Bibles among your friends, also churches, Sunday schools, bazaars, etc. Send for a few and try it.

The CONJURER'S CASKET

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment

ANYONE CAN DO THEM



50c

It is great fun mystifying your friends. Get this Conjurer's Casket, and you will be the life of your circle. It contains apparatus for seven first-rate tricks, including The Disappearing Handkerchief, where a handkerchief of your own, taken from right at your side, the Magic Vase and Ball Trick (a Wooden Ball is placed inside, and upon requesting the ball has disappeared and is found in someone else's pocket); The Magic Nail Trick (apparently cut your finger almost in two; the Wonderful Card Trick (a card is placed in an envelope and when opened an entirely different card altogether is found); The Disappearing Coin Box (a coin is placed in the little wooden barrel, and when opened again, is found to have vanished entirely, or can be made to change into a coin of another denomination); The Famous Mesmerized Penny that defies the law of gravitation (a penny balances on the head, nose, chest, wall, clothing, etc.); The Glass Goblet and Vanishing Coin Trick (a coin is dropped into a glass of water, and when the water is poured out the coin has vanished). With the seven tricks described above we send full printed instructions for performing each trick, so that anyone can readily perform all the tricks to the great amusement of the friends of the public. Any boy of ordinary intelligence with the Cabinet of Tricks in his possession can become a most expert magician. Besides the tricks contained in the Cabinet, there are twenty-five other tricks and illusions fully explained with full printed instructions, by which you can perform the most wonderful appearing feats. Among them are The Means in a Pack of Cards, The Dream Card, The Hat Trick, To Knock a Number Through a Table, One Cent Robbed into Two, To Find the Number Thought of, Mysterious Wedding Ring Trick, and the secret of performing three wonderful stage tricks, as follows: The Art of Cremating a Woman, Walking on the Ceiling of a Room, and the Disappearing Lady, together with an article of gentleman's and valuable hints to amateur conjurers. PRICE COMPLETE ONLY 50 CENTS.

JOHNSON SMITH & CO., Dept. E 8, 3224 N. Halsted Street, CHICAGO

The Newest Novelty Aerial Balloon



Now practically in or outdoors. This is the VERY LATEST SENSATION IN BALLOONS. A brightly colored balloon that measures sixteen inches long is blown up in the usual way and released, the air pressure sends the balloon SOARING UPWARD, the 3½-inch propeller SPINNING AROUND AT A LIVELY RATE. The effect is startling. It is a graceful affair that makes the passers-by WILD WITH JOY. May be used repeatedly indoors or outdoors. An immensely interesting toy. Price 10c each, 3 for 25c, postpaid.

JOHNSON SMITH & CO., Dept. E 8, 3224 N. Halsted Street, CHICAGO

"The Baby" Double Action Hammerless Revolver

A HANDSOME AND MOST EFFECTIVE WEAPON

$5.50



Measures but 4½ inches long

Takes regular .22 caliber cartridges

The new Baby Double Action Hammerless Revolver has been produced to meet the ever increasing demand for a revolver that would combine small size and light weight with the essential features of Efficiency and Practicability. It is small in size, yet in fact as effective and serviceable as the most expensive 38 that you can buy. Every one should have a revolver and should know how to use it, and there is no safer or better one made than the Arrest Action, with its safety action that guards against accidental discharge, making it quite safe for young men and ladies. The illustrations give an idea of its appearance, but it must be seen and used to be thoroughly appreciated. The construction and the handsome finish of the weapon from the cartridges can be shipped only by express. The purchaser three or a check to one number. The operation of the charging mechanism is extremely simple and absolutely reliable; it will not expend shells can be fired in so many seconds. The revolver is very well constructed, with finest nickel plated blued barrels of cylinder, and it weighs only 9½ ounces. The price at one dozen can be only $6.50, sent by express. JOHNSON SMITH & CO.

THE EXPO WATCH CAMERA



The most wonderful and ingenious Camera made

It is but little larger than a watch, which it closely resembles. You can carry the Expo about in your pocket and take pictures without any one being the wiser.

One Cent a Picture

The Expo loads in daylight with 25 Exposure Films, costing but One Cent per picture, including the developing. It is a compliment itself to operate. Takes pictures through the glass, where the Hand First Lens is located. The photos (6/8 1½) may be enlarged to any size.

Price $2.50

QUICK AS A FLASH

Time and Instantaneous shutters; Graphic bar 8 speeds. Sight plated, Endorsed by amateurs and professionals the world over. Thoroughly practicable printing and developing of films just the same as ordinary cameras—is daily use by the public at our private apartments, detectives, and the professional. Hundreds of boats have been secured with the Watch Camera by enterprising reporters. Produces clear, sharp negatives indoors or outdoors equal to any camera on the market, at one-quarter the price.

Expo Watch Camera Postage 10c Extra **$2.50** FILMS, 25 Exposures 15c, 25 Exposures, 25c Leather Pocket Carrying Case, 35c.

Johnson Smith & Co., Dept. E 8, 3224 N. Halsted St., Chicago

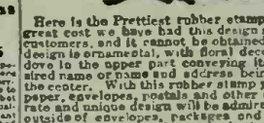
This Pretty RUBBER STAMP AND INK, 75c WITH PAD



Here is the Prettiest rubber stamp you ever saw. At very great cost we have had this design specially engraved for our customers, and it cannot be obtained except through us. The design is ornamental, with floral decorations, with a beautiful dove in the upper part conveying its message of love, the desired name or name and address being tastefully displayed in the center. With this rubber stamp you can brand your letter paper, envelopes, postals and other stationery, and the elaborate and unique design will be admired by all. Placed upon the outside of envelopes, packages and other mail matter, it ensures their return to the sender in the event of non-delivery for any reason. It looks very pretty stamped on books, music, photographs, etc. With each stamp we include a self-inking stamp pad and a bottle of ink for re-inking the pad, and the PRICE of the COMPLETE OUTFIT, in box, is ONLY 75 CENTS, POSTPAID.

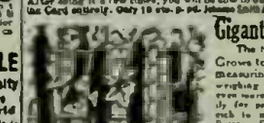
New Vamping Card

No Teacher Needed Surprisingly Simple System



Persons having neglected their Musical Education need not despair, for with the aid of our new VAMPING CARD (about the size of a postage stamp) and a little practice you will be able to dispense with the use of the Vamp. The Card entirely. Only 10 cts. p. pd. Johnson Smith & Co., Dept E8

Gigantic Butter Beans



The New Edible Vegetable Wonder

Grows to an astonishing size, the Beans measuring from 3 to 6 feet long and weighing anything from 10 to 15 lbs. and even more. One Bean is sufficient for a family for several meals. Very palatable and much in nutritious materials. The Butter Beans is much appreciated. The Vines are rarely grown, very prolific, and a most welcome and valuable adjunct to your garden. Try them; you will find them the most delicious vegetable you have ever tasted. Imported direct. Unobtainable elsewhere. Sample package of Beans, with full directions for cultivating and cooking, 25c postpaid.

JOHNSON SMITH & CO. DEPT E8 3224 N. HALSTED STREET CHICAGO

SHARPEN-M-ALL SAFETY RAZOR STROPPER

SHARPENS EVERY KIND OF SAFETY RAZOR BLADE

Sharpens the Gillette and Durham Duplex both edges at one time

ALSO SHARPENS THE GEM, JUNIOR, ED-GE-READY, ASH-LATTER, MARS, CROSS, CLARK, AUTO-STROP STAR, CAL-STEEL, AND ALL OTHERS



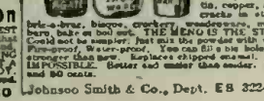
By using the SHARPEN-M-ALL STROPPER, you will not only get BETTER SHAVES, but you will SAVE MONEY on blades, as you will be able to get from 150 to 250 shaves from one blade, and the last shave will be as good as the first. The construction is genuine and will last a lifetime. There is no guess work to operate it, and no order. Any amateur can use it just as well as the most expert barber. No experience necessary, as the arrow on the stropper shows the direction in which to move the blade. It has two separate surfaces, giving the CORRECT DIAGONAL STROKE. There are no moving parts to get out of order, and nothing necessary to operate the machine. The razors are made of a special hardened steel that STROP AND HONE at the same time. The razors run only one way, so there is no fear of damaging the blade or the stropper. The STROPPER IS ALL in one piece, and is handsomely nickel plated, with rubber bottom and felt underneath. The weight of the composite material is just right amount.

Price, only $1.00, postpaid.

JOHNSON SMITH & CO., DEPT E8 3224 N. HALSTED STREET CHICAGO

Potmend

Stops a leak in a minute



The finest repairer for Ironware, Agateware, Enamelware, etc. Good for kettles, pots, pans, boilers, and every kind of ironware. Also for tin, copper, aluminum, ice boxes, iron pipes, cracks in stoves, broken chairs, porcelain, brie-a-brac, bisque, crockery, wooden ware, marble, etc. Will not chip, rot, burn, bake or boil out. THE MEND IS THE STRONGEST SPOT IN THE POT. Could not be simpler. Just mix the powder with water. HARDENS LIKE IRON. Fire-proof, Water-proof. You can fill a big hole or a small crack. Mended part stronger than new. Replaces chipped enamel. Anyone can do it. FAILURE IS IMPOSSIBLE. Better and easier than solder. Three sizes, 10 cents, 25 cents and 50 cents.

Johnson Smith & Co., Dept. E8 3224 N. Halsted St., Chicago

www.americanradiohistory.com

SAVE 1/2 - INSTALL YOUR OWN PLUMBING AND HEATING

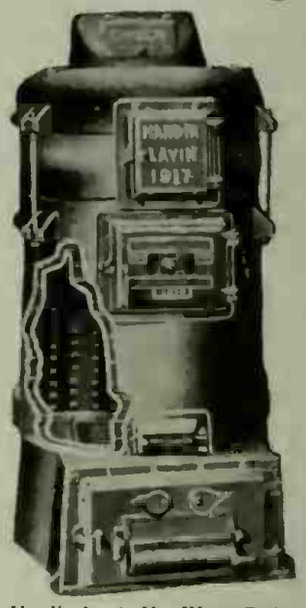
NEW HARDIN EASY WAY HARDIN-LAVIN CO CHICAGO



Reduce the High Cost of Building

Plan and Install Your Own Plumbing and Heating System

Our new HARDIN EASY WAY enables any electrician, carpenter, contractor, builder, or farmer to easily install a complete, highest-grade plumbing system. Forty years' experience selling plumbing and heating goods direct has qualified us to supply material equipped with patented, easily-adjustable connections that any handy man can install himself. Our method is perfect, simple and easy. It will enable you to save on time, labor and materials. It will reduce your installation expense ONE-HALF.



Hardin-Lavin Hot Water Boiler

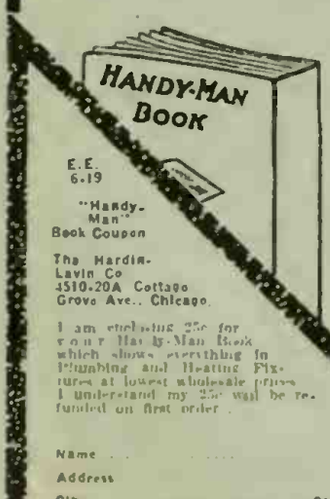
Send for Handy-Man Book

This big, valuable, instructive book contains practical and exclusive information of value to every handy man. It explains the new HARDIN EASY WAY of installing; it tells you in advance what your plumbing and heating will cost; it gives you suggestions on what fixtures to select and how to install them.

This 256-page HANDY-MAN BOOK will help you save money, time, material and labor, because it will show you fully how to put in your own plumbing and heating by our new, modern and quick method. It contains a complete line of new designs in guaranteed plumbing and heating outfits with the latest improvements, water supply systems, sinks, pipes, valves, fittings, etc. Over 10,000 different fixtures and supplies are illustrated and described in this remarkable book. You can't afford to be without it.

No Expense Spared We have spared no effort and have gone to a great expense to compile this valuable book. With economy still a national necessity, it would be unpatriotic to send this expensive book broadcast to non-interested parties. Therefore, we request a temporary deposit for each copy of 25c which we refund on first order or we send our Bargain Bulletin Free. Send today, our easy method and prices will astonish you.

Let Us Help You Plan and Install Send us a sketch or plan of your plumbing and heating job. Our engineers will show you the easiest, cheapest and most practical way. We furnish clear and easily understood plans FREE. If necessary, we will loan you the tools.



CUT-TO-FIT METHOD

Even if you intend to employ a practical plumber, your big saving by using our products and "New Method" will surprise you. Our simplified systems are fitted at the factory for the exact job for which they are intended. Any handy man with a few ordinary tools can easily install our plumbing, water supply systems, pipeless furnaces, hot water or steam heating plant this cheap, easy way. No experience required. We even furnish the necessary tools if desired. Every fixture we ship is guaranteed to give satisfaction. We will replace without cost to you any part or parts that prove defective or unsatisfactory.

40 YEARS IN BUSINESS

at the same address. $500,000 plants behind our guarantee. Send the attached coupon now for FREE HANDY-MAN BOOK and full particulars.



Hardin-Lavin Water Supply System

HARDIN-LAVIN CO.

4510-20A Cottage Grove Ave., Chicago, Ill., U. S. A.

www.americanradiohistory.com

Every Electrical Man Wants These Books and we ship them for your inspection FREE





Flexible Covers — Handy Pocket-Size Volumes

10 Volumes — 3500 Pages — 4700 Pictures

$1 Per Volume

$1 Per Month

Just what you need to know to succeed in ELECTRICITY

EVERY electrician, every engineer, every mechanic should know about these wonderfully helpful instructive books, which give in plain words a complete working knowledge of electrical engineering in all its phases.

You run into some new electrical problem almost every day. The information you need to help you in your every day work is in

HAWKINS ELECTRICAL GUIDES

These books place electricity at your finger ends. They cover every imaginable subject, principle, theory, problem, trouble, and way of doing things electrically. Every subject is indexed so that you can turn right to it. They are a study course and a reference guide in one, written in plain every day language—no wasted words—only what you need to know—chock full of up-to-the-minute electrical knowledge. The guides are a complete course in electrical engineering. They will help you in every detail of the day's electrical work. You can't ask an electrical question that Hawkins Guides can't answer.

What Electrical Men Say

Helped Him Make Good

"It is only right for me to recommend highly the Hawkins Guides, for they have been of the greatest assistance to me in placing me in my present position as Superintendent of Construction Department of one of Ohio's largest Electrical Companies. I would like to see every man have a set of Hawkins Guides."
Geo. Knecht, Columbus, Ohio.

In the Naval Electrical Dept.

"The Hawkins Guides are great help to me in the Naval Electrical Department, which they cover very thoroughly."
C. J. Cornell, U. S. Receiving Ship, Brooklyn, N. Y.

Superintendent

"I am now superintendent of the Dunnville Hydro-Electric Systems, and Hawkins Guides were a great help to me in holding down a responsible position."
W. E. Swartz, Dunnville, Ontario.

Wireless Operators

"I have worked wireless for ten years—but I wish I had these books years ago, as they have saved me a great deal of trouble." H. Marshall, Steamer M & B No. 2, Walkerville, Ont.

Pocket-Size Flexible Covers

The books are small enough to slip into your coat pocket—handsomely bound in flexible black covers.

You can carry each volume with you until you have mastered its contents. 3,500 pages of actual information and 4,700 illustrations. Once you see these books and put them into actual use you will never again want to be without them. Try it at our expense.

SEND NO MONEY

It will cost you nothing to receive these books—to look them over—ask them all the questions you can think of—use them in your work—study them—pick up some information that will increase your earning ability. We will ship you the entire set of 10 volumes entirely FREE.

This is a sign of our confidence in the guides. Pure gold does not object to being tested. Keep them for seven days and if you do not decide that you can't get along without them, return them to us and owe us nothing.

When you decide to keep them you only have to pay $1.00 down and remit the balance of $2.00 on the easy payment of $1.00 a month till paid for.

Use this coupon to get the books. It will pay you many times over.

THEO. AUDEL & CO.
72 Fifth Ave. New York, N. Y.

SEND NO MONEY - USE THE COUPON

READ THIS PARTIAL LIST OF CONTENTS

No. 1 Contains 348 pages, 388 illustrations. Electrical signs and symbols—static and current electricity—primary cells—conductors and insulators—resistance and conductivity—magnetism—induction coils—dynamo principles—classes of dynamos—armatures—windings—commutation—brushes, etc.

No. 2 Contains 348 pages, 394 illustrations. Motor principles—armature reaction—motor starting—calculations—brake horsepower—selection and installation of dynamo and motors galvanometers—standard cells—current measurement—resistance measurement—voltmeters—wattmeters—watt hour meters—operation of dynamos—operation of motors, etc.

No. 3 Contains 300 pages, 423 illustrations. Distribution systems—wires and wire calculating—inside, outside and underground wiring—sign flashers—lightning protection—rectifiers—storage battery systems, etc.

No. 4 Contains 270 pages, 379 illustrations. Alternating current principles—alternating current diagrams—the power factor—alternator principles—alternator construction—windings, etc.

No. 5 Contains 320 pages, 614 illustrations. A. C. Motors—synchronous and induction motor principles—A. C. commutator motors—induction motors, transformers; losses, construction, connections, tests—converters—rectifiers, etc.

No. 6 Contains 298 pages, 472 illustrations. Alternating current systems—switching devices—circuit breakers—relays—lightning protector apparatus—regulating devices—synchronous condensers—indicating devices—meters—power factor indicators—wave form measurement—switch boards, etc.

No. 7 Contains 316 pages, 379 illustrations. Alternating current, wiring power stations—turbines; management, selection, location, erection, testing, running, care and repair—telephones, etc.

No. 8 Contains 332 pages, 436 illustrations. Telegraph—simultaneous telegraphy and telephony—wireless—electric bells—electric lighting—photometry, etc.

No. 9 Contains 322 pages, 627 illustrations. Electric railways—electric locomotives—car lighting—trolley car operation—miscellaneous applications—motion pictures—gas engine ignition—automobile self-starters and lighting systems, electric vehicles, etc.

No. 10 Contains 513 pages, 589 illustrations. Elevators—cranes—pumps—air compressors—electric heating—electric welding—soldering and brazing—industrial electrolysis—electro plating—electro-therapeutic—X-rays, etc.

Also a complete 126-page ready reference index of the complete library. This index has been planned to render easily accessible all the vast information contained in the 10 electrical guides. There are over 13,500 cross references. You find what you want to know instantly.

THEO. AUDEL & CO.
72 Fifth Ave.
New York, N. Y.

Please submit me for examination Hawkins Electrical Guides (price $1 each). Ship at once, prepaid, the 10 numbers. If satisfactory I agree to send you $1 within seven days and to further mail you $1 each month until paid.

Signature.....

Occupation.....

Employed by.....

Residence.....

Reference..... E. E. June

www.americanradiohistory.com



Superintendent of Power Plant
$2500 to $5000 per year
City Technician
$1500 to $3000 per year
Electrical Draftsman
$2000 to $3000 per year
Testing Room Foreman
$2000 to $3000 per year
Supervisor of Maintenance of Electrical Motive Equipment
$2500 to $4000 per year
Technical Salesman and Director of Factory Power Installations
$3000 to $6000 per year

Unparalleled Opportunities in the New Field of *Electro-Technics!*

Announcing a New Specialized Course of Electrical Instruction to Train Men for This Newest and Biggest Field in the Electrical Profession

FOR years there has been developing in the industrial life of this country a wide commercial gap between the skilled, technically-trained Electrical Engineer and the "apprentice-trained" Electrician. At the top of the electrical profession has stood the Engineer—at the bottom, the Electrician. And in between has grown up a tremendous field of high-salaried industrial positions calling for *technically-trained electricians*—the field of Electro-technics! Thousands of leading industrial concerns today are looking for men who can fill these higher-grade electrical positions—men who can qualify as Power Plant Superintendents, City Technicians, Electrical Draftsmen, Testing Room Foremen, Supervisors of Maintenance of Electrical Motive Equipment, etc.—*Electro-technicians!*

You boys who are interested in an Electrical career—you men in the electrical trade who are handicapped by lack of technical training—*here is your big opportunity!*

Become An Electro-technician—Thousands of Liberal-Salaried Positions Opening Up All Over the Country in This Big, Uncrowded Field

Now is the time to start your training—with a tremendous nation-wide industrial reawakening right at hand—*with the most stupendous skilled-job market in history awaiting you when you graduate!* Already the first signs of the new industrial era are on the horizon. Rise to this world-epoch opportunity. Follow the example of the thousands of men of all ages in all walks of life, who at the close of the Civil War *revolutionized their entire life-careers in the great commercial readjustment that followed the War of the Rebellion.*

Mailing This Coupon Today May Prove the Turning Point of Your Life!

SEND ME THIS BOOK

I am interested in the big success-opportunities offered in the new field of Electro-technics. Send me a copy of Booklet-Catalog "*The Electro-technician — A New Factor In Modern Industry.*"

It is of course understood that this request places me under no obligation.

Name .....

Address .....

City ..... State .....

Age ..... Education .....

Present Occupation .....

If Tel... about your "Earn While You Learn" Plan



The Only School in the Country That Offers This Specialized Electro-technician Course

Nowhere else can you at present secure this valuable, specially-arranged, condensed course of Electro-technical training—training that is thoroughly sound and practical from start to finish—training that combines work-shop, laboratory, drafting-room and recitation-room instruction in equal measure and in efficient daily sequence.

Entrance Requirements

The course is open to all applicants who have at least a common grammar school education or its equivalent. All completed High School work in studies essential to engineering, such as Mathematics, Physics, Chemistry, etc., will be credited to student on entering. Such students will be given advanced standing that will enable them to complete the course in *one-half to three-fourths the regular time*, according to the number of credits they have on entering.

Next Term Opens July 1st
Classes Forming Now

Quick action is necessary as the number of students that can be accommodated in this term is limited. So don't delay. Look at your calendar—note the date—clip the coupon at the left—and some day you'll be looking back to this day and congratulating yourself over and over again for taking the first step in the greatest field Electricity has ever offered!

SCHOOL OF ENGINEERING OF MILWAUKEE

91 373 Broadway, Milwaukee, Wis.

THE CAREY PRINTING CO. INC.

www.americanradiohistory.com

JULY, 1919
20cts.

ELECTRICAL EXPERIMENTER

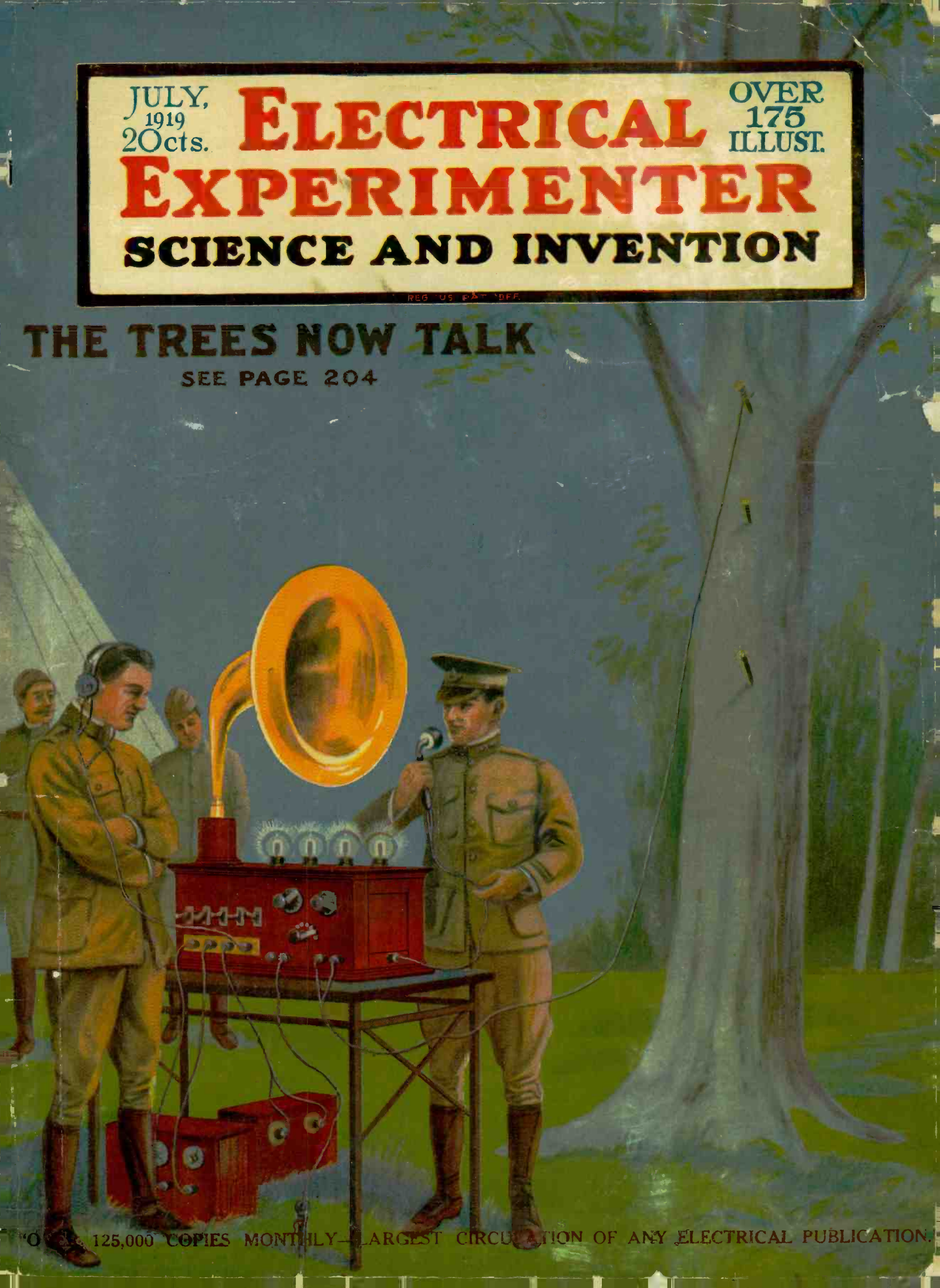
OVER 175 ILLUST.

SCIENCE AND INVENTION

REG US PAT OFF.

THE TREES NOW TALK

SEE PAGE 204



OVER 125,000 COPIES MONTHLY—LARGEST CIRCULATION OF ANY ELECTRICAL PUBLICATION.

Electricity Wins!



Jobs Requiring No Special Training Pay from $12 to $25 a Week and Offer No Future

L. L. COOKE
CHIEF ENGINEER
CHICAGO ENGINEERING WKS.

The Expert Electrician Earns from $46 to $100 a Week and is Always in Line for the Big Jobs

ELECTRICITY-L·L·COOKE-SUCCESS
I TEACH ELECTRICITY. LET ME MAKE YOU A SUCCESS

Be a Certificated Electrician!

Electricity is to-day lighting and moving the world. It is calling for experts in this business and offers you a bigger success than any other profession. Go after some real money. Qualify for one of the thousands of splendid positions open. All you need to start is a few months' snappy, *practical* instruction from a competent engineer. Come with me—*NOW*. I'll give my personal care to ensure rapid and efficient progress. My course is intensely practical. It is highly condensed, simplified, up-to-date and complete.

SATISFACTION GUARANTEED

I am so sure you will make a splendid success in this study, that I will *Guarantee Under Bond* to return to you every cent paid for tuition, if you are not entirely satisfied when you receive your Electrician's Certificate granted you as a graduate of my school.

Prepare yourself for a real position by my *Home Study Course* in *Practical* Electricity. I am Chief Engineer of the Chicago Engineering Works. I have trained thousands of men and can help you better than anybody else. We also have large, splendidly equipped shops where you can come at any time for special instruction without charge. No other correspondence school can give you this.

FREE—LESSONS AND OUTFIT

Send me the Free Outfit Coupon at once.
Do it *now!* For a limited period I am making a slashing cut in the cost of tuition, and giving each new student a grand outfit of Electrical Tools, Material and Instruments—in addition—*Absolutely Free*. I will also send you—free and fully prepaid—Proof Lessons to show you how easily you can be trained at home to enter this great profession, by means of my new, revised and original system of mail instruction.

WRITE NOW—DON'T DELAY

Delay never got you anything. Action is what counts. Get started—and get started now. Write for my big new book—"How to Become an Electrical Expert."

L. L. COOKE, Chief Engineer

CHICAGO ENGINEERING WORKS

Dept. 27 **441 Cass Street** **CHICAGO**

USE THIS "FREE OUTFIT" COUPON

Chief Engineer Cooke, Dept. 27, 441 Cass St., Chicago, Ill.

Sir: Send at once—fully prepaid and entirely free—complete particulars of your great offer for this month.

Name .....

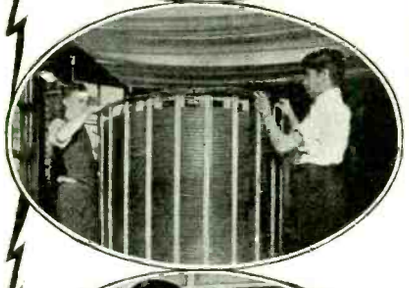
Address .....

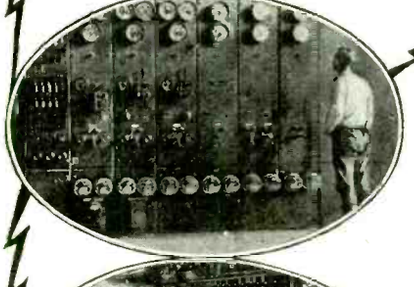
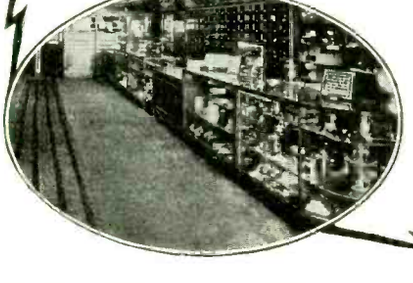
City .....

State .....

Learn ELECTRICITY as in practice



Electricity as experts know it—

RIGHT before you there is pictured a compact set of books which contains all the information you require to advance to the highest positions in the world of electricity. No instruction, no consultation by correspondence is necessary. The entire subject is before you, clearly written and clearly illustrated.

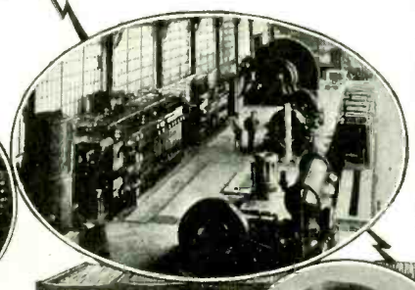
Whether you have spent years with electricity, or are a mere beginner, CROFT'S LIBRARY OF PRACTICAL ELECTRICITY will enable you to master modern practice, and fit you quickly for one of the thousands of responsible positions now open to those who are properly trained in electricity.

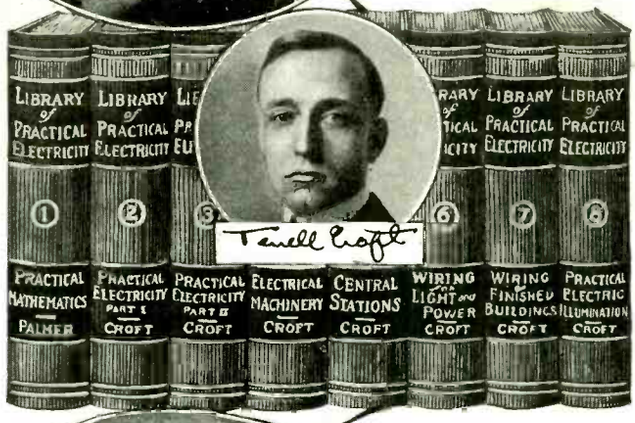
NOT ONE CENT IN ADVANCE

In twenty years' practice Terrell Croft has learned many things about electricity. As apprentice, as lineman, as draftsman, and finally as electrical engineer with the Westinghouse Company, he has learned the practical man's wants.

With his own practical experience, and with the co-operation of a score of other authorities, he has completed what is considered the most valuable study and reference course ever attempted.

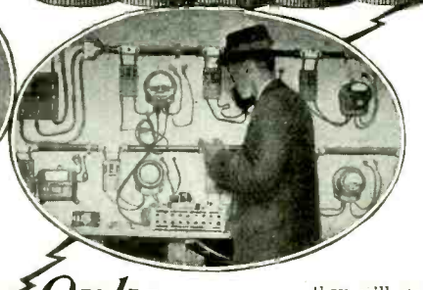
No other set of books or course of instruction ever adhered so closely to actual work. Nothing else of the kind ever told so vividly the story of electricity as experts know it.





CROFT'S LIBRARY of PRACTICAL ELECTRICITY

8 Vols.-Flexibly bound-3000 Pages 2100 Illustrations



A SET of books which covers the wide subject of electricity completely, comprehensively and practically cannot be adequately described, therefore we extend to every reader of this paper an invitation to examine the books absolutely free.

Merely fill out the coupon below and return to us. We will ship the books, all charges prepaid, for ten days' free use. The books are pocket-size. Carry one or two with you to work, and look them over evenings. Test their usefulness by using them in connection with your work. Keep them ten full days. Then return them at our expense if you think they will not enable you to know electricity as experts know it.

Pay only $2 per month for eight months if you are thoroughly pleased.

This is your opportunity. Will you grasp it?

Only $2 per month for 8 months for a complete electrical education

McGraw-Hill Book Co., Inc.,
239 W. 39th Street,
New York, N. Y.
Gentlemen: The CROFT LIBRARY OF ELECTRICITY reached me March 3 and more than came up to my expectations. I have been in the electrical business for fifteen years, and know the general run of electrical books. Terrell Croft's Library is the best I have ever had the pleasure of examining.
Yours truly,
EDWARD T. HOFF.
713-3rd Avenue,
Asbury Park, N. J.

Free Examination Coupon

McGraw-Hill Book Co., Inc.
239 W. 39th St., New York

Gentlemen:—Please send me the Library of Practical Electricity (shipping charges prepaid), for 10 days' free examination. If satisfactory I will send $2 in ten days and $2 per month until $16 has been paid. If not wanted, I will write you for return shipping instructions.

Name .....

Home Address .....

City and State .....

Where Employed .....

Occupation Ex-7-19

Electrical Experimenter

233 FULTON STREET, NEW YORK

Publisht by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer;) 233 Fulton Street, New York.

Vol. VII. Whole No. 75 **JULY, 1919** **No. 3**

THE TREES NOW TALK.....Front Cover
From a painting by George Wall
TALKING FROM PLANE TO EARTH..... 203
TALKING THRU THE TREES..... 204
By Maj. Gen. George O. Squier, Chief Signal Officer, U. S. Army
A DASH TO THE CLOUDS, by George Holmes..... 206
AN OYSTER'S AUTOGRAPH..... 207
"HELLO EUROPE"—VIA RADIO, by Charles M. Ripley, E.E..... 210
A 100 HORSE-POWER VOICE, by Jefferson Williamson..... 212
DISASTROUS AIRPLANE CRASHES..... 213
FLYING ACROSS THE ATLANTIC, by H. Winfield Secor, E.E..... 214
POPULAR ASTRONOMY—ASTRONOMICAL FACTS FOR ALL, ASTEROIDS AND HOW THEY ARE DISCOVERED..... 216
By Isabel M. Lewis
ELECTRIC FANS FOR MADAME HOLSTEIN..... 218
"THE KAISER IS CANNED,—CAN FOOD"..... 219
By Grace T. Hadley, Society for Electrical Development
PRACTICAL CHEMICAL EXPERIMENTS—CLEANSING CLOTHES AND OTHER MATERIALS. By Albert W. Wilsdon. 220
"HOW BIG ARE ATOMS AND ELECTRONS?"—EVERYDAY FACTS ABOUT THE ELECTRON, by L. R. Jewett..... 221
ELECTRIC SHOOTING GALLERY..... 222
IMPROVED CAPILLARY BATTERY, by Thomas Reed..... 223
THAT WONDERFUL ELECTRIC ACTION-DELAYER..... 223
By Thomas Reed
STORAGE BATTERY TESTING..... 224
By Harold R. Adams, Storage Battery Engineer
A SERIES-PARALLEL BATTERY SWITCH..... 225
HOW-TO-MAKE-IT DEPARTMENT, PRIZE CONTEST..... 226
WRINKLES, RECIPES AND FORMULAS, Edited by S. Gernsback.. 227
ELECTRICAL OSCILLATORS, by Nickola Tesla..... 229
RADIO DEPARTMENT—NEW 1 K.W. PANEL TRANSMITTER.. 230
By Lester F. Ryan
HOW EUROPEAN RADIO "SIGS" ARE PHOTOGRAPHED HERE 231
THE PLIOTRON OSCILLATOR, by William C. White..... 232
MUSICAL RADIO—TELEGRAPHIC SETS..... 233
By Jacques Boyer, Paris Correspondent
OPERATE YOUR AUDIONS ON A.C., by Elliott C. White..... 234
DESIGN, PUMPING AND TESTING OF AUDION TUBES..... 235
By C. Murray
HOW DON FLASHED THE "S.O.S.", by Mabel M. Davis..... 236
"LATEST PATENTS" DIGEST..... 237
AMATEUR ELECTRICAL LABORATORY PRIZE CONTEST..... 238
SCIENCE IN SLANG, GETTING DOWN TO THE BONE..... 239
By Emerson Easterling
THE ORACLE..... 240

EDITORIAL

Piped Cold

ONE of the most profound annual summer mysteries of the twentieth century—at least to the writer—is our hot office or our hot home. We would not think of an unheated house or office in the dead of winter with the temperature near the zero point, but curiously enough we allow ourselves to suffer cruelly from the heat in the summer time when the temperature rages up in the nineties. Is it not a most curious world in which we live?

We think nothing of spending fabulous sums in the winter for our coal supply in order to keep warm and comfortable. But in the summer we prefer to spend nothing and suffer untold misery in consequence. Babies and grown up sick folk die like flies by the thousands on account of the heat, while we stand by helpless, or rather as if we were devoid of all intelligence, while the totally unnecessary slaughter goes on incessantly. How our grandchildren will read with astonishment that for decades human beings had their houses piped for heat, but had not enough sense to run a freezing solution or other freezing agent thru the self-same pipes in the torrid summer days!

There might be an excuse for our criminal negligence if we had not the means at hand to keep us cool and comfortable in summer. But we really have all the means, all the apparatus; in fact, everything—including our radiators and pipes. But we prefer not only to let our babies and our feeble old folk die unnecessarily every summer, but we actually lose untold millions of dollars thru non-production when the "dog-days" are upon us. No one can work at his best when the mercury climbs to dizzy heights. Production, whether mental or physical, slows down anywhere between forty and eighty per cent. Statistics prove it. Factories as well as offices slow down and just barely creep along. Think of this enormous, incalculable loss alone, not to mention all the physical suffering due to the heat.

Ah, yes, we *do* have our brave fans—which, however, do not cool at all, but only remind us how hot our bodies are the minute we are not in the immediate vicinity of one of these spinning monuments to our stupidity.

For our dear fans only stir up the hot air *and* the dust. Our skin, wet or moist from perspiration, meets this stirred up air and due to a well known physical phenomenon, *surface evaporation*, we experience a *sense of coolness*, but the air itself is *not* cooled. It is true that surface evaporation produces cold, but in order to have it, it is necessary to let the fans blow upon us, or nearly so, and everyone knows this is far from healthy, frequently producing severe colds. Besides, as soon as we leave the fan our suffering from the heat is all the more acute.

Where is the practical genius who will "study up" on refrigeration and sell us a cheap refrigerating machine which we can connect to our already existing steam or hot water radiators? For the same money which we now spend on fans we ought to be able to buy the machine. And for the money it costs to run the fans we can run the refrigerator, too.

Hundreds of refrigerators have been invented, but the simplest and best no doubt for our purpose is the *cold-air process*. It is based on the principle that the compression of air generates heat and in its subsequent expansion absorbs heat. The air is first comprest, is then past thru a cooler under pressure, after which it is expanded in a cylinder. No chemicals are used with this system and it possesses the very distinct advantage that extremely low temperatures are readily obtainable.

H. GERNSBACK.

The **ELECTRICAL EXPERIMENTER** is publisht on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions. Canada and foreign countries, $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 20 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. **A green wrapper indicates expiration. No copies sent after expiration.**

All communications and contributions to this journal should be address to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

ELECTRICAL EXPERIMENTER. Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered U. S. Patent Office.

Copyright, 1919, by E. P. Co., Inc., New York. **The Contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.**

The ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris.

Member of the Audit Bureau of Circulation.



El Paso, Texas, Oct. 1, 1917.

MR. CHARLES F. HAANEL, St. Louis, Mo.

In Re "The Master Key."

My Dear Mr. Haanel: The value of an idea is determined by its application. Pragmatism has long since spread beyond the confines of Missouri. The world to-day insists on being shown.

The lash of circumstances and the logic of events are, more than ever, impelling men to think. Whether an idea be a new process for picking cabbages, or an old process (Kaiserism, for instance) for preserving kings, we are from Missouri.

A philosophy of life having as its base blind optimism; a religion that won't work seven days a week, or a proposition that isn't practical, appeals to the intelligent not at all. It is results that we want and the acid test is: will it work?

The Master Key qualifies. It is the most lucidly scientific statement of "Truth" that I have seen. It reconciles rationalism and religion; illumines economic determinism and the materialistic conception of history, and is an infallible guide to understanding. It contains in condensed form the substance of an entire library on science. Its teaching, if consistently applied, will make a man healthy, wealthy and wise. Its distribution is supermissionary work in excelsis. Those who wish to think intelligently will find it invaluable.

Intelligence rules. Desire, intelligently directed, is a creative force which automatically causes its object to manifest on a material plane. It is the law. Let him that hath an ear to hear, hear.

Yours truly,

CHAS. A. HEARD.

May 15, 1918.

DEAR MR. HAANEL: Ever since I have been old enough to read, I have been reading metaphysical literature. I have waded ears deep through the books from all ages, all lands, all schools.

I have rejected tons of lies, oceans of misconceptions, an entire universe of false deductions.

I have found grains of truth in mines of folly, and worlds of truth in a single grain. The pursuit was interesting in itself, and I do not regret the time spent upon it. But it was a genuine surprise to read your Master Key System and find within, the essence of all that I had read, with much more added thereto.

In this extraordinary system you have sifted the true from the false; you have given in concrete form all that is worth while in many schools of philosophy.

You have placed arcane truths into the hands of the uninitiated as weapons they can learn to use without danger to themselves. I congratulate you. You are doing mankind a service.

Yours very sincerely,

CHARLES F. OURSLER.

501 Fifth Avenue, New York City, N. Y.

Detroit, Mich., May 28, 1917.

DEAR SIR: The words, "Your world will change as if by magic, the moment you realize the marvelous power within your control," page 6, I have underlined. They state a fact, a real live fact; and to me this is the most wonderful, the most important fact of all—that one may put this knowledge to an immediate test, that one may, after learning of this power, proceed to apply it with a definite knowledge as to results.

W. M. HOWE.

THE LOWE OBSERVATORY
Edgar Lucien Larkin, Director
Los Angeles, Cal., Dec. 6, 1916.

MR. CHAS. F. HAANEL, St. Louis, Mo.

DEAR SIR: Your booklet, Master Key, ought to be expanded into a book. Its teachings that Mind is the all-dominating creative force is precisely in line with the wonders of the most recent psychology. All persons having desks should have this pamphlet thereon. And it would be a fitting pocket companion.

EDGAR LUCIEN LARKIN.

which can unlock the secret chambers of success and throw wide the doors which seem to bar men and women from the Treasure House of Nature.

FREE

There is no charge for "The MASTER KEY," It is FREE!

Some men and women seem to attract success, power, wealth, health and attainment with very little conscious effort; others conquer with great difficulty, still others fail altogether to reach their ambitions, desires and ideals. Why is this so? Why should some realize their ambitions easily, others with difficulty, and still others not at all?

"The Master Key" will tell you why and open your eyes to the great possibilities before you. No one can read it and not be a changed man or woman. None but who will emerge from its magic pages with a firmer grasp of the future—a surer understanding of what he or she can do and has been all along able to do, but didn't know they could. You are perhaps one of these—and this key is certainly for you. It will help you—tell you how to make a real success of your life, how to lift yourself up, to be more, to do more and to have more.

"The Master Key" is a key with which many are converting loss into gain, fear into courage, despair into joy, hope into fruition; a key with which many are finding health, self-reliance, power; a key which thrills, fascinates, carries conviction, understanding, perception, inspiration, the key which is changing the lives of many and may have an almost unbelievable influence upon your life.

Charles F. Haanel, 423 Granite Bldg., St. Louis, Mo.

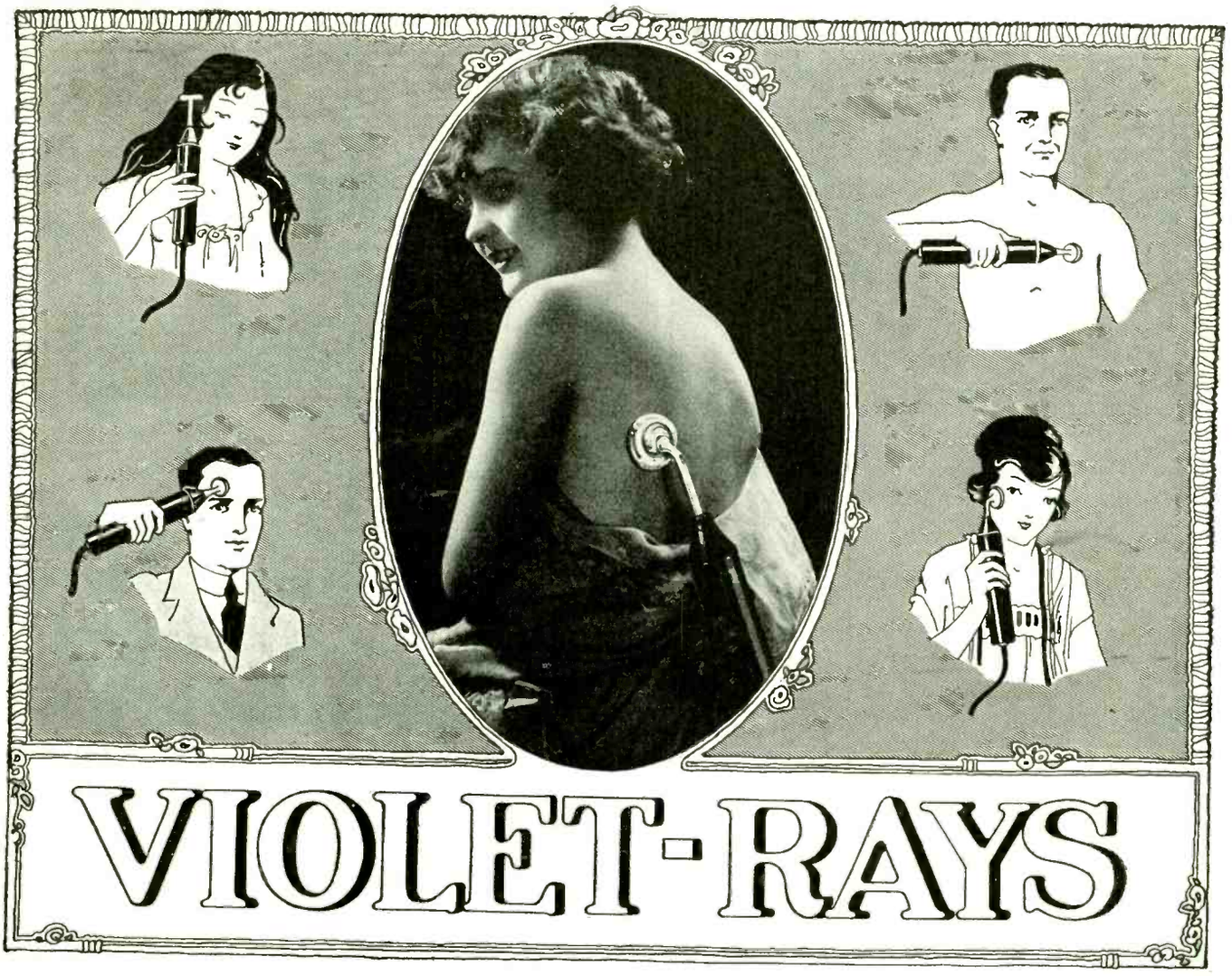
Send me the Master Key without cost or obligation of any kind.

Name .....

Address .....

Post Office..... State.....

NOTE—*Tomorrow, today* will be *yesterday*. Get your Master Key TODAY! NOW!



VIOLET-RAYS

The Magic-like Reliever of Pain. The Marvel of the Age for Rheumatism, Neuralgia, Neuritis, Arteriosclerosis, Hemorrhoids, and Practically Every Other Ailment to Which Flesh is Heir. A Wonderful Beautifier Too! Amazing in the Treatment of Eczema, Blackheads, Wrinkles, Falling Hair, Dandruff, and Every Other Faulty Condition of the Skin and Scalp!

10 DAYS FREE IN YOUR OWN HOME

See for yourself the miraculous results of Violet-Rays. Get the wonderful Violetta Violet-Ray Machine for 10 days' free use in your own home. Give yourself exactly the same Violet-Ray treatments for which eminent physicians and beauty specialists charge big fees. Note the marvelous relief that comes even with the first treatment. See how you can virtually feel the Violet-Rays reaching to the very root and cause of any ailment with the great curative forces of Heat, Light, Electric Energy, and Ozone. See too how Violet-Rays youthifies the skin, purifies the scalp and stimulates hair-growth. Note above all how refreshing the effect of Violet-Rays to mind and body—how invigorating and vitalizing—how much better you work, eat and sleep. Prove all these benefits to yourself without obligation. Try the Violetta for 10 days free, and if you are not more than amazed and delighted, simply send it back.

BLEADON-DUN CO., Dept. 2F,
326 W. Madison St., Chicago, Ill.

Please send me your free book and 10 days' free trial offer on the Violet-Ray Machine. Also full information as to treatment for ailments marked below.

Asthma	Earache	Piles
Barbers' Itch	Eczema	Paralysis
Boils	Eye Diseases	Pimples
Blackheads	Headache	Pyorrhea
Bunions	Hay Fever	Rheumatism
Callous	Goitre	Skin Diseases
Chilblains	Insomnia	Sore Throat
Colds	Lumbago	Sprains
Corns	Nervousness	Tonsilitis
Constipation	Neuralgia	Whooping Cough
Dandruff	Neuritis	Warts and Moles
Deafness	Obesity	

Name .....

Address .....

City ..... State

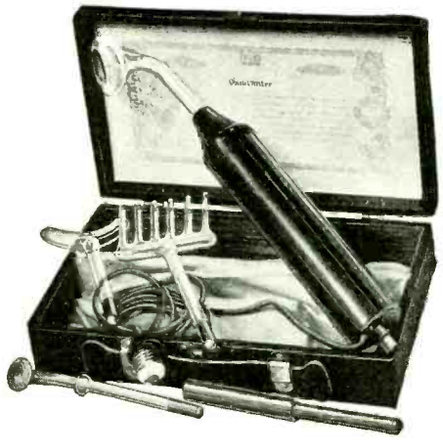
BOOK FREE

Write today without fail. Mail coupon or just a postcard. Let us send you our beautifully illustrated free book, describing the Violetta in detail. Read the amazing phenomena produced by Violet-Ray High frequency current. Why it produces stimulation and sedation. How to give spinal treatments with the Violetta, how to treat various ailments, including nervous troubles, rheumatism, obesity, hay-fever, skin treatments, facial treatments. With the free book we will also send you particulars of our special free trial offer. Mail coupon or postcard now.

BLEADON - DUN CO.

Dept.2F 326 W.Madison St.,Chicago,Ill.

Electrical, Drug and other Jobbers and Dealers: Write us today for our Co-operative Selling Plan.



Not a Vibrator

The Violetta is not a machine that contracts the muscles—it does not shock, it does not pound the muscles—it is absolutely painless. Violet Rays administered by the Violetta are wonderful even for infants!

This advertisement copyright 1919, by Bleadon-Dun Co.

Was $100

SAVE $43

Now $57

By Being Your Own Salesman

Try the Oliver for Five Days at Our Expense



This Simple Plan Makes It Easy to Own an Oliver

This sales plan is a legacy of the war, which taught us all new economies —ones we won't forget.

By reorganizing our method of distribution, we were able to make a radical reduction in price.

We did not change the famous Oliver an iota. The machine we now sell for $57 is the identical one formerly priced at $100—our latest and best model.

During the war we learned that it was unnecessary to have great numbers of travelling salesmen and numerous, expensive branch houses throughout the country. We were also able to discontinue many other superfluous, costly sales methods. You benefit by these savings.

Pre-war extravagances were ended. And our plan of selling made simpler. We send the Oliver to you for free trial, so that you may judge it, in solitude, without being influenced.

Only $3.00 Per Month

Do not buy or rent any typewriter until you know the Oliver. A five days' trial will help you decide. Besides saving you $43, we make the payments easy. We ask no advance payment. But merely $3 per month until the $57 is paid.

Do not confuse this offer with those for second-hand or rebuilt typewriters. Our $57 Oliver is our brand new identical Model 9, formerly priced at $100. It has not been changed in the slightest.

No Money Down

Merely send us the coupon. We ship an Oliver to you. Try it for five days. Then, if you agree that it is the finest typewriter at any price, merely send us $3 per month, until the $57 is paid.

If you do not believe that this is the greatest typewriter opportunity, return the Oliver to us, express collect. We even refund the outgoing transportation charges. You have not placed yourself under any obligation to buy.

When the Oliver comes to you, you will admire its many advancements —all the refinements made possible during 24 years of typewriter-making. A finer typewriter is impossible.

The coupon below gives you the opportunity to be your own salesman and save yourself $43.

Note that it brings EITHER an Oliver for Free Trial, or further information. Check it accordingly.

Over 700,000 Sold

Olivers are in use all over the world. Some of the large concerns in the United States using Olivers are: U. S. Steel Corporation, Baldwin Locomotive Works, Nat'l City Bank of N. Y., Diamond Match Company, Pennsylvania Railroad, Hart, Schaffner & Marx, American Bridge Company, Encyclopedia Britannica, Otis Elevator Company, Bethlehem Steel Company, Boston Elevated Railways, N. Y. Edison Company, and a host of others of equal importance.

And thousands of Olivers are used by individuals—every business is represented among our users. And every profession.

You can depend on this wide use of the Oliver as a guarantee of its worth.

No Finer Built

Examine the Oliver carefully. It is built in a model factory with a heritage of ideals. Only the finest materials are used. And this accounts for the prolonged life of the Oliver, its durability, its inbuilt service. It is simplified in construction and built to withstand the hardest usage. The Oliver in war service proved its fine design and construction.

You can't buy a better typewriter at any price.

Mail the coupon now for either a Free Trial Oliver or further information.

The Oliver Typewriter Company

67-A Oliver Typewriter Building, Chicago, Illinois

Canadian Price, $72

THE OLIVER TYPEWRITER COMPANY
67-A Oliver Typewriter Building, Chicago, Ill.

☐ Ship me a new Oliver Nine for five days free inspection. If I keep it, I will pay $57 at the rate of $3 per month. The title to remain in you until fully paid for

My shipping point is .....

This does not place me under any obligation to buy. If I choose to return the Oliver I will ship it back at your expense at the end of five days.

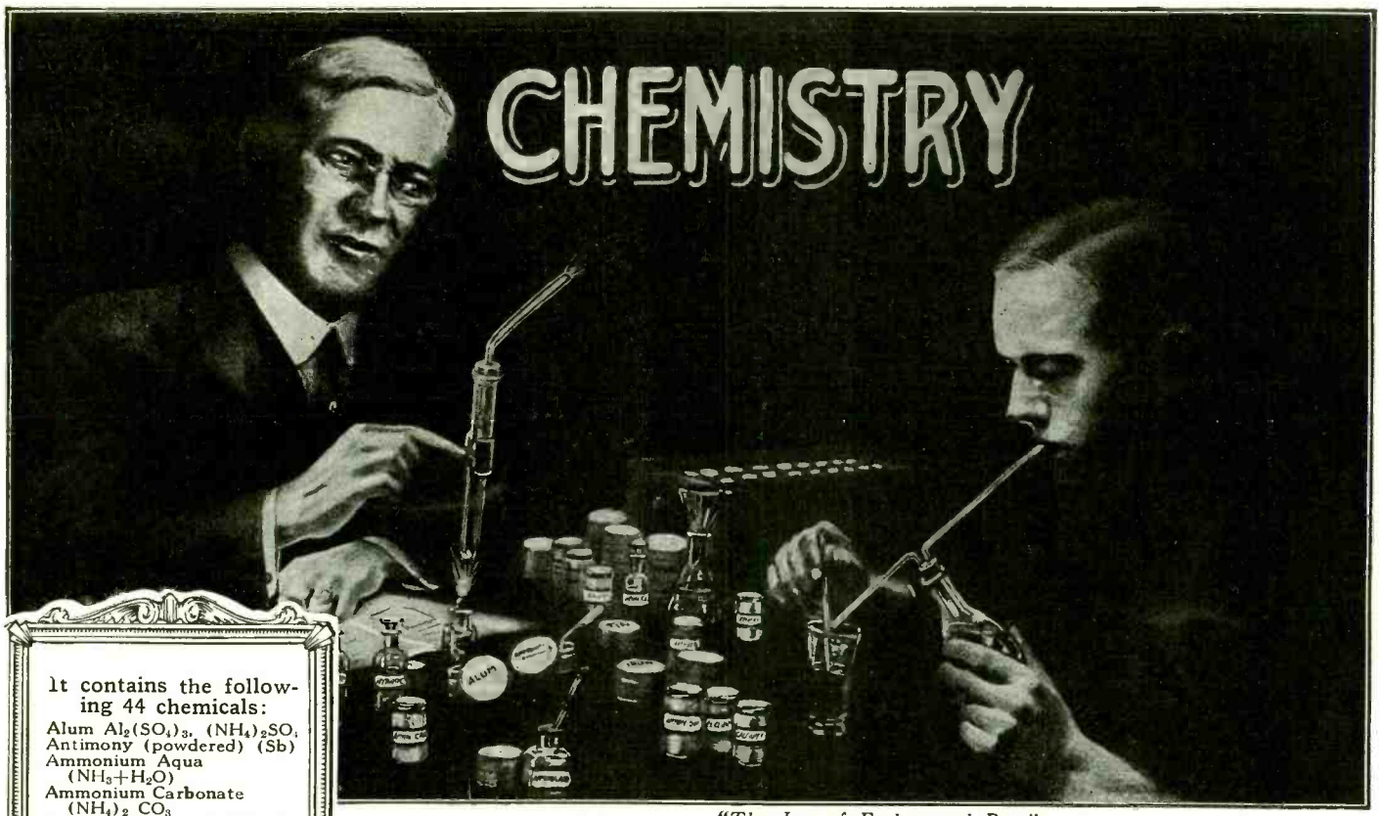
☐ Do not send a machine until I order it. Mail me your book—"The High Cost of Typewriters—The Reason and the Remedy" your de luxe catalog and further information

Name .....

Street Address .....

City ..... State .....

Occupation or Business .....



"The Joy of Father and Boy."

It contains the following 44 chemicals:

Alum $Al_2(SO_4)_3$, $(NH_4)_2SO_4$
Antimony (powdered) (Sb)
Ammonium Aqua (NH_3+H_2O)
Ammonium Carbonate $(NH_4)_2\ CO_3$
Ammonium Chloride (NH_4Cl)
Ammonium Sulphate $(NH_4)_2\ SO_4$
Barium Chloride $(BaCl_2)$
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride $(CaCl_2)$
Calcium Oxide (CaO)
Calcium Sulphate $(CaSO_4 2H_2O)$
Charcoal (Carbon) (C)
Chloride of Zinc $(ZnCl_2)$
Copper Sulphate $(CuSO_4)$
Ferrous Sulphate $(FeSO_4)$
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5(OH)_3$
Hydrochloric Acid (HCl)
Iodine (I)
Iron Chloride $(FeCl_2)$
Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
Magnesium Carbonate $(MgCO_3)$
Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
Nickel Chloride $(NiCl_2)$
Oxalic Acid $(H_2C_2O_4)$
Sodium Bicarbonate $(NaHCO_3)$
Sodium Borate $(NaBO_2)$
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate $(NaNO_3)$
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride $(SnCl_2)$
Sulphate of Nickel $(NiSO_4)$
Sulphate of Zinc $(ZnSO_4)$
Sulphuric Acid (H_2SO_4)
Tin (Granulated) (Sn)
Zinc (Metal) (Zn)
Zinc Carbonate $(ZnCO_3)$

The following apparata are furnished:

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube
Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure
Glass Tubing
One book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

"ELECTRO"

Chemical Laboratory

We present herewith to our friends our new **E. I. Co. Chemical Laboratory** which contains real chemicals and apparata to perform real chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing **a Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.**

DESCRIPTION OF THE OUTFIT:

The outfit consists of forty-four (44) Chemicals all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) enough to make dozens of experiments with each. See list of Chemicals herewith.

The apparata furnished are all of the best obtainable make and of standard laboratory size and shape. A list of the 17 pieces of apparata furnished with this outfit is printed also herewith.

The Instruction book is a real **Chemistry Course for the Beginner.** Some of the Contents are: **Division of Matter:** This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. **Chemical Nomenclature.** This explains in simple language the derivation of the chemical names of the Elements and their compounds. There is a chapter on **Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms,** etc.

A good part of the book is devoted to Weights and Measures. The Metric System, the English system and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights, Volume, Capacity and Length; Per Cent solutions; Conversion of Measure expressed in parts; Poisons and their antidotes; Technical and common name of chemical substances; Formulas for Cleaning various substances, etc., etc.

Among the **100 Experiments** are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to Make Chlorine Gas and smoke (German War Gas); How to bleach cloth and dowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

The price is still $5.00

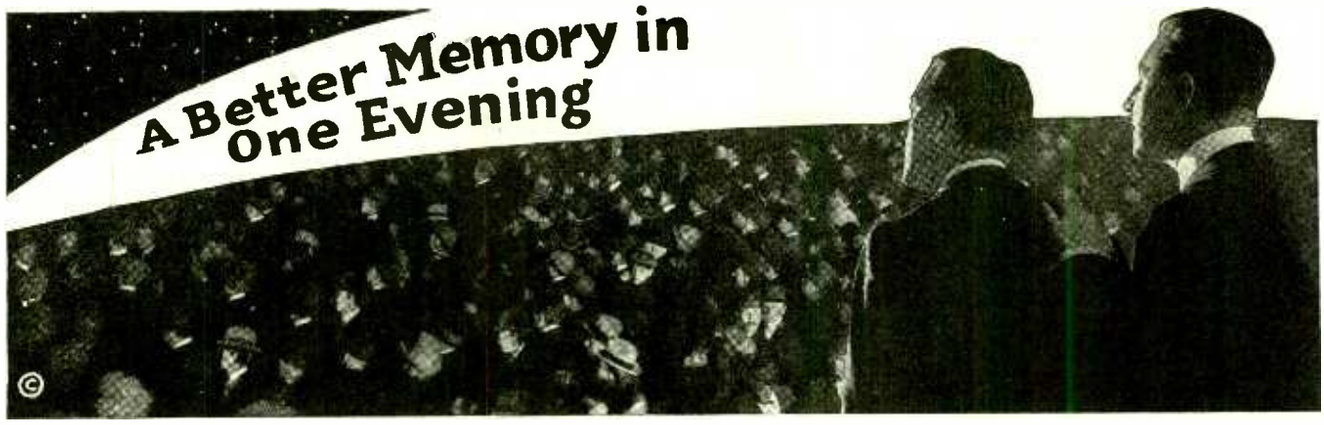
Shipping Weight 10 lbs.

(Can be shipped by Express only.) Send your order today to:

TRADE MARK **THE ELECTRO IMPORTING CO., Mfrs.** TRADE MARK

231 FULTON STREET NEW YORK CITY

See our full page Ad, on page 256 for Free Cyclopedia



Can You Be Given A Better Memory In One Evening?

It has been done for over a quarter of million men and women in all walks of life—what they say about their amazing experiences

A BETTER memory in one evening It sounds impossible. Yet this is exactly what Mr. Roth, the world-famous memory expert, has done for over a quarter of a million men and women—given them a better memory in a single evening!

You've doubtless seen Mr. Roth give his startling memory demonstrations in public. At any rate, you've heard of him.

No one denies that Mr. Roth himself has a remarkable memory—that has been proved beyond question. But many people say that while Mr. Roth's marvelous memory is beyond dispute, it was "born in him," and that it is doubtful if the average man or woman can ever develop a memory that approaches Mr. Roth's. And, least of all, in one evening! A fair question, that. So let us see how it works out in actual practice.

From time to time testimonials have been published from enthusiastic users stating the wonderful memory powers they have developed by following Mr. Roth's method. Evidence from people who have actually done it is conclusive. And, in addition to this, the publishers of Mr. Roth's Memory Course have offered to send it on five days' free trial. No money was asked for. The entire course was sent wholly on approval. The recipient was free to test Mr. Roth's method for five days. Then if he found that it had not brought about a remarkable improvement in his memory, he could return the Course and he wouldn't be out a penny. An offer such as this could not have been made unless the Course would do all that was claimed for it.

Over a quarter of a million Roth Memory Courses have been sent out to the general public—and paid for—on this basis. What happened? This—the publishers were flooded with letters endorsing the Roth Memory Course in the highest possible terms. By far the great majority of people paid for the Course in less than five days. So delighted were they with the remarkable improvement it had made in their memory, that they were eager to own it at once.

If you could drop into the offices of the publishers you would be shown a huge pile of enthusiastic testimonial letters which would take you days to read. They all tell the same story—amazement at the wonderful nature of the Course—enthusiasm over the marked improvement it has made in weak memories—appreciation of the opportunity to possess it—and surprise at the low cost!

These thousands upon thousands of letters of appreciation came from Members of Congress, ministers, doctors, lawyers, professors, teachers, students, managers, clerks, stenographers, bookkeepers, salesmen, factory executives—men and women in all walks of life.

Here are extracts from a few of the many thousands of letters received from users of the Roth Memory Course:

"You claim to give 'a better memory in one evening.' You ought to change it to 'one hour,' for I improved my memory 100 per cent in one hour."

Many a man who is called upon to speak in public fails to get his message "across" because a weak memory forces him to read from notes. A prominent public man says:

"I have made a wonderful improvement in my ability to speak in public. Formerly I had to read from notes. Now I can speak extemporaneously and get a smash and drive in my talk which amazes me as much as it impresses my audience."

Lots of people who can think keen thoughts fail miserably when it comes to talking them. They blame their lack of confidence and a limited vocabulary. In most cases the real cause is a weak memory. An enthusiast writes:

"No longer do I stammer, and sputter my words. Now I am looked upon as a brilliant conversationalist, and the Roth Memory Course did it."

Many a business man is handicapped because he cannot instantly recall prices, selling talks, and other data about his business. A salesman says:

"I had been trying to memorize a selling talk for several weeks, but failed completely. By applying Mr. Roth's principles I memorized it in thirty minutes."

The main handicap of the young man in business is lack of experience. Experience is largely a matter of never forgetting facts and experiences which apply to the matter under consideration. A young man says:

"I have just been promoted to an important position which I never dreamed of getting for at least five years. The Roth Memory Course got me the promotion by enabling me to instantly recall all the vital facts and figures about our business which I have ever learned."

Educators by the score write in to say that the Roth Memory Course should be taught in every school and college, and that it would not only make better students, but would considerably shorten the period of instruction.

The father of a little girl of 13 says: "As a result of using Mr. Roth's principles my little girl's papers are rated the highest in the class."

Students by the dozen say that the Roth Memory Course enables them to master in a few hours studies that formerly required weeks of grinding effort.

One of the greatest surprises about the Roth Memory Course is that there is really nothing to study and no hard work to do. It is largely a question of following a few simple principles. In one hour you can improve your memory—in an evening you can easily double its power—and inside of a week you can have a memory that will surprise you as well as your friends.

"I am amazed at the simplicity of this wonderful work"—"studying it is a continuous pleasure"—"The system works like magic"—"I am thrilled by the power the Course gives me"—"It is as simple as child's play and as efficient as a filing cabinet"—expressions like these have been written in by the score.

And the price!—

"The first lesson alone is worth 100 times $5," says one enthusiast. Hundreds of people have stated that they would gladly have paid many times the price of five dollars. "I am sending you the money by return mail,"—and "I've never let go of a 'five' with so much pleasure," says another.

You have always wanted a "good memory." Now you can have it. There is no laborious study to undertake. Mr. Roth shows you that a good memory depends mainly on applying a few simple principles which you can learn in less than thirty minutes. You can master the whole Course in a few hours of delightful reading.

Here is what you will find after you apply Mr. Roth's simple principles: Names and faces will flash instantly to your mind. Facts and figures which you now forget, or laboriously write down, will be on the tip of your tongue the instant you want them. Your conversational powers will improve wonderfully. The right word, the right expression, the right thought will almost speak itself the instant you want it. Never again will you be humiliated by saying, "I forgot!" Once put a thing into your mind and it will be there as permanently as though etched in steel, and as easily recalled as taking a card out of a card-index. Your mental powers will become sharper and quicker. At all times you will have that keenness of mind most men experience only occasionally. Your self-confidence will increase. You will thrill with a new sense of power. You will——

But there's no need to go further. For you can see for yourself, at no cost, exactly what the Roth Memory Course will do for you. Merely fill in and mail the coupon. Send no money. The complete Course will be sent to you immediately, all charges prepaid. Examine it thoroughly. Test it in every way you can think of. Apply its simple principles. Note the almost magical change it brings about in your memory.

Then, after you have done this, if you feel that you can possibly afford to be without the Roth Memory Course, send it back and you will owe nothing But if you feel, as over a quarter of a million others have felt, that you simply cannot afford to be without the Roth Memory Course, then send only five dollars in full payment.

In one week from today you can have a memory that will thrill you with power and amaze your friends. You can do this if you mail the coupon NOW.

FREE EXAMINATION

Independent Corporation

Publishers of The Independent Weekly

Dept. R-1107, 119 West 40th Street, New York

Please send me the Roth Memory Course of seven lessons. I will either remail the course to you within five days after its receipt or send you $5.

Name .....

Address .....El. Exp. 7-19

What they say:

"Every business man should avail himself of this wonderful system of Memory Training."
G. L. Helms, Indianapolis, Ind.

"I have studied only the first lesson, but it has proved invaluable."
R. H. Gifford, Chicago.

"Worth thousands of dollars to anyone in business."
J. M. Thompson, Columbus, O.

"It has been of such great value to me as a lawyer that I cannot find words to express my appreciation."
George J. Lemmon, Denver, Col.

"So simple and fascinating that it is play to study it."
E. W. Buckingham, M.D., Norfolk, Va.

"I am amazed at my increased memory powers since studying the first lesson."
Anne S. Leach, Wytheville, Va.

"I am thankful to have your Course. It is worth many times five dollars."
Rev. J. A. Northrup, Streator, Ill.

"The system works like magic."
Ralph D. Stoddard, Cleveland, O.

"I was surprised to see how I improved my memory the first evening."
M. J. Blackenshop, Mohawk, W. Va.

"I find that I can do my work much easier after studying the first two lessons."
A. R. Johnson, Palestine, Texas.

"It has done wonders for me."
Arthur Lippincott, Erie, Pa.

"Wonderful!—I would not sell it for any amount of money."
Ella Busse, State College, Pa.

SPECIAL OFFER

To Experimenter Publishing Co., 231 Fulton St., N. Y.

Name .....

Address .....

City.....State.....

We will accept till July 25th the following special charter subscription rates: 1 year $1.25; 2 years $2.20; 3 years $3.00; 5 years $4.75. (Add 50c a year for Canada & Foreign.) I enclose herewith $.....for.....years charter subscription to RADIO AMATEUR NEWS. Begin with July issue.

VOID JULY 25

E. E. 7-19

15c The Copy

$1.50 A Year

Canada and Foreign $2.00 A Year

SEND 15c FOR SAMPLE COPY TO-DAY

"THE 100% WIRELESS MAGAZINE"

RADIO AMATEUR NEWS

15 Cents JULY 1919 Edited by H. Gernsback



48 Pages 125 Illust's

CONTENTS OF JULY ISSUE

"The Audion and the Radio Amateur", By Dr. Lee de Forest
"How I Became A Radiobug", By Thomas Reed
"Trans-Atlantic Radio Reception", By Major Chas. L. Culver
"Design of Roger's Ground Antennae", By J. Stanley Brown
"Experiments on Ground Antennae", By Chas. D. Herrold, E.E., R.E.
"New Type of Electron Tube", By H. P. Donle
"Radio Translator", By Major Chas. A. Culver
"Modern Amateur Radio Apparatus", By A. H. Grebe
Club Doings
"A New High Note Shunt Radio Buzzer", By Louis Gerard Pacent, I.R.E.
"U. S. Navy Airplane Sets", By L. F. Ryan
$100.00 Radio Prize Contest
"The Future of the American Radio Amateur", By H. Gernsback
"Sustained Wave Radio Telephone and Telegraph Transmitter", By Samuel D. Cohen
"Audio Frequency and Radio Frequency"
"Some Experimental Radio Suggestions", By Thos. W. Benson
"A Buzzer Practice Outfit DeLuxe", By Oscar Schwendt
"A Simple Hot-Wire Meter", By Francis H. Ransford
"A Radio Amplifier", By Fred Whitehouse
"Loose Coupling of Amateur Transmitter", By Geo. M. Baker
"Ideas", By Thos. W. Benson
"High Voltage Audion Battery", By L. M. Lafave
With The Amateurs
"Open Once More"
"Dusting 'Em Off"
"Vacuum Tube Amplifier With Crystal Detector"
"Banked Windings"
Radio Digest
Junior Section
I Want To Know (Questions & Answers)

WHAT THE RADIO AMATEUR NEWS IS:

It is destined to become the greatest Radio magazine in the world. Indeed its first issue, the July number, with a circulation of 15,000 copies and its 48 pages and cover in two colors, its 125 wonderful illustrations, already make it the *greatest and biggest Radio Magazine in print today.*

RADIO AMATEUR NEWS is the only INDEPENDENT monthly wireless magazine in existence. It caters to no commercial interests—it has no boss save its readers. It is "different"—it has the latest radio news. It is a scientific magazine but it caters largely to the RADIO AMATEUR—it is by and for the Amateur. It is publisht by the publishers of the ELECTRICAL EXPERIMENTER, but there will be no duplication of articles in the two magazines. Both will be entirely different—but both together will give you ALL the radio news of all the world. Whether you are a Professor or an Amateur, get a sample copy or order it from your News-dealer today.

FOR SALE AT ALL NEWS-STANDS.

$100.00 RADIO CONTEST is announced in the July issue of RADIO AMATEUR NEWS.

"An Ideal Receiving Outfit" is the subject of the contest. $100.00 in cash prizes for the best manuscripts submitted.

JUDGES OF THE CONTEST ARE:

Dr. Lee de Forest, Inventor of the Audion
Dr. Greenleaf W. Pickard, Inventor of the Crystal Detector
Dr. Louis Cohen, Ph.D., Radio expert and inventor
Samuel D. Cohen, Amateur Radio expert
H. W. Secor, Assoc. I.R.E., Associate Editor, Electrical Experimenter
H. Gernsback, Editor, Electrical Experimenter & Radio Amateur News
Fritz Lowenstein, Radio expert

EXPERIMENTER PUBLISHING COMPANY, 231 Fulton Street, New York City



"I was astounded at my new power over men and women. People actually went out of their way to do things for me—they seemed EAGER TO PLEASE ME"

The Secret of Making People Like You

"Getting people to like you is the quick road to success—it's more important than ability," says this man. It surely did wonders for him. How he does it—a simple method which anyone can use instantly

ALL the office was talking about it and we were wondering which one of us would be the lucky man.

There was an important job to be filled—as Assistant-to-the-President. According to the general run of salaries in the office, this one would easily pay from $7,000 to $10,000 a year.

The main requisite, as we understood it, was striking personality and the ability to meet even the biggest men in their offices, their clubs and their homes on a basis of absolute equality. This the firm considered of even more importance than knowledge of the business.

YOU know just what happens when news of this sort gets around an office. The boys got to picking the man among themselves. They had the choice all narrowed down to two men—Harrison and myself. That was the way I felt about it, too. Harrison was big enough for the job, and could undoubtedly make a success of it. But, personally, I felt that I had the edge on him in lots of ways. And I was sure that the firm knew it too.

Never shall I forget my thrill of pleasure when the president's secretary came into my office with a cheery smile, looked at me meaningly, handed me a bulletin, and said, "Mr. Frazer, here is the news about the new Assistant-to-the-President." There seemed to be a new note of added respect in her attitude toward me. I smiled my appreciation as she left my desk.

At last I had come into my own! Never did the sun shine so brightly as on that morning, and never did it seem so good to be alive! These were my thoughts as I gazed out of the window, seeing not the hurrying throngs, but vivid pictures of my new position flashing before me. And then for a further joyous thrill I read the bulletin. It said, "Effective January 1, Mr. Henry J. Peters, of our Cleveland office, will assume the duties of Assistant-to-the-President at the home office."

PETERS! Peters!—surely it *couldn't* be Peters! Why, this fellow Peters was only a branch-office salesman. . . . *Personality!* Why, he was only five feet four inches high, and had no more personality than a mouse. Stack him up against a big man and he'd look and act like an office boy. I knew Peters well and there was nothing to him, nothing at all.

January the first came and Peters assumed his new duties. All the boys were openly hostile to him. Naturally, I felt very keenly about it, and didn't exactly go out of my way to make things pleasant for him—not exactly!

But our open opposition didn't seem to bother Peters. He went right on with his work and began to make good. Soon I noticed that, despite my feeling against him, I was secretly beginning to admire him. He was winning over the other boys, too. It wasn't long before we all buried our little hatchets and pulled up with Peters.

The funny thing about it was the big hit he made with the people we did business with. I never saw anything like it. They would come in and write in and telephone in to the firm and praise Peters to the skies. They insisted on doing business with him, and gave him orders of a size that made us dizzy to look at. And offers of positions!—why, Peters had almost as many fancy-figure positions offered to him as a dictionary has words.

WHAT I could not get into my mind was how a little, unassuming, ordinary-to-look-at chap like Peters could make such an impression with every one—especially with influential men. He seemed to have an uncanny influence over people. The masterly Peters of today was an altogether different man from the commonplace Peters I had first met years ago. I could not figure it out, nor could the other boys.

One day at luncheon I came right out and asked Peters how he did it. I half expected him to evade. But he didn't. He let me in on the secret. He said he was not afraid to do it because there was always plenty of room at the top.

What Peters told me acted on my mind in exactly the same way as when you stand on a hill and look through binocular glasses at objects in the far distance. Many things I could not see before suddenly leaped into my mind with startling clearness. A new sense of power surged through me. And I felt the urge to put it into action.

Within a month I was getting remarkable results. *I had suddenly become popular.* Business men of importance who had formerly given me only a passing nod of acquaintance suddenly showed a desire for my friendship. I was invited into the most select social circles. People—even strangers—actually went out of their way to do things for me. At first I was astounded at my new power over men and women. Not only could I get them to do what I wanted them to do, but they actually anticipated my wishes and seemed eager to *please me.*

One of our biggest customers had a grievance against the firm. He held off payment of a big bill and switched to one of our competitors. I was sent to see him. He met me like a cornered tiger. A few words and I calmed him. Inside of fifteen minutes he was showering me with apologies. He gave me a check in full payment, another big order, and promised to continue giving us all his business.

I could tell you dozens of similar instances, but they all tell the same story—the ability to make people like you, believe what you want them to believe, and to do what you want them to do. I take no personal credit for what I have done. All the credit I give to the method Peters told me about. We have told it to lots of our friends, and it has enabled them to do just as remarkable things as Peters and I have done.

BUT YOU want to know what method I used to do all these remarkable things. It is this: You know that everyone doesn't think alike. What one likes another dislikes. What pleases one offends another. And what offends one pleases another. Well, there is your cue. You can make an instant hit with anyone if you say the things they want you to say, and act the way they want you to act. Do this and they will surely like you, and believe in you, and will go out of their way to PLEASE YOU.

You can do this easily by knowing certain simple signs. Written on every man, woman and child are signs, as clearly and as distinctly as though they were in letters a foot high, which show you from one quick glance exactly what to say and to do to please them—to get them to believe what you want them to believe—to think as you think—to do exactly what you want them to do.

Knowing these simple signs is the whole secret of getting what you want out of life—of making friends, of business and social advancement. Every great leader uses this method. That is why he is a leader. Use it yourself and you will quickly become a leader—nothing can stop you. And you will want to use it if for no other reason than to protect yourself against others.

WHAT Peters told me at luncheon that day was this: "Get Dr. Blackford's 'Reading Character at Sight.'" I did so. This is how I learned to do all the remarkable things I have told you about.

You have heard of Dr. Blackford, the Master Character analyst. Many concerns will not employ a man without first getting Dr. Blackford to pass on him. Concerns such as Westinghouse Electric and Manufacturing Company, Baker Vawter Company, Scott Paper Company and many others pay Dr. Blackford large annual fees for advice on dealing with human nature.

So great was the demand for these services that Dr. Blackford could not even begin to fill all her engagements. So Dr. Blackford has explained the method in a simple seven-lesson course entitled "Reading Character at Sight." Even a half-hour's reading of this remarkable course will give you an insight into human nature and a power over people which will surprise you.

Such confidence have the publishers in Dr. Blackford's Course, "Reading Character at Sight," that they will gladly send it to you on approval. Send no money. Merely fill in and mail the coupon. The complete course will go to you instantly, on approval, all charges prepaid. Look it over thoroughly. See if it lives up to the claims made for it. If you do not want to keep it, then return it, and the transaction is closed. And if you decide to keep it—as you surely will—then merely remit Five Dollars in full payment.

Remember, you take no risk, you assume no obligation. The entire course goes to you on approval. You've everything to gain—nothing to lose. So mail the coupon NOW, while this remarkable offer remains open.

FREE EXAMINATION COUPON

Independent Corporation

Publishers of the Independent Weekly

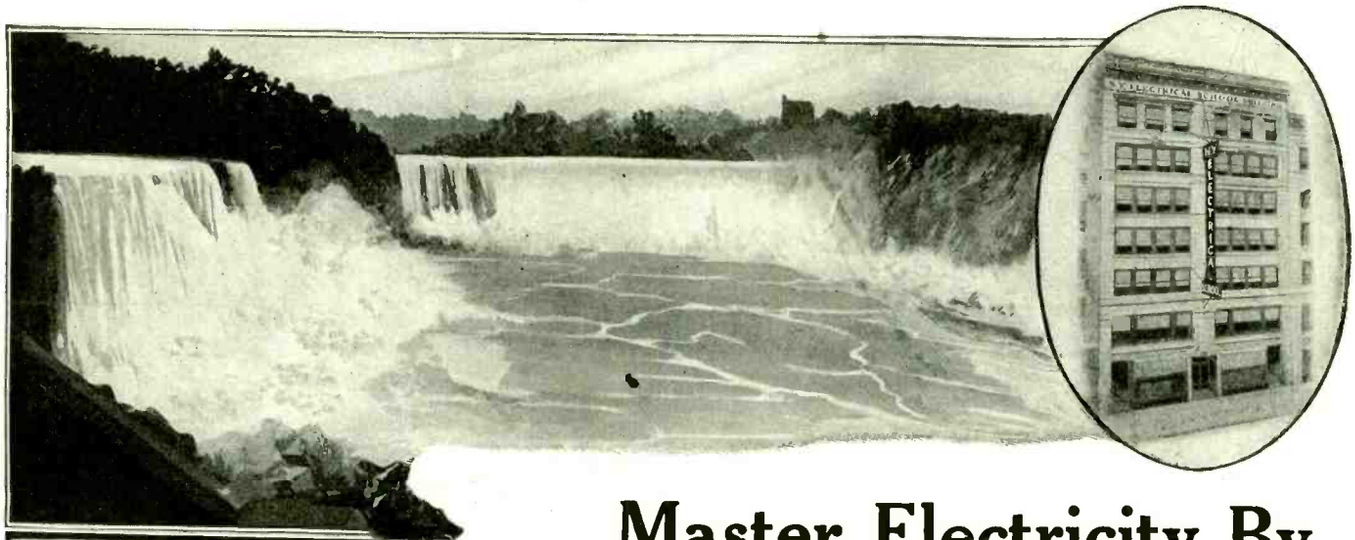
Dept B-1107, 119 West 40th Street, New York

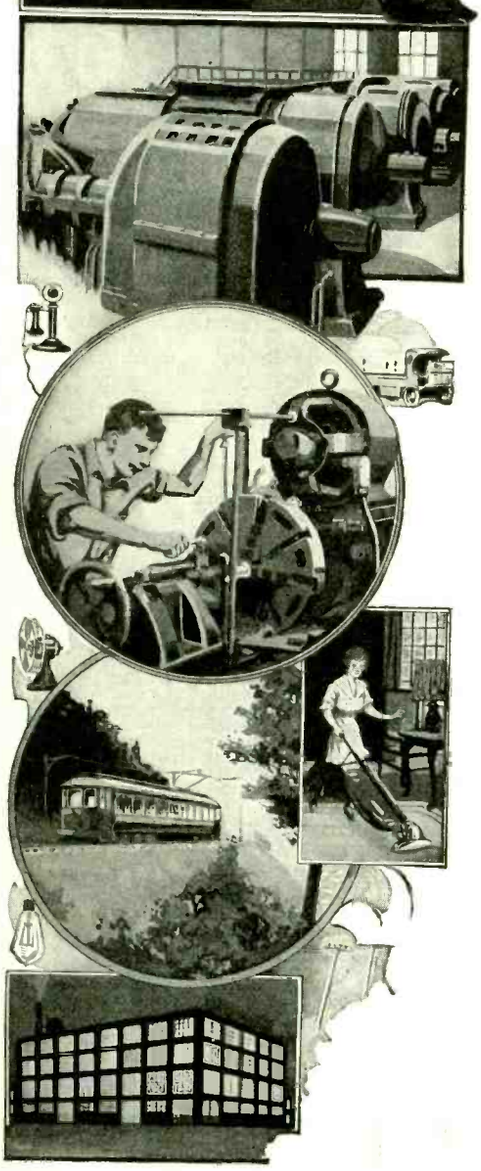
You may send me Dr. Blackford's Course of seven lessons entitled "Reading Character at Sight." I will either remail the course to you within five days after its receipt, or send you $5 in full payment of the course.

Name .....

Address .....

..... Elec. Exp. 7-19





Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 5,500 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Special Automobile Ignition Course

We have just installed a special automobile ignition course for auto mechanics, garage men and owners. The course covers completely ignition, starting, lighting and other electrical equipment in connection with automobiles, motor boats, etc.

Let us explain our complete courses to you in person. If you can't call, send now for 64-page book—it's FREE to you.

New York Electrical School
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

_____(NAME)

_____(ADDRESS)

New York Electrical School

29 West 17th Street, New York

ELECTRICAL EXPERIMENTER

H. GERNSBACK – EDITOR
H. W. SECOR – ASSOCIATE EDITOR

Vol. VII. Whole No. 75 JULY, 1919 No. 3

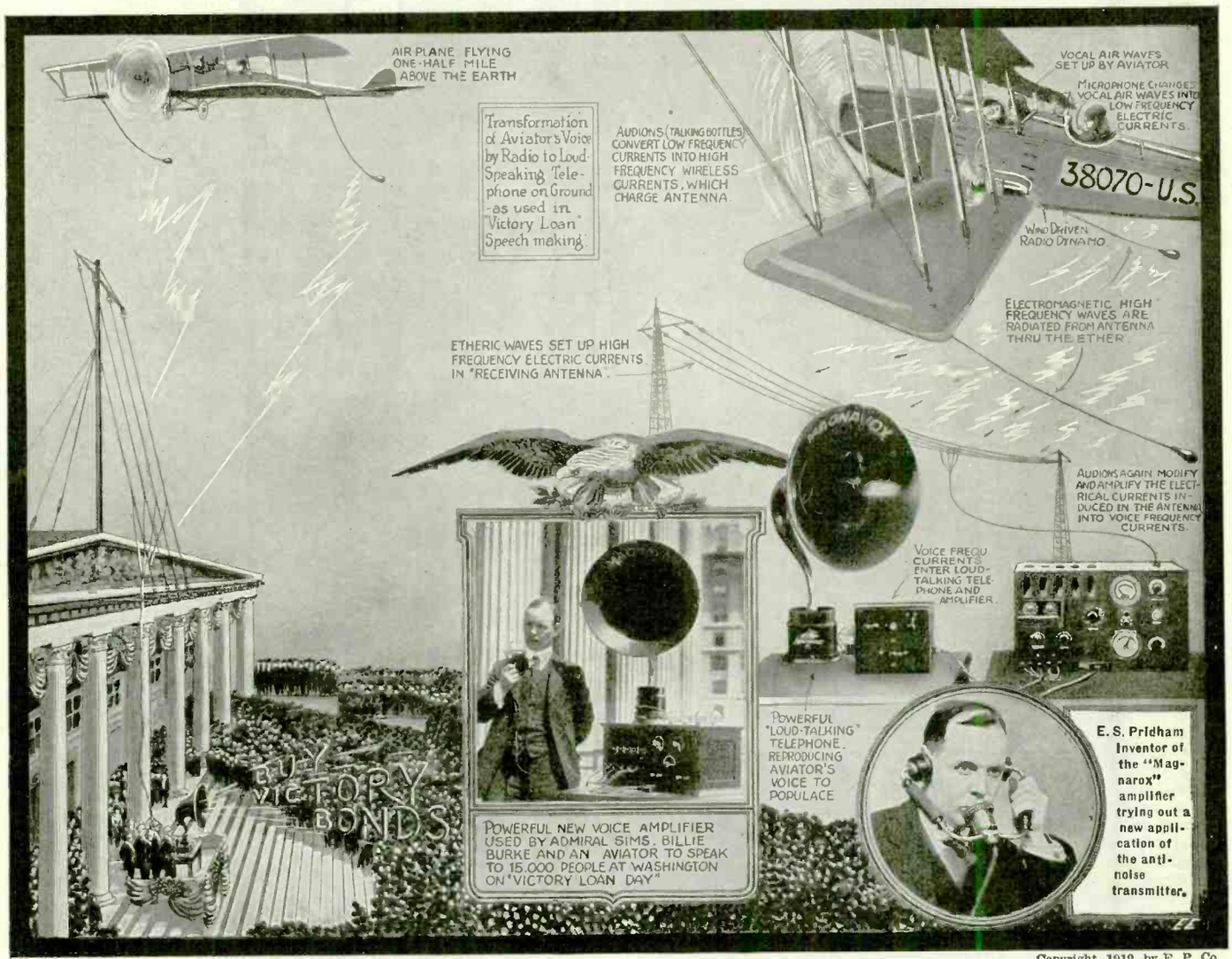
Talking from 'Plane to Earth

How it is Done Explained in Non-Technical Terms

"HELLO! hello, Treasury!" cried the aviator. "I am now 2,600 feet over you in plane 38,070 from Bolling Field." The aviation officer then read President Wilson's "Victory Liberty Loan" message by wireless, thru the air, and concluded by bidding good-bye to the crowd. Lieutenant H. E. Metcalf, the radio officer aboard the 'plane, talked from an airplane flying 2,600 feet overhead to 15,000 persons assembled at the southern steps of the Treasury, at Washington, D. C., by the use of the wireless telephone and a newly invented *sound amplifier*, which possesses great power.

The throng of Government employes, dismissed for the capital's opening demonstration for the loan, cheered the President's message as spoken thru the air and enun-

(*Continued on page* 281)



Copyright, 1919, by E. P. Co.

Thanks to the Remarkable Developing of the "Loudspeaking" Wireless Telephone in His Absence, President Wilson Will Be Able to Talk to His Constituents on This Side of the Atlantic from Midocean on His Way Home. It is estimated that the President's Voice May Be Heard by 50,000 Persons Grouped About a Reproducer Here, While He Is Yet 1,000 Miles at Sea. The New Wireless Telephone Device Is the Invention of Three San Francisco Men—E. S. Pridham (Shown in the Picture), P. L. Jensen and O. B. Moorehead. It Consists of an Anti-Noise Transmitter, Called a "Magnavox," and an Amplifier. It was Used by Admiral Sims and Billie Burke When They Addrest 15,000 People on the Steps of the United States Treasury Building, Washington, D. C. Mr. Pridham, on "Victory Loan Day," April 21, Personally Supervised the Demonstration of the Wonderful New Anti-Noise Telephone That Made Telephone History. An Aviator 2,600 Feet (One-Half Mile) Overhead Spoke, With This Instrument, to 15,000 People Thru a "Magnavox" Amplifier.

Talking Thru the Trees

By MAJOR-GENERAL GEORGE O. SQUIER

Chief Signal Officer, U. S. Army

AS long ago as 1904, the author conducted some experiments with a view to utilizing growing trees as *antennae* for radio-telegraphy and discovered the efficacy, in a general way, of using a direct metallic contact to certain trees (principally *eucalyptus*) to increase the audibility of radio signals. My attention was first called to this phenomenon during the course of summer maneuvers of the Army at Camp Atascadero, Calif., where, due to the prevalence of the dry season and the unusual character of the soil, it was found that the regular Army buzzer telephone and telegraph sets were inoperative with any ordinary ground or earth but became operative when connected to a metallic nail driven in the trunk or roots of a *live tree*. This incident led the author to pursue the subject experimentally in the autumn of 1904 continuing the experiments to the range of frequencies then employed in radio-telegraphy.

Tree Antennae.

In connection with the organization and development of *Transatlantic radio reception*, which was carried out during the period of the war to provide against the possibility of the interruption of the submarine cable system, the Signal Corps established a chain of special receiving stations in different parts of the United States to copy and record enemy and Allied radio messages from European stations for the information of our Army General Staff.

In the prosecution of this work, directions were given to the Signal Corps Laboratory at Camp Alfred Vail, Little Silver, N. J., and also to the experimental staff in Washington to test the efficiency of *growing trees* as receiving antennae, in connection with this service, using the vastly superior technique and facilities now represented in the radio Art as compared with the crude apparatus with which the discovery was made in 1904. With a collection of apparatus representing the most advanced state of the radio Art, the problem, as a war measure, was attacked anew and has now reached a point where a very brief outline of some of the physical results obtained should be presented in the interests of the development of the Art in general. Since the phenomena involved embrace a variety of physical problems rather than strictly engineering ones, these data are presented in the hope that our scientists may see in the experiments some points of departure for further research.

How Trans-Atlantic Radio Messages Are Copied Via Tree Antenna

European Radio Signals, Via the Trees.

It was immediately discovered that with the sensitive amplifiers now in use it was possible to *receive signals from the principal European stations* by simply laying a small wire netting on the ground beneath the tree and connecting an insulated wire *to a nail driven in the tree well within the outline of the tree top*. See Fig. 1. Messages having been received from England, France, Germany and Italy.

This encouraging first result justified a more careful examination of the phenomena and the most suitable arrangement of circuits for the purpose.

And Now the "Floraphone."

The messages carried over this tree telephone and telegram system have been named by the writer. They are to be "floragrams." The tree telephone is to be a "floraphone"; the tree telegraph a "floragraph."

The discovery is now announced after experiments covering fifteen years, beginning in California and continuing intermittently until the outbreak of the war, when they went forward with vigor as an emergency means of communication. The system was utilized during the war in "listening in" on the German radio communication.

The final development took place in a small portable laboratory, purchased from a mail order house, capable of being carried to any place in the woods. A group of soldiers, sleeping in the house and taking turns at copying messages, assisted the writer in the development of the apparatus.

Without entering into the details of these preliminary experiments here it may be said that one of the best receiving arrangements is found to be an elevated tree earth-terminal in the upper part of the tree top, *and an earth consisting practically of several short pieces of INSULATED wire, SEALED AT THE OUTER END, radiating out from a common center, and buried a few inches beneath the surface of the ground in the neighborhood of the tree.* See Fig. 2.

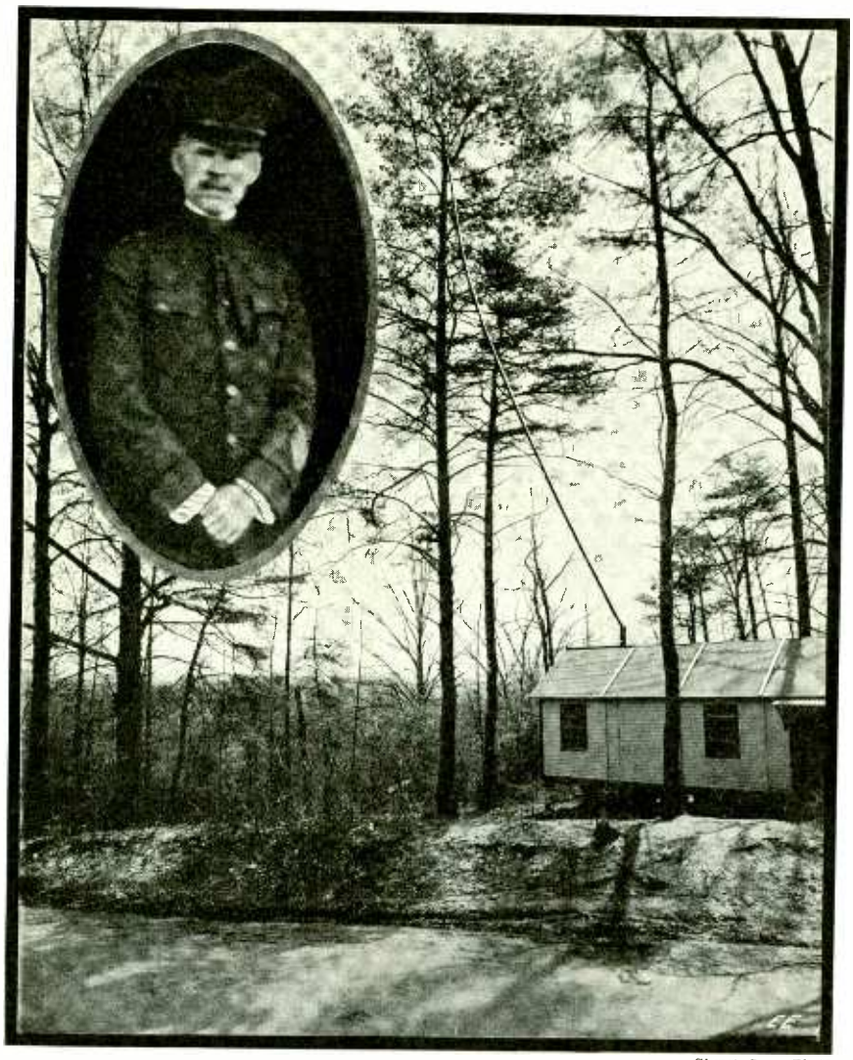
It was soon found that a tree-antenna could be used efficiently as a *multiple radio receiving set over widely different wave lengths*, see Fig. 3A, receiving either from separate terminals at the same (shown dotted in Fig. 3A) or different heights of the tree, *or in series from the same terminal.* See Fig. 3B.

This same type of circuit was employed in an inverse manner for radio-telephonic transmitting purposes, altho the experiments thus far have been limited to short distances. It was found that *2-way radio telephonic communication* was easily established with remarkably low values of transmitting antenna current. See diagram of this test illustrated at Fig. 4.

The flexibility of this arrangement is very striking. The linking up of *wire* and *wireless* methods was found to be both convenient and efficient. *Radio-telephonic messages from airplanes* were readily received by the tree-antenna arrangement and *transferred thence to the wire system* of the city of Washington and finally received at any point desired. See Fig. 5.

Furthermore, *radio-telephonic transmission* thru the tree-antenna was *received by*

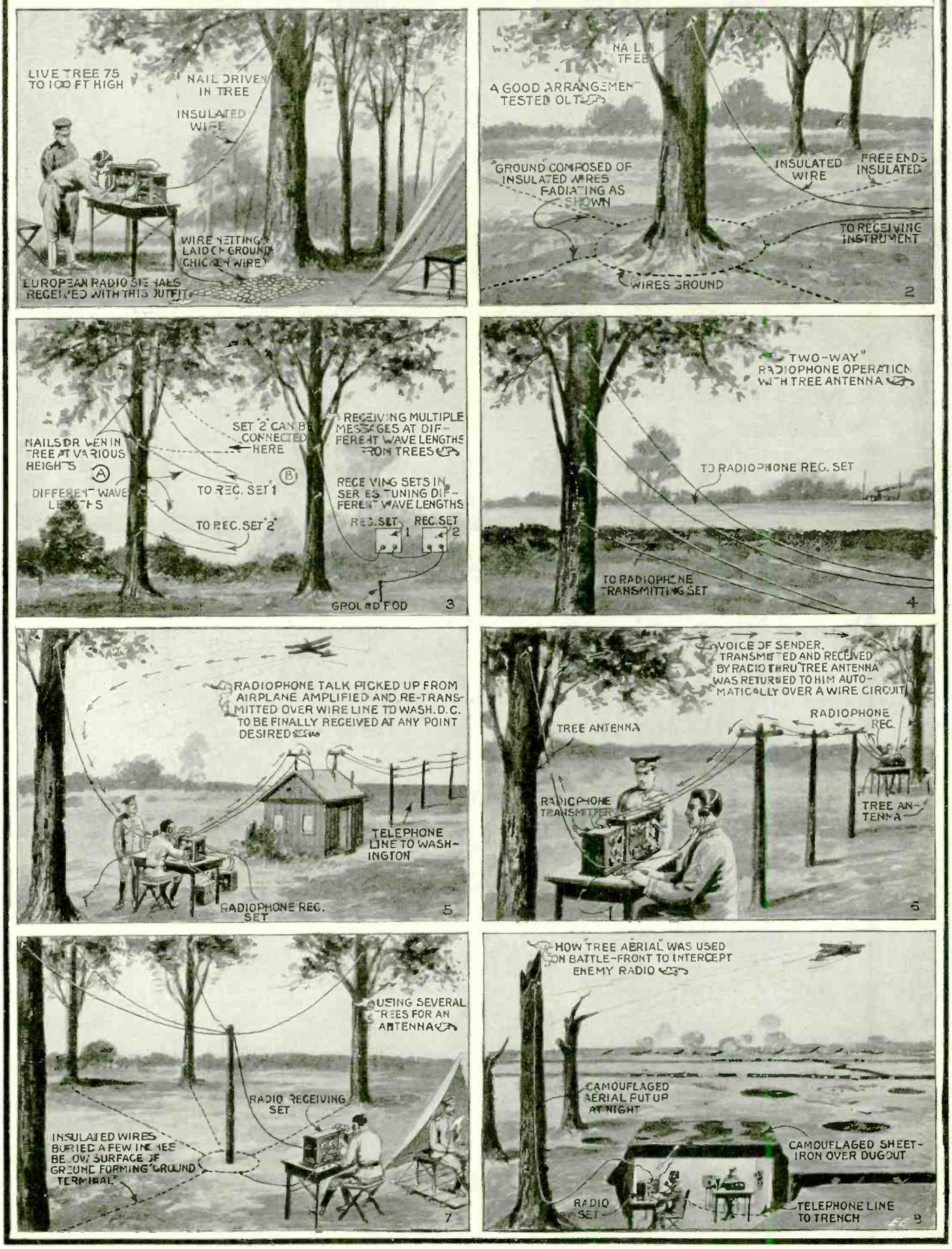
(*Continued on page* 271)



Signal Corps Photo

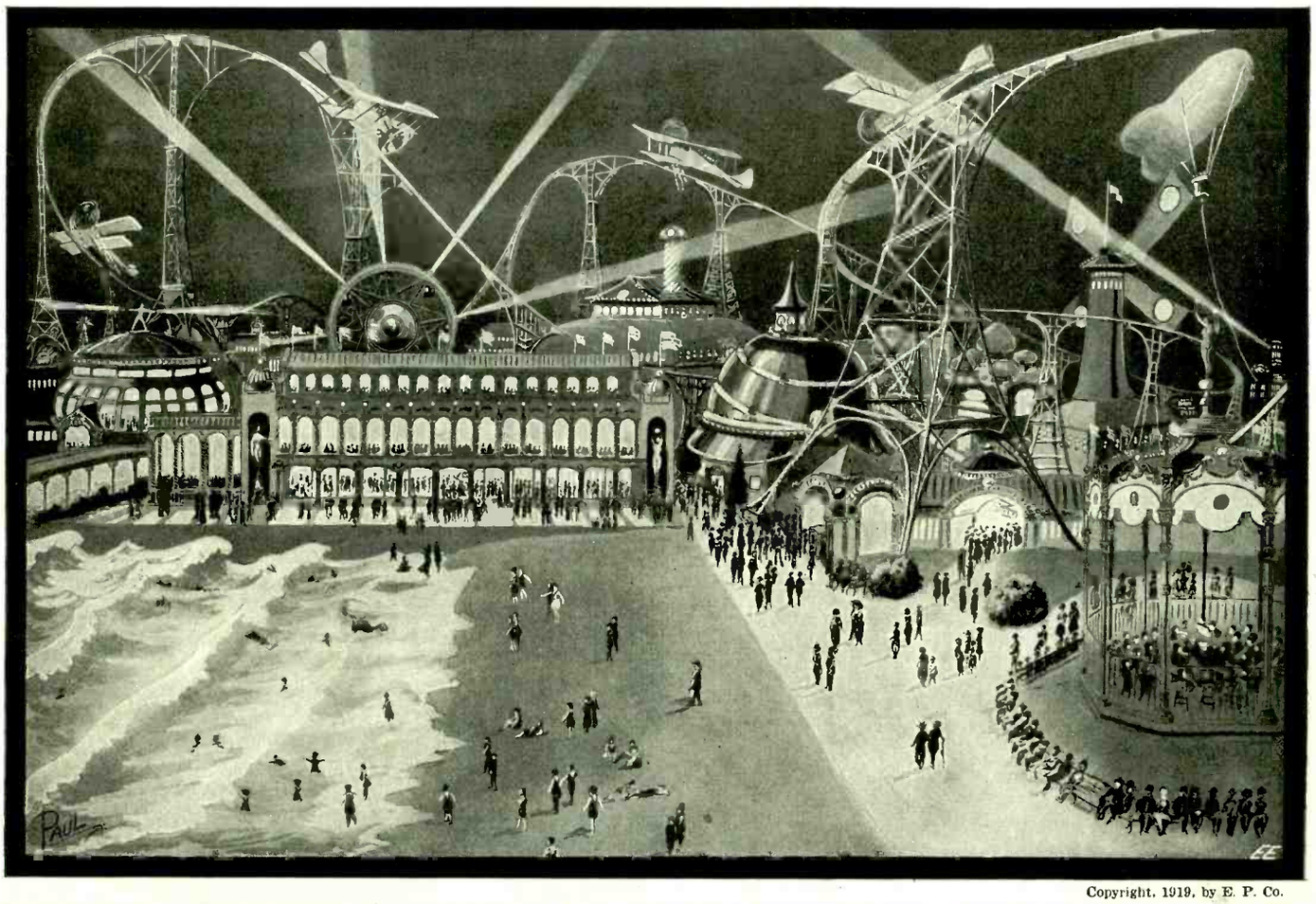
The U. S. Signal Corps Laboratory Near Washington, D. C., Where Remarkable Results Were Obtained Using Living Trees as Radio Antennae. Signals from Europe and Other Countries Were Easily Copied. Trees Have Been Successfully Used Also for Radiophone Transmission. Insert View: Major General George O. Squier, Inventor of "Tree Wireless."

TREE WIRELESS



Copyright, 1919, by E. P. Co.

FULL DESCRIPTION OF TREE AERIALS ON OPPOSITE PAGE.



Copyright, 1919, by E. P. Co.

Dashing Thru the Night With Flames Spouting from Their Exhaust Pipes, and Propellers Whirling, Shoot These Captive Airplanes With Their Joy-Seeking Passengers. The Latest Idea in the Summer's Pleasure Grounds. The "Bronx Exposition Amusement Park," in New York City, Will Feature This Diversion. It Gives All the Thrills of a Real Ride in an Airplane.

A Dash to the Clouds

By GEORGE HOLMES

THE restless feeling that comes to everyone at the first sign of spring—the trees budding, birds returning from the South and gaily announcing the rise of the sun each morn—stirs the blood of every man, woman and child, the young or old, and makes them want to get out into the great outdoors. Those who are not able to go far away into the hills, mountains and seashore for extended periods to cure this "spring fever" must needs find some attraction nearer home. The average person dwelling in the city in the little cigar boxes we are wont to call apartments finds himself cramped for room. It is like the old story of the dog who was forced to wag his tail up and down, instead of sideways. He *had* to wag it up and down because the walls of the apartment were too close together and he could not wag it any other way.

Enterprising business men have found a solution for the everyday worker and his family, by bringing within easy reach amusement parks and seaside resorts, where he may either spend a week with his family or have his family there during the week and be able to go there himself in the evenings after he is thru with the business of the day, and also on Saturdays and Sundays. Principal among these resorts, one rather new and practically in its infancy, but rapidly growing, is the *Bronx Exposition Amusement Park,* within the boundary of New York City.

Just a short time ago, in visiting the grounds, you could hear the hammering and sawing of carpenters, the concrete mixers running, steel and structural workers on the job, and general signs of activity. To the layman this work has always proven of great interest, but so few have the opportunity of witnessing these gigantic buildings rise as if from nothing. Usually under cover in great secrecy, these surprises are manufactured. On the opening day, the great crowds of visitors come to gasp in astonishment at the amazing array of amusement devices, both old and new, devised and evolved during the long winter slumber between seasons.

This year we have what is perhaps the largest, greatest and most spectacular device ever before shown to the public. In the many years of fairs, expositions and amusement parks, gone by, we have never before witnest a most startling affair than that of the *"Captive Airplane"* complete in every detail, spouting flames from its exhausts, and the whirring of the propeller, mounting higher and higher into the heavens, and then shutting off its power, in a series of dips taking away one's breath, gradually coming back to the starting point. This device, which has never been tried out before, even in the model form, is being constructed from plans evolved as the work progresses, and has every possibility of becoming a success. There will be several machines which will consist of the regular airplane body, wings and necessary stays. In addition there will be a motor attached to the propeller. This motor and propeller will be more for attraction and sensation than actual driving power. The cars themselves will travel on a monorail track driven by electric power taken thru a contact shoe to the rail and back to the motors underneath the car. This machine will start from a height of about 5 feet above the ground and gradually rises over a steep incline several hundred feet over the tops of the amusement buildings, and, arrived at the top, the power will be shut off, when the car will begin its dizzy descent of the many loops of monorail track. Death defying, some people might say, but so scientifically and carefully is this device constructed that there is not the least bit of danger to any of the sixteen passengers in the car. Most glorious will be the spectacle at night when the many lights of the park and searchlights will play upon the snorting monster of the air as it carries its load of pleasure-seekers on its startling trip thru the clouds, for then it will present the true airplane appearance, as no track will be visible. It will give an effect far greater than can ever be shown in our illustration.

Approximately 175,000 feet of lumber will go into the making of this new airplane railway. The railway itself from start to finish will be 3,200 feet in length, each car carrying sixteen persons. The

(*Continued on page* 244)

The Oyster's Autograph

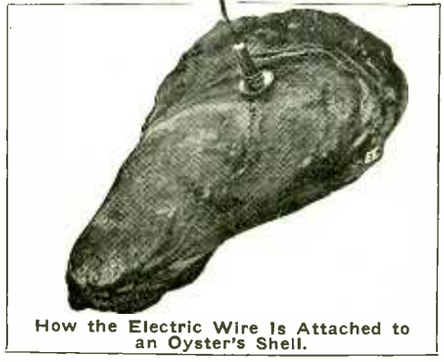
How the Oyster tells us when he eats

IF we could learn what food the oyster really needs, we could then raise better crops of this highly delicious and edible sea food. Not being possest of any supernatural powers, we must resort to some crude means, mechanical or electrical, for determining the environment factors and the foods which are best suited to the oyster. This field up to a short time ago had not been investigated to any appreciable extent. Heretofore, the growth of the oyster had been left mostly to fishermen, who, in raising these oysters in the oyster beds, had not been doing all that was best for them, causing illness and even deaths in many instances by poisoning in one form or another thru eating oysters which had possibly reposed in sewage or other polluted waters.



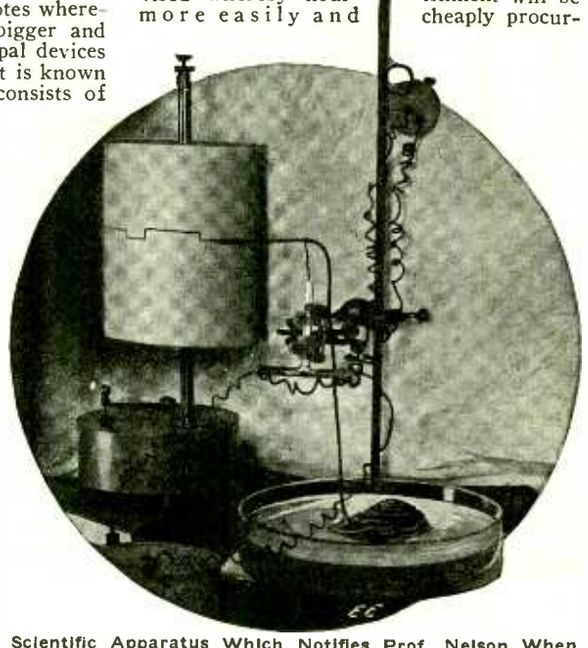
Professor Thurlow C. Nelson, Who Is Making a Scientific Study of the Oyster. He Is Here Seen Wiring an Oyster Preparatory to Feeding It. See Recording Apparatus at Right.

It remained for Professor Thurlow C. Nelson, Assistant Professor of Zoölogy at the State University of New Jersey, to open up a research laboratory in the midst of the oyster beds at Tuckerton, N. J., to perform a series of experiments and studies on the oyster to determine how best to raise a better crop each season. Professor Nelson has fitted out a houseboat in Little Egg Harbor, provided with a number of ingenious contrivances to aid him in gathering a fund of information as to the oyster's routine, particular stress being made on what he normally eats, and the effects that certain foods will have when fed to the bivalves. In this way a method may be determined from these notes whereby we can grow and breed a bigger and better oyster. One of the principal devices used in these experiments is what is known as a standard recorder, which consists of a drum with a cylinder mounted on it, and a cross-sectioned chart paper, on which the oyster records its various minute movements. To the oyster itself a wire is attached, which is connected to the indicator. When the oyster opens, the movement of the shell closes an electric circuit. The indicator or recorder then functions, and the observer can read on the drum the time that it takes to open, how long it remains open, and when the shell closes again!



How the Electric Wire Is Attached to an Oyster's Shell.

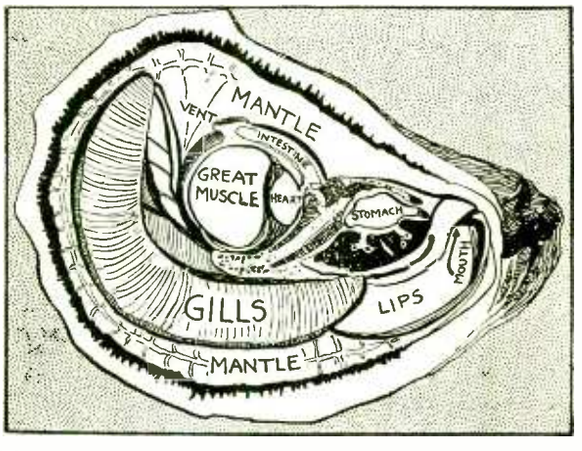
With the closing of this electric circuit, a bell rings notifying the attendant that the oyster is displaying some activity. By means of this apparatus it will be possible to determine the time, day or night, that the oyster feeds, the frequency of these periods and their duration and the kind of food that is consumed over any period. Just what kinds may be learned by removing the oyster from this apparatus and noting its weight after a period of treatment, the weight before going under the treatment being also carefully noted. A microscopic examination of the stomach is then made which shows the contents before assimilation. The rate of growth can also be studied in connection with the effects of artificial feeding. It is a generally accepted fact that it requires three seasons before an oyster reaches market maturity. It therefore becomes obvious that any reduction of this period will result in many advantages to the oyster grower, and also it will mean cheaper oysters to the consumer, with less chance of getting typhoid fever. The U. S. Government has conducted many experiments with oysters in different bodies of water. According to data issued in their bulletins, they have found that many of the tricks of the oysterman have robbed the oyster of much of its nutritive value. Another factor is the danger from disease infection in the waters which are saturated with filth from city sewers. Professor Nelson is now conducting experiments to collect a fund of definite knowledge of the oyster's dietary requisites. From these records a method will be devised whereby nourishment will be more easily and cheaply procurable. The natural flavor variety of oyster will again be restored, and the *drinking* process now used among dealers will be abandoned.



Scientific Apparatus Which Notifies Prof. Nelson When the Oyster Is Feeding and Records the Movement of Its Shell. Electricity Actuates the Instrument.

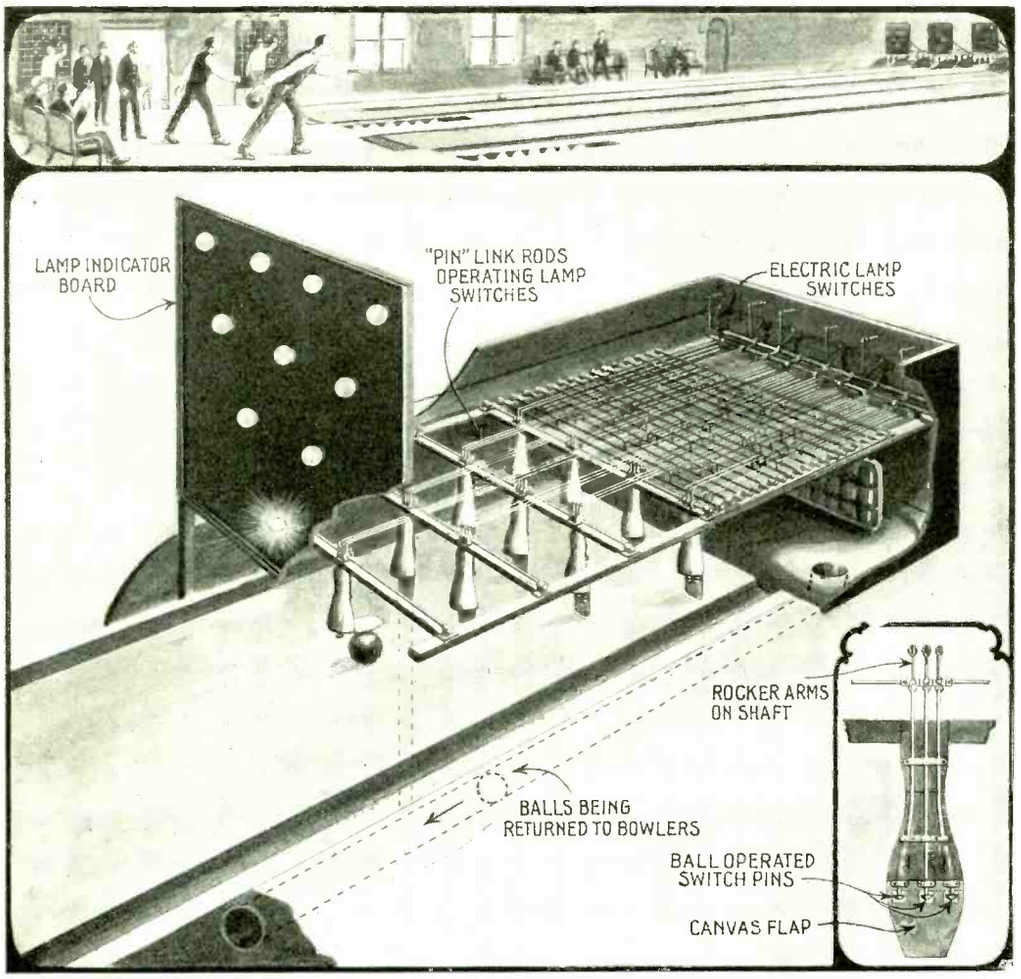
The *drinking* or *plumping* fraud as practised on consumers hoaxes the uninformed into the belief that the resulting bloated whiteness of the bivalves is a mark of par-excellence. As a matter of fact, the oyster so treated loses the greater part of its flavor, and due to conditions under which the trick is carried on, there is the likelihood of its being laden with germs, which may cause serious illness and in many cases death. Thousands of cases of typhoid fever and various other stomach and intestinal troubles result from the con-

(*Continued on page 244*)



The Anatomy of the Oyster—Just Think, Fellow-Banqueters, of All the Wonderful Machinery of Nature We Devour in Every Oyster Cocktail.

Electrifying The Bowling Alley



At Last—Sportsmen—an Electrified Bowling Alley. No Score Keepers, no Pin Boys. Just "Shoot" the Ball Down the Alley. The "Play" is indicated on the Lamp Indicator Board as Here Shown. The Pins Are Self-Resetting.

HATS off to a Milwaukee electrician, Max A. Drews, who has at last come to the rescue of the sporting man, who wonders what science is anyway, with an up-to-date *electrified bowling alley*. Who bowls? The answer is—everybody, in America. So, as we are all interested in bowling, let us take a look at the wonderful invention which Mr. Drews has solved and perfected, which makes it possible at last to bowl all by your lonesome self in your bomb-proof bowling alley down in the basement of your country castle, without the bother of pin boys. In this twentieth century electrified bowling alley *de Luxe*, all the "hits" are chalked up on an electric lamp score-board, automatically—the pins all reset themselves—and the balls, after having wrought more or less terrible havoc among the pin brigade return, thru a gravity conduit, to the bowler's position at the front of the bowling alley.

The details have been worked out very carefully, indeed, by the inventor, so that any regular bowling play is correctly registered on the electric-lamp score-board.

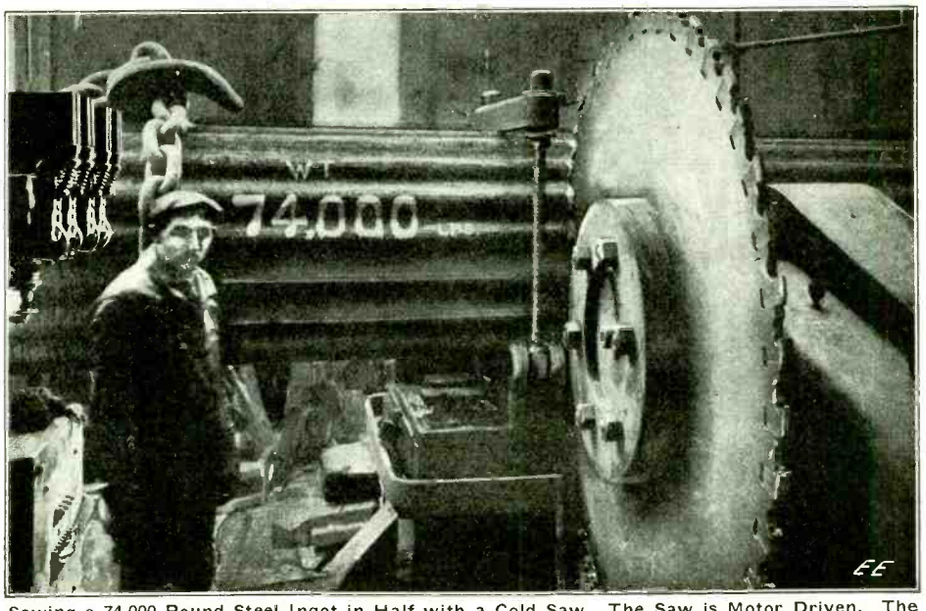
The pins are cleverly arranged and consist of a solid upper member and a canvas or other flexible flap for the lower member, as the detail illustration shows. Generally speaking, there are three electrical contacts and actuating fingers arranged on each pin, one in the center, and one at either side. In the general illustration a ball is shown just passing under the front pin of the set. It will be noted how it passes easily under the upper rigid portion of the pin and presses the flap backwards, without being checked in its onward travel. When the ball, however, passes under the stationary half of the pin, one of the three electrical contact pins is pushed upward, and in doing so it actuates a rocker arm fastened on the cross-wise plates supporting the pins, which in turn connects, thru a wire link, with one of a battery of switches at the rear of the alley, all in the manner apparent. The rear ball pocket of the alley is tapered so that all of the balls, after they have struck the padded cushion, move toward the conduit opening, thru which conduit they travel under the effect of gravity back to the bowling pit at the front of the alley. The lamp score-board is arranged in the formation of the pin set-up, as the illustration shows. It represents one of the cleverest devices ever brought out.

Sawing a 74,000-lb. Steel Ingot

THE accompanying illustration shows a remarkable inserted tooth saw, developed at Pittsburgh, Penna. In the photograph may be seen an 84-inch diameter inserted tooth saw blade, with plate 1 inch thick, and a width of kerf 1½ by 5/16 inches, having a weight of 2,000 lbs., cutting a 35-inch diameter ingot of 31 carbon steel, weighing 74,000 lbs.! Some of these saws are made as large as 90 inches in diameter.

It may be stated that these inserted tooth saw blades are extensively used for cutting ingots, bars, forgings, castings, rails and structural shapes and are made for arbor or sprocket drive machines.

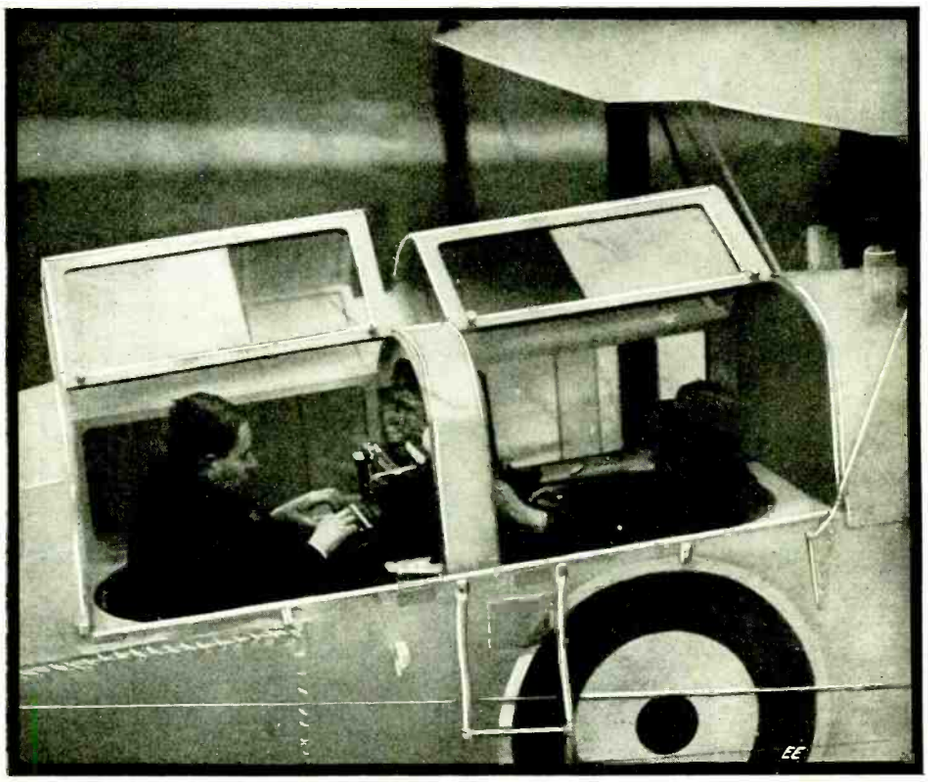
It is claimed that this design permits the use of more teeth than any other inserted tooth blade, and light sections of material can be cut more rapidly than with solid blades, as the rigid construction will withstand a heavier feed. The body of these blades is made of hardened vanadium alloy tool steel, in the grooved slots of which are inserted the best of high-speed steel cutters, treated suitably for all classes of metal cutting. The teeth are secured by interchangeable tool steel wedges and are adjusted from the bottom by hex-head brass screws to obtain correct height when assembling. (*Continued on page* 250)



Sawing a 74,000 Pound Steel Ingot in Half with a Cold Saw. The Saw is Motor Driven. The Saw Teeth Never Touch the Steel—the Air Compresst in Front of the Teeth Does the Cutting.

Typewriting in an Airplane

The photograph herewith demonstrates how the warring countries of Europe are fast adapting themselves to peacetime pursuits, in sport, pleasure and business. This illustration shows what was formerly a powerful French bombing plane converted into a business man's traveling plane, and fitted with an up-to-date office, including a typewriter. Many business men of today do not lose even a moment's time, once they leave their home for the office, and have typewriters fitted in their automobile. One of the leading New York newspaper editors, Arthur Brisbane, has a typewriter fitted in his car, and makes the trip from his home night and morning with his ever-ready "mill" at his side, in the event that he may wish to dash off a new editorial inspiration before it has flown away—unregistered. The same idea of recording thoughts on the wing, as it were, holds as well for business men as for authors and editors. Not only this, but in the spacious airplane cock-pit here shown, the business man using such a modern conveyance to or from business can carry his secretary along.



The Photograph Herewith Shows How a Powerful French Bombing Plane of Large Size Was Converted, After the Signing of the Armistice, Into a Model Business Man's Plane. In the Spacious Cabin of the Plane There Is Ample Room for a Desk and a Typewriter, and the Business Man May Carry His Secretary With Him. The Cock-pit Here Shown Is for Passengers, and Is Separate From the Pilot's Compartment.

Recording Galvanometer and Tuning Fork Timer

An ingenious recording galvanometer and tuning fork timer, as used by the U. S. Signal Corps, is shown in the photograph herewith. The recording galvanometer employs a paper tape, especially prepared by a chemical process, on which the light image reflected from the galvanometer mirror is photographically recorded, and the tape is afterward past thru a chemical bath, which develops the image, similar to the usual photo printing method. Wherever accurate measurements have to be made by means of such a recording device, in which the fluctuations of an electric current are to be recorded in the form of an undulating or wavy line, running along the recording tape, it becomes necessary to accurately space off the tape, so that the time period of each current variation can be readily determined, such as cycles per second, the interruptions of a circuit per second, its frequency, etc.

To solve this problem, use is here made of a simple and yet extremely accurate timer in the form of a musical tuning fork. It is well known that when such a fork is struck by a wooden hammer, that it vibrates with a certain musical note, depending upon the length of the fork and its other physical dimensions. This is the principle upon which the tuning fork timer, which has helped to solve many of Uncle Sam's intricate wire problems in electricity, operates. To one leg of the vibrating tuning fork there is attached an electrical contact which controls a second light image in front of the moving tape and at regular time intervals, this auxiliary timing circuit is closed so as to give spots of light on the paper tape at definite intervals, so that it becomes a simple matter to determine just how many pulsations of the galvanometer string, and in turn the current passing thru it, have taken place in a given space of time. These tuning fork timers are electrically operated in a very ingenious manner. The electromagnet is placed between the limbs of the tuning fork, and by means of a contact placed on one of the limbs, the magnetic circuit is made and broken many times per second, in exactly the same manner as the movement of ordinary vibrating bell functions.

The electrical tuning fork timer, as here described, has been used during the war in solving difficult problems in connection with harbor and coast-defense work, etc. The accurate periodic timing and the closing and opening of an electric circuit by this form of device, have proven very useful in many acoustic or sound problems on which they were engaged to the scientists connected with the Naval Advisory Board and the National Research Council, which covered the recording of sounds from coast defense and warship guns over considerable distances for the purpose of determining by *sound ranging* the distance at which a gun was located when it was fired, etc. Also much study was carried on during the war on the behavior and performance of various calibres of guns by detecting sound and other resultant characteristics whenever the gun was fired. In such work as this, the apparatus here shown, or similar apparatus, proved very useful, and in fact invaluable.

The United States Signal Corps Laboratory developed a great many new and novel instruments during the war. Some of these were not only ingenious and radically new both in conception and design, but marked a new era in scientific apparatus, especially that class of instruments which would lend themselves to use in the field where it is usually considered impossible to design an instrument of extremely sensitive nature, which will possess the proper qualities of high sensitivity and ruggedness so as to withstand rough usage.

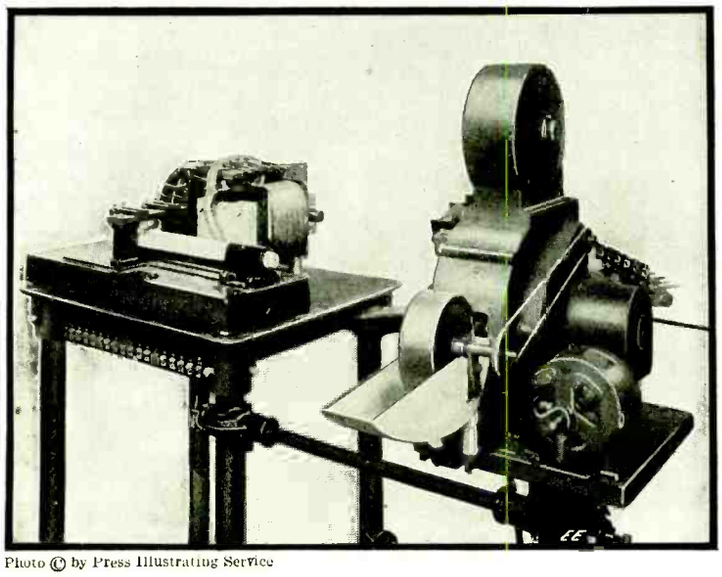
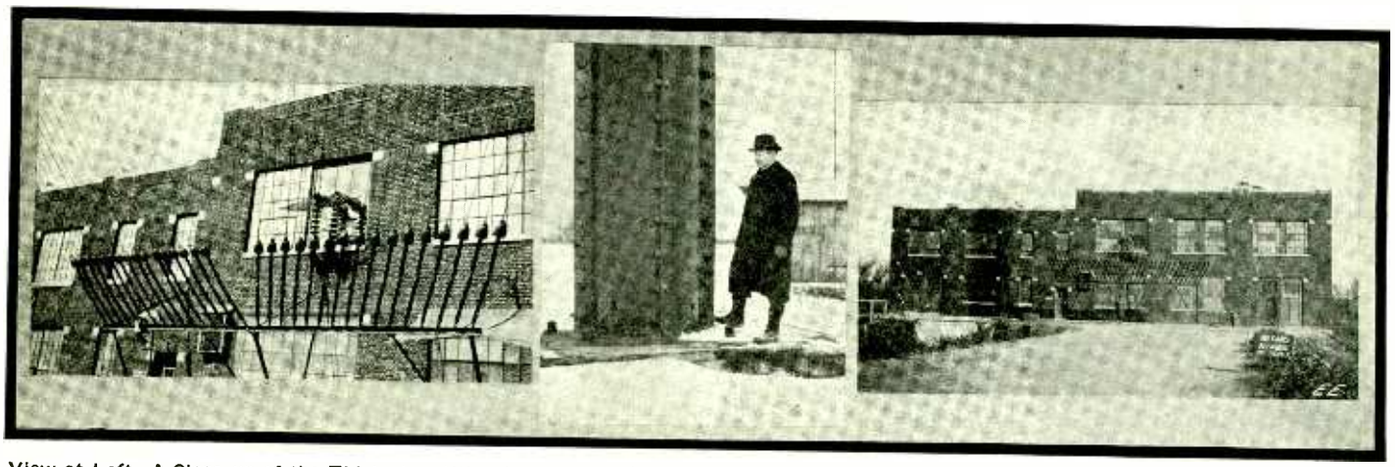


Photo © by Press Illustrating Service

The Accompanying Photograph Shows an Ingenious Recording Galvanometer and Electric Tuning Fork Timer as Used by the U. S. Signal Corps In Studying the Velocity of Sound of Large Guns and for Other Purposes Connected with Harbor and Coast Defence. The Recording Galvanometer Employs a Paper Tape Prepared by a Special Process, On Which the Light Image Reflected from the Moving Galvanometer Is Photographically Recorded. The Paper Tape Is Afterward Past Thru a Chemical Bath Which Develops the Image In the Same Manner as Photographic Prints Are Exposed and Developed. The Tuning Fork Carries an Electrical Contact On One of Its Prongs, and It Is Caused to Vibrate at a Constant Period by an Electromagnet Placed Between the Prongs, the Circuit of Which Is Opened and Closed by the Vibration of the Fork Itself.



View at Left—A Close-up of the Thirty-two Wire Antenna Lead-in Entering the New Brunswick Station. Center—Mr. Alexanderson Standing at the Base of One of the 400 Foot Aërial Masts. Right—General View of Antenna Side of New Brunswick Trans-Atlantic Radio Station, Thru Which Station Secretary Daniels Talked by Wireless Telephone to Europe.

"Hello Europe"—Via Radio

By CHARLES M. RIPLEY

The powerful wireless telephone and telegraph plant at New Brunswick, N. J., described in full detail by an engineer who visited the plant—Why "N. F. F." (New Brunswick's call) called "P. O. Z." (Nauen, Germany), in war time—How the voice of Secretary of the Navy Daniels was wafted thru space over 2,000 miles by wireless to President Wilson, on board the "George Washington" in Brest Harbor, France—How the voice starts with an initial energy of one one-thousandth watt, which is amplified and boosted thru marvelous apparatus until it leaps forth from the 32-wire, mile-long antenna intensified 100,000,000 times, with the power of 270 horses or 2,700 men, a great, turbulent, seething mass of noiseless electrical energy, which shoots thru the earth and air at a speed of 186,000 miles per second! A modern express train, traveling at a mile a minute, is like the lowly snail by comparison.

WITH the outbreak of war an impenetrable curtain of censorship was dropt between the public and many of the world's activities. But, at fever heat, like the stage hands in the cosmic theatre, the world's scientists and inventors have been surpassing themselves in setting the stage for the showing of a new scene.

The Curtain Rises.

Now the curtain begins to rise on this new scene which will tell us a romantic story of accomplishment, out-rivalling the imagination of a Jules Verne. It discloses a great transoceanic wireless telegraph station, providing daily communications direct to our armies, with our Allies in London, Rome and Paris—and, what is most surprising of all, our *communication direct to Germany.*

Late in October, 1917, the Washington key which actuates the great wireless station in New Brunswick, N. J., clicked off

. - - . - - - - - . . . - . - . . . - . . . - .

This translated from the telegraph code into the alphabet reads:

P — O — Z — DE — N — F — F

And then in quick succession:—

"POZ—POZ—POZ— de —NFF—NFF—NFF"

This fairly electrified the men in the station: "Washington is calling Germany direct"—SOMETHING EXTRAORDINARY!!!

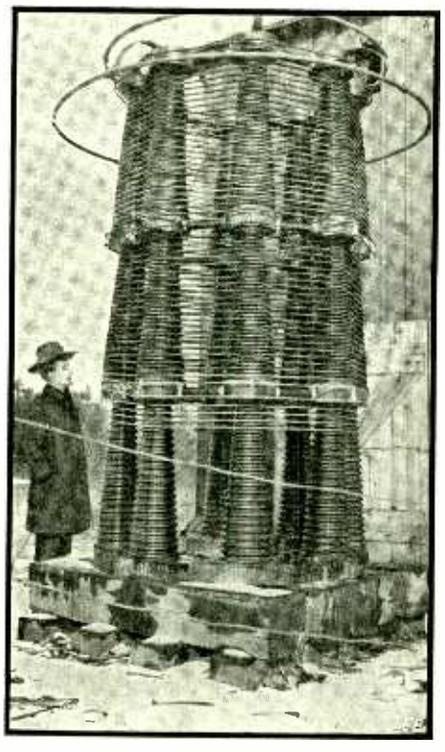
"POZ" is the call for the Nauen station in the outskirts of Berlin, and "de NFF" meant "from New Brunswick, U. S. A." Thus all diplomatic precedents had been shattered by direct communication between two nations at war! Shortly the message came from Nauen that they were in receipt of the call, and according to gossip the German operator said, "Your signals are fine, old man."

Then followed the historic note of President Wilson demanding the abdication of the Kaiser, stating that the American Government will not negotiate with any but the German people direct. So, from the very beginning, the negotiations leading up to the armistice were conducted thru the New Brunswick, N. J., Naval Radio Station.

Other achievements of this station are numerous; out of 44,640 minutes in the month of January, 1919, the New Brunswick station in the 41,961 minutes of its operation rendered some of the following services:

First—Every day New Brunswick communicated with San Francisco and San Diego, Cal.

Second—Every day New Brunswick communicated with Admiral Sims' flagship in British waters.



One of the Gigantic Tuning Coils Used on the "Multiple Tuned Antenna" Devised by Mr. Alexanderson, the Engineer Who Developed Trans-Atlantic Radiophony to a Practical Basis.

Third—Every day New Brunswick signals are received in Paris, Rome and Wales.

Fourth—So clear are these signals that the ordinary receiving sets on battleships in various parts of the world get these messages. It has been frequently reported that the small portable field sets in France have received the New Brunswick messages.

Fifth—For practically a year a daily International Press service was transmitted thru this station; thereby making American opinion known all over the world—particularly among Germany's dissatisfied allies.

Sixth—Secretary Daniels "spoke" to President Wilson thru the New Brunswick station while on board the *George Washington* in the middle of the Atlantic Ocean.

Seventh—And the wireless telegraph of the "George Washington" receives New Brunswick messages continually and keeps President Wilson informed of world and home events while on the high seas.

Such is the work done by this station.

Here is the stage-set, the curtain of censorship lifts still higher and discloses the station. A country road which swings in close to the Raritan River, which parallels the old Delaware and Raritan canal. Two old-fashioned canal boats are being towed by three mules. They suggest the days of hoop-skirted ladies in 1812, with ardent gallants in knee breeches and silk stockings dancing attendance and quadrilles. The effect is heightened by the stooped old gray-haired driver, trudging thru the red mud beside the horses.

In the distance are seen the thirteen giant 400-foot steel towers of the U. S. Naval Radio Station piercing the sky—their insulators glistening in the Spring morning's sun.

What a contrast—the most powerful radio station in the New World, flashing messages thru the skies to our armies in Europe, and the old canal boat passing close to the weird building. A century and a half stretched its wonderful history between that old unpainted barge and this modest red brick building bristling with

(*Continued on page* 262)

"HELLO EUROPE"—VIA RADIO

How Secretary of the Navy Daniels' voice was hurled by wireless telephone across the broad expanse of the Atlantic Ocean to President Wilson who was on board his ship, the "George Washington," in Brest Harbor, a distance of 3,000 miles.



THE HUMAN VOICE TRAVELS OVER A PAIR OF WIRES TO TELEPHONE EXCHANGE

ABOUT 1/300 H.P.



TELEPHONE EXCHANGE

VOICE CURRENTS TRAVEL OVER CIRCUIT TO RADIO STATION

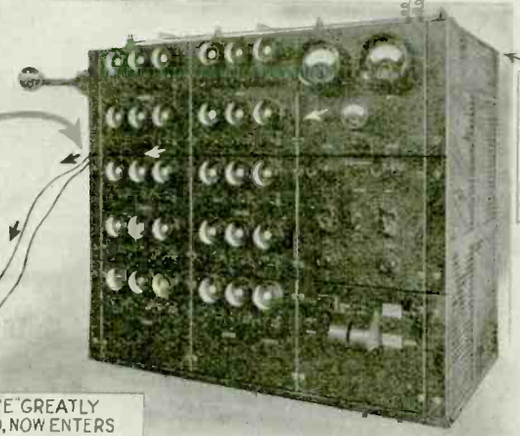
TELEPHONE TRANSFORMER



TALKING TO AND FROM AIRPLANES



DETAILED VIEW OF "PLIOTRON" OR TALKING BOTTLE



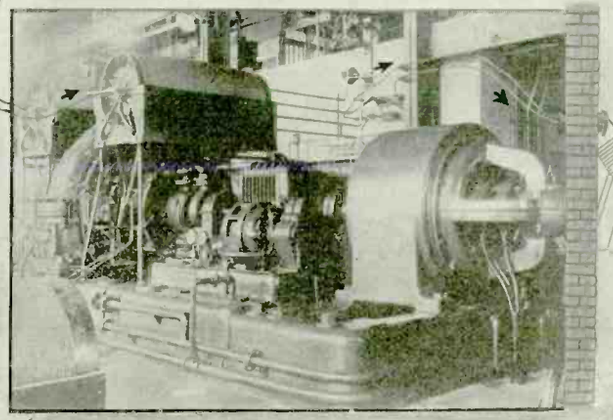
MILD VOICE CURRENTS ENTER AMPLIFYING SWITCH BOARD PASS THRU BANK OF THIRTY "PLIOTRON" BULBS (TALKING BOTTLES AND EMERGE INTENSIFIED TO SEVERAL HUNDRED WATTS!

SECY OF THE NAVY DANIELS SPOKE TO PRES. WILSON ACROSS THE ATLANTIC OCEAN

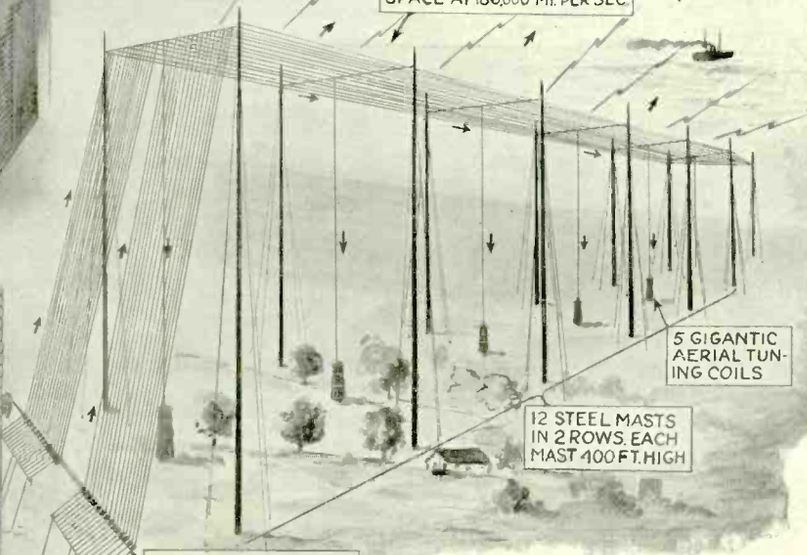
HERE'S YOUR VOICE, MULTIPLIED 100,000,000 TIMES, SHOOTING THRU EARTH & SPACE AT 186,000 MI. PER SEC.



YOUR "VOICE" GREATLY AMPLIFIED, NOW ENTERS THE MAGNETIC AMPLIFIER AND COMES OUT STILL MORE POWERFULLY INTENSIFIED



HERE YOUR VOICE CURRENTS, ENTER THE CONTROL WINDINGS WHICH REGULATE THE OUTPUT OF THE ALEXANDERSON 200 K.W. (270 H.P.) ALTERNATING CURRENT DYNAMO



5 GIGANTIC AERIAL TUNING COILS

12 STEEL MASTS IN 2 ROWS, EACH MAST 400 FT. HIGH

32 ANTENNA CABLES BUNCHED AND LEAD INTO STATION THRU PLATE GLASS WINDOW

ANTENNA 1 MILE LONG

The Accompanying Article Explains the Details of the Apparatus Shown in the Illustration Above. The Majority of This High Power Radio Apparatus Has Been Under Secret Development During the War. As Will Be Evident Upon Inspection of the General Illustration Above, Secretary Daniels' Voice Was Carried Over the Telephone from Washington Thru a Telephone Exchange and Then Entered the Great Radio Station at New Brunswick, N. J.

Copyright, 1919, by E. P. Co.

A 100 Horse-Power Voice

By JEFFERSON WILLIAMSON

A PRACTICALLY unlimited range for the voices of orators addressing outdoor crowds is now made possible by the introduction of what is called the *loud speaking* telephone. This device was used by speakers thruout the recent Victory Liberty Loan Campaign at "Victory Way" in New York City. "Victory Way" was a section of Park Avenue, five blocks in length, just north of the Grand Central Terminal. It had been specially decorated and otherwise elaborately fitted up as a "show place" which was meant to be the center of outdoor activities on behalf of the sale of Victory Notes. Each day several programs were presented at the "Way" and by means of the loud speaker the orators and musical entertainers were distinctly heard at all parts of the "Way," regardless of the fact that the line of fire of the voice of the average orator normally is only about eighty feet. In other words, without the loud speaker, the average orator could convey his ideas at a closely packed outdoor meeting to only about *five thousand* persons. The loud speaker, with its five-block range, made it possible for *tens of thousands* of people to hear the voices of the speakers intelligently.

But the range of the loud speaker is practically limitless. The farther in any direction your audience extends, the more telephone receivers of the loud speaker variety you use. The size of the audience does not matter if the orator speaks clearly and distinctly, and an orator is not an orator unless he does so speak.

Mrs. Carter Glass, wife of the Secretary of the Treasury in Washington, D. C., was the principal speaker at the opening ceremonies of "Mothers and Wives Day" at "Victory Way." Mrs. Glass spoke over the long-distance telephone from the Capitol and her words were distinctly transmitted to every person on the "Way" by means of the great receivers hung at intervals over the heads of the crowd. Mrs. Glass was followed by Mrs. Vincent Astor, who spoke from the platform at "Victory Way" into the transmitter, which carried her words to every woman in the crowd.

The crowds in "Victory Way" were thrilled one night by speeches from officers in the Great Naval Dirigible 34, which flew over the Way from the station at Rockaway Point. The words of the man in the air were carried distinctly to the waiting throngs thru the receivers of the wireless telephones overhead.

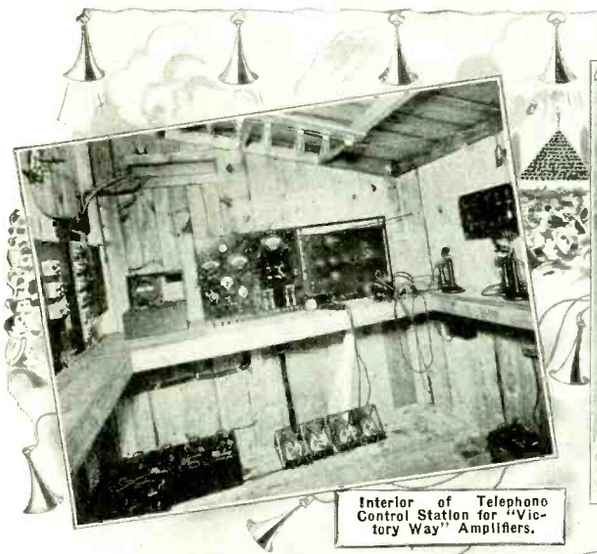
"Hello," came the message from Lieutenant Gilbert Douglas in the airship.

"Hello," was the answer from the speakers' platform, while every person on the Park Avenue plaza hurried to join one of the groups under the receivers.

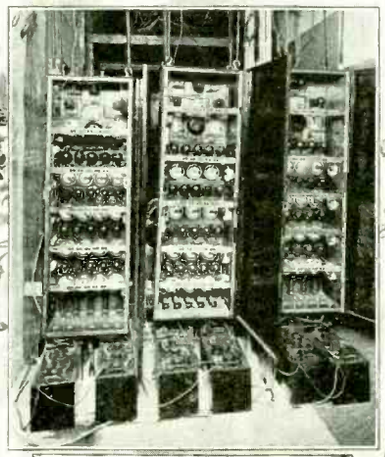
"We hope every man and women in 'Victory Way' will buy a Victory Note," was Lieutenant Douglas's parting message as the great aircraft turned her course homeward.

It is not necessary for the orator to be in front of his audience. He can be hundreds of miles away and yet be heard distinctly. For instance, each day the crowds on "Victory Way" heard at least one address transmitted from Washington. Among these speakers were Secretary of War Newton D. Baker, General Peyton C. March, and other high governmental officials. And at the close of their addresses the speakers in Washington were able to hear the applause of the New York crowds at "Victory Way." Also, a message delivered by wireless telephone from the U. S. Dirigible C-4, of the Rockaway Naval Air Station, as it hovered five thousand feet high over the East River, was transmitted to all parts of "Victory Way" by means of the loud

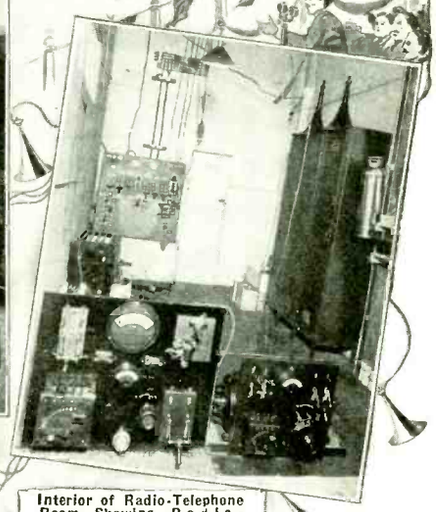
(*Continued on page* 255)



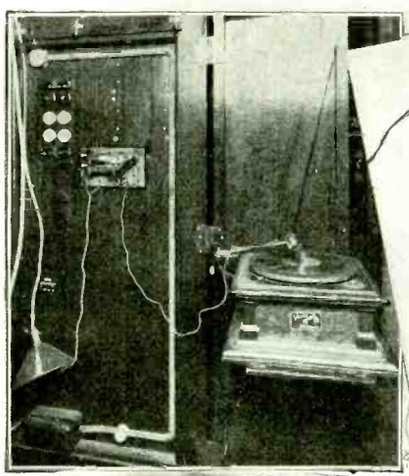
Interior of Telephone Control Station for "Victory Way" Amplifiers.



The Vast Array of Audions for Amplifying Voice.



Interior of Radio-Telephone Room Showing Radio-Telephone Apparatus.

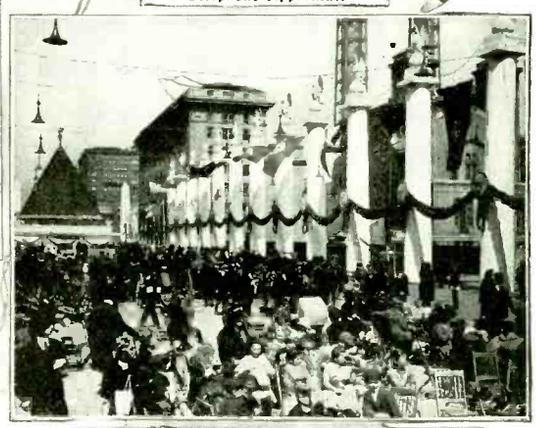


How Phonograph Was Used to Talk Thru Amplifier and Loud-Speaking Telephones.



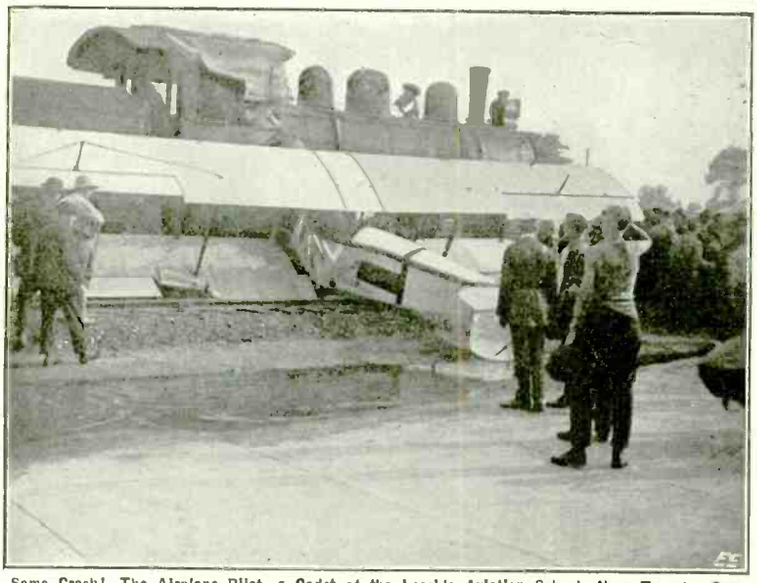
One of the 120 Loud-Speaking Telephone Reproducers.

Microphone Used to Pick Up Talk.

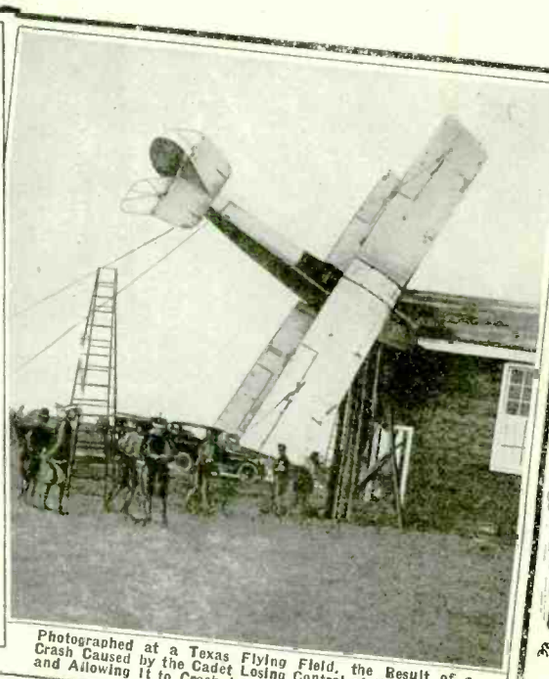


View of "Victory Way" and Some of the Loud-Speaking Telephones Suspended On Wires.

Disastrous Airplane Crashes



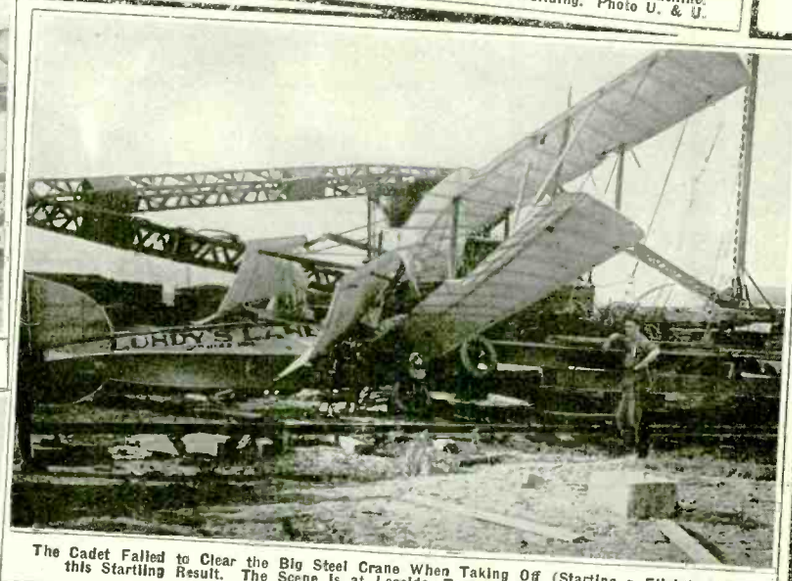
Some Crash! The Airplane Pilot—a Cadet at the Leaside Aviation School, Near Toronto, Can., Was Trying to Land. He Hit the Locomotive and Then He Landed Quickly.



Photographed at a Texas Flying Field, the Result of a Crash Caused by the Cadet Losing Control of His Machine and Allowing It to Crash Into a Building. Photo U. & U.



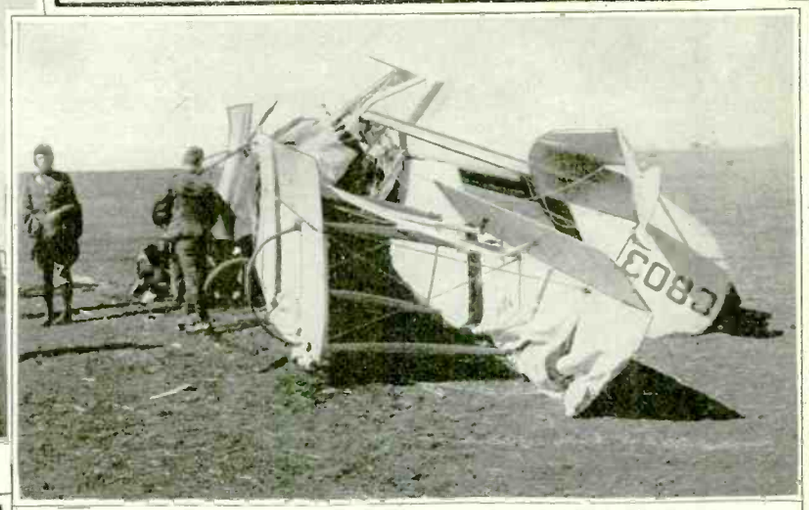
A Fatal "Nose Dive" of 2000 Feet. Engine Undamaged But Pilot Killed. Blood Stains On Left Wing. Photo Frank Hall.



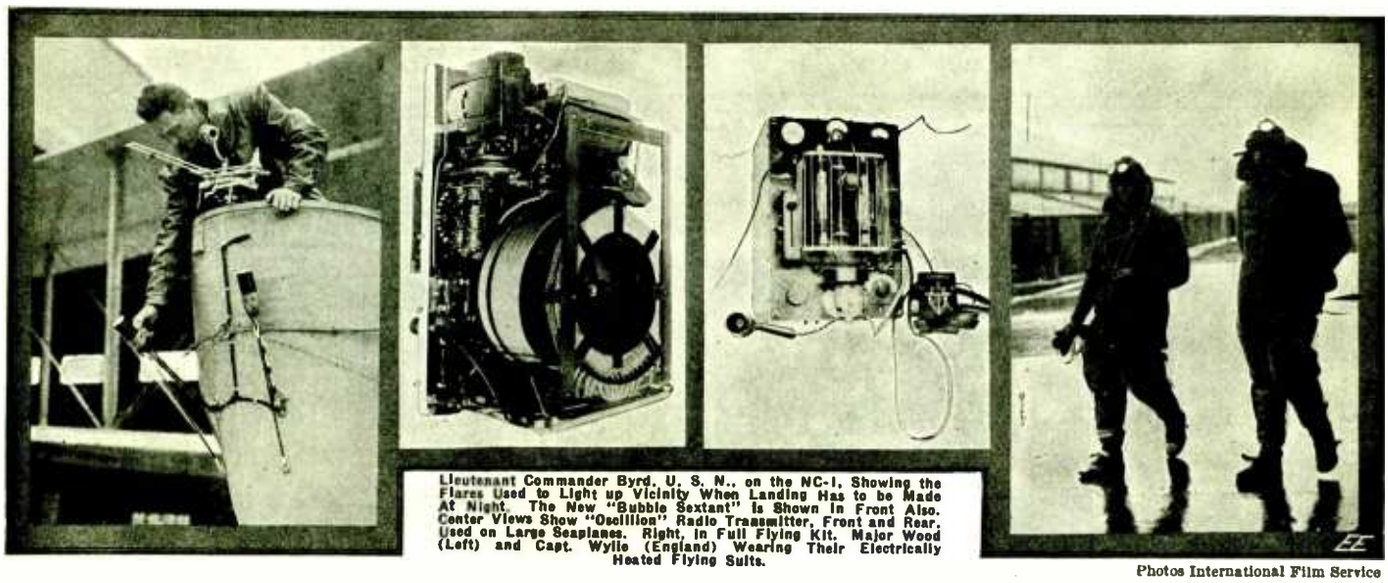
The Cadet Failed to Clear the Big Steel Crane When Taking Off (Starting a Flight) with this Startling Result. The Scene Is at Leaside, Toronto, Canada. Photo U. & U.



The Wreck of a Small Seaplane which Crashed Into a Tank of Hydrogen at Rockaway L. I., May 6th. The Two Aviators, Were Instantly Killed. Photo © by Press Ill. Ser.



Another Fine Crash at an Illinois Flying Field. 'Plane Fell 200 Feet While Piloted by Student Aviator. It Turned Over After Landing. Photo Frank Hall.



Lieutenant Commander Byrd, U. S. N., on the NC-1, Showing the Flares Used to Light up Vicinity When Landing Has to be Made At Night. The New "Bubble Sextant" is Shown In Front Also. Center Views Show "Oscillion" Radio Transmitter, Front and Rear, Used on Large Seaplanes. Right, In Full Flying Kit. Major Wood (Left) and Capt. Wylie (England) Wearing Their Electrically Heated Flying Suits.

Photos International Film Service

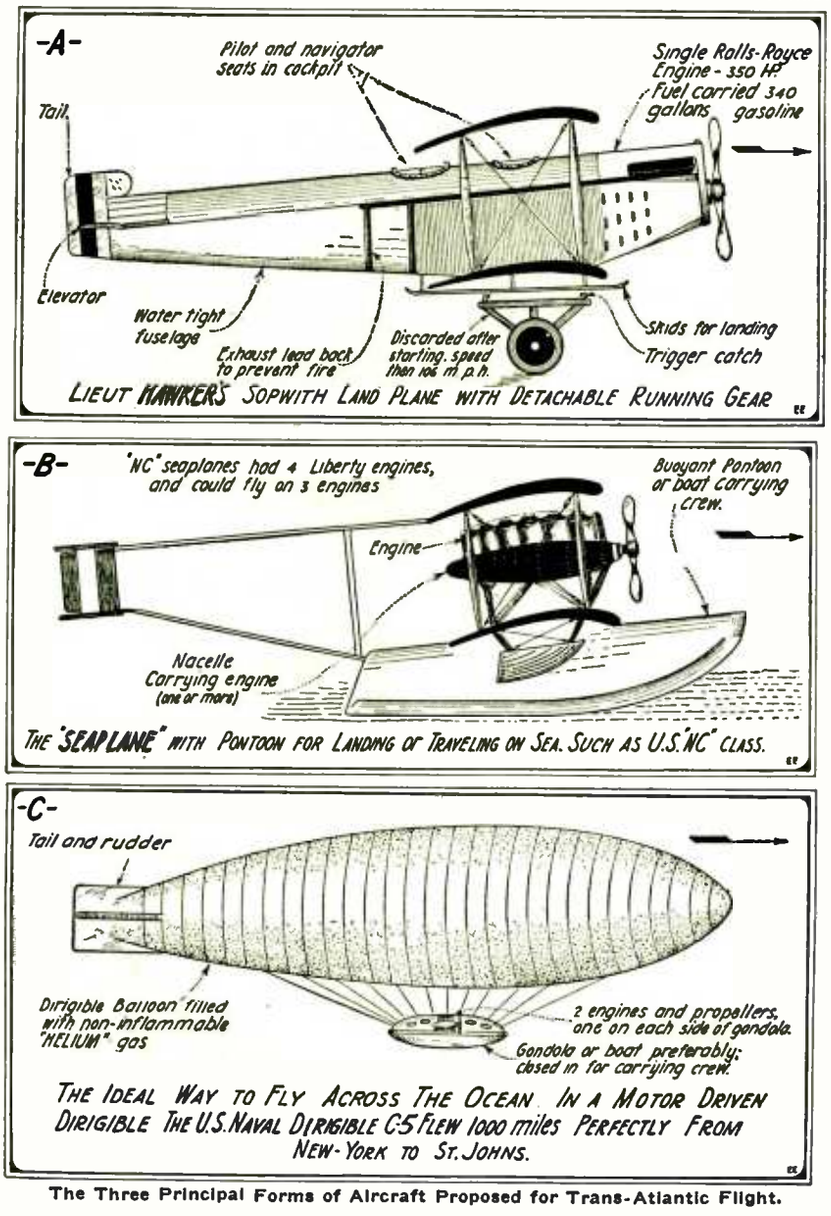
Flying Across the Atlantic

By H. WINFIELD SECOR

TRANS-ATLANTIC flying has been a dream among aëronautical enthusiasts for many years, and we of the present generation are indeed fortunate in seeing this great feat of aërial engineering and exploitation carried to a successful conclusion by the U. S. Naval seaplane NC-4. At the same time we cannot help but pause and give honor to Lieut. Harry G. Hawker, the daring young English pilot who undertook to fly the Atlantic Ocean over a course which was not even covered by the regular ocean steamships, let alone marked by even a single English naval or other ship. Hawker demonstrated that he had unlimited faith in his machine, which was shared by his navigator, Lieut. Commander McKenzie Grieve, R. N. This trip as planned averaged from 1850 to 2000 miles, and was to have required from 22 to 26 hours of flight.

In considering the trans-Atlantic flight we are, after a little philosophizing on the subject, bound to be confronted with the three principal methods of crossing such a great span as this, i.e., with respect to the type of machine which should be employed. The U. S. Navy has shown that its undoubted faith in the large pontoon form of seaplane was based on sound logic and correct scientific design. As an example of the efficiency of this type of flier for such form of travel over vast water distances, the NC-3 has shown that it can land on the ocean and stand considerable buffeting about without sinking for several days.

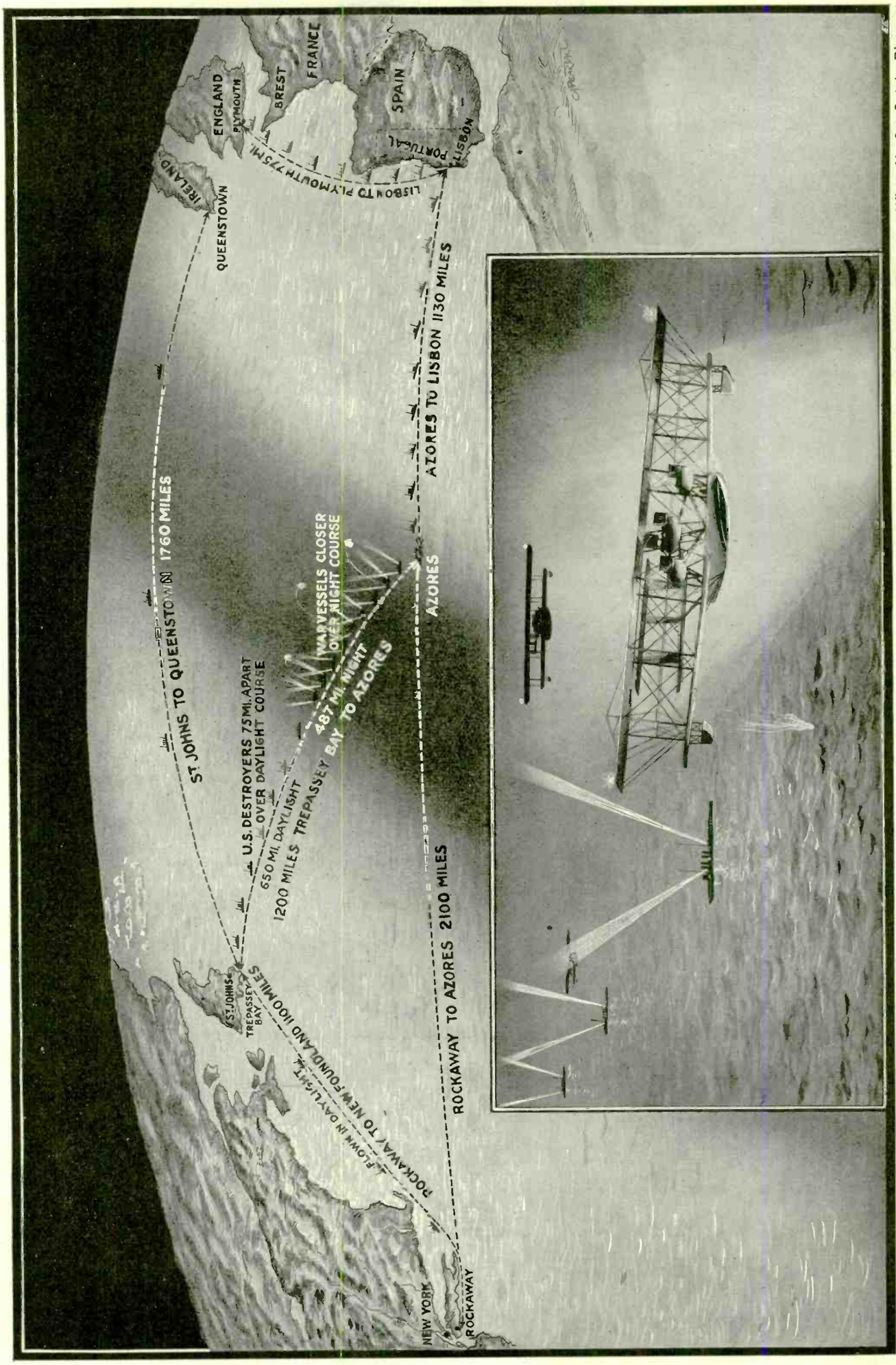
Types of Trans-Oceanic Aircraft



The Three Principal Forms of Aircraft Proposed for Trans-Atlantic Flight.

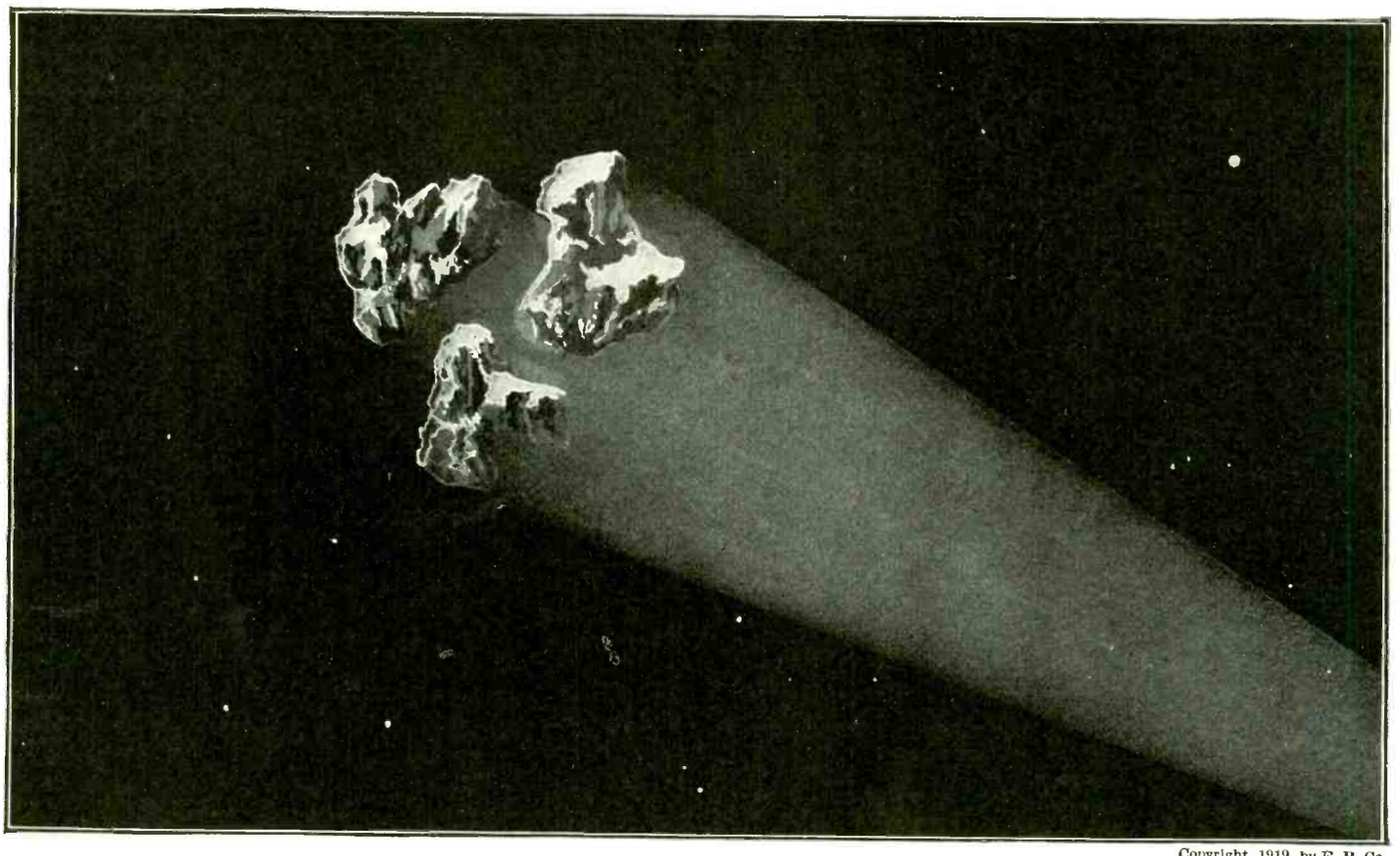
Let us take up the three distinct types of aircraft suitable for trans-Atlantic flight, each of which has been or soon will be tried for bringing the Old and New Worlds closer together. The first type we will consider principally because it seems to have a slight chance of carrying its passengers safely across the 2000 miles of watery deep, is that employed by Hawker and his navigator, Grieve. Lieut. Hawker's airplane was, to begin with, of the *land-going type* and not adapted in any way to oversea travel. Many people have asked why he should have ever thought of starting out with a 'plane of this type on such a long and hazardous trip over the vast ocean span, on the greatest aërial feat ever attempted in the history of flight by man. The reason for choosing this form of 'plane was, primarily, that he was thoroly familiar with it from considerable war experience in Europe, and also there was no useless weight being carried such as is occasioned when any form of pontoon is attached. Lieut. Hawker had the right theoretical idea, but he carried it too far, it would seem to us now. Not only did he choose a land-type 'plane, but he had the under-running gear, comprising the cradle and wheels on which the 'plane traveled over the ground in starting, specially arranged with a trigger release device, so that once he got in the air and started oceanward he could, by the pull of a lever, disengage the running gear so as to reduce the weight of the 'plane

(*Continued on page* 245)



The Accompanying Illustration Shows Us Vividly a Few of the Outstanding Features of a Trans-Atlantic Flight—the Greatest Aërial Feat of the Age. Like Columbus When He Set Out to Discover New Lands, with His Three Tiny Ships, So the U. S. Naval Birdmen Flew Away from Trepassey Bay on the Afternoon of May 16th. Of the Three Giant Seaplanes to Start, the NC-4 Alone Completed the Trip on Schedule. The NC-1 Was Forced to Land on the Water—the Crew Was Picked Up by a Vessel. The NC-3 Also Landed on the Water Due to the Heavy Fog and After a Day and a Night of Floating on the Water, It Came Into Ponta Delgada, Azores, Under Its Own Power. The NC-4, the First Heavier-Than-Air Flying Machine to Cross the Atlantic Ocean, Will Undoubtedly Be Preserved and Placed on Exhibit in the Smithsonian Institution at Washington, D. C. The NC-4 In Its Flight from Trepassey Bay to Lisbon, Portugal, Covered a Distance of 2,150 Nautical or 2,506.9 Statute (Land) Miles In 26:47 Hours actual Flying Time, or at an Average Speed of 80.3 Nautical Miles. The Three Seaplanes Left Trepassey at Sunset on May 16, and the NC-4 Reached Lisbon Soon After Noon on May 27, the Eleventh Day After Its "Hop" from Newfoundland. The Official Trans-Atlantic Flight Ended with the NC-4's Arrival at Lisbon. The NC-4 and Her Original Crew Then Proceeded to Plymouth, England, Where They Were Officially Congratulated and Welcomed.

Copyright, 1919, by E. P. Co.



Copyright, 1919, by E. P. Co.

For a Long Time Astronomers Have Been Puzzled on Account of the Variability of the Light of Many of the Asteroids. These Small Heavenly Bodies Measuring an Average from 3 to 5 Miles in Diameter Are Nothing But Huge Rocks Hurtling Thru Space Along Well Defined Orbits. It Is Now Believed That the Variability of the Light Is Caused by Two or Three Asteroids, Very Close Together, Revolving Among a Common Center. Our Artist Has Shown in This Illustration How a Small Cluster of These Asteroids Would Appear When Viewed from a Distance of About Ten Miles. The Three Bodies Shown Average from 3 to 5 Miles in Diameter.

Popular Astronomy

By ISABEL M. LEWIS

Of the U. S. Naval Observatory

Astronomical Facts For All

FOR the past year Mrs. Lewis has presented a series of very fine astronomical articles to the ELECTRICAL EXPERIMENTER. We are happy to say that we have renewed our arrangement with Mrs. Lewis for another year, and we believe that our readers will welcome the announcement.

In the past Mrs. Lewis has written a monthly article covering only one subject. For the coming year, this arrangement will be slightly changed, and we will endeavor to show every month a variety of articles—"Astronomical Facts for All." In addition to this, we have opened a Question and Answer department which is starting in the present issue. We invite our readers to send in their questions on astronomical subjects which Mrs. Lewis will answer monthly.—EDITOR.

1. Asteroids and How They Are Discovered.

ONE is apt to picture the asteroid seeker painstakingly sweeping the heavens with his telescope to discover a new asteroid or comet. As a matter of fact astronomers spend very little time searching for new asteroids or comets these days when so many other problems are demanding attention. These heavenly bodies are now usually picked up photographically.

The comets are always welcome and interesting visitors, the discovery of a new asteroid is not apt to arouse any marked enthusiasm in the astronomer's heart, despite the fact that occasionally an asteroid has turned out to be an important tho tiny member of the sun's family—as, for instance, Eros, an asteroid only a few miles in diameter that comes within thirteen million miles of earth at times and therefore furnishes a very valuable means for determining the distance of the earth from the sun. Approximately one thousand asteroids have now been discovered, and to name and keep track of these troublesome little members of the sun's family is a tremendous task, especially since they are subject to so many perturbations from the larger members of the sun's family, in particular Jupiter. It is only the hope of finding out a few valuable facts from the exceptional asteroids that keeps the astronomers at the task of caring for this troublesome family of asteroids.

If a photographic plate is fastened to the eye end of a telescope and the sidereal clock work of the telescope started so that the telescope will follow the stars, the stars will be immovable in the field and their images will be sharp points of light on the plate, but any object within the field of view that is moving relative to the earth will leave a short trail of light on the plate owing to its motion during the period of the exposure of the plate, which is usually two or three hours.

Practically all asteroids and all periodic comets whose returns are predicted are discovered by this method. Whether the body is a faint comet or an asteroid, additional plates and an approximate computation of its path will decide.

The four largest asteroids, Ceres, Pollas, Vesta and Juno, are respectively 485, 304, 243 and 118 miles in diameter. These are the values found by Barnard as a result of measurements with the 36-inch telescope of the Lick Observatory. A few more of the asteroids may exceed one hundred miles in diameter, but the great majority are simply huge rocks five miles or less in diameter. These small bodies have such a weak gravitational attraction that they are unable to hold an atmosphere and as a result there can be no form of life, either animal or vegetable, on even the largest of them.

Various estimates have been made of the total mass and bulk of the asteroids. Their average density has been estimated as about equal to that of the earth's surface crust. The great mathematician and astronomer, Leverrier, the discoverer of Neptune, proved that the total mass of matter between the orbits of Mars and Jupiter, where the asteroids are to be found, could not exceed one-fourth of the earth's mass, and later computations reduced this to one-one hundred and fifteenth of the earth's mass. As the combined mass of all the asteroids so far discovered falls far below this value there are probably thousands of small asteroids still undiscovered, tho it is very unlikely that any asteroid whose diameter exceeds one hundred miles has escaped detection.

As the mass of Mars is about one-tenth

and the mass of Mercury about five one-hundredths that of the earth, it is evident that all the asteroids combined could not furnish enough material to fashion a planet that would approach even the smallest of all the planets, Mercury, in size.

The orbits of the asteroids differ greatly in size and form and in inclination to the ecliptic. Some are almost perfect circles, others greatly elongated ellipses. Their inclinations to the plane of the earth's orbit vary from zero to thirty-five degrees. In this respect they differ greatly from the orbits of the planets which lie very nearly in the same plane.

It has been suggested that variability in the light of many of the asteroids may be due to a difference in the reflecting power of different portions of their surface or to irregularities of form. Unlike the major planets, the asteroids are not spheres but simply jagged rocks, huge mountains hurtling thru space, whirling round and round on their axes as they journey about the sun. Possibly, as some have suggested, they may be the larger fragments of periodic comets of unusual size that have in the course of ages been shorn of their appendages. This might account for the suspected existence of double or multiple asteroids, in which two or more of these huge rocks are grouped so closely together as to appear as one in the telescope. This would also account for the variability in the light of some of the asteroids.



This Shows How Asteroids Are Discovered, Not Thru the Telescope, But on the Photographic Plate. The Stars Standing Still, Any White Streak Left on the Plate Must of Necessity Be Either a Planet or a Comet.

2. Shooting Stars.

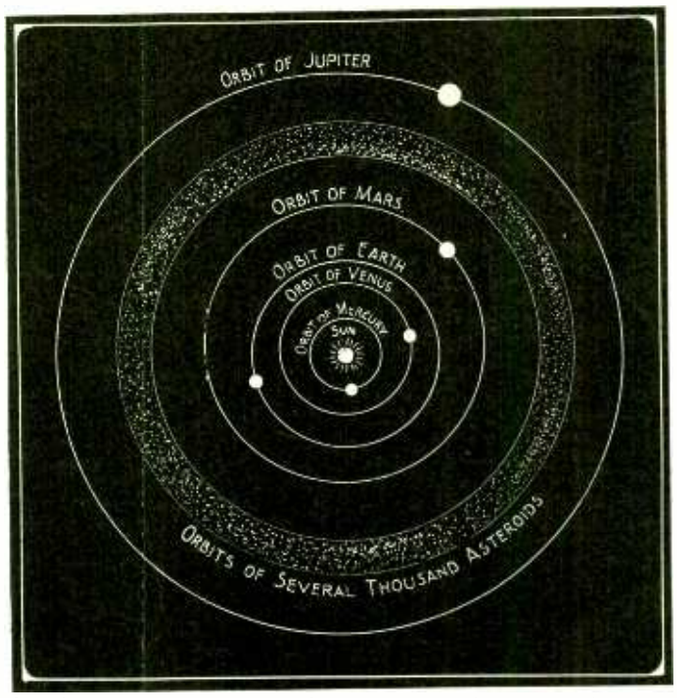
"SHOOTING stars" is an unfortunate name for the small masses, weighing usually only a few ounces, that enter the earth's atmosphere from outer space, are ignited by friction with the atmosphere, glow brightly for a few brief seconds and then fall to the surface in the form of dust.

It has been estimated that shooting stars or meteors, as they are more fittingly called, enter the earth's atmosphere by the millions every day, only a very small percentage of them being visible to the naked eye at any one place. They fall by day and by night, over land and sea, in polar regions and in the tropics. The snowy wastes of the far north are dusted with the ashes of shooting stars that have been consumed by friction with the earth's atmosphere, which they enter at a speed varying from ten to forty miles a second.

Astronomers quite frequently observe meteoric particles invisible to the naked eye, flitting across the field of the telescope. Some of the larger of these masses weigh several pounds, in rarer instances even several hundred pounds. They are thus referred to as meteorites or fire-balls. These are not entirely consumed by friction with the earth's atmosphere, but after traveling with loud reports and explosions a distance of many miles, fall to the earth's surface.

Comets, it is generally believed, disintegrate gradually into swarms of meteors and the earth and other planets are constantly encountering these fragmentary particles in their journeys around the sun. Periodic swarms are encountered at certain definite times of the year whenever the earth's path crosses the paths of these disintegrated comets.

The study of the origin and nature of meteors forms a most interesting branch of astronomy to which even the amateur astronomer may contribute observations of value.



Showing Where the Orbits of Several Thousand Asteroids (Planetoids) Are Located. Their Orbits Take In the Intermediate Space Between That of Jupiter and Mars. These Little Planets Vary In Size from Three Miles to 485 Miles in Diameter. There Are Undoubtedly a Great Many Thousands Also of Even Smaller Diameter or as Small as an Ordinary House.

Questions and Answers.

1. *How many stars are there in the sky and how do astronomers know the number of the stars?*

The approximate number of stars of each magnitude has been found by counting the number of stars in regions of a certain definite size and then estimating from the result the number of stars of each magnitude in the whole sky.

In speaking of "magnitude" of a star, its apparent brightness and not its true or intrinsic brightness is meant. A star of the first magnitude is, according to the scale adopted, two and one-half times brighter than a star of the next fainter magnitude, the second magnitude, and one hundred times brighter than a star of the sixth magnitude, which is the faintest star visible without a telescope. The exact ratio of one magnitude to the next lower is the fifth root of one hundred, so that a drop of five magnitudes represents a division of the brightness by one hundred. A sixth magnitude star has only one hundredth the brightness of a first magnitude star and an eleventh magnitude star only one hundredth the brightness of a sixth magnitude star or one ten-thousandth the brightness of a first magnitude star.

There are in the whole sky only five thousand stars visible without the aid of a telescope; that is, five thousand stars of the sixth magnitude or brighter. Since only one-half of the sky is visible at any one point and since faint stars near the horizon are invisible on account of the greater density of the earth's atmosphere in this direction, there are only about two thousand stars to be seen at any one point on a clear, cloudless night, though one receives the impression that an infinite number of stars exists.

A small three-inch telescope will show stars down to the ninth magnitude and there are two hundred thousand stars brighter than the ninth magnitude.

Fainter stars are far more numerous and it has been estimated that there are approximately *fifty-five million stars* in the first seventeen magnitudes.

The forty-inch Yerkes refractor will show stars of the seventeenth apparent magnitude and the great one hundred inch Mt. Wilson reflector stars of the twentieth magnitude. This represents the limit of telescope power at the present time, and it is doubtful if it ever can be greatly surpast.

It has been estimated on the basis of counts of stars in sample regions that there are three hundred million stars in the sky within reach of the great reflector.

It is assumed that there is a definite limit to the number of stars within our own sidereal system, for it is evident from actual star counts that the ratio of the number of stars of one magnitude to the number of stars of the next fainter magnitude falls off rapidly for the fainter stars. By the time the seventeenth magnitude is reached a falling off of fifty per cent. in the ratio is reached, which is an indication that the total number of stars is approaching a finite limit provided, as is generally assumed, there is no marked extinction of light in space. It is conceivable that there may be other stellar systems far beyond our own, however, and light from such exterior systems may be in some manner shut off from our own. Nothing is known either to prove or disprove this belief.

Some astronomers have devised formulas based on star counts to ap-

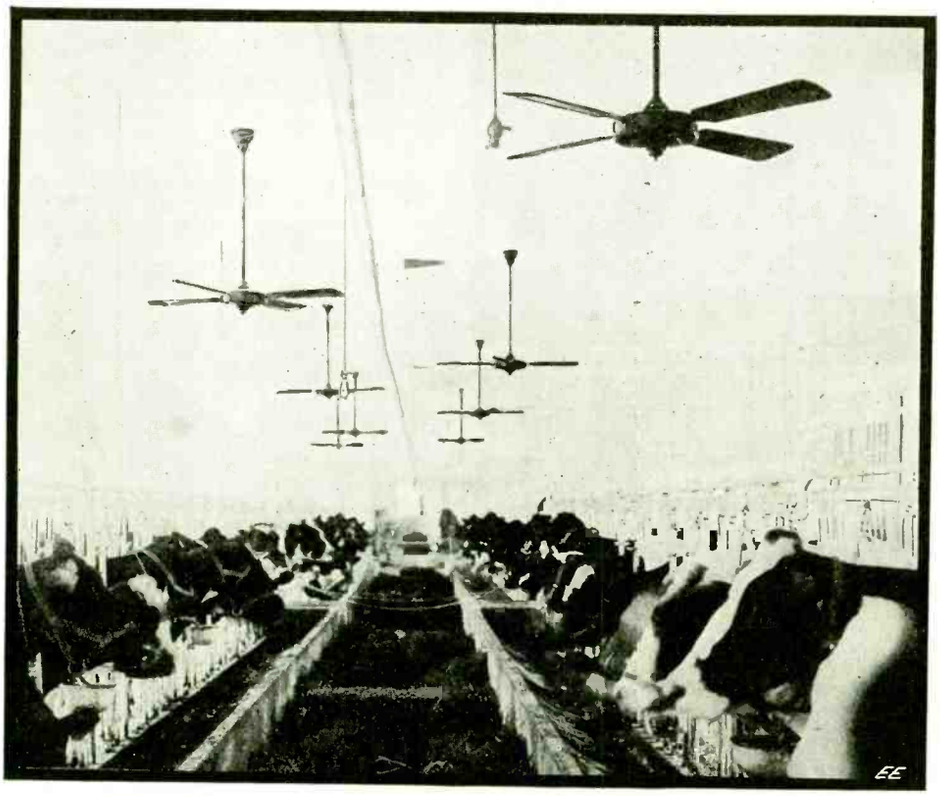
(*Continued on page* 258)





Showing the Comparative Size of Some of the Planets and the Total Volume of All of the Asteroids. Ceres, Pallas, Vesta, and Juno Are the Largest of the Planets. Ceres, Having a Diameter of 485 Miles, Juno 118 Miles Diameter.

Electric Fans for Madame Holstein



Madame Holstein in Her Glory—180 of Her Enjoying the Cool Breezes from the Electric Ceiling Fans as Installed in a Large Southern Dairy. As Abie Kabibble Would Say—"Some People's Cow-Barns Are Better Than My Parlor, Ain't It?—the Wery Idee."

The cow is distinctly a feminist. Pigs aren't: they don't care. But Madame Holstein is as exacting in her tastes as the most pampered female of the species. Doesn't it strike one as a little ultra-fashionable for 180 cows to drink out of individual fountains while electric fans waft the cool breeze over their aristocratic backs? Mr. Asa D. Chandler, Jr., of Atlanta, Georgia, doesn't think so. He says that his cattle show the results, and he proves it by referring to "Lizzie," who since her entrance into the lap of luxury produces 44 quarts of milk daily.

The barn is provided with concrete floors, wooden blocks, *electric lights, fans* and milking machines, steel frame stalls, novel drinking fountains, concrete feed troughs, electric equipment for the silo and bottling the milk. The Farm has a colony of 180 full-blooded registered Holstein cattle.

Electric *Ceiling Fans* are shown cooling the atmosphere in summer and ventilating in winter. The electric lights are also shown. "Lizzie" has a private drinking fountain. There is always a small amount of water in the bottom of the cement cup to entice her. When she makes the attempt unconsciously, she forces the valve open and hence always has fresh water.

The green corn for ensilage is cut with the aid of a 15-H.P. electric motor, and is blown thru a conveyor into the top of a 40-foot Silo.

Just as soon as the milk arrives at the milk house, it is strained and past over a cooler until it reaches the proper temperature. From here it passes to a bottle filling machine, where the bottle is automatically filled and sealed. (Photo courtesy Westinghouse E. & M. Co.)

Instructor Telephone Boards for Students

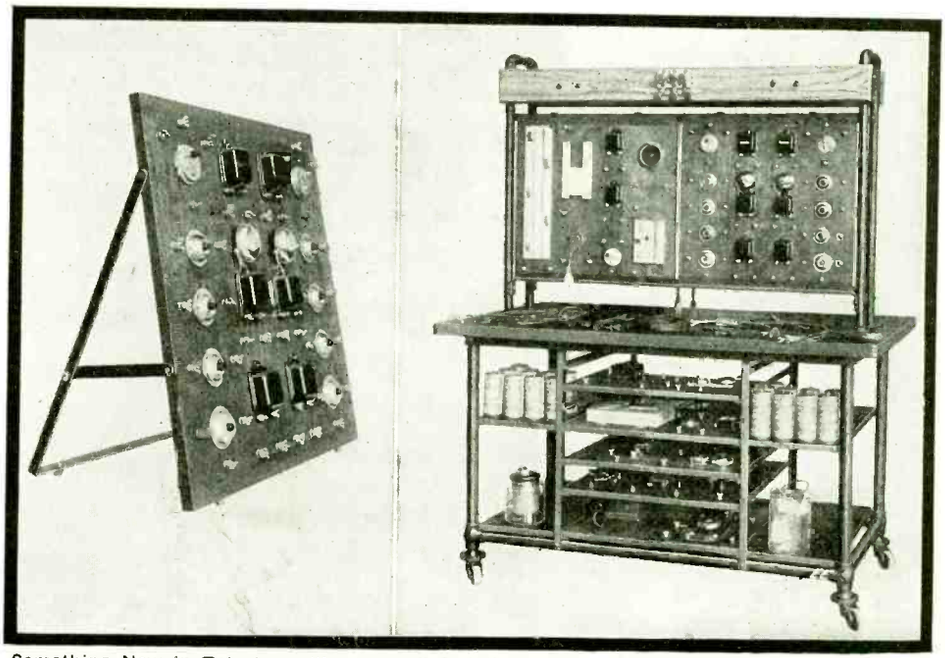
There has long been a demand on the part of high school physics instructors the country over, for a practical method whereby the principles of *telephony and telephone wiring* may be taught in the High School courses. Hitherto it has been extremely difficult to secure proper apparatus, sufficiently durable for laboratory purposes, and inconvenience and expense of installing the necessary instruments for successful instruction in telephony has been very often the cause of the absence of this important branch of instruction in many schools.

To overcome the objections to the old method, and furnish a substantial, practical set of telephone apparatus for the laboratory, the telephone board here illustrated has been designed.

One of the most important features from a practical standpoint of the telephone units is the method by which the contacts are made for interior wiring of the instruments, Ordinarily in laboratory instruments of this character the wiring must be attached directly to the delicately constructed terminals of the apparatus itself, and naturally thru the wear and tear of laboratory usage they quickly become worn out and broken. By the "Instructor" method, these connections are made, not to the instruments themselves, but to substantial wing-nut terminals, which are in turn permanently wired to the proper terminals on the instruments. In this way the life of the apparatus is indefinitely prolonged, as well as much time and effort saved by the making of quick, efficient connections.

There are two types of the bracket form of intercommunicating telephone boards. The single form of board, size 24" x 24", contains two sets of instruments for experiments in intercommunication, while the other type has four telephone sets, permitting the wiring of two, three, or four intercommunicating systems on the same unit. The frame of this latter unit varies from the single bracket board in that it is constructed so as to contain four separate unit boards 9" x 24" in size.

In connection with both of the bracket units there has been designed a *portable table*, substantially constructed with an iron pipe frame, and a heavy, stained table top.



Something New in Telephone "Instructor" Switch-boards. The Students Have to Make the Proper Connections on the Face of the Boards. The Best Idea for Schools That Has Been Brought Out in Some Time.

"The Kaiser is Canned—Can Food"

By GRACE T. HADLEY
SOCIETY FOR ELECTRICAL DEVELOPMENT

TO save vegetables and fruits by canning this year is a patriotic duty. War has made the need for food conservation more imperative than at any time in history. America is largely responsible for the food supply of Europe. The American family can do nothing more helpful in this emergency than to can all food that can be canned. In this way, the abundance of the summer may be made to supply the needs of the winter.

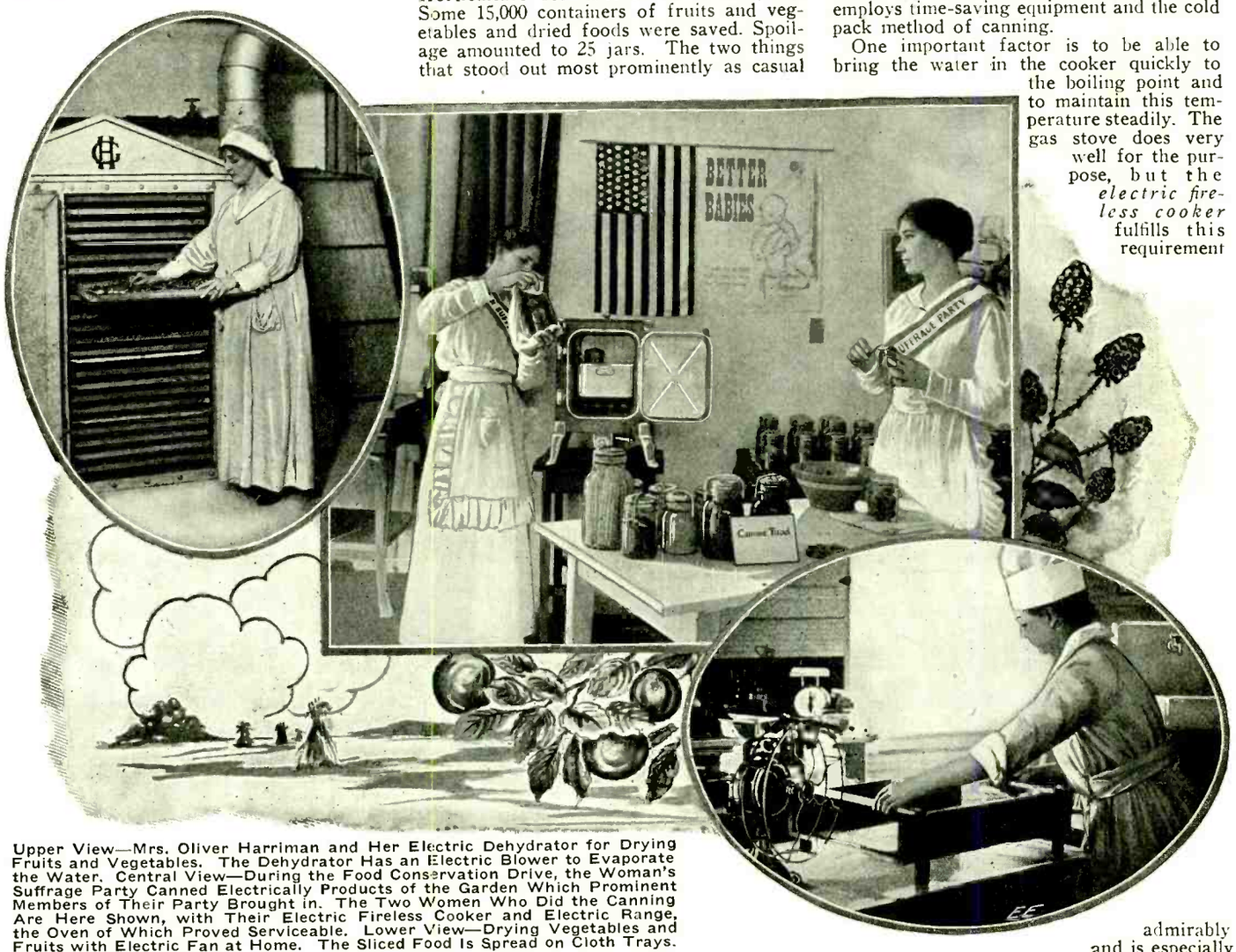
The preservation of food stuffs by canning is always food thrift. It effects the saving of a surplus of foodstuffs that would otherwise be wasted, thru excess of supply over immediate consumption. It eliminates the cold storage cost that must be added to the prices of commodities bought during the winter. Of vital importance also, is the fact that it relieves the strain on transportation facilities of the country.

The president of the *National War Garden Commission* tells us in the *Home Canning Manual* that victory must necessarily bring a large increase in our obligation. We must not only produce food as close to the kitchen door as possible, but we must *save* a vast volume of this food for winter use. To save it, we must can it, dry it, or otherwise prepare to have it in readiness for the winter months. Canning and drying, therefore, are as imperative today as if the great world war were just beginning. A country whose people "can" will never be found wanting.

The Demonstration Kitchen in Ambler, Pa.

During the food conservation drive several hundred women worked in the demonstration kitchen at the School of Horticulture for Women in Ambler, Pa. Some 15,000 containers of fruits and vegetables and dried foods were saved. Spoilage amounted to 25 jars. The two things that stood out most prominently as casual factors were poor rubbers and the development of flat sour.

"In spite of quick and scientific work," Caroline G. Peeler states, "*flat sour* gave us some trouble. We looked for the cause at the beginning of the work and followed it right thru the processing but never thought of looking for it at the time when the jars were sitting happily on the table cooling off. In reply to an 'S. O. S.' call, Washington told us to cool those jars quickly and to do this by placing them one foot apart, so that the air could circulate thru and around them. They must not be in a draft, but the temperature must be reduced rapidly. The jars when first removed from the sterilizer can be seen to be bubbling or boiling. If they are placed close together the heat is confined as in a fireless cooker, causing them to keep warm for hours, chemical changes take place and *flat sour* develops."



Upper View—Mrs. Oliver Harriman and Her Electric Dehydrator for Drying Fruits and Vegetables. The Dehydrator Has an Electric Blower to Evaporate the Water. Central View—During the Food Conservation Drive, the Woman's Suffrage Party Canned Electrically Products of the Garden Which Prominent Members of Their Party Brought in. The Two Women Who Did the Canning Are Here Shown, with Their Electric Fireless Cooker and Electric Range, the Oven of Which Proved Serviceable. Lower View—Drying Vegetables and Fruits with Electric Fan at Home. The Sliced Food Is Spread on Cloth Trays.

Lamp Socket Canning.

Whether one has a sixteen-acre farm or one of the three sizes of commuter's garden, one is sure to have some surplus products and such products should be either dried or canned. "Can surplus food, but use jars and cans wisely," was the verdict last season in order to save every ounce of available food. The thrifty housewife who heeds the foregoing will find that she has quite a store for winter use, with little labor and slight cost, especially if she employs time-saving equipment and the cold pack method of canning.

One important factor is to be able to bring the water in the cooker quickly to the boiling point and to maintain this temperature steadily. The gas stove does very well for the purpose, but the *electric fireless cooker* fulfills this requirement admirably and is especially well suited to take care of surplus products from a commuter's garden. All thru the season odd lots of vegetables that might otherwise go to waste, may be gathered, canned by the cold pack method and sterilized in an electric fireless cooker which is a lamp socket appliance, easy to operate and a great time-saver.

In New York City during the food conservation drive, the Woman's Suffrage Party canned electrically at one of the headquarters stations. Prominent suffragists brought in the products of their gardens which were canned by two women volunteers and the canned products were then sold for the cause of suffrage. Electric fireless cookers were used for the processing as well as the oven of an electric range.

Home Canning Manual.

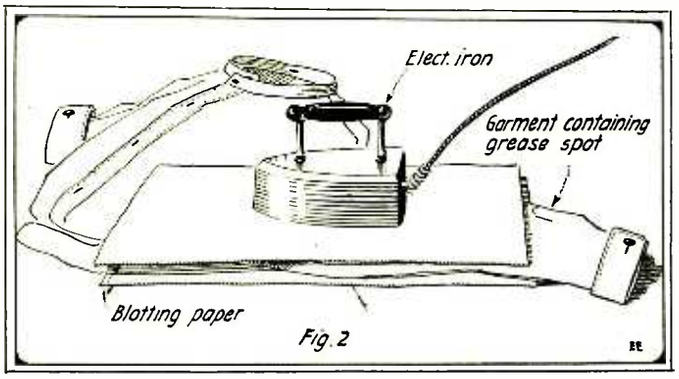
The *Home Canning Manual* issued by the National War Garden Commission of Washington should be in the hands of every woman who contemplates canning. It contains all the necessary instructions for canning vegetables and fruits, the princi-

(*Continued on page 277*)

Practical Chemical Experiments

By ALBERT W. WILSDON

Cleansing and Washing Agents



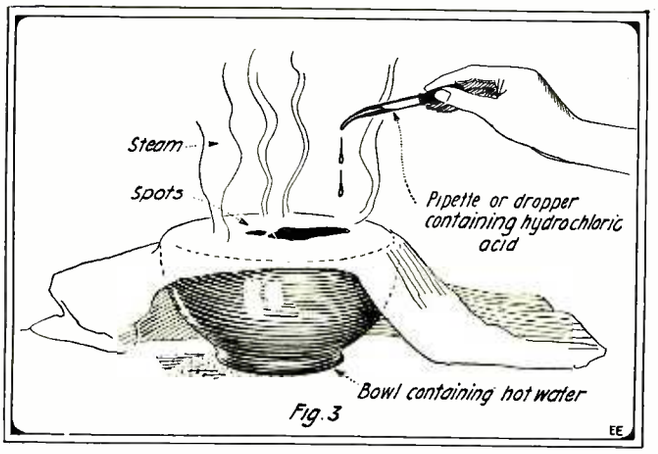


Fig. 2. Left—Method of Removing Grease Spots With a Hot Iron (Electric Iron Very Adaptable) and Two Sheets of Blotting Paper.
Fig. 3. Right—Removing Iron Rust Spots. Place the Soiled Cloth Over a Bowl of Steaming Hot Water. Drop Hydrochloric Acid on the Spots and They Will Come Out.

IT is quite likely that practically every reader has at some time encountered the problem of removing some stain or cleaning some substance, and due to the lack of chemical knowledge of the principles of cleaning, has failed in his object. This subject has such frequent applications that it was deemed of sufficient importance to warrant its presentation in this form. Formulas have been omitted, but if desired information regarding them will be furnished by the writer.

Substances used for cleaning may act either mechanically or chemically to remove the dirt or other substances from clothing. In the use of soap and sand for scouring, there is a combination of these methods, and in fact, when the chemical loosens up the fibers or sets free the dirt, some mechanical process, as the washboard or washing machine, preferably electrically driven as shown in Fig. 1, is required to remove it.

Most of the polishing and cleaning powders on the market depend for their efficiency upon the action of a very finely divided substance like Silica, precipitated chalk, or rouge. These are mixed with some fat or oil. In selecting a polishing material, care should be exercised in selecting one that is so finely divided that it will not *scratch* the metal. Dry sodium Bicarbonat (Baking Soda) can be safely used for cleaning and polishing.

Borax, added to water, greatly aids in the removal of dirt. Most readers are familiar with the household Ammonia, which is used for this purpose. As ammonia forms a soap with the oily matters of the fabrics washed, it is a convenient cleaning agent. A teaspoon of Ammonia to a quart of water is an excellent wash for wood-work, and may be used to brighten carpets or rugs. Much of the household ammonia on the market is of a very low grade, and so it is always advisable to purchase it from a supply house, or if necessary from the druggist.

A cleaning material should not only remove the grease or dirt, but it must be of such a nature that the article cleaned will not suffer injury by its application.

Cleansing Leather and Metals.

In some cases, as with wood, leather, metals, etc., the dirt does not penetrate into the interior, but remains on the surface. In other cases the whole fabric is filled with dust and grease. All polished wood surfaces, except those finished with wax, may be cleaned with a weak solution of Ammonia, or soap, but they should never be treated with a strong alkali solution.

As solvents for grease, either kerosene or turpentine may be used, and ordinarily should be applied with a soft cloth. Painted surfaces, especially in white, may be cleaned with a little whiting (Calcium Carbonat), which may be applied with a piece of cheesecloth. The wood is afterwards washed with water and wiped dry. Painted walls, if painted with oil paints can be cleaned in the same way, but tinted walls, since water colors are used, would be disfigured by this treatment.

Leather may be kept bright and clean by the use of kerosene, or occasionally a little oil. Marble may be scoured with sandsoap, and finally polished with a coarse flannel. It should not be forgotten that marble is Calcium Carbonat, and therefore should never be treated with an acid. Metals can usually be cleaned with a hot alkaline solution or a little kerosene. To clean glass, it may be covered with a paste of whiting, ammonia, and water, and after this is dried this may be rubbed off with a woolen cloth or with paper. Alcohol is used extensively for cleaning delicate glass, as for instance, lenses and microscope objectives. In using alcohol for lenses, great care must be exercised, as the mounting paste or adhesive may be dissolved. In extremely cold weather, when water would freeze, kerosene may be used.

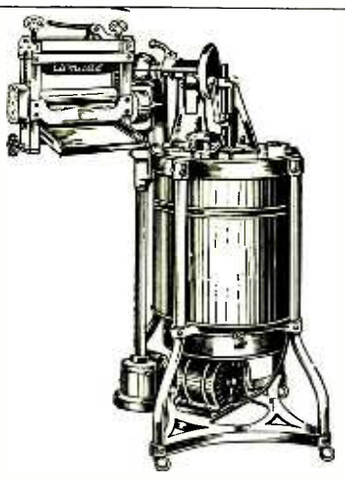


Fig. 1. The Modern Way to Cleanse Clothes Is by Means of the Electric Washing Machine. Many of These Devices Possess Distinctive Improvements Which Make Them Much Superior to Hand Methods.

Dangerous Cleaning Solutions.

Household fabrics are often washed with alkaline solutions or with soap. In some cases Naptha may be used for washing such fabrics. It is to be remembered that in some of the solvents, as Naptha, Benzine, Turpentine, and Gasoline, which are frequently used for cleaning, these vapors are all very volatile, and for this reason *they are dangerous, if employed near a FLAME of any character. These vapors may take fire from a lamp, gas jet, or stove, even at some distance.* Thus it is advisable to do work of this character out of doors if possible. Not infrequently have very serious disasters occurred through failure of the operators to familiarize themselves with the combustibility of the cleansing agents which they employ. Carbon Tetrachlorid is used widely as a scouring and cleansing agent as a substitute for gasoline. Owing to the lack of Hydrogen in its composition, it has the great advantage over the substances mentioned above, of being non-inflammable. In the use of volatile solvents, like gasoline, enough should be used to cover a large portion of the goods, and if possible afterwards washed thoroly with water.

Grease Spots.

To remove stains, spots, and tarnish, the knowledge of a limited chemistry will serve an excellent purpose. As grease is readily absorbed by blotting paper, spots may often be removed from fabrics by placing the goods between two pieces of blotting paper, and then heating with a warm iron, see Fig. 2. French chalk will sometimes absorb the grease, especially if the spots are fresh. Grease may also be removed by the use of hot water and soap, ammonia, or even borax. If there is no danger that these solvents will injure the goods or the colors, it is better to use some solvent such as Chloroform, Ether, Alcohol, Turpentine, Benzine or Naptha. Ether and Chloroform are better adapted to the more delicate fabrics. The troublesome dust spot has usually a neglected grease spot for its foundation. After the grease is dissolved the dust must be cleaned out by rinsing thoroly with fresh liquid or by brushing after the spot is dried.

Removing Paint Spots.

Paints consist of *oil* and *some coloring matter* and *lead or zinc oxids,* thus paint spots should be treated with a solvent for the oil, and then the coloring matter can be brushed off. Fresh spots may be treated

(*Continued on page* 251)

How Big Are Atoms and Electrons?

By L. R. JEWETT

THE study of electrons has recently led to great improvements in apparatus for producing and detecting currents of radio frequency. Doubtless many wireless enthusiasts read about the electron and its behavior in the operation of the electron relay (Audion) but do not know of the characteristics of the electron. The writer will endeavor to set forth some interesting, yet elementary, facts in reference to its characteristics, according to the modern theory of matter.

All bodies are complex structures composed of small particles called atoms and still smaller particles known as electrons. Molecules are groups of atoms and a molecule is the smallest part of a substance which can exist and still retain its chemical properties. For instance, two atoms of hydrogen and one atom of oxygen compose one molecule of water, namely, H^2O. Electrons may be contained in the molecules or free in space between the molecules. None of the particles can be detected by a microscope and the smallest visible particle so far detected with the ultra-microscope is about *twenty-five times the diameter of one of the largest molecules.*

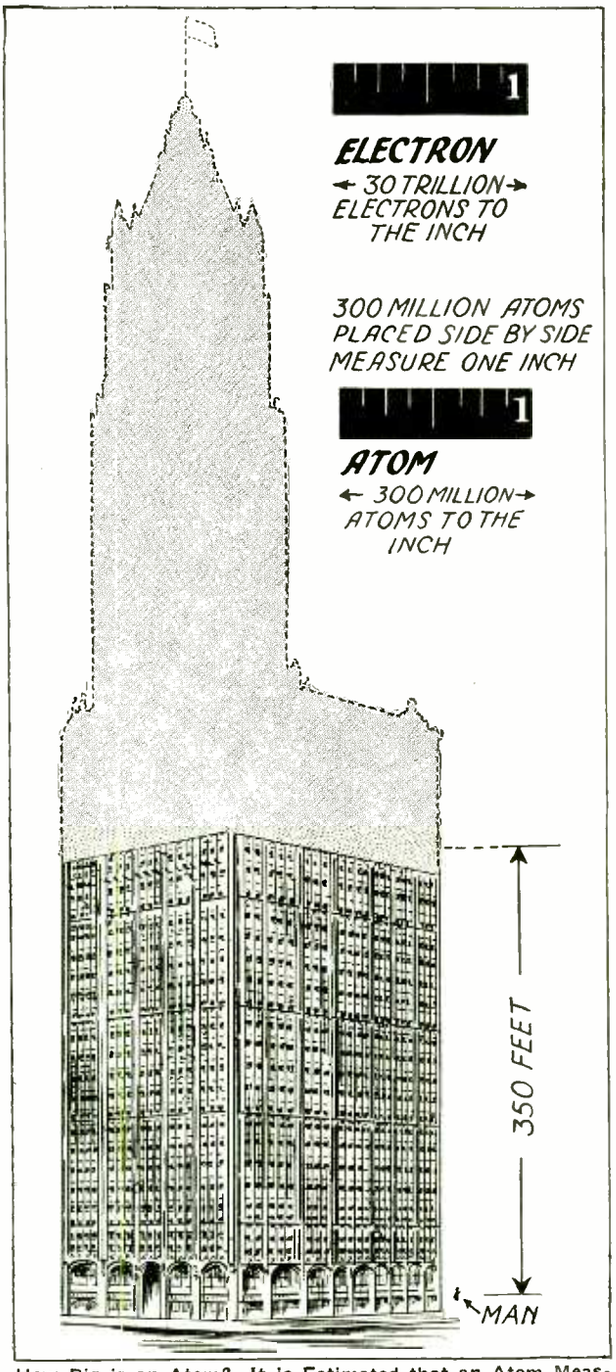
An *atom* is about *one three-hundred-millionth of an inch in diameter.* If the earth were composed of baseballs, it would be an approximate model to a drop of water composed of atoms. In size the *electron* is very much smaller than the atom and it is believed to have a diameter of about *one one-hundred-thousandth that of an atom;* i.e., 1/100,000 of 1/300,000,000 inch, or 1/30,000,000,000,000 inch, diameter of an electron (or there would be 30 trillion electrons to the inch). Thus, if a large building 200 feet square and 350 feet high represented a comparative size of an atom, *an electron would be about the size of the head of an ordinary pin.* Thus the reader may be able to realize the size of the electrons whose performance is so important in many electrical phenomena.

The assumption upon which the electron theory is based is that in every substance, whether charged or uncharged electrically, there exists both positive and negative electricity, distributed on discrete particles. All bodies appear to have large quantities of both positive and negative electricity, usually in equal amounts; thus one charge neutralizes the other and consequently no electricity seems to be present.

The smallest negatively charged particle which can exist in nature and which it is possible to detect is called an electron. Its charge, which is always negative, is less than one billionth of a billionth of a coulomb.

Experiments indicate that the electron is spherical in shape, altho it has not been proven. Its mass is generally regarded now by physicists to be entirely electromagnetic; i.e., it contains a negative charge only and *does not consist of a material substance.*

Electrons are attracted towards all positive charges and repel each other, since they are all of the same charge. There is an attraction between an atom and an electron, but it varies according to the characteristics of the atoms. Attraction between atoms and electrons in non-metals is weak, whereas in metals it is comparatively strong. Thus an electron could move about in a metal with comparative ease. If a stream of electrons is caused to move thru a metal, an electric current results. Therefore, an electric current thru a metal is said to be a stream of electrons moving thru relatively large spaces between the atoms or thru the atoms themselves. The actual speed of the electrons is exceedingly slow, but the rate of transmission of motion from one electron to another electron is very great. This impulse travels one hundred and eighty-six thousand miles per second, but *the electrons themselves may move only a few inches a minute.*



How Big is an Atom? It is Estimated that an Atom Measures One Three-hundred-millionth of an Inch in Diameter. There Are 30 Trillion Electrons to One Inch. If a Building 200 Ft. Square and 350 Ft. High Represented the Comparative Size of an Atom, an Electron Would be About the Size of the Head of an Ordinary Pin. See Comparative Size Man Holding Pin in Illustration.

Interesting Facts About the Electron

Hertzian waves are always produced by causing a charge of electricity to oscillate back and forth, and according to the modern wave theory when this electronic charge vibrates to and fro it radiates electrical waves which go out in all directions in space.

If a metal which contains large numbers of electrons is heated hot, some of the electrons would be given off into space. This is true when the filament of an electron relay or audion tube is heated. Since the plate is positively charged the electrons are attracted to it. Further discussion of the theory of the action of the electron relay or tube will be found in previous issues of this magazine. It is possible to calculate the magnitude of the electron flow from a hot filament.

$$I_B = AT^{\frac{1}{2}} e^{-\frac{b}{T}}$$

Where I_B = Electron current in milli-amperes per CM^2 of filament surface,

T = absolute temperature
$A = 2.5 \times 10^{10}$
B = 52500

A and B are true for a tungsten filament.

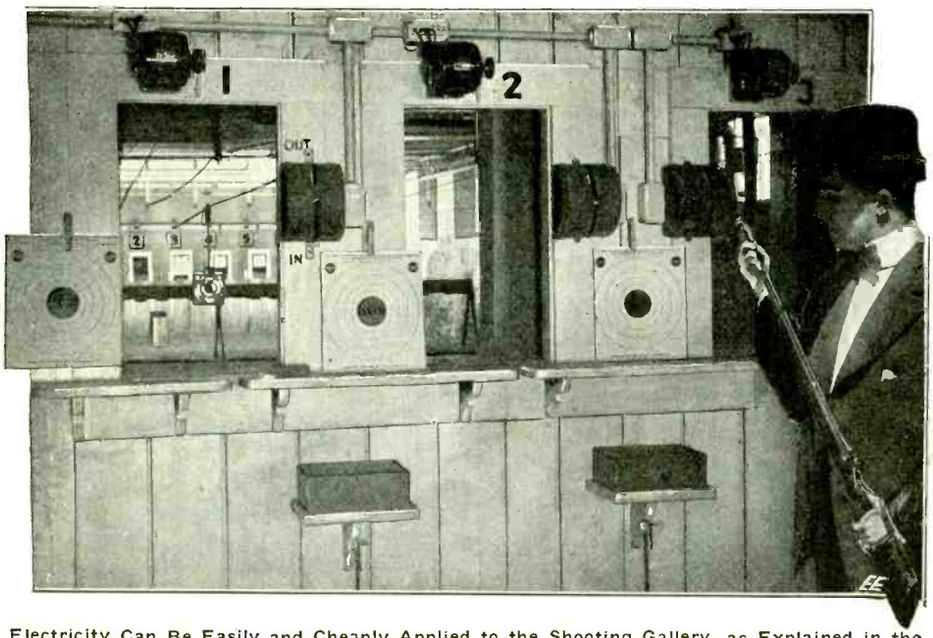
There is sometimes a misunderstanding concerning the difference between an electron and an ion. An electron has been defined as an "electromagnetic mass" having a negative charge. An ion is a material mass having a negative or positive charge as signified. Thus, if a tube containing a heated filament is purely a vacuum tube containing no air, it is a purely electronic emission and no ions are present. This is true of the so-called pliotron and dynatron, the Coolidge X-Ray tube, etc. But if a gas of any sort, for example, ordinary air or pure nitrogen is present in any degree in the tube, ions will be present also since the gas is "ionized" by the collision of the electrons and the atoms.

The modern electron theory is playing a very important part in the theory of the performance of different wireless instruments and systems. The above facts will no doubt tend to give the amateur a general idea of what an electron is and its behavior.

Those interested in the study of the electron theory will do well to look up some of the highly interesting articles publisht in back numbers of this journal, as well as such works as Professor Millikan's excellent treatise, "The Electron"; "Conduction of Electricity Thru Gases," by Thomson, and "Nature of Matter and Electricity," by Comstock and Troland. Articles in past issues of this journal: "Cosmic Force," by L. M. Correll, April, 1918; "Can Electricity Destroy Gravitation?" by Nipher, March, 1918; "Modern Physics and the Electron," by Prof. R. A. Millikan, January, 1918; "Does Radiant Light Possess Weight?" by A. R. MacPherson, July, 1917, issue.

THE CONSTRUCTOR

An Electric Shooting Gallery



Electricity Can Be Easily and Cheaply Applied to the Shooting Gallery, as Explained in the Accompanying Article. The Targets are Carried to and from the Marksman's Position by Motor Operated Cables. The Motors are Reversed by a Simple Switch. The Motors May Be Ordinary 1/15 H.P. Fan Motors. You Can Thus Check Your Own Targets.

IN the ordinary shooting gallery or rifle range it is invariably necessary for someone to replace the targets and also to keep the score where continuous shooting is carried on. Therefore, even with the individual rifle range, it has always been a serious draw-back in that someone had to be employed to change the target and either keep the score in a score book, or else after a given number of rounds to return the target to the marksman. These desideratums have been well taken care of and circumnavigated by a very ingenious electrical scheme which has proven an unqualified success at the rifle range of the Lynn Rifle and Revolver Club, maintained by the employees of the General Electric Co., at Lynn, Mass.

The Lynn Rifle and Revolver Club has about 160 members and the membership is open to all employees who are citizens of the U. S. A. In addition to the Rifle Range, the club has also facilities for pool, billiard, chess, checkers and cards. The whole is installed in the basement of an old office building on Center Street, together with the Bowling Club Alleys.

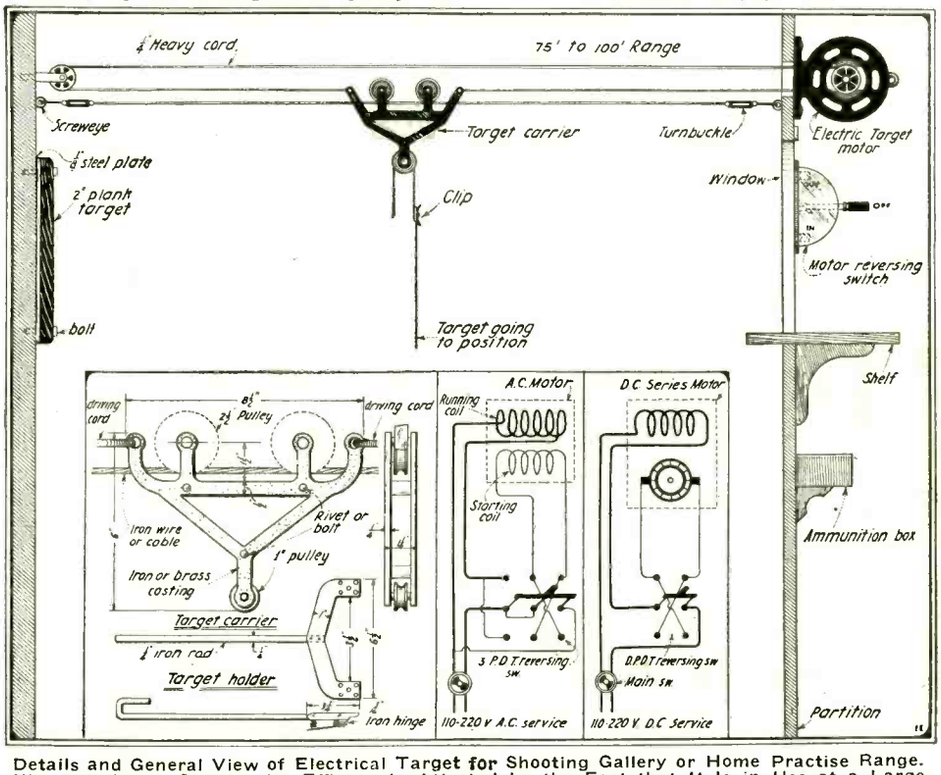
This electric shooting gallery contains eight stations. The present view was taken from the firing station and shows the small electric motors for driving the target carriers which are type 1/15 H.P.-220 volt-60 cycle motors. These are controlled by double-pole double-throw knife switches with a fiber guard which is also shown.

The accompanying diagrams show how the carrier, which may be made of aluminum or cast iron, wrought iron bar, or even of wood, is arranged to travel along the carrier cable. This cable may be made of ¼ inch galvanized steel stock, such as is sold for wash line purposes, and it can be anchored on either end by means of large screw-eyes, thoroly secured in walls or posts, and placing a turnbuckle at one end of the cable so that it can be tightened up as required. The driving cord which pulls the target carried back and forth may be a piece of ¼ inch rope, and by utilizing special wide-grooved pulleys on the motors, the hauling rope can be given a turn or two about the pulley, so as to have a much better frictional contact with it.

Two different ways of starting, stopping and reversing electric motors suitable for controlling the target carrier are shown herewith. Any electrician can hook up these motors, and in fact anyone a little handy in electricity and mechanics can rig up the switching scheme whereby the motors are controlled. The principle of reversing small motors may be stated as follows: For small series-wound D.C. motors, the stationary or field coil terminals must be reversed to change the direction of rotation. However, either field or armature connections may be reversed for shunt-wound D.C. motors, while for the usual type of self-starting single phase A.C. motors, it is necessary in order to reverse the direction of rotation, to reverse the connections of the starting coils, or rather the terminals going to these coils and which lead out to the terminal board of the motor.

The *modus operandi* of this electric shooting gallery is carried out thusly: The marksman turns the main switch and then throws the *reversing switch* to the "in" position, if the target carrier happens to be at the rear of the range. When it approaches the forward end and the range at which it is stationed, the reversing switch is pulled out to the "neutral" position. A new target card is then inserted in the spring clip of the carrier and the old target kept for checking up the score. The reversing switch is then thrown to the "out" position, so that the motor reverses its di-

(*Continued on page 254*)



Details and General View of Electrical Target for Shooting Gallery or Home Practise Range. The Details are Simple. Its Efficacy Is Attested by the Fact that It Is in Use at a Large "Gun and Revolver Club" at Lynn, Mass.

Improved Capillary Battery

By THOMAS REED

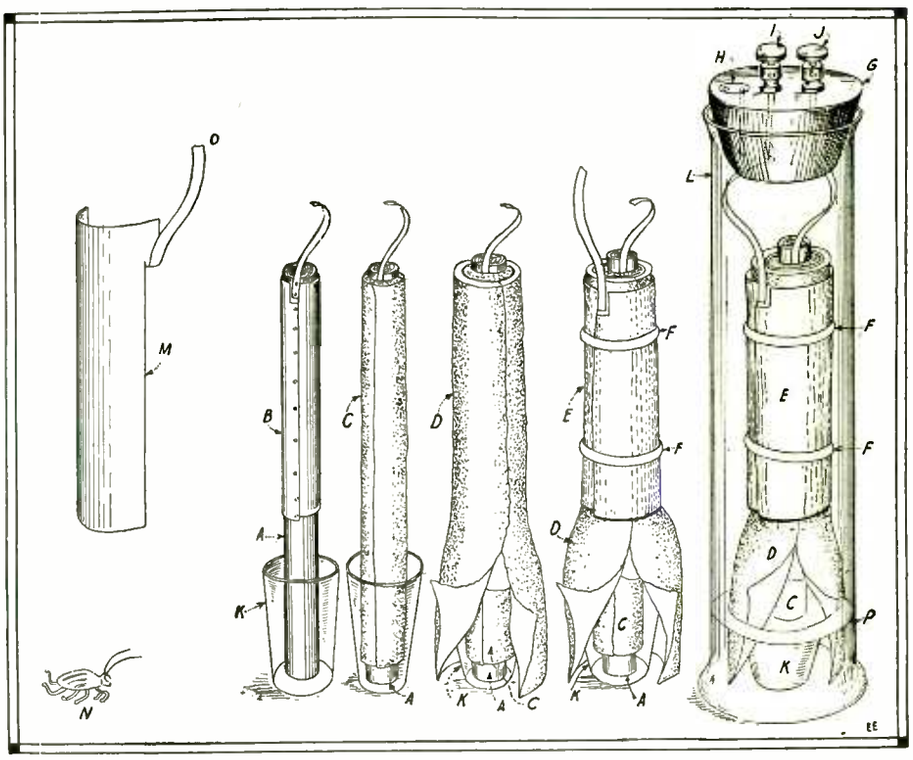
YOU remember my *capillary battery* using two solutions, copper and zinc sulfate, which demonstrated that the solutions wouldn't mix when contained in a capillary mass like burlap, thus giving a battery of very long life on open circuit, or one of small output? The only trouble with *that* battery was its high internal resistance, and I've doped out a startling modification of it with a lower resistance, which may amount to something, provided the solutions still decline to mix under the new arrangement.

I have to postpone trying it out until I get to the "summer place" on the Cape, where my tools are; but as it's so simple perhaps some fellow "Bug" would like to make the experiment now, and beat me to it. I'll say it's worth while, for even if the cell produces but ¾ of a volt, it wouldn't take an unreasonable number of 'em to form a nice "B" battery for Audions, while they'd cost practically nothing, and if they worked at all they'd work for years.

I've drawn the thing in successive stages, to make its construction perfectly clear. You begin with a wooden dowel A, of a length proportioned to the containing bottle you're going to use. Around this you bend the very thin copper sheet B, and tack it on with copper tacks. M shows the manner of preparing this sheet, with a strip O slit nearly to the top and turned up to form a connector. K is a small whiskey-glass (anybody'll give you a whiskey-glass after July 1st) which will contain the sulfate of copper solution.

Next, you wrap the dowel—with its partial copper-coating—in the thick burlap C. I should think one layer would be enough. This goes nearly the full length of the dowel, as it is to extend down into the copper solution and draw it up by *capillarity*. At this point soak C with copper solution, so you won't have to wait for it to soak up later, also to prevent its exhausting the contents of K.

Now for another layer of burlap, D, a little longer this time, as it goes down outside of K, and dips into the sulfate of zinc (or acidulated water) solution. Nothing between these two layers of burlap; each will be saturated with its own solution and they're supposed not to mix on account of the capillary action. I have folded D back to show the interior, but the flaps will be let fall in practise. Soak D in acidulated water before putting on.



Successive Stages in Building Tom Reed's Improved Capillary Battery. It Gives Approximately Three-quarters of a Volt and Should Prove Useful in Making up "B" Batteries for Audion Circuits.

Finally comes E, a sheet of zinc, also prepared with a connecting strip. No soldering necessary, just bent around and held by the two rubber bands F F. 'Tis well to amalgamate the zinc.

Now for the bottle, L, an olive or pickle bottle with a well-fitting cork G. The zinc and copper strips are connected to the binding posts I, J. You'll also want a vent-hole H, covered with a piece of soft rubber, to release the gases without evaporating the liquids. P shows the common level of the liquids both inside and outside the cup K—saturated copper sulfate, with a few crystals added inside, and acidulated water outside.

N represents an industrious "Bug" beating me to it. Hope he doesn't return with news it's no good. We thank you for your kind attention. Refreshments, second door on the left.

That Wonderful Electric Action-Delayer

By THOMAS REED



Applying Mr. Beiler's "Thermostatic Time-Switch" or Action-Delayer to the Shopping Bag. It Opens the Purse Two Minutes After You Decide to Buy Some Worthless Junk—Giving You Time to Change Your Mind!

DID you read that article in the November number by Mr. Albert H. Beiler, describing a "thermostatic time-switch" he'd invented? Lighting a lamp, not just when you push the button, but two minutes afterward? And did you mind what he said—"If you ask me what real use it has. I can't tell you?" S-ay . . . !

If ever there was a Regular inventor—"Regular" with a Capital "R" at the beginning and a Scotch growl at the other end—it's A. H. Beiler. Invents an invention—and such an invention as THAT—and doesn't know what it's good for! Why, Al, for the love of Pete wake up and put your collar on before the cheering crowd gathers at your door! It's an epoch-maker.

There may not be any great object in delaying the action of a light, because you generally want it about the same time that you get around to pushing the button; but if you substitute for the lamp a motive apparatus, think, Man, what you've got—the greatest little second-thoughter in the world! You can have all the effect of a final decision in pushing the button, and yet have two whole minutes in which to change your mind.

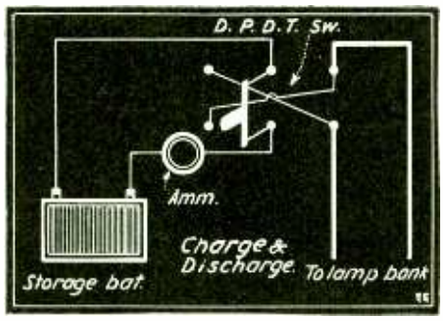
I see where it's going to be applied to every door-lock right away. The Missis hears a ring, and pushes the door-button. Almost immediately she thinks, "What if it's a tramp?" She goes to the window, and sure enough there's a coat-tail sticking out from under the porch. It looks untidy, possibly ragged. Visions of robbery and murder, but—the lock has not yet operated, thanks to the beneficent Beiler. There's time to run back, press another button and cancel the order. As a matter of fact it's not a "burgular" but her brother with a nice

(*Continued on page* 277)

Storage Battery Testing

By Harold R. Adams
STORAGE BATTERY ENGINEER

AN outline of the methods used in commercial storage battery work, adapted to the requirements of the layman and amateur electrician is given in the following paragraphs, which may prove of assistance. The first



Handy Circuit for Charge and Discharge of Storage Battery in Testing Work. An Ammeter Should Always Be in Series With the Battery.

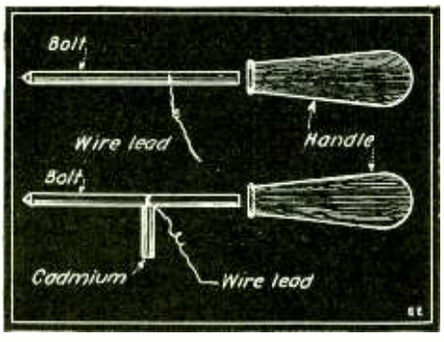
step is to determine the capacity of the battery under test. The capacity in ampere-hours, the charging rate at start and finish, etc., will usually be found on the name-plate of the battery.

When these have been determined the battery should be connected to a source of *direct current* and charged at the finishing rate until the cells gas freely and the E.M.F. (voltage) reads in the neighborhood of 2.5 to 2.6 volts, connected to charging current.

If the battery is of the starting or lighting type the specific gravity should read 1.285 at 70 deg. F. The *gravity* of truck batteries sometimes is a little lower than the above; however, it should be given on the name-plate or in the instruction pamphlet that is sent with the battery.

Before going any farther we will sum up the instruments needed to properly conduct the tests.

1 Hydrometer reading from 1.150 to 1.300
1 Thermometer (floating type)
1 Ammeter
1 Voltmeter (3 volt scale)
1 Lamp bank (where 110 volt direct current is used) or
1 Rheostat (where low voltage generator is available)
2 Iron bolts, 4 inches long, ¼ inch dia.
1 Cadmium rod 3 inches by ¼ inch
12 Feet stranded rubber covered cable, 14 B. & S. gage.



How the Battery Testing Prod and Cadmium Electrode Is Constructed. Brad Awls Make Good Test Prods and Cost About 10 Cents Each.

The heads should be cut from the bolts and the threaded ends inserted in wooden handles shown in figure. The cadmium rod should be soldered to one of the bolts as shown in the same drawing.

The stranded wire should be cut in half and one piece soldered to each *prod*, as shown in the illustration, the other end being connected to the voltmeter. The prod with the cadmium electrode should be connected to the positive terminal of the meter.

A very convenient hook-up is here given for charging and discharging the battery or cells. An ammeter should be in series with the battery all of the time.

When everything is ready the battery should be put on charge at the finishing rate, until the cells gas freely and the voltage reads 2.5 to 2.6 volts per cell, and the gravity of the electrolyte is correct. If the gravity of the electrolyte does not increase to the proper point after a couple of hours charging it will be necessary to add a little strong acid, great care being exercised in doing so and also in making temperature corrections in case the temperature is other than 70 deg.

The following rules governing the cadmium test should be carefully studied before going any farther if the tests are to be a success.

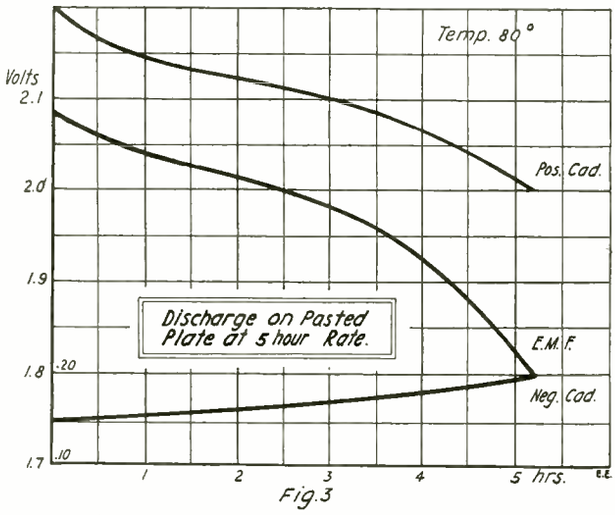


Fig. 3

Curves Showing Cadmium Readings on Test of Pasted Plate Battery at Five-Hour Rate.

The sum of the positive and negative cadmium readings should nearly equal the voltage across the cell when the cell is charging.

The difference between the pos. and neg. cadmium readings should equal the voltage of the cell when on discharge.

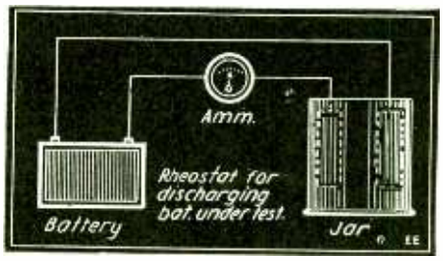
The positive cadmium always reads plus.

When the cell is charging neg., cadmium reads minus.

When the cell is discharging the neg., cadmium reads plus.

To take a cadmium reading immerse the cadmium electrode in the electrolyte and bring the other prod in contact with either the pos. or the neg. pole of the cell according to which cadmium you wish to read. When the cadmium is not in use it should be kept immersed in dilute acid (electrolyte), otherwise the readings will be incorrect.

When the cell is fully charged the E.M.F. across the cell should read from 2.5 to 2.6 volts and the pos. cad. from 2.38 to 2.44 plus. The neg.— cad. should read from —.16 to —.20 when the cell is in good condition. It has once been noticed by the author that a neg. cad. read *plus* on charge. This was found to be due to the fact that the battery had been heavily overcharged.



A Water Rheostat Proves Useful for Absorbing the Energy from Storage Battery on Discharge Test.

The plates were removed and prest, and gave very good service afterwards. The heavy overcharge had filled the pores of the plates with hydrogen which is positive to cadmium.

A slight overcharge of a couple of hours at the finishing rate about every five cycles is good for the battery, but a heavy prolonged overcharge, especially at a high temperature, will result in the ruin of the battery if allowed to occur too often.

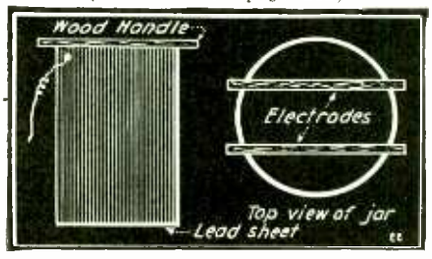
When the battery has been fully charged and the readings recorded it should be arranged for discharge.

To discharge a battery at the standard *eight-hour rate* requires quite a little time. However, it has been noticed that when a battery is discharged at a higher rate that the *ampere-hour output is lessened a certain per cent.*, depending on the ratio of the rate of the discharge. Advantage may be taken of this fact and the following table of percentages and the time needed for the test considerably reduced. The figures in this table are taken from experiments made by the author and may be used for any make of lead plate battery, except the Edison, which is an iron-nickel element.

Table 2

Hour Rate	Pasted Plate	Plante Plate	Hour Rate	Pasted Plate	Plante Plate
8.00	100 %	100 %	1.50	53.5%	63%
7.00	96 %	99 %	1.00	46 %	55%
6.00	92 %	96.5%			
5.00	86.5%	93 %			
4.00	80 %	88 %			
3.00	72 %	80 %			
2.00	61 %	70 %			

(*Continued on page 282*)



Details of Water Rheostat for Battery Testing. The 2 Electrodes are Made of Lead or Iron, Etc. Solution May Be Salt and Water or Bicarbonate of Soda.

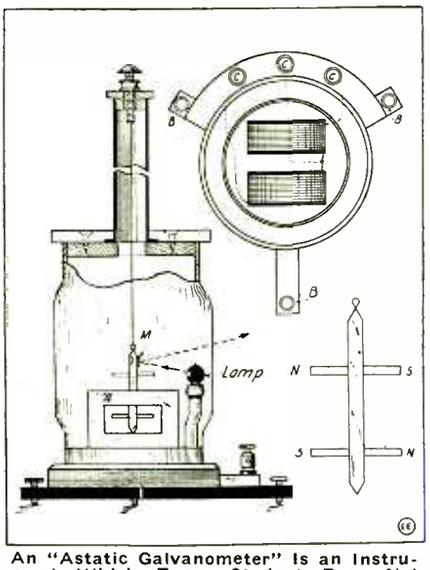
HOW TO BUILD AN ASTATIC GALVANOMETER.

By C. G. Yungblut.

THE great trouble with many "how-to-make-it" articles is that they call for tools or material which the experimenter does not possess, and generally time or pocket-book prevents him from obtaining them. But luckily in electrical construction, if one thing is lacking, another can generally be supplied that will perform the service quite as well, and the experimenter can turn out a creditable piece of work whatever his resources may be. Especially is this true in the constructing of galvanometers.

Suppose, for instance, you want a good sensitive galvanometer, and you want to make it yourself. The *D'Arsonval* type is out of the question, let us say, because you haven't the required magnets. Make an *astatic,* then. The first thing that causes trouble is a covering to protect the delicate suspension from currents of air. A clear glass cover the proper size and shape would cost a good deal. But here's an easy way out of that dilemma. Get one of those glass chimneys used on gas burners, one of the cylindrical kind, that narrows down at both ends. Procure one of good clear glass, free from bubbles and ridges, and you have an excellent cover. The next difficulty is the suspension. To be delicate, it should be high, higher than the cover itself.

Let us make a top for our cover. If you have a lathe turn one from wood or fiber that will just fit into the top of the cover,



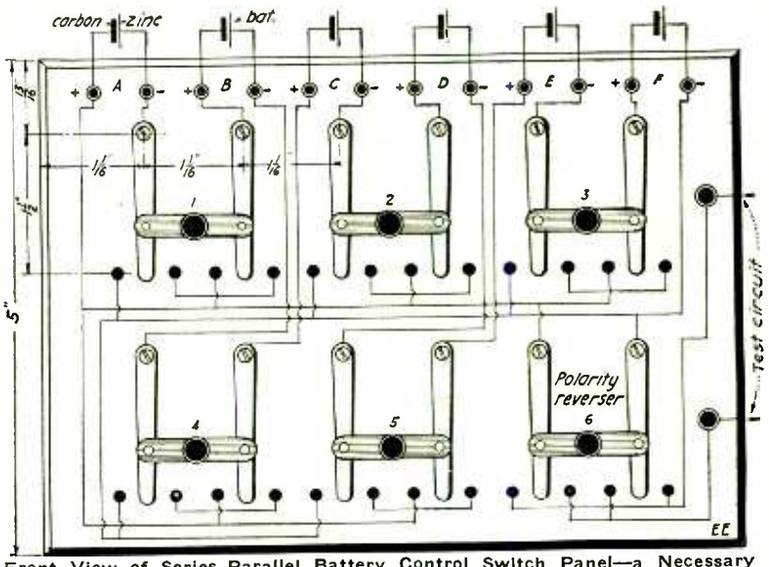
An "Astatic Galvanometer" Is an Instrument Which Every Student Does Not Care to Purchase. Yet He Often Needs It Urgently. The Present Article Tells How to Build a Very Sensitive One of the Reflecting Mirror Type.

with a flange to keep it from slipping thru. If you have no lathe, cut out two disks of thin wood with your pen knife, or a scroll saw, one just large enough to slip into the top of the chimney and the other about three-sixteenths of an inch larger all around. Fasten the two disks together, and you have a cover as good as one turned on a lathe. Next get a large test tube, and cut off the closed end, so that a cylinder of glass with a flange at one end is left. Bore a hole in the center of the cover you have just made, slightly smaller than the internal diameter of the test tube, and fasten the tube in place over this hole. If you have made the cover of two disks, the flange of the test tube can conveniently be placed between the two before you fasten them together, as the diagram suggests. Now assemble the cover and its top with the tube in place. You can at once see that if the astatic element, M, is hung from the top of the tube, the suspension will be high enough, and will be completely protected.

(*Continued on page 278*)

A Series-Parallel Battery Switch

A very convenient switch for quickly and easily connecting battery cells in a variety of combinations is herewith described. No machine work or intricate designing is necessary. Carefully lay out the location of the holes on the fiber base according to the diagrams. The holes on the under side of the base, which are not shown in the present illustrations, are drilled with a No. 40 drill to a depth of 3/16" with a 4/36 tap; tap one turn enough to get a screw started. Be careful not to go thru the base with the drill or tap. The continuation of these holes in the fiber strips forming the sub-base are drilled with a No. 32 drill, to allow the 4/36 screw to slip thru easily, and slightly countersunk. The size of the holes for the binding posts will depend on the size of the binding post shank. All other holes in the base are drilled with a No. 18 drill. Fasten the sub-base strips to the under side of the base with the No. 4/36 by ⅞" screws; be careful not to strip the threads. File and sandpaper the whole base to give as near as possible the appearance of a solid piece.



Front View of Series-Parallel Battery Control Switch Panel—a Necessary Adjunct to the Experimenter's Laboratory. Any Desired Grouping of the Cells—Series, Parallel or Series-Parallel—Is Possible by Its Use.

The following materials will be needed:

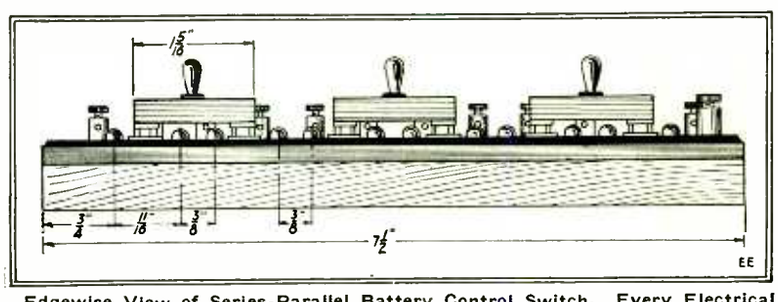
One fiber base, 7½" x 5" x ¼".
Two fiber strips, 7½ x ¾" x ¼".
Two fiber strips, 4½" x ¾" x ¼".
Twelve fiber strips, 1 1/16" x ¼" square.
Twelve copper strips, 1¾" x ¼" x 3/32".
Fourteen small binding posts.
Twenty-four round-head machine screws, 8-32 x ½".
Twelve round-head machine screws, 8-32 x ¾".
Twelve flat-head machine screws, 4-36 x 3/16".
Eight flat-head machine screws, 4-36 x ⅞".
Forty-eight hexagonal 8-32 nuts.
Eighty-four ⅜" dia. washers.

Next, drill a No. 18 hole ⅜" from one end of each of the copper strips; also drill a No. 32 hole 1⅜" from the same end, and countersink. The corresponding holes in the ¼" square by 1 5/16" fiber strips are drilled to a depth of 3/16" with a No. 40 drill; make these holes ⅛" from each end, and tap the turn with 4/36 tap; the screw will then go in very tightly without binding on the copper strip. Fasten these handles on the switch blades first; then put an 8/32x¾" screw thru from the top of each blade and run up a nut on the other side. Then put on a washer and insert in the proper holes in the base, and put on two washers; then fasten with one nut. For the contact-points, put an 8/32x½" screw thru each of the proper holes on the base, put on two washers underneath and then proceed to fasten with one nut.

The connections are made according to the diagram in Fig. 3. Unless all connections are soldered, the wires must be run from one contact to the other, instead of being tapt off as shown. Do not use smaller wire than No. 18 D. C. C. for this purpose. Place all ends of wires between washers, and screw nut up tightly, being careful the switches do not bind. Then coat the wires with heavy shellac or glue to hold them in place.

The cells to be operated are permanently connected to the binding posts marked by the letters "A, B, C, D, E, F" in Fig. 3; connect one cell to each pair of posts; the positive and negative polarities must alternate as indicated. The possible combinations are tabulated in Fig. 4, which should be used for reference. Switch No. 6 is first thrown to the left or right, according to the polarity desired at the test current terminals. When using the switch-board this switch must be thrown either in one position or the other. Under "CELLS" look for combination desired; under "SWITCH POSITION" find position of switches to give the combination. For example: to obtain current from 3 cells in series and 2 in parallel, look in column marked "CELLS" and in "Series" column find 3 and in "Parallel" column find 2. Under "SWITCH POSITION" in columns marked "LEFT" and "RIGHT" find "2" and "1, 3, 4, 5," respectively. Place switch No. 2 on its left-hand contacts and switches Nos. 1, 3, 4 and 5 on their right-hand contacts; the current is taken from the pair of binding posts near the right-hand edge of the base. If the polarity is to be changed, move switch No. 6 to the opposite position. The switches that are not specified in the table for any particular

(*Continued on page 275*)



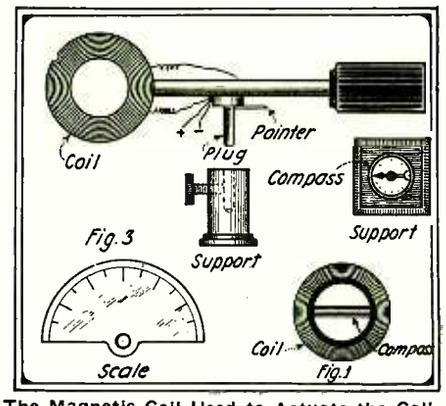
Edgewise View of Series-Parallel Battery Control Switch. Every Electrical "Bug" Will Find This Switch of Great Usefulness in His Laboratory.

HOW-TO-MAKE-IT

This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 is awarded; for the second best idea a $2.00 prize, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

A Laboratory Measuring Instrument

FIRST PRIZE, $3.00

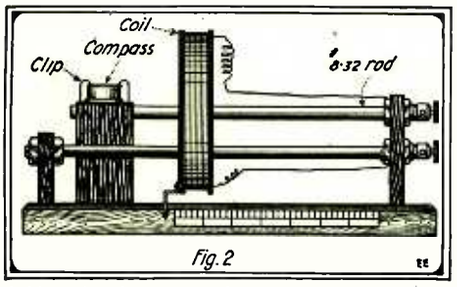


The Magnetic Coil Used to Actuate the Calibrated Compass Is Here Shown Mounted in a Pivoted Pedestal.

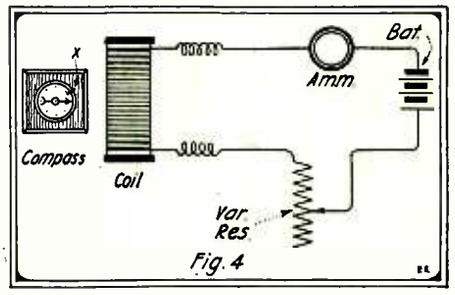
If we take a coil of wire as shown in Fig. 1 and set a compass in the center as shown, with the compass needle pointing in the plane of the coil, then when current is past thru the coil the needle will swing at right angles to the plane of the same. One objection to this type of apparatus is that it is very critical and no direct readings can be taken to scale—for this reason the following instruments if properly constructed will be of advantage to any experimenter in his laboratory. It not only being cheap in construction but it is likewise efficient when calibrated by a method given below.

In Fig. 2 one type of instrument is shown. A compass is clamped on a wooden stand by two brass clips as shown and the coil (current coil) is supported by the 8/32 rods and slides back and forth on them. A pointer is affixt to the coil and moves over the scale.

In Fig. 3 the compass is supported on a wooden stand in the same manner described above, but here the coil rotates away from the compass on a 90 degree angle (or quarter circle) decreasing its distance from the compass in that manner. Here, of course, the scale has to be affixt to the support which also holds the coil, its arm and handle.



A Very Useful Form of Home-Made Measuring Instrument. The Compass Is Affected in Proportion as the Coil Is Moved Toward or Away from It.



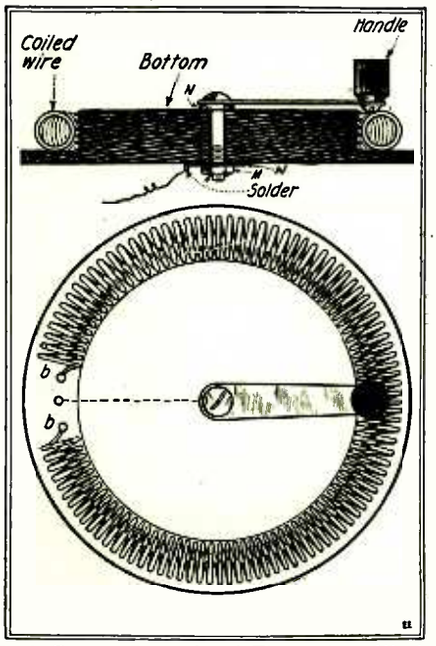
Hook-Up of Apparatus for Calibrating. The Current in the Coil Is Varied by a Rheostat.

Calibration of the Instrument: As shown in Fig. 4 a standard ammeter for battery use is connected in series with the coil and the batteries, the current from the batteries is regulated by a variable resistance. A mark is made with black paint on the compass as shown at X in the drawing. This mark is employed in the following manner: The coil is moved one degree on the scale and the resistance varied until the compass deflects to the mark—this is noted on the scale—and the coil is then moved back another notch on the scale and the same procedure complied with, until finally the entire scale is plotted. This makes a very neat and efficient measuring instrument.

Contributed by E. T. JONES.

A Rheostat Push-Button

SECOND PRIZE, $2.00



Push Button Bases Lend Themselves Nicely to the Construction of Home-Made Spiral Wire Rheostats.

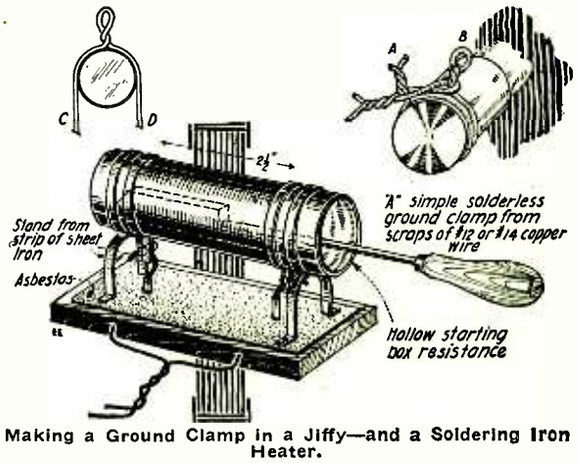
Remove all contacts and other trimmings from the bottom of a common wooden push-button. Then make a coil of resistance (iron, German silver, etc.) wire, put it in position shown, and fasten the ends in place by two binding posts, b and b. The contact arm is sheet brass, 1/16 inch thick. The handle is a piece of one-half inch dowel, fastened by a small round-head wood screw, which makes contact with the wire. The arm is fastened securely to the bolt by a nut, N. A washer, W, is slipt over the bolt on the back at the bottom, and then another nut, M, which is soldered to the bolt. A wire is soldered to the washer for connections. This rheostat should be used for light work only.

Contributed by ROBERT HERTZBERG.

Soldering Iron Heater

THIRD PRIZE, $1.00

sketch explains the stunt sufficiently, except that in putting on the clamp the loop (B) should be made first; then the two ends (c and d) bent around and twisted at (A). The lead wire is looped around A and B and twisted up tight, giving a firm joint.



Making a Ground Clamp in a Jiffy—and a Soldering Iron Heater.

The other stunt is a soldering iron heater made from a discarded starting box coil.

Contributed by E. McALLISTER.

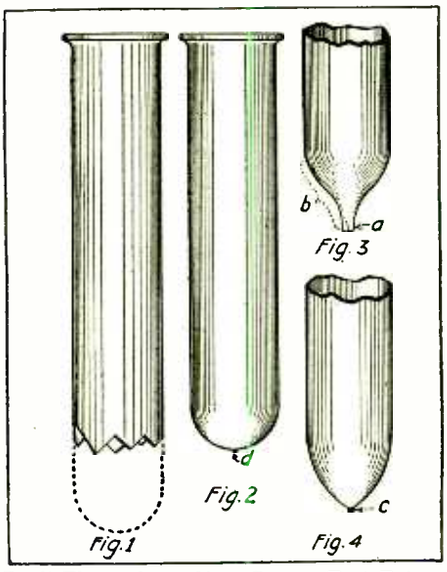
A "TWO SECOND" GROUND CLAMP AND SOLDERING IRON HEATER.

My "two-second" ground clamp is made from scraps of No. 12 or 14 B. & S. gage copper wire. I have used a clamp like this and find it gives entire satisfaction. The



REPAIRING TEST-TUBES.

Being short of test-tubes and unable to obtain more at the time, I chanced upon the idea of mending some of the broken ones. My first trials were unsuccessful because of the bottom being too thick. I



Don't Throw Away Your Broken Test-Tubes. You Can Repair Them Easily. Just Try!

managed to get a good, thin bottom by the following method:

The broken test-tube was lowered into the Bunsen flame and the jagged edges, when soft enough, (still held in the flame) were pulled out with the aid of an ordinary pair of pliers. When the walls seemed thin enough, the jagged ends were drawn together thereby closing the end of the tube as in Fig. 3. The heat was concentrated on "b," Fig. 3, and when soft enough the tip "a" was drawn out (*while held in the flame*). The result appears at Fig. 4. Still holding the tube in the flame, the bottom was heated until soft when it was quickly removed, the open end placed to the mouth, and the breath forced into it. This was done several times until the bottom assumed the shape of that at Fig. 2. Then it was annealed well in the luminous flame and set aside to cool. The result is a test-tube that may be used for all ordinary purposes not requiring heat. The tube may also be used in the flame if the tip of thick glass "d," Fig. 2, is removed with the aid of a grinding wheel or an oil-stone and the tube re-heated and annealed again.

The jaws of the pliers must be hot when it comes in contact with the hot glass and preferably one with narrow jaws and insulated handles. Before introducing the broken test-tube in the flame it must be well heated in the air above the flame to prevent further cracking.

Contributed by HAROLD OLSEN.

SHOP KINKS

Lay dull files in diluted sulphuric acid until they are eaten deep enough.

Chasing Threads in Aluminum: When cutting threads on aluminum use a little oil with coal oil, about (1) one teaspoon of oil to (1) one pint of coal oil, and the threads will not clog up, but will take a fine finish as if cut in steel.

Contributed by CLYDE G. PATTERSON.

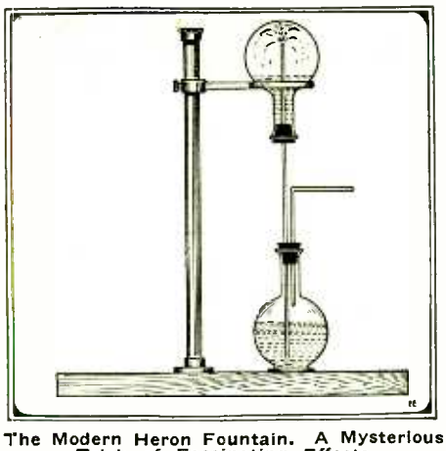
SOLUBILITY OF GAS PRODUCES FASCINATING EFFECTS.

A very interesting chemical experiment can be performed with the apparatus shown in the illustration. A perfectly dry Florence flask is used for the upper vessel. It is filled with hydrogen chlorid gas, which is prepared by heating a mixture of moistened common salt (sodium chlorid) and sulfuric acid. The gas is collected by downward displacement as it is heavier than air.

This flask is connected by means of a glass tube to a similar vessel, which is nearly filled with a blue litmus solution. This solution is made by dissolving a very small quantity of the blue litmus dye in water. The end of the tube, opening into the upper flask is drawn out, so as to make a rather fine jet. All the stoppers are fitted tightly.

By blowing into the open tube of the lower vessel, a few drops of the liquid are forced into the upper flask. The hydrogen chlorid at once dissolves, thus diminishing the pressure inside the vessel. The blue solution then forms a fountain at the jet and continues to do so, until almost all the chlorid is used up. This gas has also the property of changing blue litmus to red, hence as soon as the solution comes in contact with it, the color is changed immediately, thus presenting a very mysterious appearance to a novice.

Contributed by JOHN C. JACK.



The Modern Heron Fountain. A Mysterious Trick of Fascinating Effects.

FIREWORK PAPERS AS PYROTECHNICS.

Red Fire

Strontium nitrat	20	parts
Potassium chlorat	10	"
Alcohol	20	"
Water	100	"

Green Fire

Barium chlorat	20	"
Alcohol	20	"
Water	100	"

Yellow Fire

Sodium oxalat	10	"
Potassium chlorat	10	"
Alcohol	20	"
Water	100	"

Blue Fire

Potassium chlorat	10	"
Copper chlorat	20	"
Alcohol	20	"
Water	100	"

Violet Fire

Strontium chlorat	15	"
Copper chlorat	15	"
Potassium chlorat	15	"
Alcohol	50	"
Water	100	"

Lilac Fire

Potassium chlorat	20	"
Copper chlorat	10	"
Strontium chlorid	10	"
Alcohol	50	"
Water	100	"

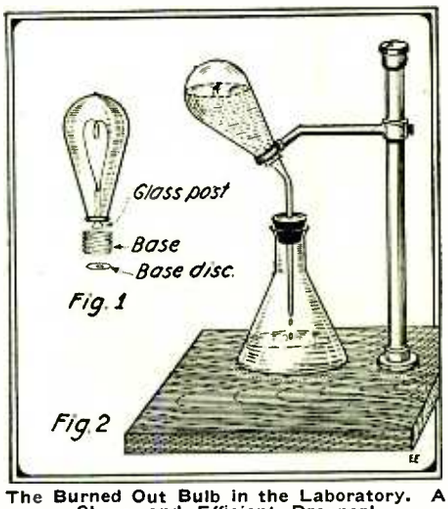
Unsized paper is put in the solutions. When the paper becomes saturated, then remove and dry by hanging it over a string stretched across a warm room. A sheet of paper about 12 by 16 inches may be made to burn for several minutes.

Contributed by BRUCE L. LEWIS.

DROPPER FROM OLD LAMP BULBS.

I have found a very good use to which old worn out electric bulbs can be put. First, the solder is melted from end of the base and the small disc is removed. Now, by using a little pressure, the entire base may be removed. Then, with a piece of heavy wire or a nail, the glass post on which the tungsten filament is attached, can be broken. The glass pieces and tungsten wire must then be removed. Care should be taken to keep the opening at the bottom as small as possible. If the bulb is now filled with water and quickly inverted, the water will not flow out but by slightly tilting it, the water will come out drop by drop. This makes a very good dropper for use in chemical experiments. If a rubber tube is attached as in Fig. 2 the dropper may be used on any receptacle.

Cont. by WERNER KRETSCHMER.



The Burned Out Bulb in the Laboratory. A Cheap and Efficient Dropper!

Electrical Oscillators

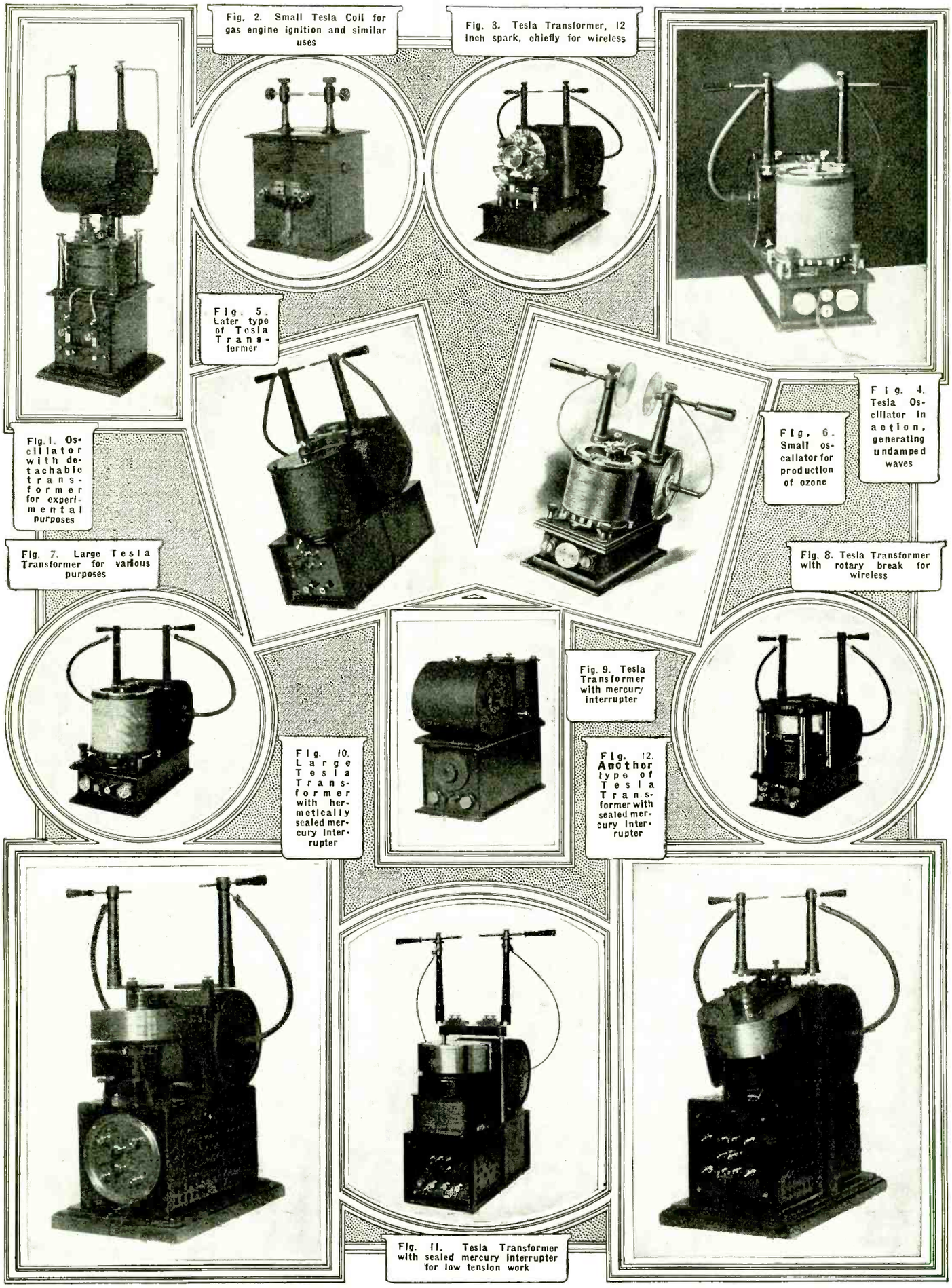


Fig. 1. Oscillator with detachable transformer for experimental purposes

Fig. 2. Small Tesla Coil for gas engine ignition and similar uses

Fig. 3. Tesla Transformer, 12 inch spark, chiefly for wireless

Fig. 4. Tesla Oscillator in action, generating undamped waves

Fig. 5. Later type of Tesla Transformer

Fig. 6. Small oscillator for production of ozone

Fig. 7. Large Tesla Transformer for various purposes

Fig. 8. Tesla Transformer with rotary break for wireless

Fig. 9. Tesla Transformer with mercury interrupter

Fig. 10. Large Tesla Transformer with hermetically sealed mercury interrupter

Fig. 12. Another type of Tesla Transformer with sealed mercury interrupter

Fig. 11. Tesla Transformer with sealed mercury interrupter for low tension work

Electrical Oscillators

By NIKOLA TESLA

MR. TESLA makes a very important contribution to the electrical arts with this article.

The pioneer of all high frequency apparatus divulges much that is new and startling in these pages. Few people realize the enormous value of Mr. Tesla's machines and the many different important uses to which they can be applied in our everyday lives. New and startling uses are being found every year for these machines.

It is characteristic of Mr. Tesla that he has developed and actually built an astounding variation of these machines, and we regret that we can publish only a very few of the more important models.

Most of the Tesla coils shown have never been publisht before. —EDITOR.

FEW fields have been opened up the exploration of which has proved as fruitful as that of high frequency currents. Their singular properties and the spectacular character of the phenomena they presented immediately commanded universal attention. Scientific

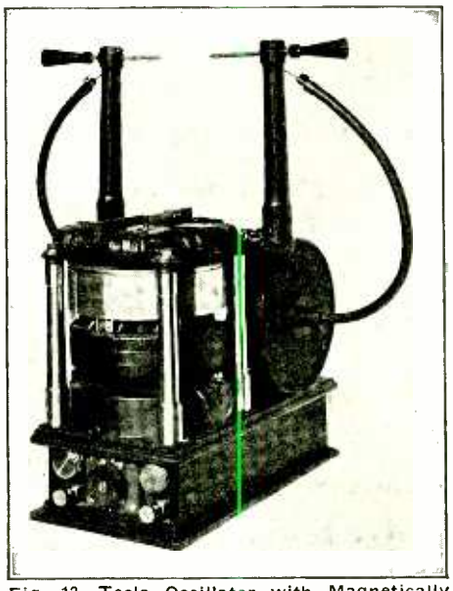


Fig. 13—Tesla Oscillator with Magnetically Controlled, Sealed Mercury Interrupter.

men became interested in their investigation, engineers were attracted by their commercial possibilities, and physicians recognized in them a long-sought means for effective treatment of bodily ills. Since the publication of my first researches in 1891, hundreds of volumes have been written on the subject and many invaluable results obtained thru the medium of this new agency. Yet, the art is only in its infancy and the future has incomparably bigger things in store.

From the very beginning I felt the necessity of producing efficient apparatus to meet a rapidly growing demand and during the eight years succeeding my original announcements I developed not less than fifty types of these transformers or electrical oscillators, each complete in every detail and refined to such a degree that I could not materially improve any one of them today. Had I been guided by practical considerations I might have built up an immense and profitable business, incidentally rendering important services to the world. But the force of circumstances and the ever enlarging vista of greater achievements turned my efforts in other directions. And so it comes that instruments will shortly be placed on the market which, oddly enough, were perfected twenty years ago!

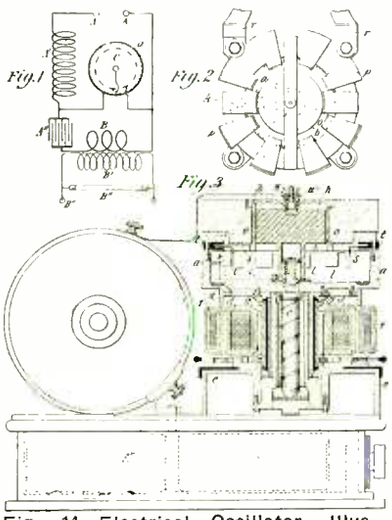


Fig. 14—Electrical Oscillator, Illustrated in Fig. 13, Showing Details and Circuit Connections.

These oscillators are expressly intended to operate on direct and alternating lighting circuits and to generate damped and undamped oscillations or currents of any frequency, volume and tension within the widest limits. They are compact, self-contained, require no care for long periods of time and will be found very convenient and useful for various purposes as, wireless telegraphy and telephony; conversion of electrical energy; formation of chemical compounds thru fusion and combination; synthesis of gases; manufacture of ozone; lighting; welding; municipal, hospital, and domestic sanitation and sterilization, and numerous other applications in scientific laboratories and industrial institutions. While these transformers have never been described before, the general principles underlying them were fully set forth in my publisht articles and patents, more particularly those of September 22, 1896, and it is thought, therefore, that the appended photographs of a few types, together with a short explanation, will convey all the information that may be desired.

The essential parts of such an oscillator are: a condenser, a self-induction coil for

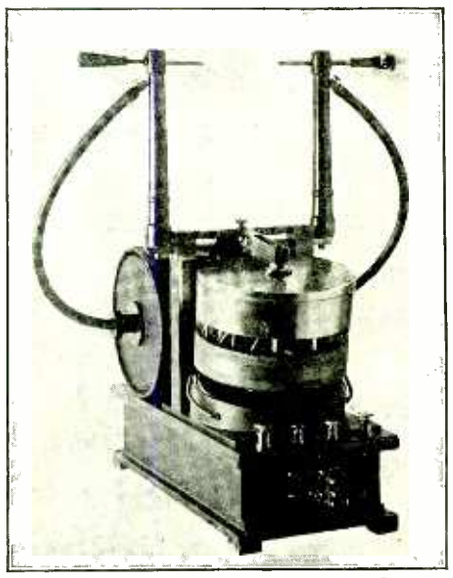


Fig. 15—Tesla Transformer with Gravity Controlled, Sealed Mercury Interrupter.

charging the same to a high potential, a circuit controller, and a transformer which is energized by the oscillatory discharges of the condenser. There are at least three, but usually four, five or six, circuits in tune and the regulation is effected in several ways, most frequently merely by means of an adjusting screw. Under favorable conditions an efficiency as high as 85% is attainable, that is to say, that percentage of the energy supplied can be recovered in the secondary of the transformer. While the chief virtue of this kind of apparatus is obviously due to the wonderful powers of the condenser, special qualities result from concatenation of circuits under observance of accurate harmonic relations, and minimization of frictional and other losses which has been one of the principal objects of the design.

(*Continued on page 259*)

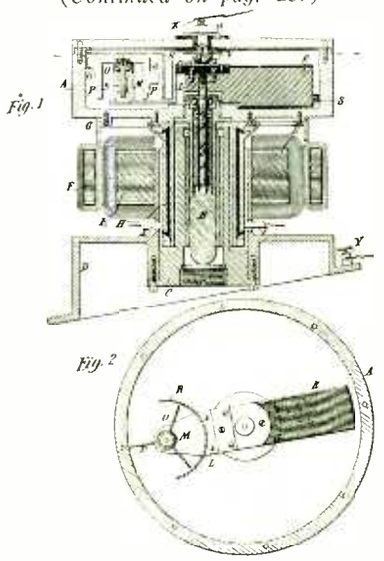
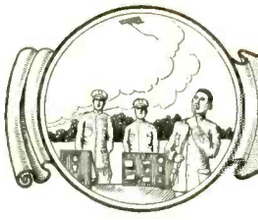


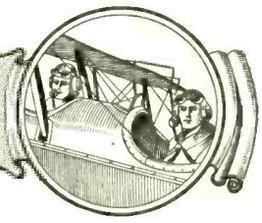
Fig. 16—Electrical Oscillator, Illustrated in Fig. 15, Showing Details of Motor and Break Mechanism.

SPECIAL NOTICE

Last month we announced another special feature article by Mr. Tesla, which altho made in good faith by us was not authorized by him. Due to very important duties of Mr. Tesla, it was impossible for him to furnish his historical article this month, so the special feature article publisht on this page takes its place. An important historical article will appear in the August issue.—Editor.



RADIO DEPARTMENT



New 1 K.W. Panel Radio Transmitter

By LESTER F. RYAN

THE great war has wrought tremendous changes in the design of radio apparatus. Among these designs is the 1 K.W. panel transmitting set used by the U. S. Navy on a great many of their vessels during the war, and in use at the present time on a great many of the U. S. Shipping Board vessels.

The 1 K.W. set is one of the most efficient sets in use, being constructed for both efficiency and durability. The panel consists of two bakelite-dilecto pieces mounted vertically, the top panel carrying the hot-wire ammeter as well as the unique-wave changing devices.

The lower panel consists of the A.C.-D.C. voltmeter, wattmeter, the latest design of quenched gap, also the control switches. The panel is 0.5 inch thick. Back of this is the framework upon which the panels are securely fastened. At the bottom is a tray constructed of rigid iron cross-pieces upon which the motor-generator is securely bolted. The motor-generator is driven counter-clockwise from the motor end by D.C., at 120 volts, and is rated 2.1 H.P. at the motor. The generator is rated at 1.25 KVA, or 1000 watts at 80 per cent. power factor. It is of the inductor type, and has 15 poles, and is a 500 cycle machine.

The motor-field strength is controlled by an 18-point rheostat, which varies the frequency between wide limits. The D.C. service switch is rated at 20 amperes, 250 volts.

The automatic starter consists of five distinct parts, two solenoids and two contact discs which are carried by plungers working in the solenoids, also a common resistance box. The right-hand solenoid has two separate windings, the first being a *current* winding in series with the motor-generator and starting resistance. The left-hand solenoid has this type of winding solely. The extra winding on the right-hand solenoid is connected across the service line as shown in diagram. This is termed the *potential* winding. The generator field rheostat is a single plate of the iron-clad type, 6 inches in diameter, giving a total resistance of 300 ohms. The control of the rheostat is effected by a handle which is operated from the front of the panel.

The meters are of the Weston type, the A.C. and D.C. voltmeter being of the double-scale design. The resonance inductance which is furnished with this set is of the iron-clad type. It has two windings, one being for full power operation, the second, which is larger inductance, is for low-power operation. Actual operating tests show that the natural period of the A.C. armature, resonance, inductance and transformer primary is 425 cycles. The operating frequency ranges from 450 to 550 cycles.

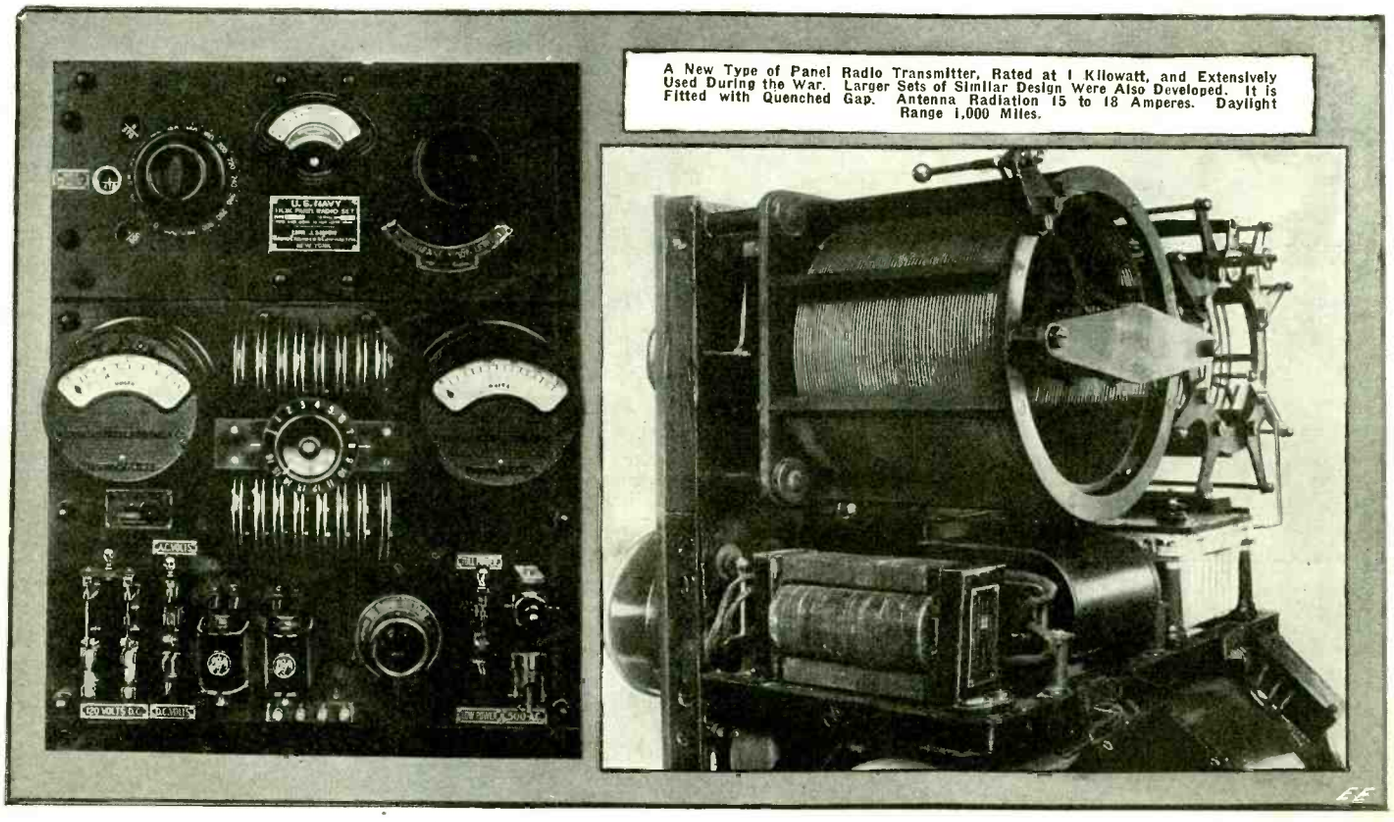
One of the most unique parts of this set is the combination flame-proof Morse key and antenna switch. The key is made with large contacts for carrying audio-frequency currents at low potential. It is encased in a gas-tight housing of black Japanned sheet brass, this housing making the "live" parts of the key free from all electrical contact with the power circuit. The connection between the key and the panel is made by two lengths of flexible cable, each five feet long. By means of the antenna switch, both the generator armature circuit and also the generator field circuit are broken when the switch is in receiving position.

The transformer used in connection with this set is of the closed-core, dry type, and is rated at 1000 watts, 500 cycles and 150 volts at the primary winding terminals. The ratio of transformation is 38 to 1. The transformer is insulated for dielectric stresses of 30,000 volts. The protective gap consists of three balls in shunt with the secondary, forming an inverted triangle, the lower ball being grounded to the frame of the transformer. They are set to stand a potential of 50 per cent above the maximum secondary voltage. The losses in this transformer due to hysteresis and eddy currents are less than 50 watts at full rated load.

The two condensers used are of the Dubilier type of .004 M.F. capacity, and connected in parallel. These condensers are made of select mica, and were tested to show minimum dielectric resistance and hysteresis. Each condenser is mounted in an aluminum housing. This is to insure durability.

The quenched-spark-gap switch is one of the most efficient yet developed. It is in

(*Continued on page* 254)



A New Type of Panel Radio Transmitter, Rated at 1 Kilowatt, and Extensively Used During the War. Larger Sets of Similar Design Were Also Developed. It is Fitted with Quenched Gap. Antenna Radiation 15 to 18 Amperes. Daylight Range 1,000 Miles.

How European Radio "Sigs" are Photographed Here

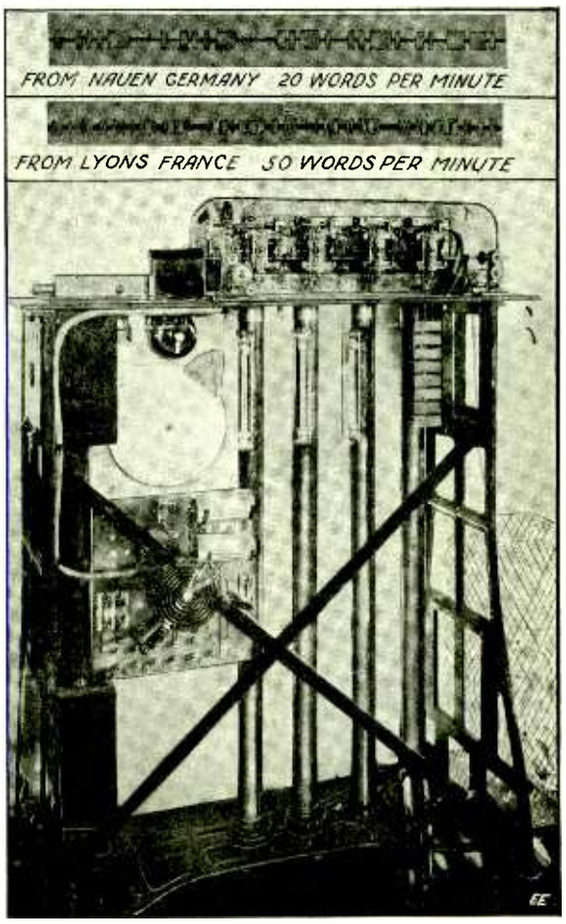
Messages Can Be Taken at 600 Words Per Minute. Deaf Persons Can Receive Them

PHOTOGRAPHIC receiving and recording of wireless messages as a matter of regular daily routine is now being carried on by naval engineers at the Otter Cliffs receiving station near Bar Harbor, Maine. They use an instrument invented by C. A. Hoxie.

The use of this invention permits the eye to either supplement or replace the ear in reading wireless messages. In fact, a totally deaf man could be a wireless receiving operator in a station so equipt.

It is stated that messages have been deciphered with its assistance, when operators were unable to get a single word of it by ear alone. From now on receivers do not hear by their ears alone.

Thus the outstanding obstacles to accuracy in wireless receiving have been eliminated, except for severe static interference.



Visual Radio Receiving Device. Tape Starts at Extreme Right and After Being Exposed to Flashes Corresponding to the Wireless Dots and Dashes, is Developed and Dried in the Four Tubes in Center, and Then Runs Off End at Extreme Left Into Basket, the Same as a Broker's Ticker Tape. The Upper Tape is a Reproduction of a Message Sent from Nauen, Germany, to Bar Harbor, Maine, at the Rate of 20 Words a Minute. The Lower Tape is that of a Message Sent from Lyons, France, to Bar Harbor at the Rate of 50 Words a Minute.

Receiving 600 Words a Minute.

As to speed in receiving, this machine has frequently recorded at the rate of 400 words per minute, as fast as a machine gun shoots, and recently in a test made by Mr. Hoxie, the machine recorded a low power message at 600 *words a minute!* Up to this time the most rapid method of recording radio signals has been by the phonograph, but this must still be transcribed by the ear and not the eye. Moreover, no permanent visual record is made. The phonographic method has never yet approached the rate of 600 words per minute, so the new instrument has hung up a new speed record. An interesting sidelight on this feature of the invention is that high speed messages are *secret messages* to all who are not equipt with this device.

A commercial phase of the speed question is peculiarly linked up with the atmospheric-electric phenomena of the northern temperature zone. For years it has been found that the best time for transmitting all wireless messages between here and Europe was from 4 A. M. to 10 A. M. Speedy sending and receiving can condense the traffic into this most favorable period, or a greater volume can be sent with a minimum number of stations. When it is remembered that a pair of stations—one in Europe and one here—can easily cost $2,000,000—the item of keeping down overhead charges by rapid sending will be easily appreciated.

Expert operators have been known to receive 35 words per minute for a short time under perfect conditions, but average reception up to this time has been 15 to 20 words per minute—or 1,000 words per hour.

It has been a race between sending and receiving speeds. Prior to this invention it has been possible to send the message faster than it could be received, but now the situation has been reversed.

The photographic recorder has been in daily operation at Bar Harbor, Maine. It has repeatedly recorded regular traffic schedules ranging from 1,000 to 7,000 words without interruption; and at a speed of 40 to 55 words per minute every word is perfect and easily and quickly read. It is used supplementary to the ordinary type of receiving set.

Not only is the message permanently recorded on a tape of special photographic paper, but a fleeting visual image of the signals can be seen on the ground glass of the machine at the same instant that the electric impulses arrive from the antenna.

Important Articles in this month's "Radio Amateur News"

The Audion and the Radio Amateur
By Dr. Lee de Forest

How I Became a Radiobug
By Thomas Reed

Design of Rogers Ground Antennae
By J. Stanley Brown

Radio Translator
By Major Chas. A. Culver

Announcement of a $100.00 Radio Prize Contest

Building a Sustained Wave Radio Telephone Transmitter
By Samuel D. Cohen

New Type of Electron Tube
By H. F. Donle

And even more than this—an audible reception can also be made simultaneously by the regular telephone method.

How the Recorder Works.

The mechanism is based on a comparatively simple electrical engineering principle. A light-weight mirror "flutters" in electromagnetic tune with the minute electric impulses coming from the receiving antenna. The duration and extent of the mirror's oscillations vary according to the dot, dash or silence of the sending station. This mirror reflects a beam of light on the moving sensitized tape. This tape, propelled by an electric motor, progresses up and down thru the vertical pipes which contain the developing and fixing chemicals.

Automatically the tape enters the developing fluid and then the hypo fixing bath; then it is washed in running water, and is dried by electric heat assisted by forced draft—all invisibly effected inside this single machine. Like the tape from a stock-ticker, the message pours out of the wonderful device and into a basket. In rapid receiving there is an average of *one word for every inch of tape.* The receiving operators can read the record at a speed of 50 to 100 words per minute.

The time to record, develop, fix, wash and dry the tape is from *two to four minutes.* The rolls of tape are 1,000 feet long and a continuous message of 10,000 words can be recorded without reloading the machine.

A remarkable performance of this machine only recently promises great things. As told by Mr. Hoxie:

All On One Aërial.

"Two simultaneous messages from different sources were coming in to one receiving circuit connected to the new photographic recorder. One of these messages was sent at a train frequency of 1,000 cycles per second, and the other at 975 cycles per second. Ordinarily two frequencies so close to each other would have interfered with reception, and I was pleased that I could receive one of the messages. But by a slight adjustment of the machine I was able to receive the other message; then back to the first; then switched off to the second—receiving either message without interference from the other.

"I hope to perfect the instrument so that in the not far distant future several photographic recorders can be attached to a single antenna and simultaneously receive messages from Rome, Lyons, Carnarvon, Wales, Nauen, Germany, and San Francisco! This may be called simultaneous multiplex receiving from one antenna.

"When this is accomplished, an international receiving station would have but a single antenna; and in a room inside the station there would be a row of machines with tapes pouring into baskets. One could pause at the first basket and read of the new president of Germany; stepping to the next basket he would read of a volcanic eruption in the Philippines, and only a few feet further on will be the baskets marked 'London,' 'Paris,' 'Rome,' 'San Francisco,' 'Sydney' and 'Shanghai.'!"

It has long been the dream of radio engineers to realize a perfected device for recording accurately wireless signals.

The Pliotron Oscillator

By WILLIAM C. WHITE

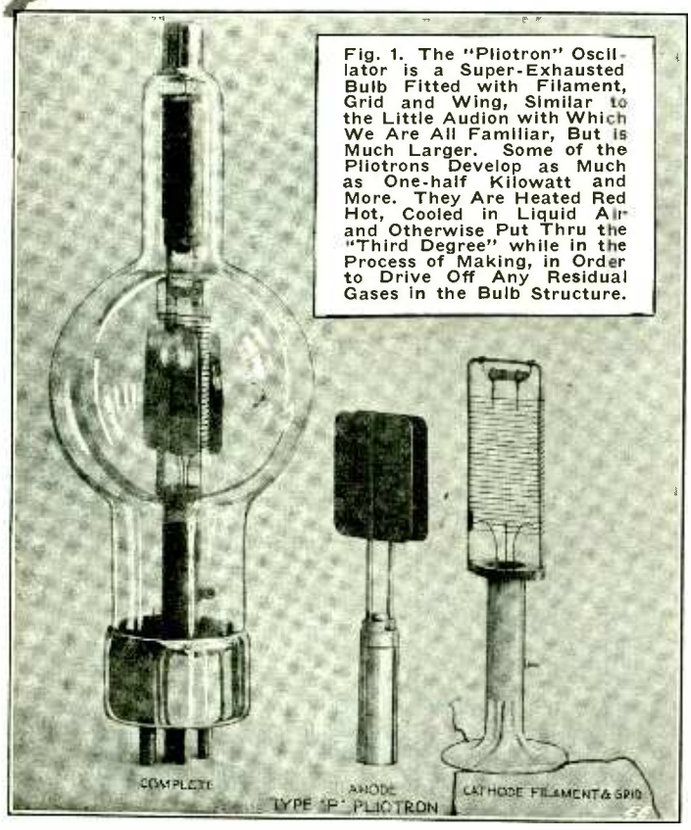


Fig. 1. The "Pliotron" Oscillator is a Super-Exhausted Bulb Fitted with Filament, Grid and Wing, Similar to the Little Audion with Which We Are All Familiar, But is Much Larger. Some of the Pliotrons Develop as Much as One-half Kilowatt and More. They Are Heated Red Hot, Cooled in Liquid Air and Otherwise Put Thru the "Third Degree" while in the Process of Making, in Order to Drive Off Any Residual Gases in the Bulb Structure.

THE *pliotron* vacuum tube when used as an oscillator for the production of alternating current from a direct-current source of energy, has the characteristics of an amplifying relay. That is, the wave shape of any variable electromotive force applied between the electron emitting cathode and the grid (or controlling member) will be faithfully reproduced by the currents in the main anode to cathode circuit.

Therefore, the input of a small amount of alternating-current energy will set up a relatively larger amount, identical in frequency and wave shape. Now by utilizing a small proportion of the alternating-current energy thus produced to feed back to the input circuit, the system can be made self-exciting. Alternating-current energy can thus be obtained from a direct-current source, the pliotron and its auxiliary apparatus forming a type of converter.

The type of pliotron utilized in the arrangements to be described is shown in Fig. 1, and is of the same design as used for the circuits referred to in previous articles.

In this article, two pliotron oscillator arrangements for high-frequency will be described, the first for the production of relatively large current and the second for the production of relatively high voltage. In each case the amount of energy involved is comparatively small, of the order of 150 watts or less.

In a resonance circuit the current will rise until the losses become equal to the input energy. With practical circuits the lower limit of power-factor obtainable is about one-half of 1 per cent., unless unusual precautions are taken. This means that the maximum resonance current produced is about two hundred times the value of the true energy current fed into the resonance circuit.

Therefore, where large currents are desired from a small quantity of energy, the total volt-amperes of the circuit must be kept small; and this condition requires that for such a resonance circuit a large capacity and small inductance must be used.

There is another principle which must be kept in mind. If the amount of electrical energy which can be furnished by a certain source is limited by the definite amount of primary power available, or by the losses in transmission, it is important to so adjust the resistance of the load to the voltage of the supply that the energy is most economically utilized. In the present case this means that the resistance of the heavy current circuit must be given the apparent value most suitable for insertion in the pliotron circuit. This adjustment of apparent resistance is accomplished by electro-magnetic coupling or transformer action.

The diagram of an arrangement to produce currents of from 10 to 25 amperes from one pliotron tube at frequencies between 100,000 cycles and 1,000,000 cycles is shown in Fig. 2.

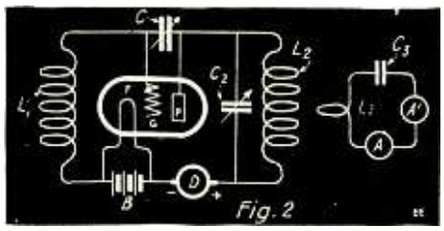


Diagram Showing Arrangement of Circuits to Produce Currents of from 10 to 25 Amperes from One Pliotron Tube at Frequencies Between 100,000 Cycles and 1,000,000 Cycles. Energy Amounts to About 150 Watts.

Suppose it is desired to calibrate a hot-wire ammeter by means of direct comparison with a standard. These two ammeters are represented by A and A_1 and are connected in series as part of a resonant circuit, the inductance and capacity of which are shown at L_3 and C_3 respectively. The product of the values of L_3 and C_3 to be used for any particular case is found by the usual resonance formula:

$$f = \frac{1}{2\pi\sqrt{LC}}$$

As mentioned in a previous paragraph, a low power-factor and volt-ampere product is desirable; and therefore the inductance value of L_3 is made the minimum possible, consisting usually of only one or two turns of heavy conductor. With the range of frequencies specified, this gives values for C_3 of the order of about 0.1 microfarad. In this heavy-current circuit it is of course very necessary to use condensers of low energy loss and to reduce the ohmic resistance of the conductors to a minimum.

The inductance L_3 obtains energy by electromagnetic coupling from the coil L_2 which is located in the plate circuit of the pliotron.

By means of an adjustment of the values of L_1, L_2, and C_1, the pliotron system can be made to set up a high-frequency current corresponding in period to the tuned heavy-current circuit.

Owing to the relative values of L_2 and L_3, the apparent resistance in the plate circuit of the heavy-current load circuit is greatly multiplied, but still is not of a sufficiently high value to absorb all the available energy. To further increase this apparent resistance, a variable capacity C_2 is shunted about the inductance L_2. Then, by simultaneous variation of these two factors, the apparent resistance of the load can be adjusted to give the largest energy output available.

The heavy-current output is dependent upon the voltage of the direct-current source D, a useful range being between 200 and 750 volts.

Pliotrons may be operated in parallel to produce a load current larger than that obtainable from one tube.

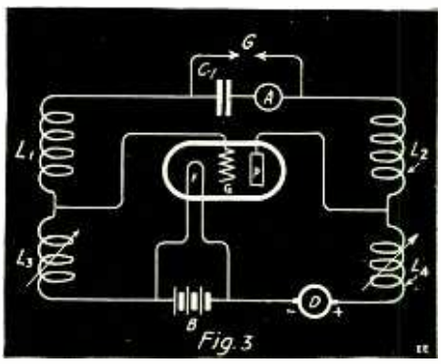
For the production of *high-voltage* in a resonance circuit, the conditions are almost a reverse of those in a heavy-current circuit; that is, with a fixt value of inductance and capacity to give the desired frequency, the capacity must be small and the inductance large, relatively speaking. There is a practical limit, however, to this increasing of inductance and lowering of capacity; and it is reached when the distributed capacity effect in the inductance becomes comparable to the capacity of the condenser used for resonance.

A pliotron oscillator arrangement for the production of high voltages is shown in Fig. 3. The high voltage is obtained across the condenser C_1, and may be tested by the gap G. A condenser in the form of two metal plates suspended in air* is the most convenient, and it may have a capacity value between 20 and 200 microfarads for a frequency of 100,000 cycles. By means of a hot-wire ammeter A in circuit with the condenser and by knowing the frequency, the voltage produced across C_1 may be simply calculated.

The inductances L_1 and L_2 are similar and each has a value of about 8 millihenries. The inductances L_3 and L_4 are also similar to one another and each has a

* Two metal plates, each 10 in. by 10 in. and spaced ½ inch apart, give a condenser having a capacity of approximately 40 micro-microfarads.

(*Continued on page* 287)



Pliotron Oscillator Arrangement for the Production of High Voltages. The High Potential is Obtained Across the Condenser C1, and May be Tested by the Spark Gap G.

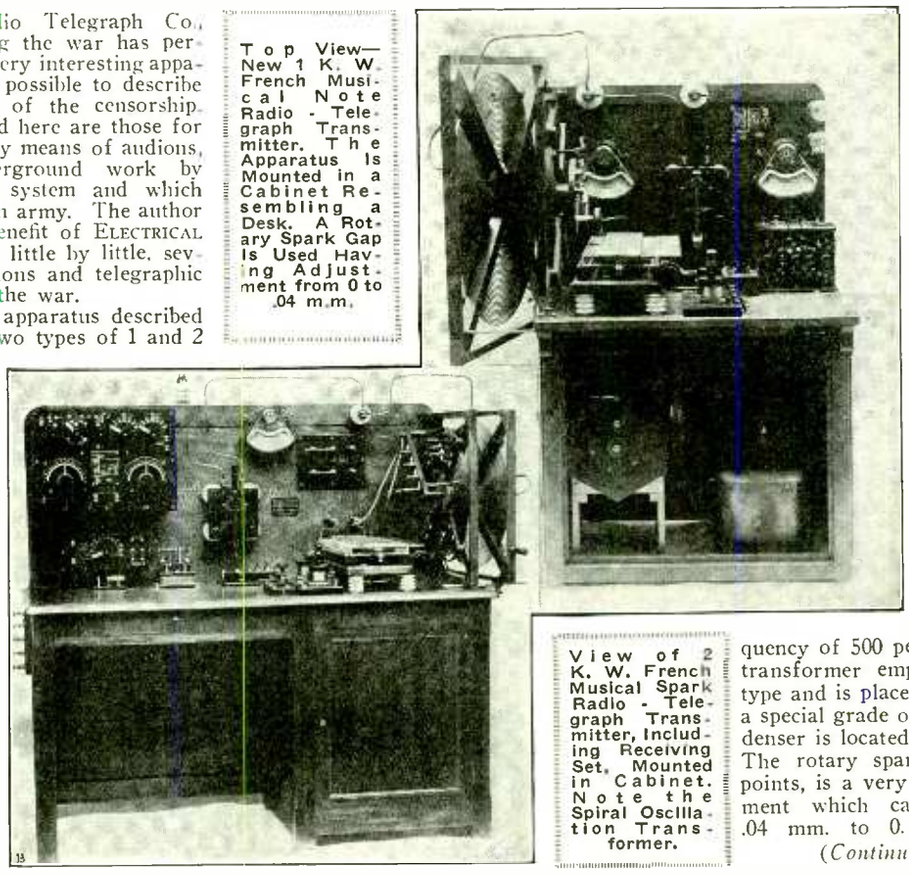
Musical Radio-Telegraphic Sets

By Jacques Boyer

Paris Correspondent, ELECTRICAL EXPERIMENTER

THE French Radio Telegraph Co., "C. G. R.," during the war has perfected a series of very interesting apparatus which it was not possible to describe heretofore on account of the censorship. The apparatus described here are those for sending and receiving by means of audions, particularly for underground work by means of the Rogers system and which were used by the French army. The author will describe for the benefit of ELECTRICAL EXPERIMENTER readers, little by little, several remarkable inventions and telegraphic apparatus used during the war.

The musical sending apparatus described this month comprises two types of 1 and 2 K. W. capacity. The 1 K. W. set here described was used a good deal by the French submarine chasers, and proved highly efficacious. The antenna is energized by shock excitation. The principal property of this excitation is that the antenna gives out a unique wave, its length and amortization (dying out period) being independent of the excited circuits. The musical emission which gives rise to a very high tone is obtained by charging the condenser from a "shock circuit," using alternating current of a frequency of 500 periods per second. This spark frequency of 1000 periods per second produces a very high musical tone at the receiving end.



Top View—New 1 K. W. French Musical Note Radio - Telegraph Transmitter. The Apparatus Is Mounted in a Cabinet Resembling a Desk. A Rotary Spark Gap Is Used Having Adjustment from 0 to .04 m.m.

View of 2 K. W. French Musical Spark Radio - Telegraph Transmitter, Including Receiving Set, Mounted in Cabinet. Note the Spiral Oscillation Transformer.

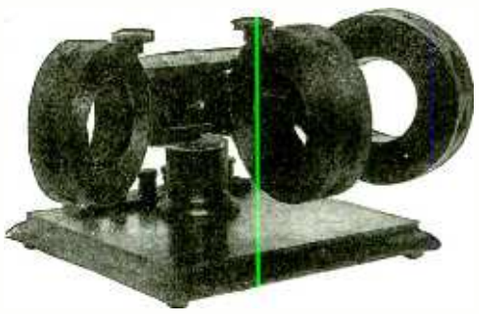
The sending machinery comprises a monophase alternator of 1,820 volt-amperes under an intensity of 7½ amperes, coupled directly with the direct current machine. The inductor of the alternator is fed by a little excitation dynamo which is built right into the alternator. The usual switchboard arrangement is shown in our illustration.

The normal speed of the group is 3,000 revolutions per minute, which gives to the alternator a frequency of 500 periods per second. The transformer employed is of the usual type and is placed in a vessel containing a special grade of oil. The sending condenser is located in a bath of petroleum. The rotary spark gap, which has ten points, is a very accurately built instrument which can be regulated from .04 mm. to 0. Regulation is made

(*Continued on page 278*)

New Honeycomb Inductance

Now that amateur wireless is fast getting back onto a pre-war basis, some very interesting new apparatus is being brought out. Of particular interest to the amateur is a new type of inductance coil developed by Mr. R. F. Gowan, of New York City. It has been well named the "Honeycomb Coil," as can be seen by the illustration.



The Latest Thing in Radio Coils—the "Honeycomb" Inductance. Maximum Inductance, Banked Winding, and Nil Distributed Capacity.

This new coil winding was designed to reduce *distributed capacity* to a minimum and at the same time to concentrate a winding with a large value of inductance, in as small a space as is practicable.

A great amount of research work was done on these coils to determine the most efficient size and spacing of the wire, capacity of the windings, etc. The distributed capacity has been reduced to a minimum and to as low a value as practicable.

By actual measurements it was determined that the high frequency resistance of these coils was only 20 to 28 per cent greater than the D. C. resistance against the usual 100 per cent of the average inductance coil. The coils are remarkably small compared to their inductance values. For instance, a coil one inch wide and about four inches in diameter has a wave length of over 15,000 meters when shunted by a capacity of less than .001 mfd.

Various mountings are furnished for these coils. When properly mounted as a coupler, they make an instrument which cannot be surpast in efficiency and selectivity. Dead end or open winding absorption losses are entirely done away with.

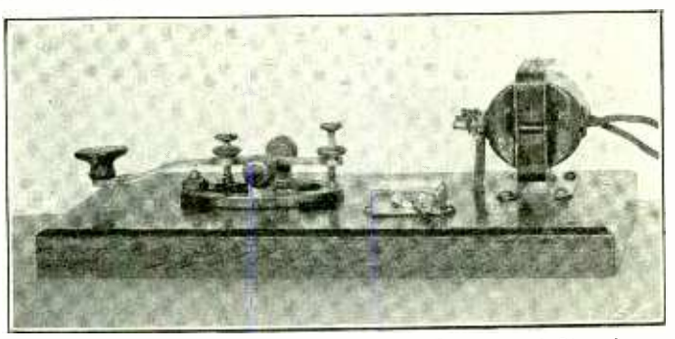
The three coil mounting is shown in the photograph. Here the three coils are used as primary, secondary and tickler. The writer had the pleasure of listening in on a set using this combination with a variable condenser of .001 mfd. maximum capacity in the primary and secondary circuits. The antenna used was a single wire with a natural period of 185 meters. All types of signals from the lowest wave spark set to the extremely long wave undamped stations were received. The sharpness of tuning and amount of regeneration possible on all wave lengths was remarkable. This form of coil is being adopted for many commercial radio outfits, owing to its great space economy.—*Photo Courtesy De Forest R. T. & T. Co.*

New Buzzer Set

An inexpensive outfit for buzzer practise may be easily constructed by any amateur from material obtainable from any electrical supply dealer.

The outfit illustrated is very neat and compact and consists of a bell-ringing transformer, a standard telegraph key and high-pitch buzzer, all wired and mounted on suitable base.

The use of a small transformer eliminates dry cell troubles and produces a note more nearly like that of the large stations. This form of buzzer code practise set, operated as it is from an alternating current step-down transformer, should commend it particularly to schools and colleges where the radio code is taught. For one thing, the tone of the signals given off by the buzzer is more even and regular, and thus resembles more accurately, actual commercial radio signals than is the case where batterics are employed. The operating cost is infinitesimal.—*Photo G. E. Co.*



New Code Practise Set Comprising Key, Buzzer and Step-down Alternating Current Transformer. No Batteries to Bother with and No Operating Expense.

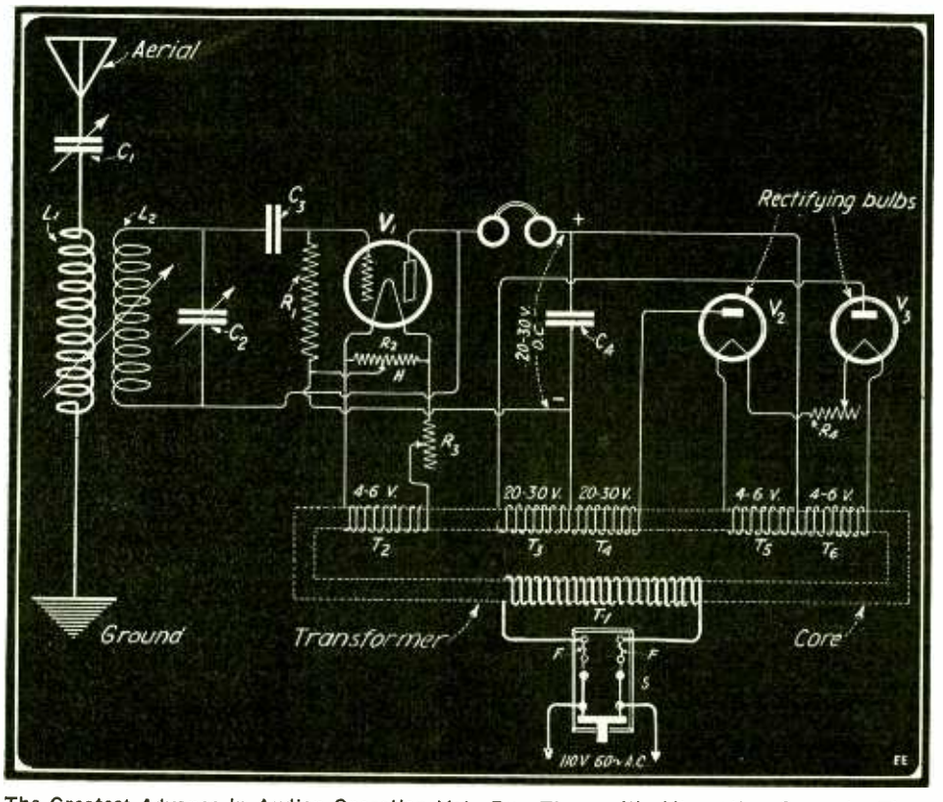
Operate Your Audions on A. C.

By ELLIOTT A. WHITE

FORMERLY INSTRUCTOR IN RADIO, AIR SERVICE SCHOOL FOR RADIO MECHANICS, CARNEGIE INSTITUTE OF TECHNOLOGY

I OPENED my Radio Receiving Station with a sensitive regenerative receiving set using vacuum tubes, but with **no storage battery for the filaments or dry cells for the plates,** running my tubes entirely on ordinary 60-cycle **Alternating Current** tapt off the electric light fixture. The accompanying figure shows how it is done.

Altho any regenerative hook-up will serve, the one I am using with good results for receiving both damped and undamped waves has the antenna circuit C1 L1, and the secondary circuit L2 C2. The secondary circuit is connected on one side to the plate, and on the other side to the detector grid, thru a stopping condenser C3 of .00015 microfarad capacity. This is a familiar hook-up thus far. The new wrinkle is in substituting A. C. (alternating current) for the storage battery to light the filament, and *rectified* A. C. for the high voltage dry cells to operate the plate circuit.



The Greatest Advance In Audion Operation Yet—Run Them with Alternating Current. The Accompanying Text Tells How to Build the Step-down A. C. Transformer which Supplies the Proper Potential Current for the Filament and Plate. Tungar Rectifier Bulbs or Even Old Audions Serve to Rectify the A. C. for the Plate Circuit.

A transformer is necessary to furnish the low voltage for lighting the filaments of the receiving tubes, detector V1 and amplifiers (not shown), and also the filaments of the rectifier tubes V2 V3; and to furnish high voltages for the plates. The windings of the complete transformer are as follows: the primary T1 connected to the 110 v. or 220 v. A. C. lighting circuit; a secondary T2 to step this down to 4—6 volts for the detector (and amplifier) filaments; a secondary T3 T4, to give 20—30 volts from each half (or 40—60 between end terminals) for the plate; and another secondary T5 T6, to give 2—4 volts or more from each half (or 4—8 or more between end terminals) for the filaments of the rectifiers, the voltage required depending on whether they are connected in series or in parallel, as either connection is satisfactory. It is seen that windings T3 T4 and T5 T6 have taps taken off the middle, and that T3 T4 must have a total voltage *twice* that necessary for the plate.

Altho the transformer may be purchased in the form of two toy or bell-ringing transformers for the filaments and one 110—55 volt transformer for the plate (with tap in middle of 55 volt winding), all the primaries being connected in parallel, it is easy and convenient to wind a single transformer to run the whole set, as the low voltages and small currents permit the use of small wire and few turns. In a closed-core transformer the windings may easily be computed from the familiar equation $E = 4.44\ \phi\ f\ N\ 10^{-8}$ or $N = \frac{E}{4.44\ \phi\ f\ 10^{-8}}$ where E is the voltage for that particular winding, ϕ the flux per sq.in. of core which may here be put at 60,000, f the frequency, here 60, N the number of turns required per sq.in. cross section of core, and 10^{-8} is 1/100,000,000, giving $N = \frac{.625 \times E}{A}$ where A is cross sectional area of core in sq. in. In other words, to find the number of turns needed in any winding, divide the voltage of the winding by the area of cross section of the core and then multiply by .625; that is, the number of turns needed for 60-cycle current and a flux density of 60,000 lines per sq.in. is six and a quarter times the required voltage divided by the area of the core. For example, if the core is say 1 in. by 3 in. (the one I used), the area is 3 sq.in. and the number of turns is therefore approximately twice the voltage, or *half a volt to a turn.* For the winding T1, which is connected to the supply, this gives 220 turns for a 110 volt supply (or 440 turns for 220 volts); for T2, 12 turns for 6 volts, and so on. In such a transformer, small and of low power and intermittent service, it is not necessary to be exact, so long as *the ratio between turns on primary and secondaries is always the same as the ratio of their required voltages.* Any core area can easily be substituted in the formula mentioned above—$N = \frac{.625 \times E}{A}$

The size of wire depends only on the current carried. As each filament draws a little over an ampere, any size which will carry this will do for T2, unless the winding supplies amplifiers as well, in which case they must be allowed for; V2 V3 will draw about 2 amperes if in parallel or about 0.5 ampere if in series. It is therefore convenient to use ordinary No. 18 bell wire for the windings T2 T5 T6, if no larger wire is on hand. Wire as small as No. 30 cotton or enamel covered is good enough for windings T3 T4, as the amount of current is negligible, tho No. 24 cotton or enameled wire or larger is better as it is not so likely to break. As the whole transformer will draw 3—5 amperes at 4—6 volts on the low side, depending on the number of amplifiers used on the set, we can allow 35 watts as the maximum power consumption (running over 3 hours for a cent), or say 0.5 ampere on the supply side, allowing for the magnetizing current. In spite of the small current, however, it is best to use wire as large as No. 18 or No. 14 for winding T1 as well as for T2 T5 T6. My transformer, for example, is wound as follows: T1, 220 turns No. 18; T2, 12 turns No. 18; T3, 45 turns No. 24; T4, 45 turns No. 24; T5, 8 turns No. 18; T6, 8 turns No. 18 (rectifier filaments in series). Of course these details depend on the materials on hand, such as core and wire. The taps and terminals can be brought out to ten binding posts on a small board or piece of fiber clamped to the core, and the whole put inside an iron transformer case or tin cracker box to avoid "cross talk" with the set, as will be mentioned later.

The detector V1 is an ordinary 3-electrode audion receiver tube, but preferably of the new *high vacuum* type manufactured during the war, which requires no close adjustment of filament current or plate voltage but operates on 1—1.1 amperes for the filament and, for the plate, approximately 20—25 volts as *detector,* and approximately 40—45 volts as *amplifier.* If the high vacuum type is used, a grid leak R1 is required, of about 1 megohm (1,000,000 ohms) when oscillating or 2 megohms when not, if the grid circuit insulation is good. The leak may be a pencil line drawn on card or fiber and may vary considerably in resistance.

For the rectifiers V2 V3 ordinary receiving tubes may be used, again preferably *high vacuum,* with grids connected to plates; or, if obtainable, two-electrode tubes may be used, such as the Kenotron or Tungar *rectifier tubes* now available on the market. There is no reason why the experimenter may not construct them by inserting a disk in a tungsten filament light bulb and re-exhaust with a vacuum pump.

Besides the transformer and rectifier

(*Continued on page* 266)

The Design, Pumping and Testing of Audion Tubes

By C. MURRAY

THE purpose of this article is to bring out some of the salient points which might be of interest to the amateur radio experimenter on the design, pumping and testing of the vacuum tube detector and amplifier, or so-called *Audion*. All of these tests I have conducted in my laboratory and I have plotted curves to show the exact relations one element has to another.

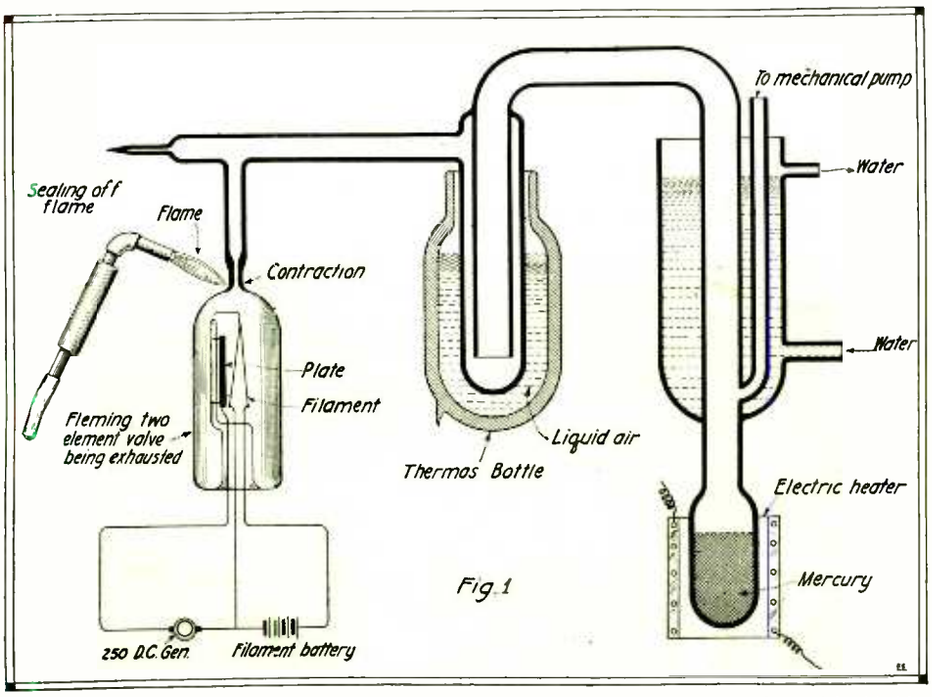
The *Fleming valve* is the true rectifying detector, but Dr. de Forest, by inserting the *third element* in a vacuum tube, created a genuine relay, or energy control detector, which gives it a great many advantages over the two-electrode Fleming valve. The three-element Audion can be used as an oscillator, amplifier, and a detector of both damped and undamped waves; also it can be used as an undamped wave generator for use in either radio-telegraph or telephone transmission, whereas a two-element tube can only be used as a detector of damped waves or the ordinary spark signals.

The characteristics of a given three-element tube depend almost entirely on the grid, its surface area and its distance from the plate and filament.

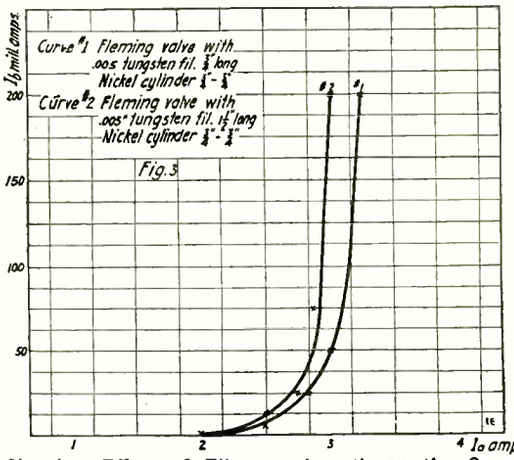
The dimensions of the three elements vary according to the uses of the tube, altho all designs are interchangeable to a certain extent and will work with a fair degree of efficiency in any rôle.

There are several abbreviations that are used in the testing of vacuum tube detectors and amplifiers, and I have used some of them in plotting the present curves:—

Ea = voltage across the filament.
Ia = current consumed by the filament.



Apparatus Used to Produce Super-Exhaustion in Audion Bulbs by Means of the Liquid Air Trap. This High Degree Vacuum Pump Is Backed Up by a Regular Mechanical Pump as the Diagram Shows. This Is the Regular System Used Commercially During the War in Turning Out Thousands of Audions Daily.



Showing Effect of Filament Length on the Space Current Passing Between the Plate and Filament. The Longer Filament Can Be Run at a Lower Temperature to Give the Same Results with a Longer Life.

with various chemical compounds, such as calcium oxid, barium, strontium nitrat, sulfur and lime. Many other mixtures have been experimented with, yielding good results.

The coated filament gives the best results and has one advantage over tungsten; it consumes less filament current to produce the same results, as can be seen by referring to the curves plotted for two Fleming valves, Fig. 2. Both filaments are the same length and Eb is kept at 200 volts during the test.

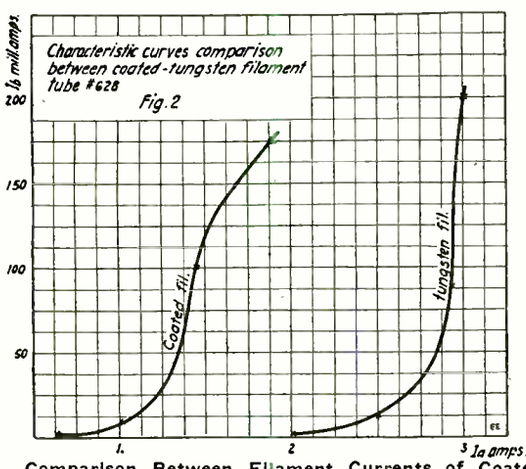
Tungsten emits very few electrons at a low temperature. The value Ib increases very rapidly as the filament temperature is raised.

The length of the filament also has some effect on Ib, as can be seen in Fig. 3. One tube has a tungsten filament ¾ inch long and the other 1½ inches long. It is seen that the longer filament can be run at a lower temperature and it will give the same results, besides giving it a longer life.

The proper length of filament to be used is determined by the voltage of the filament battery; also we must take under consideration the size of the plate, the amount of plate current to be past and its voltage.

By using too small a plate or too short a filament we will be limited in the amount of plate current we can pass, as by referring to Fig. 6 we will find a point of saturation; that is, if we raise the filament temperature still higher the valve Ib will remain at a certain point. Likewise it is true of the plate; suppose we design a tube to work at 150 volts Eb and a space current of 30 milliamperes; we can raise the Eb even to 200 and the Ib will remain the same.

(*Continued on page 264*)

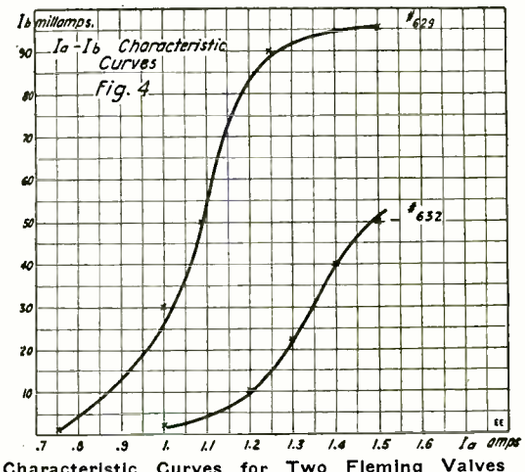


Comparison Between Filament Currents of Coated and Plain Tungsten Filaments for Audions, Showing the Smaller Current Taken by the Treated Filament.

Eb = voltage imprest on the plate.
Ib = current passing between plate and filament.
Ec = voltage imprest on the grid.
Ic = current passing from the grid to the plate.
Io = current in the oscillating circuit.

The filament plays a very important rôle in vacuum tube work. It must be of such material that when heated to incandescence it will give off electrons, which form a conducting path; or, in other words, a current of electricity will pass thru the space (in one direction only) from the hot to the cold electrode.

The filaments used most extensively to-day are tungsten wire and platinum ribbon coated



Characteristic Curves for Two Fleming Valves with Different Size Cylinders. During the Tests Eb Was Kept at 200 Volts and Ia Was Varied Until a Saturation Point Was Reached.

How Don Flashed the "S. O. S."

By MABEL M. DAVIS

DONALD JOHNSON'S mother says she feels sure the careless nursemaid they had when "Don" was a baby must have mixed an *electro-lytic solution* with the milk he was fed. She cannot believe that otherwise any boy could be so permeated with electricity. He could not have caught it from his family as he was an only child, and his mother could not tell a fuse-plug from a dry battery, and his father's abilities in electrical matters were all confined to paying the electric light bill on time each month.

It was different with Don's chum Will Merton. He was the youngest of a large family, all of whom were wound up and went by electricity, and that was their sole motive power.

The story of all the weird and wonderful inventions and imitations of inventions that were produced by these two boys in Don's "Lab." would fill a book. One worth while and early accomplishment was the mastery by both boys of the International Morse code and they often flashed or tapt out signals to each other from various points in the neighborhood.

One evening near dusk "Don" was hurrying home from their favorite resort, the dumping grounds of the Ajax Electrical Company's factory. He heard a faint mewing that seemed to come from overhead and looking up he finally located a cat at the very top of a nearby electric light pole. The nine-lived feline was crying pitifully and Don's sympathies were touched. Being a senior in high school, Donald was rather ashamed of showing any fondness for cats. But he glanced this way and that and not a soul was in sight. So he made a jump and a scramble, hoping to shinny up to the first spikes on the pole. He did not make it and realized for the first time how heavily he was loaded. In the pockets of his mackinaw he only had a piece of zinc rod, a large magnet for a telephone magneto, some brass rod, copper tubing, a pocketful of assorted screws, bolts, nuts, washers, another pocketful of lengths of iron core wire, and nearly a pound of miscellaneous binding posts. So he cast his treasures from him—coat and all and went to the rescue.

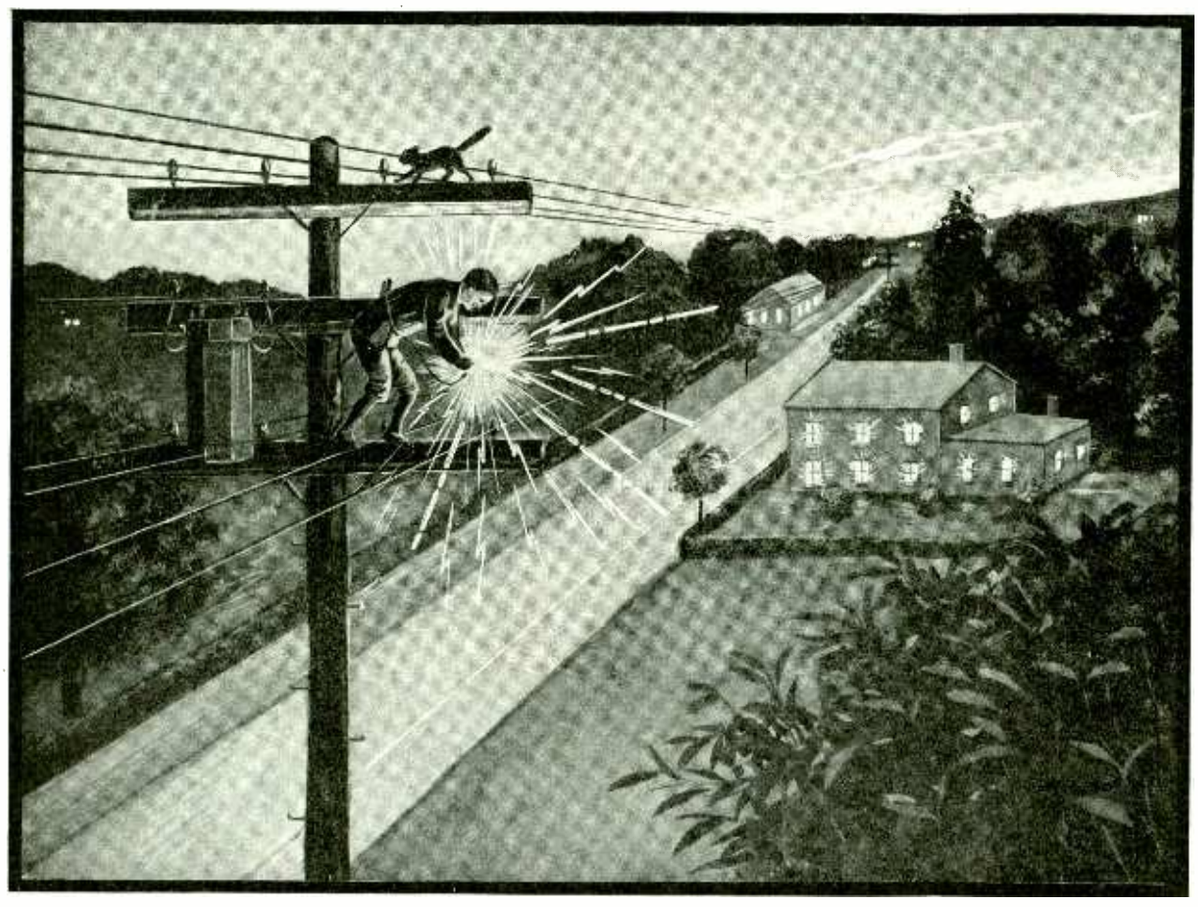
After a hard scramble he gained the spikes and climbed quickly up. Standing on the lowest cross-arm he tried to persuade "Pussy" to come down within reach, but she was suspicious of the proffered help and remained fast at her post. He gained the next arm and his persuasiveness brought her down a little way. He reached for her but she backed out to the end of the arm, over his head. Donald followed along to the end of his cross-arm when horrors, his foot slipt and he started to fall. Donald never could tell just how it all happened, but he suddenly found himself with his two feet on the cross-arm below and the peg of the arm above hooked thru the belt of his Norfolk coat. In falling his foot had struck the glass, broken it, released the wire, and, as his body slid by the peg it had hooked him. Luckily, his belt had held until his feet found the arm below and relieved the strain a little. He was in a very awkward and uncomfortable position. He tried cautiously to squirm about and get the belt off the hook, tho he was very much afraid that if he succeeded he might not be able to hold on to the cross-arm without the support of the stout peg under his belt.

Fortunately his belt was securely buckled in front, not buttoned. He twisted and tried to turn, finally fingering his belt to see if he could unbuckle it in case he got up his courage to try it. But that question was not to be put up to him to decide as the buckle had slipt around to the back and with all his squirmings he could not get it within reach of his fingers.

He rested with one arm over the cross-arm, his feet very insecurely placed on the cross-arm below, and the pole too far away to reach. He tried a few yells for help but they cracked in delivery, so he gave that up.

He had come across lots from the factory and struck into his own street near the end of it, where there were no houses for a long distance and rarely a passerby.

Another factory recently built on a side street had caused the electric lighting company to put up a transformer for that neighborhood. "Don" and "Will" had watched and assisted at the installation of that transformer. The cat had chosen to ascend the very pole that held the transformer. As it began to get dark "Don" noticed the humming of the transformer increasing. He could see Will Merton's house away down the street. Their lights appeared and "Don" could imagine the family all gathered about the supper-table.



The Cat Had Chosen to Ascend the Very Pole that Held the Transformer. As it began to Get Dark "Don" Noticed the Humming of the Transformer and He Could See Will Merton's House Lighted Up Down the Street. Try as He Might, He Could Not Extricate Himself from the Cross-Arm. Suddenly a Bright Idea Flashed Across His Mind—Why Not Cut the "Secondary" Low Voltage Wire and by Interrupting the Light Current, Signal His Dilemma by Dots and Dashes, to His Friend Will Merton.

The transformer was humming louder now. An idea suddenly came to Donald. After a terrific squirm he succeeded in getting the fingers of his free hand on the chain of his wire-cutters which, out of school hours, he always carried attached to his person. With the wire-cutters clasped firmly in his right hand he reached for the secondary lead of the transformer which hung in a loop over his head. He knew that it was safe enough to tackle that wire without gloves, as it carried only 110 volts. It was hard work and took a long time, but the trusty wire-cutters did the trick. There was a blinding flash and the loop was cut. Donald could see that the Merton's house and others nearby were dark. He grasped one wire in his right hand, then by touching this to the other, which hung loose, he caused a short flash of light in all the houses, then followed this by two long flashes, which was his chum's private wireless call. He repeated this carefully, then

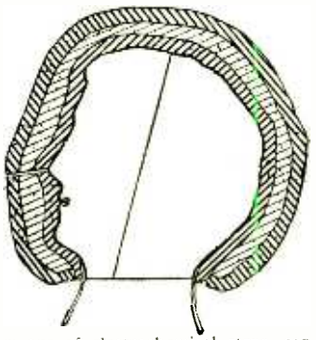
(*Continued on page 275*)

LATEST PATENTS

Process of Galvanoplasty.

(No. 1,296,453, issued to Blasius Bart.)

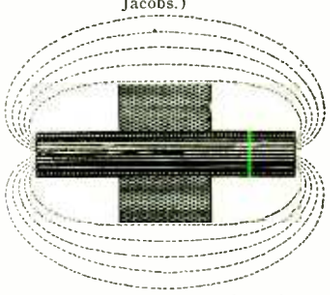
By means of this new development it is possible to obtain by



means of electrochemical steps, copies in all sizes, reproducing every feature and detail of the model. The copies can be made entirely in one piece having uniform thickness. A matrix is placed upon the model and so fixt that it will reproduce each detail. This matrix is composed entirely of a metallic substance of high electrical conductivity to receive the electrolytical deposits. A means is also provided whereby a non-conductive covering can be applied on the matrix where no electrical deposits are required. One wire is then connected with the matrix and the other to a sprayer or atomizer, whereby a metallic composition is used to cover the surface of the metal.

Spark Coil.

(No. 1,296,963, issued to George A. Jacobs.)

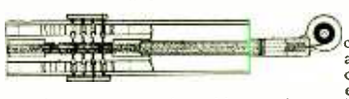


Most spark coils are dependent on the air for return magnetic circuit between both ends of the core. To overcome this difficulty of the high magnetic resistance of the air, the inventor employs soft iron wires for the secondary winding, thereby helping to partially close the external magnetic air circuit. It consists essentially of the usual core over which insulation is placed and then a primary coil of heavy copper wire; on the insulating tube over the primary is a winding of fine insulated iron wire, forming the secondary.

Apparatus for Sherardizing.

(No. 1,291,866, issued to Herbert Champion Harrison.)

This invention consists of a new and simple method of sherardizing articles which are of narrow width and great length, such as wire or ribbon material or small cross-section bars, etc. It consists essentially of an elongated chamber containing the sherardizing powder. A second

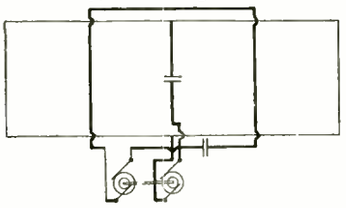


chamber also contains this powder. The third chamber contains an air seal and substantially cold sherardizing powder adapted to gradually reduce the temperature of the article after the sherardizing re-action. The second chamber containing the sherardizing powder also has a hopper above it, so that the sherardizing powder can float freely into the chamber. A movable system of taking up the long ribbon or wire for carrying it thru the various chambers is provided and an electric pyrometer is used.

Aërial for Radio Signaling.

(No. 1,296,177, issued to Charles Franklin.)

Makes use of two equal rectangular or frame aërial circuits erected in the same vertical plane so that they have one vertical edge common to both (or parallel). The two circuits will have no mutual inductance or coupling effect on one another if they are properly proportioned; that is to say, alternating currents ex-

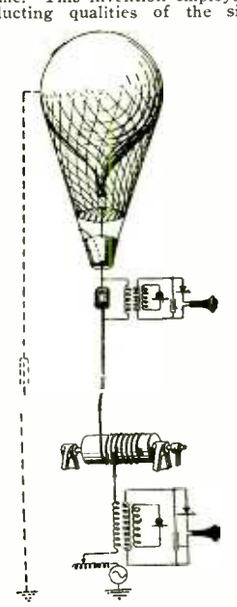


isting in one will not affect alternating currents existing in the other. Under these conditions each circuit tends to produce its own radiation independently of the other circuit. The radiation will then have a maximum value in one direction only, gradually diminishing in value to zero at 90 degrees on either side of this maximum direction, and being practically zero thruout the other 180 degrees.

Signaling from Balloons.

(No. 1,296,687, issued to Harold W. Nichols.)

A unique method for signaling to and from captive balloons over the single steel cable by which the balloon is anchored to earth. No additional wires are necessary in this scheme. This invention employs the conducting qualities of the single



cable connecting the balloon to earth as one side of the circuit, and the circuit is completed by virtue of the electrostatic capacity between the balloon and the ground. To enhance this effect, the balloon may be covered with tin-foil for a portion of its area, or the rubber covering otherwise metallized.

Submarine Destroyer.

(No. 1,296,646, issued to George H. Georgelis.)

The craft illustrated has an exterior hull so that it is continuous and adapted to rotate about the car or body of the craft and which

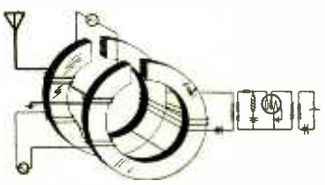


is driven for propelling the craft thru the water at a high rate of speed due to exterior spiral fins mounted on the hull. A sharp steel prow or ramming point is provided at the forward end of the submarine destroyer, as well as periscopes for locating enemy craft, subsea and wireless telegraph apparatus, anti-submarine guns, etc. The hull may rotate about the shaft and periscope plug without disturbing the position of the periscope. The hull is mounted upon a plurality of rollers which constitute bearings between the hull and the shaft. A suitable motor or engine is employed for propelling the craft.

Modulating System.

(No. 1,287,982, issued to Ralph V. L. Hartley.)

The quality of the speech transmitted by ordinary magnetic modulators is relatively poor, as the modulated high frequency wave form is distorted by the hysteresis of the magnetic core used in the modulator. In the present modulator this hysteresis of the magnetic core is reduced by subjecting the core to a relatively weak but rapidly alternating "cross-magnetization," which

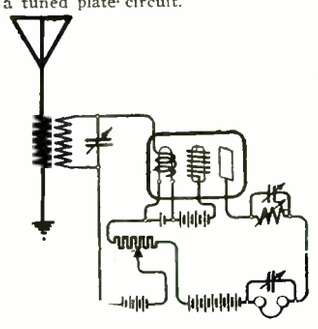


keeps the molecules of the iron in a constant state of agitation, rendering them more susceptible to changes in the longitudinal magnetization produced by the modulating speech currents.

Radio Receiving System.

(No. 1,291,527, issued to Albert W. Hull.)

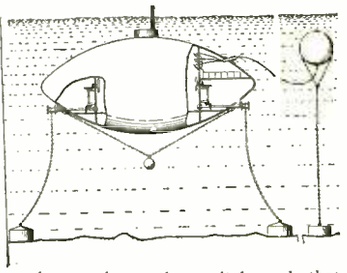
A vacuum tube device intended for amplifying variable currents, particularly received radio signals. This patent covers an improved circuit arrangement in which a four-electrode audion may be utilized for receiving radio signals, whereby the sensitiveness and selectivity of the receiving circuit may be greatly increased. By this arrangement undamped wave signals may be received by means of the "heterodyne" or beat method. A special telephone circuit is utilized in connection with an inductance and capacity, giving a tuned plate circuit.



Submersible Mine Controller.

(No. 1,296,816, issued to Jan A. and Albert Krecioch.)

The submersible feature of the outfit permits the unit to submerge and thus protect itself should the occasion demand it. The operating devices include a switchboard, to which are connected the various circuits connecting with the mines lying in different numbered sections of the adjacent water. When an enemy ship lies within the numbered square corresponding to the mine of that number, then the officer in

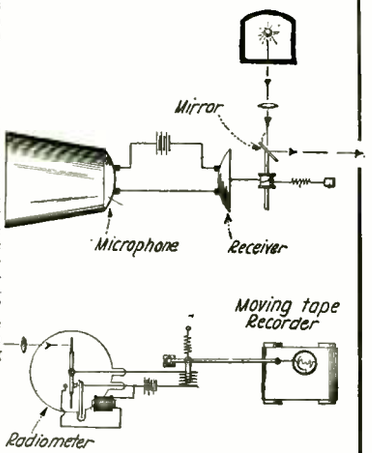


charge closes the switch and that mine or any group of mines instantaneously explodes. Observation may be carried on by a periscope.

Apparatus for Recording Sounds.

(No. 1,294,861, issued to Lindon W. Bates.)

This idea mainly consists of a means of using the oscillations produced in the receiver by the sound waves to produce oscillations of light waves, which in turn will break an electric circuit. The time of breaking of the circuit is recorded by a standard recorder and also its duration. These several operations are practically instantaneous. The time of breaking may be taken as the time for the receipt of the sound in the detector. A horn or microphone is used for collecting the sound waves and directing them to a microphone attached to the diafram of the receiver, on which a thread of silk passes around a drum, after which it is attached to a very delicate spring. With this arrange-



ment vibrations imparted to the diafram and microphone will cause the compression of the granules of carbon, the microphone thereby setting up a current in the receiver. This in turn pulls the fine silk thread on the drum, and to the spindle of the drum is attached a mirror with a light shining on it. This pulling back and forth of the drum causes the changes in the light waves which are taken up by a radiometer, and by means of relays the current so set up actuates the drum stylus and records the sound waves.



THE ORACLE

The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be publisht. Rules under which questions will be answered:

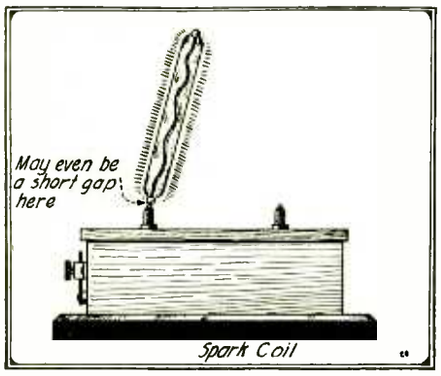
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., **must** be on separate sheets. Questions addrest to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of **25 cents** is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

TESLA COIL AND GEISSLER TUBE HOOK-UPS.

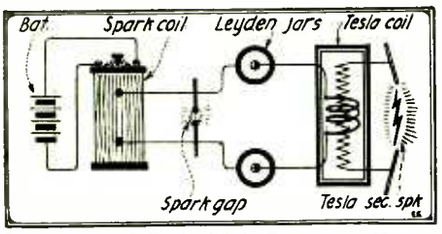
(1012) A. Terkel, Reedley, Cal., asks:

Q. 1. For a diagram of connections for Tesla coil, Geissler tubes, etc.

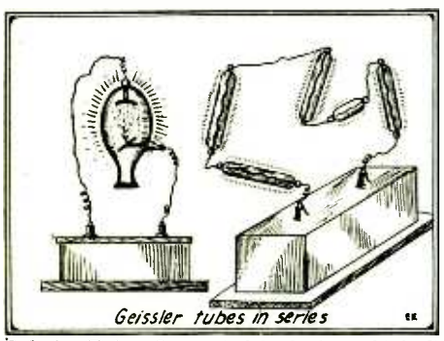
A. 1. We are pleased to give you herewith the diagram of connections for two inch spark coil. Tesla coil, Leyden jars, Geissler tubes, etc.



Lighting Geissler Tube from One Terminal of Spark Coil.



Connection of Tesla High Frequency Transformer, Leyden Jars, Spark Coil and Gap.



Geissler Tubes Connected in Series. At Left —A Fancy Vertical Pedestal Tube.

CHANGING SPEED AND VOLTAGE OF DYNAMO.

(1013) M—, Telephone System, Michigan, writes:

Q. 1. We have a 240-volt, 12.5-ampere, 4-pole, 1,250 R.P.M. dynamo. The four high resistance windings were in series with each other and the complete resistance connected to each feed; also the fields have another low resistance winding which carries all of the current going to the main line. In other words, it is *compound wound.*

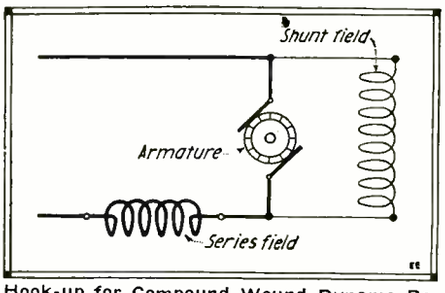
We have altered it by connecting the four high resistance field windings in multiple with each other and the armature, but have left the low resistance winding of the compound field unaltered.

We are using it at 40 volts, at which we seem to require to run it at 450 R.P.M.

Kindly state what the amperage, voltage and speed in R.P.M. should be when used thus, and if the dynamo is as efficient when so used.

A. 1. Considering that the dynamo when operated at 1,250 R.P.M. produces 240 volts, and that it has four field poles fitted with four shunt field coils, then, as is the case with practically all classes of dynamos, the voltage will vary directly with the speed, and if a dynamo is to be operated to produce 40 volts, then the speed should be approximately 1/6 of 1,250 R.P.M., or 208 R.P.M. For this voltage the four field coils should be connected in parallel, which would adapt them to operation at the reduced voltage, but the speed of the machine might have to be run up to between 300 and 400 R.P.M., owing to the fact that you could not obtain a sufficiently low resistance in your shunt field for 40-volt operation by connecting the four coils on parallel.

Originally, each of the four shunt field coils took 60 volts, and thus under ordinary conditions when you connect the four shunt field coils on parallel, you adapt them to operation on that potential, viz.: 60 volts, and not 40 volts. As these field coils will require, in accordance with Ohm's law, more than 40 volts, to force the necessary current thru them in order to produce the same number of ampere-turns and magnetic flux per pole, as becomes evident, it will be seen that the dynamo will have to be operated at a greater speed than 1/6 of the original value.



Hook-up for Compound Wound Dynamo Referred to in Rewinding Query No. 1013.

With regard to the amperage of the machine, this would be less than that in the original output, as there would be higher ohmic losses in the armature and field due to the reduced voltage, in proportion to those present when the machine was originally operated at the higher potential, or 240 volts. Roughly, the amperage would be probably about one-half of the original value.

The "August" Electrical Experimenter

"Bombs—How to Handle Them"—by Owen Eagan, Bomb Expert, Department of Combustibles, New York City Fire Department. A complete authoritative article with remarkable photographs by America's greatest expert on bombs and explosives, which tells you what to do should you receive a bomb by mail.

"A New Hydrostatic Wheel-less Railway"—by H. Gernsback. A Railway which has seen actual service. Without wheels it runs on a "film of water."

"Insanity from the Teeth?—What the X-Ray Shows"—by Dr. Henry A. Cotton.

"Electrical Refrigeration"—by Grace T. Hadley.

"Hot-Air and Other Engines"—by John J. Furia.

"Sir William Crookes' Researches on Psychical Phenomena" by Herewood Carrington, Ph.D.

"My Inventions" Part 6—by Dr. Nikola Tesla himself.

"Changing Nature's Face"—How Dynamite, plus Electricity, is used for clearing stump and rock-strewn property, blasting irrigating ditches, and changing the course of rivers.

"Experiments in Physics"—A new series. No. 1, perpetual motion, and popular fallacies concerning it exploded. By John J. Furia, Department of Physics, New York University.

"Loop Antennae"—An article of interest to all "Wireless Bugs." By Prof. Lloyd M. Knoll.

"Invention of the Crystal Detector"—by Greenleaf Whittier Pickard.

TESLA AND OUDIN COIL DATA.

(1014) E. W. Thatcher, Oberlin, Ohio, wants data:

Q. 1. For building Tesla and Oŭdin coils.

A. 1. We refer you to copy of this magazine wherein you will find the complete construction of a Tesla high frequency coil, also the Oŭdin coil. The article in question appeared in the May, 1917, issue of the ELECTRICAL EXPERIMENTER.

(*Continued on page* 242)

To Practical Men and Electrical Students

THE BURGESS BLUE BOOK is a pocket size note-book which was compiled especially for practical men, and those who are taking up the study of electricity. It contains drawings and diagrams of electrical machinery and connections, over two hundred formulas for calculations, and problems worked out showing how the formulas are used. This data is taken from my personal note-book, which was made while on different kinds of work, and it will be found of value to anyone engaged in the electrical business.

The drawings of connections for electrical apparatus include Motor Starters and Starting Boxes, Overload and Underload Release Boxes, Reversible Types, Elevator Controllers, Tank Controllers, Starters for Printing Press Motors, Automatic Controllers, Variable Field Type, Controllers for Mine Locomotives, Street Car Controllers, Connections for reversing Switches, Motor and Dynamo Rules and Rules for Speed Regulation. Also, Connections for Induction Motors and Starters, Delta and Star Connections and Connections for Auto Transformers, and Transformers for Lighting and Power Purposes. The drawings also show all kinds of lighting circuits, including special controls where Three and Four Way Switches are used.

The work on Calculations consists of Simple Electrical Mathematics, Electrical Units, Electrical Connections, Calculating Unknown Resistances, Calculation of Current in Branches of Parallel Circuits, How to Figure Weight of Wire, Wire Gauge Rules, Ohm's Law, Watt's Law, Information regarding Wire used for Electrical Purposes, Wire Calculations, Wiring Calculations, Illumination Calculations, Shunt Instruments and How to Calculate Resistance of Shunts, Power Calculations, Efficiency Calculations, Measuring Unknown Resistances, Dynamo and Dynamo Troubles, Motors and Motor Troubles, and Calculating Size of Pulleys.

Also Alternating Current Calculations in finding Impedance, Reactance, Inductance, Frequency, Alternations, Speed of Alternators and Motors, Number of Poles in Alternators or Motors, Conductance, Susceptance, Admittance, Angle of Lag and Power Factor, and formulas for use with Line Transformers.

The "Burgess Blue Book" is published and sold by the Burgess Engineering Company for one dollar ($1.00) per copy, postpaid. If you wish one of the books, send me your order with a dollar bill, check or money order. I know the value of the book and can guarantee its satisfaction to you by returning your money, if you decide not to keep it after having had it for five days.

THIS BOOK IS RECOMMENDED BY PRACTICAL MEN.

It is surprising how much information, drawings, etc., can be concentrated into a pocket size book. These books should sell fast as when practical men who have any ambition to go ahead, wants one as soon as he sees it. I wish you every success, and will do my best to interest my brother workers in this work.
Yours truly,
J. J. Hanhauser, L. U. No. 98, I. B. E. W.

Received your BLUE BOOK, showed it to a friend, presto, I have no BLUE BOOK now. Enclosed find check for which please send me three more copies.
Yours very truly, E. F. Leisy, Tacoma, Washington.

The concise form of the BURGESS BLUE BOOK should appeal to the men on the job. It is 100 per cent information. J. L. Sleeper, Santa Ana, California.

Received your "BLUE BOOK" and must say it is the best book I ever saw. I showed it to a friend of mine and he refused to give it back to me, but he paid me a dollar and told me to get another. Rather than be without this book I am sending Money Order for three of them so I can show them to two more of my friends and have one left for myself. Wishing you would mail them at once, I am Joseph Braith, Electrician, Madison, Wisconsin.

Your "BLUE BOOK" received and it is just the book I have been looking for. Please mail me three more by return mail for which I am enclosing Money Order.
Respectfully,
V. E. Johnson, Western Union Tel. Co., Marion, Ohio.

Have received the copy of the "BURGESS BLUE BOOK" and am very well pleased with the easily found formulas and data contained in it. I am enclosing Money Order for four additional copies.
Yours very truly, Thure C. Anderson, Ridgeway, Pa.

BURGESS ENGINEERING CO.
Yorke Burgess, *Consulting Engineer*
750 East 42nd Street Chicago, Illinois



ELECTRICITY

Taught By A Practical Man

And In Your Own Home

Put Part of Your Spare Time To A Good Purpose

A HOME STUDY COURSE FOR AMBITIOUS MEN

My Home Study course is actually an extension of a consulting engineering experience, which gives my students an opportunity of becoming familiar with electricity as applied to everyday work, and to understand how to manufacture, maintain, test, locate troubles and repair electrical apparatus and machinery.

MY PURPOSE

This course was designed and written by me with a view of reaching those who do not have a lot of time and money to devote to an electrical education. Some of my students are beginners, some have had a little experience, some have been in the game for years, but all are ambitious and trying to get ahead and realize that the SERVICE I am able to give is valuable and of such a nature that they have been unable to obtain it in any other way.

NOT A CUT AND DRIED BOOK PLAN

In addition to my practical and consulting experience, which covers a period of seventeen years, I have designed instruction courses for various educational institutions which has given me an unusual opportunity to study the teaching business from the standpoint of a practical man. I certainly would be a chump if I did not understand the situation and realize what was needed, after the opportunities I have had through which to learn what men need in order to make good in the electrical industry. For years. I made notes of small jobs, large jobs, and big installations, including maintaining, troubles, testing and repairing, and laying particular stress on the unusual things. This information is included in my regular lessons and anyone engaged in electrical work knows it is the kind of information he needs and wants.

BEGINNERS AND EXPERIENCED MEN

My course of study and SERVICE suit both beginners and experienced men, but they must have backbone and work with me as I work with them. This I insist on, as my SERVICE is my bread and butter and I will not waste it on one who will not be a credit to me. Anyone with an ordinary education and a good knowledge of the English language can successfully complete this work and make good in the electrical field, if he attends to business and follows my instructions. I do not tell you that I will fit you to qualify as an Electrical Engineer in a couple of months, because it cannot be done. Neither do I say you can earn fifty or one hundred dollars a week when you complete this work with me, as I, or any other man cannot correctly estimate the earning capacity of a student. How much you may earn depends on you as much as it does on me and my service. Many men I have taught are earning very large salaries and there are men who have doubled their earning capacity in a very short while, through my help, but how good *you* become, IS UP TO YOU. If you are in earnest, look into this proposition and send for my catalog, which tells the whole story in a plain, simple way, and in a way you cannot misunderstand and expect something you will not get.

RESULTS OF MY SERVICE

Practical Men Recommend My Course to Others.
My Students Are Invariably Promoted and Get Better Salaries.
Over 65 Percent of My Students are Engaged in the Electrical Business.
Over 11 Percent of My Present Enrollment was Obtained Through Satisfied Students.
Beginners are Able to Get Employment in Electrical Work After Taking My Course a Short While.

FIFTY-FIFTY

I work absolutely on a fifty-fifty basis with my students. You pay me the comparatively low price I ask and I give you the instruction and other help as detailed in my catalog. No student is permitted to pay for his course in full on starting, the payments being made in monthly installments. Students have the privilege of discontinuing the work if they find it is not just what they wish, and their payments stop at the same time. This is my way of doing business and a part of my fifty-fifty plan, as I do not want money from men whom I am not helping.

APPARATUS, INSTRUMENTS, MATERIAL, ETC.

Certain electrical apparatus, instruments, charts, drafting materials, etc., as described in the catalog, are included as a part of the course for which there is no extra charge as it is covered by the regular monthly payments.

Fill Out Coupon or

Write me and I shall promptly send you one of my catalogs which contains full information regarding my course and the service I offer.

Burgess Electrical School
745 East 42nd Street
Chicago, Illinois

YORKE BURGESS,
BURGESS ELECTRICAL SCHOOL,
745 East 42nd Street, Chicago, Illinois.

Gentlemen:—
Send me catalog describing your course in Electricity and Drafting.

NAME .....

ADDRESS .....

CITY .....

STATE .....



Health-Beauty-Power

Treat Yourself in Nature's Way

The Therapeutic White Rays of the Sterling Lamp are a scientific adaptation of the marvelous healing properties of the sun's rays. The warm, soothing, soft, white rays penetrate and vitalize every cell and tissue; new cell growth is stimulated; the body is refreshed and vitalized.

It brings you a clear, unblemished skin, rose-tinted cheeks, bright eyes; quickens the sluggish blood, rebuilds firm new muscle, and clear, new skin.

STERLING THERAPEUTIC LAMP

"The Light That Heals"

Relieves pain without destroying vitality. Absolutely safe; no vibration, shock or pain. Does away with use of harmful drugs. Relief from pain results the moment you snap the electric switch. Rheumatism, neuralgia, sore throat, earache, goitre, headache, nervous conditions, and innumerable other ailments, are instantly eased and relieved. Invaluable in the treatment of skin diseases. Physicians endorse and recommend Therapeutic Light to you.

Send Coupon for Free Book

Nothing vague or mystic in the Sterling Lamp. Our free book tells of its uses and many benefits—deals with the simple, fundamental laws of health and beauty. Tells you how to treat yourself at a few cents in cost, relieving you of pains and ailments and awakening your energy; how others in hospitals, sanitariums and thousands of private homes have benefited. Don't suffer headaches and other pains needlessly—let Nature and Science help you to health, beauty and greater vitality.



STERLING THERAPEUTIC LAMP CO.
Dept. 13, 546 Garfield Ave.
Chicago, Ill.

Use This Coupon

STERLING THERAPEUTIC LAMP CO.,
Dept. 13, 546 Garfield Ave., Chicago, Illinois.

Please send me, without cost or obligation, your fully illustrated booklet describing the Sterling Therapeutic Lamp, its uses and benefits.

Name .....

Street & No. .....

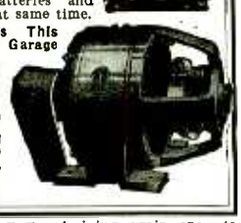
City ..... State .....

Brilliant Lights and BIG PROFITS in BATTERY CHARGING with this HB LIGHTING and CHARGING SET



This sturdy, dependable outfit makes electric lights at lowest cost, and besides brings the BIG PROFITS that battery charging pays. Operates from your line shaft or engine. Trouble proof, economical, no wear-out. Charges auto batteries and furnishes electric light at same time.

Small Payment Puts This Money-Maker In Your Garage



Balance on easy terms. Pays for itself as it runs. Absolute Money-Back Guarantee. Write TODAY for information and prices. Let our Service Department recommend size to use in your garage. Pin ad to your letterhead and mail now for full information

HOBART BROTHERS CO.
Box E73, Troy, Ohio.
Successful Mfrs. since 1893.

ELECTRICAL training again open to civilians. Over 3000 men trained for electrical industries in experience of more than a quarter of a century. For men of ambition and limited time. Condensed course in Electrical

ENGINEERING enables graduates to secure good positions and promotions. Theoretical and Practical Electricity, Mathematics, Steam and Gas Engines, Mechanical Drawing. Students construct dynamos, install wiring and test **IN ONE YEAR** electrical machinery. Course with diploma, complete.



Thoroughly equipped fireproof dormitories, dining hall, laboratories, shops. Write for catalog. 27th year opens October 1, 1919.

BLISS ELECTRICAL SCHOOL
260 Takoma Avenue, Washington, D. C.

The Oracle

(*Continued from page* 240)

HOW AND WHY OF RADIO APPARATUS SERIES.

(1015) Salvador C. Bayani, Manila, Philippines, writes this Department:

Q. 1. For a list of the "How and Why of Radio Apparatus," and in which issues the various installments appeared.

A. 1. Below we give a list of these:

No. 1. *The Induction Coil, Page* 493, *November,* 1916.

No. 2. *The Transformer, Page* 656, *January,* 1917.

No. 3. *Condensers, Page* 735, *February,* 1917.

No. 4. *Spark Gaps, Page* 113, *June,* 1917.

No. 5. *Radio Transmitting Inductances, Page* 537, *December,* 1917.

No. 6. *Radio Receiving Tuners, Page* 685, *February,* 1918.

No. 7. *Radio Receiving Condensers, Page* 766, *March,* 1918.

No. 8. *Detectors, Page* 30, *May,* 1918.

No. 9. *Telephone Receivers, Page* 176, *July,* 1918.

Radio men everywhere will undoubtedly like to obtain the complete set of these specially prepared papers on the "How and Why of Radio Apparatus." Also the following three important and timely papers on the "Calculation and Measurement of Inductance," by Secor and Cohen.

Nos. 1, 2 *and* 3 *"Calculation and Measurement of Inductance," appearing in the March, April and September,* 1917, *issues.*

Those interested in these valuable papers can obtain prices of individual back numbers containing them by writing to the "Circulation Department."

SCIENCE IN SLANG.

(*Continued from page* 239)

"But your explanation of the etheric disturbance against the wall seems to me that the etheric vibrations disturbing the ether in the place where it came in contact with an object would send pulses into the air that would be equivalent to reflection or refraction. You know what I mean, don't you? I can't explain it exactly."

"Yes," replied Jazz, "I believe I do. If the stream of cathodic rays were regular that condition would be possible, but for the fact that they are not regular I don't see but why they would not myself. Then, too, the etheric vibrations would not effect like the cathodic discharges.

"However, there is a condition that was explained by J. J. and a bird with my name, but no relation of mine, of Cambridge, and Prof. Lehmann, of Karlsruhe, and seems not such bad dope. They all bounced up with the conclusion that bodies that absorb x-rays have power to create other rays likened to the x-rays to such an extent that the old static machine could not tell them apart—if there was any diff at all. They called it 'secondary radiation'—but, for that matter, the x-ray is that.

"What made them get onto that stuff was that they found indications of their 'luminiferous ether' behind objects that absorbed all the light, and if the rays were not reflected or refracted how in the —— did they get there? Stokes (no relation of mine) figured it out mathematically that such pulses, or extremely short disturbances of ether would act in that way and be acted upon in that way."

"What all do the doctors tell with the x-ray?" asked Bender.

"Well," began Jazz, with a smile, "they are able to detect the presence and the extent of tuberculosis, pneumonia. pleurisy, hydrothorax, emphysema, empyema, and other such disorders and ailments——"

"Yes, and water on the brain, lovesickness and obesity," added Punk.

Advertising Talks

NUMBER 4

LAST month, I showed you how advertising made a firm spending many thousands of dollars a month keep up the high quality of its goods or whatever it has to sell. I gave you good proof of how every dollar advertisers spent in the ELECTRICAL EXPERIMENTER was your assurance that what you bought from them must be up to the standard so that the advertiser might hold your trade and stay in business.

Naturally the thought comes "who pays for this advertising? Can the advertiser really pay out a small fortune each month without going 'broke,' or does he add a certain percentage to the price of his product to pay for the advertising, and do I in the long run really pay his advertising bills?" **No, indeed, far from it.** True it is that the advertiser must get back in profits what he spends for every expense connected with his business. But nevertheless you really save money by dealing with advertisers as you can readily understand by studying the matter carefully for a few minutes.

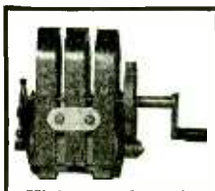
It stands to reason that the more business a concern does, the cheaper it can conduct its affairs. The small firm handling only a few orders each day and trusting to luck that customers will find their way to its doors, must make a fairly big profit on each transaction. The live, up-to-date firm, doing a business all over the country (and sometimes the world, if it advertises in the "Experimenter") systematizes its operations so thoroughly and with the use of the latest and best machinery, can turn out better products at a lower cost than its slow, unprogressive competitor. The larger the production of any one article, the lower the cost of manufacture of each individual piece, as any keen business man will tell you. Furthermore, with a large volume of orders a firm can afford to make a very small profit on each order and still, in the long run, make as much profit as the non-advertiser. And then, as an attractively low price (quality considered) is necessary to get and hold your trade and so make their advertising really effective, all far-sighted advertisers are in the habit of marketing their goods at the smallest profit they can successfully do business on, relying on a big volume of orders to keep going.

So you see that not only can an advertiser make what he sells more cheaply, but he can run his business at less expense, and he can afford to cut his profit on each order to a very small figure. This means that you get what you order from an advertiser at a cheaper price than possible elsewhere, and yet the advertiser makes enough profit *by advertising* to pay his advertising bills.

Advertising Manager.

EXPERIMENTERS!

Read every word on this page. Note the wonderful goods we are offering at rock-bottom prices. Read the details of our offer of $10.00. Don't miss anything or you will lose money.



High grade telephone magnetos—guaranteed quality; strong and substantial; output 80 to 110 volts A. C. 4 bar, 8 lbs.....$2.25
3 bar, 7 lbs.... **1.75**



Telephone ringers, or bells, of same type sold to telephone companies all over world. Perfect shape. With gongs—1000 ohm (like cut), 1 lb. $1.25
1000 ohm other styles, 1 lb.. .75
80 ohm, 1 lb. .... **.50**



Fixed telephone condensers. All capacities from ½ to 2 M.F. Tin foil and rice paper. Excellent condition.
2 M.F., 2 lbs. $.60
1 M.F., 1 lb. .50
½ M.F., 1 lb..... **.40**



Telephone Switchboard, keys or switches. German silver springs. Two switches mounted on one escutcheon. A wonderful and useful addition to your laboratory. 1 lb. .. **1.50**



Watch case receivers, double pole permanent magnet 75 ohms. composition shell. Very handy for experimenting and wireless, 12 oz. $1.25
Single pole, like cut, metal shell, very sensitive. 12 oz. **1.00**



High grade telephone receivers used on all telephones. Very sensitive. With cord, New..$1.25
Other styles 1 lb. 1.00
Stromberg-Carlson fool proof metal type. 1 lb. .. **.80**



Headband receivers, with long cord attached. 75 ohms. Very good for wireless. Extremely sensitive and more handy than plain watch case. 1 lb. .. **1.75**



Sensitive transmitters and arms complete as shown with Skinderviken transmitter button. 2 lbs. $1.75
A very convenient mounting for a transmitter. Adjustable. With other make transmitters, 2 lbs. **1.50**



Local battery or magneto induction coils provide a very desirable instrument. Make fine medical coils. Steps up sound in telephone. A cheap but effective amplifier, 6 oz. ..... **.40**

When ordering any of the equipment shown here, be sure to remit enough for postage. Any excess will be refunded. All apparatus is guaranteed high grade commercial type the same as supplied to largest telephone companies all over the country.



Here is a low priced commercial telegraph key. Strong and substantial, neat in appearance. Excellent contact points and bearings. Works very easily, with just the right touch. Adjustable springs. 1 lb. **1.25**



A large neat sounder, with a sharp "click." Aluminum lever, solid brass base. 20 ohm rubber covered magnets, large adjusting nuts, mahogany base and large binding posts. 1½ lbs. A bargain at..... **2.00**

Want Ten Dollars?

SINCE we began advertising the SKINDERVIKEN TRANSMITTER BUTTON about six months ago, we have supplied thousands to experimenters not only in this country, but in Canada, Australia, Europe and South America.

It is interesting to note the various uses to which these Buttons will be applied. The question is—"What are you doing with your button?" We would like to know, as there are thousands of other experimenters who would like to use it for the same purpose.

We will make it worth your while to submit your ideas. We are going to pay $10.00 cash for the best idea. All others, accepted by us, will be paid for in proportion. Now then, get busy, you fellows.

Any idea you may have of using a SKINDERVIKEN TRANSMITTER BUTTON will be all right. However, try to make it original.



Actual size

THE SKINDERVIKEN TRANSMITTER BUTTON is an improved compact microphone. It is extremely sensitive, easily adaptable to telephones, detectiphones, deaf phones, radio telephones and electrical experimenting. We have received dozens of letters from experimenters telling us of "its wonderful work." We furnish a booklet of instructions and diagrams for experimenting, also with outlines of suggested experiments.

We know from experience that you will find the Button a very interesting piece of apparatus. It is so very sensitive and it only needs one dry cell for its operation. Lots of fun can be had from its use.

Skinderviken Telephone Equipment Co.

2134-2136 No. Clark Street, Chicago
335 Broadway, New York

USE THIS COUPON

STECO E. E. 7-19

I enclose $.... for which please send me the following:

.....

.....

.....

Signed .....*Address* .....



The Electrotechnician

Enters the Electrical Field as a High-Salaried, Industrial Specialist.

If you desire to qualify as a Power Plant Superintendent, Electrical Draftsman, City Technician, or Supervisor of Electrical Equipment Maintenance—

Study Electrotechnics:

The time to start is right now,—when the field is unlimited—uncrowded. Industrial organizations everywhere are demanding the services of trained Electrotechnicians.

At This School Only

can you prepare especially for the field by taking the special, condensed course in Electrotechnics. The system of combined work-shop, laboratory, drafting and recitation room instruction quickly and thoroughly equip you to assume positions of importance in the industrial world.

Open to all Grammar School graduates. High School or College work credited to give you advanced standing, enabling you to shorten course from 6 to 18 months

"Earn While You Learn" if you like.

New Term Opens July 2d.

There's no time for delay if you wish a place reserved for you. Clip the coupon NOW for catalog and full particulars. It may mean your start on a new career.

School of Engineering of Milwaukee,
95-373 Broadway, Milwaukee, Wis.

— — — — — — CLIP HERE — — — — — — —

School of Engineering of Milwaukee,
95-373 Broadway, Milwaukee, Wis.

Gentlemen:—Without obligation, send me catalog and full particulars regarding the Electrotechnician Course.

Name .....

Address .....

City ..... State .....

Age ..... Education .....

School of Engineering of Milwaukee
Institute of Electrotechnics
95-373 Broadway Milwaukee, Wis.



BOYS
Build and Fly Your Own Training Plane

Train yourself in Aviation. Be an Amateur Aviator with an Aeroplane of your own. Learn how Aeroplanes are built; learn the principles of construction, operation and control. We sell IDEAL Accurate Scale Drawings, and Building and Flying Instructions which show you how to build a perfect Model Aeroplane, 3 ft. size, that will rise from the ground by its own power and fly like a big one. Send now for the Drawings and Instructions for the one you want to build.

Drawings and Instructions for
Curtiss Military Tractor
Bleriot Monoplane
Nieuport Monoplane
Taube Monoplane
Curtiss Flying Boat
Wright Biplane
Cecil Peoli Racer

25c EACH
Set of Seven $1.50 postpaid

Ideal Model Aeroplane Catalog 5c—None Free

Tells about Model Aeroplanes, Racing Aeroplanes, Flying Toys, and parts and supplies to build them with. 48 pages. Sent only upon receipt of 5 cents.

IDEAL AIRPLANE & SUPPLY COMPANY
159-161 Wooster St., New York City

Be a Mining Engineer

A great profession, not overcrowded, offers the diligent and ambitious student assured and exceptional rewards. *Located in the heart of one of the greatest copper mining districts in the world,* the College offers a unique combination of theoretical instruction with practical experience in all phases of mine development and operation. Four year course can be completed in three. Vast mines, mills, smelters, electrolytic and power plants of the most modern type, are practically a part of the College equipment and constitute a factor of enormous value in the courses of instruction. Every opportunity for specialization. A state supported college not conducted for profit. Established 1886. "M. C. M. Men Make Good." For descriptive book address Administrative Officer, Houghton, Michigan.

Michigan College of Mines

A Dash to the Clouds

(*Continued from page 206*)

cars themselves are spanned with large wings, measuring eighteen feet from tip to tip. In addition to this spectacle, several other new features are being added to the great list of amusements for the public during the season. Principal among these is the "Witching Waves," a delightful ride in the imitation of an ocean trip. An added feature is a new pony track for those who like the hobby horses. Another novel innovation will be the "U-Boat Dodger," being a ride in a small submarine boat carrying passengers and chasing another submarine. The "Tub Race" is also a new novelty. In addition there will be a new gigantic "Roller Coaster" with a 3,000-foot ride with eight of the biggest dips ever constructed, which will be equal to some of the nose dives now made famous in plane flying. This new roller coaster will cost about $25,000. The "Canals of Venice" is another interesting attraction; cost of construction, $5,000. A very interesting addition to the Park will be a large scale model of a coal mine, showing a cross-section down thru the entire region, also the street above. Here small figures automatically will go thru hundreds and hundreds of different moves, people on the street hurrying back and forth from stores to their homes, trolley cars in action, automobiles, shaft elevators in the coal mine, running up and down with men, little coal cars will go back and forth with their loads and rise to the surface and every little intricate detail of coal mining operation will be faithfully reproduced in this miniature model.

The building which was devoted last year to foreign buyers' markets and interesting collections from the world over has been turned into a skating rink this season, due to the fact that the unforeseen circumstances of the war made it impossible to get sufficient exhibits from foreign countries to run the exhibition hall this season. It is to be hoped that within the next twelve months or so conditions will have so settled themselves that by next year there may be many interesting trophies from the fields of battle. As it is, this giant roller rink can accommodate hundreds of people. Fancy skaters, those who can't skate so well or not at all, with the aid of the big band and cheery music will forget their little bumps and keep smilingly on.

Perhaps the greatest feature of all amusement resorts, fairs, parks and expositions, is the tremendous amount of electrical equipment necessary to keep all these things in motion, and which is seldom realized by the visiting public. Hundreds of horsepower are consumed hourly by these amusement devices. The power is taken directly from the New York Central Railroad, which passes the grounds, and this power at 660 volts is brought into specially constructed damp-proof vaults, where four 100 K.V.A. large oil transformers shoot the juice to all parts of the grounds. In addition there are several smaller transformers, for special purposes supplying different sections. In this case a tremendous amount of money was saved by installing the 660-volt system to every part of the grounds. These cables are carried thru underground conduits and manholes to points where the power is needed, and there the power is transformed to 220 and 110 volts. The saving in cable alone amounts to thousands of dollars, as by using 660 volts a cable approximately one-third the size is required. This gigantic system of transformers, switches, underground cables, man-holes, etc., has cost $100,000.

An immense fire alarm system has been installed to cover the entire grounds. Should a fire occur at any point, simply the pulling of a hook in a box will cause a large bell centrally located in the park to strike a certain signal, which will indicate to all the employes the location of the fire.

Also, as last year, we have the wonderful bathing pool, with its artificial waves, probably the largest in the world, where hundreds may daily disport themselves in its waters, not forgetting the kiddies with their sand pails and shovels, the big band stand with its towering jewels and sympathetic music.

The Oyster's Autograph

(*Continued from page 207*)

sumption of oysters that have drunk in disease germs in the plumping process.

The trick as carried on by the oyster dealer or grower is that he takes the oysters from their natural depths where they mature, and places them in coves and harbors where fresh water streams terminate. Being less saline, the water is less dense, and hence there is an interchange of the fluids thru the walls of the bivalve. When the oyster opens his shell for feeding or for any purposes, the tissues swell. The oysters are not placed in absolutely fresh water, for this would kill them, but in water somewhat fresher than that where they are grown.

The nutritive value which is lost in this process is quite marked. The fluids which are past out from the tissues of the oyster carry with them salts and some fats, chemical experiments showing that the oyster, tho larger after plumping, has lost 13 per cent. of its original nutritious substance, proteins, fats, carbohydrates and mineral salts. This has been found to be true by experiments conducted by Dr. H. F. Moore, of the U. S. Bureau of Fisheries. He states that with the loss of these fluids passing out from the oyster, sufficient water will have been taken up, however, to increase the total weight of the oyster from 12 to 20 per cent. Therefore, it can be seen that what the oyster has really gained is simply water, which is of no food-giving value at all.

Altho scientists are at a loss to agree upon the precise food that oysters eat, whether the beautiful diatom, a vegetable organism, or other microscopic animalcules, it has been found that in experiments recently conducted oysters planted in the sewage-laden waters of Jamaica Bay, near New York, that the oysters can become marketable after a period of eighteen months. Whereas, normally it takes three years before oysters are of sufficient size for the table. Cutting the growing period in half indicates that oysters are not exclusively partial to the natural foods of the water, but, on the contrary, they have an especial fondness for the city's sewage disposal. When Dr. Nelson finishes his experiments, he will furnish the U. S. Bureau of Fisheries, with whom he is coöperating, a constructive program on the general improvement in the culture of this important food. One of the most important phases of his investigation will be that of studying carefully the relation between environment and propagation. Authorities estimate that a single oyster spawns from sixteen million to sixty million eggs in a year, but not-

withstanding this enormous fecundity of the individual oyster, the propagative power of the beds is not so vast as might be supposed. The oysters may be planted on the bottom, especially prepared by clearing it of all refuse material, and a bed so formed of good clean gravel and shells, in order that the young "spat" will have some object to cling to, as otherwise, in a muddy bottom, they would soon be covered over. Yet with many of these precautions some beds will prove greatly fruitful, whereas others prepared in the same way and in adjacent waters result with very poor crops. Certain locations in various waters are particularly abundant in diatoms, the minute organisms on which the oyster is supposed to feed. Yet it is not the generally accepted fact that the diatom is the main article of the oyster's diet, as can be evinced by the quick growth of the oysters in waters polluted with sewage. Generally speaking it is to be hoped that when Professor Nelson finishes his experiments he will have such an array of data and abundance of far-reaching discoveries that thru artificial feeding and environment a variety of oyster may be produced that will excel any heretofore sold on the market and in addition to its phenomenal size it will be healthful and free from all disease germs. It probably will be possible thru Dr. Nelson's researches on the culture of the bivalve to produce such a type as will rank with the discoveries of Burbank's wonderful achievements in producing new and better varieties of fruits and vegetables. —*Photos Courtesy Star Company.*

Flying Across the Atlantic

By H. Winfield Secor

(*Continued from page 214*)

and increase the speed of the machine about 10 miles per hour. The illustration, A, shows some of these points on Lieut. Hawker's ill-fated 'plane, and among other considerations we would mention the following: Only one engine was used, a Rolls-Royce 375 H.P. airplane engine—and very few aviators would care to start off on such a trip with a single engine where continuous flying may have to be kept up from 22 to 28 hours. If the slightest thing goes wrong with this engine and it stops, it may spell disaster, or at least the failure to make the trip in nonstop form. Lieut. Hawker counted on saving himself if obliged to land in the water by the fact that the fuselage of his 'plane was made water-tight, and he also counted on the buoyancy of the gasoline tank as well as a life-saving suit which he wore. But the ocean is known only to those who have crost it and seen the waves roll up forty feet high. The weather was very uncertain, and a storm was said to be blowing up in mid-ocean when he started from New Foundland.

Among other weak points in this type of 'plane, we find that no pontoons were used. thus giving small chance of the 'plane staying afloat, at least for any length of time beyond a few hours. Also the 'plane was very small and frail. Added to this, we have the almost incomprehensible difficulty of navigating such a long flight over an uncharted course. The aviator would have to fly thru the night and rely only on a compass and a sextant to guide him by the help of the stars, if the clouds did not obscure them. But no pilot vessels or chart marks such as buoys, not even radio compass signal directions, were provided or arranged for. It would seem nothing short of superhuman, under these conditions, for the two intrepid fliers to ever reach the far distant coast of Ireland, as they had hoped to.

Why Not Earn $35.00 to $100 A Week As A Mechanical Draftsman?

"Get into the profession of big pay and Rapid Advancement with the help of the school that has started hundreds on the Road to Success. I am ready to help you." Roy C. Claflin, President, Columbia School of Drafting.



Learn At Home In Spare Time

You don't have to stop work or leave home in order to become a trained Draftsman. Through our practical home study Training we will teach you Right in Your Own Home so that you will soon be able to qualify for a good position at Big Pay. We will continue to instruct and help you until we know you have the knowledge necessary to succeed.

No Previous Training Necessary

Right now—TODAY—there are openings for thousands of Draftsmen in the Government Departments, industrial concerns, and the big engineering offices. One department alone recently called for 1,800 draftsmen. With this tremendous demand has come a big increase in salaries.

Draftsmen Are Getting $35 to $100 a Week

with big chances for even better pay as the demand grows. By enrolling NOW for our practical Home Study Course in Drafting you can quickly qualify for a position as Draftsman and by properly applying the principles we teach.

You Have a Chance to Become a Chief Draftsman

and get to the very top in this fascinating profession. Our course will give you just the knowledge you need. to make good as chief draftsman when your chance comes.

Peace Calls For More Draftsmen

With the problems of reconstruction facing the nation the demand for draftsmen is even Greater Than During the War. All big engineering, construction and manufacturing projects must first go through the drafting room before the workmen can commence. You can help in the work of reconstruction and secure a Big Salary with excellent opportunities for advancement. Prepare now and be ready when the demand reaches its height.

We Will Help You Secure a Position

as soon as you complete our course. We have already placed hundreds of our graduates in good paying positions and are constantly in touch with vacancies for which Draftsmen are Urgently Needed. Government Departments and Private Concerns are continually calling upon us for our graduates because they know that our instruction produces draftsmen of the caliber they need.

Thousands of Men Wanted Right Now

Drawing Outfit FREE As soon as you enroll you will be sent our special drawing outfit FREE so that you will be sure to have it to work with while taking the course. This set will be yours to keep. You are not asked to return it after completing the course.

Illustrated Book of Particulars Sent Free

Fill in the coupon below—send it to us and we will send you FREE a copy of our illustrated book telling all about our practical Home Study Course and how you may secure our instruction at once on Easy Terms so as to quickly qualify for one of the Big Positions Now Open.

Mail This Coupon To-day

Columbia School of Drafting
Dept. 1022, 14th and T Sts., N. W.
Washington, D. C.

Without obligation to me, please send me your illustrated book telling how I can secure your complete Home Study Course. the FREE DRAWING OUTFIT, and your help in securing a position as Draftsman.

Name .....

Address .....

City .....State .....



DO Your Own PLUMBING AND HEATING at low cost

Send for our big instructive 256 page well-bound Handy-Man Book Catalog. Every Home Owner, Contractor, Electrician, Farmer, Factory Manager, etc., needs it. Shows over 10,000 Fixtures and Supplies in plumbing and heating at wholesale. Shows how to save skilled labor, hard work and unnecessary material by



OUR NEW

Cut-to-fit-Method

This wonderful book helps you select and install the proper Plumbing, Water Supply System, Hot Air, Water or Steam Plant. Besides being our Wholesale Catalog it has many practical plans, diagrams, sketches, elevations, etc., showing how to do the work this newer, cut-to-fit way. Any handy man with a few tools can easily do his own installing with the aid of this



Big Handy-Man Book

We have spared no effort and have gone to a great expense to compile this valuable book. With economy still a national necessity, it would be unpatriotic to send this expensive book broadcast to non-interested parties. Therefore, we request a temporary deposit for each copy of 25c which we refund on first order, or we send our Bargain Bulletin Free. Address Today

HARDIN-LAVIN COMPANY
40 Years At
4510-20 Cottage Grove Ave., Chicago
$500,000 plants behind our guarantee



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle massage. Can be used with or without electric current.

All users of the Lek-Tro-Shav speak well of it

A barber says—"Have shaved for years and have never used any shaving device near its equal."
A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."
No. 1 Made for use from Light Socket.
No. 2 Made for use from Dry Battery.
Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.

VIBRATING ELECTRIC RAZOR CO.
Dept. 122. Omaha, Nebr.

FUN  **$5.00**

Noiseless Target Practice

Fit your .22 with a Maxim Silencer and get no end of fun this summer practicing in your back yard and on your vacation.

MAXIM SILENCER MAKES YOU A BETTER MARKSMAN

It eliminates recoil and all noise of the report, and steadies your aim. Direct from Dealer or Factory $5.00. Write for Free Book of Stories.

FREE BOOK 

MAXIM SILENCER CO.
89 Homestead Ave., Hartford, Conn.

READ THE CLASSIFIED ADS. ON PAGES 284 - 286

Superiority of the Seaplane.

Fig. B shows the second type of aircraft which has been tried and tested with great success by the U. S. naval flying men for trans-Atlantic work. Not only are these 'planes fitted with large roomy pontoons which are about the size of the usual unsinkable life-boat found at all coast guard stations along the seaboard, but the 'planes have been designed with every possible engineering consideration in mind, particularly any failure of the engine plant. It should always be possible, or let us say feasible, especially when small 'planes are to be used for such trans-Atlantic or trans-Pacific travel, to provide them with an engine plant consisting of more than one engine. But there is no doubt about it that for any form of heavier-than-air machine, such as sea- or airplanes, more than one engine should be installed. With some of the twin-engined biplanes used several years ago it was found possible to keep the 'plane airworthy, and flying on one engine when the other engine, for any reason, failed. The same logic applies to the Navy-Curtiss seaplanes, or "N C" 'planes, as they are familiarly called. Four 400 H. P. Liberty engines are fitted on each seaplane, and if one of these engines should fail, three would be left to maintain the 'plane in the air. However, at least three engines are normally required to keep these heavy ships in the air, as seaplanes are much heavier than land-type 'planes, size for size; the "N C" 'planes weighing with load about 28,500 pounds when they took the big "hop-off" for Europe.

Thus far we see that the Navy's flying boats have two great advantages which should not be overlooked in designing any machine intended for trans-oceanic flight, and among other features which were made available for the flight of the three 'planes on their history-making journey across the broad Atlantic we find the following: Radio-telephone apparatus operating from 'plane to shore or ship stations, and between other 'planes, with a range of 30 to 40 miles; also radio-telegraph apparatus capable of transmitting and receiving up to 150 miles. A new record was made in airplane radio transmission during the seaward flight of the "N C" 'planes, when an unrelayed message was picked up from the NC-4 at a distance of 400 miles, at the Otter Cliffs radio station in Maine. Not only was the regular radio communication made available at every turn, but the U. S. Government exercised special precautions to render certain that the aviators, in case they should have to descend on the ocean, should not lose their lives unnecessarily. It placed warships, including cruisers and destroyers, in a complete chain from the American coast to the Azores, as well as from the Azores to Lisbon, Portugal, the official terminating point of the trans-Atlantic flight by the seaplanes. These vessels were placed about 75 miles apart and closer together in the regions where night flying occurred.

The vessels along the route could communicate by wireless with the 'planes and get their bearings, weather conditions, etc., from the ships of the air as they sped along overhead. At night the war vessels used their searchlights and were otherwise marked with electric signal lamps. On the decks appeared the ship's station number in electric lights, so that the 'planes could see at a glance as they flew ahead just what position on the route they were at. Provision was also made for receiving directive radio compass signals. These considerations and provisions would perhaps seem overdrawn or overimportant to the lay reader, but each and every one of them represents a fine piece of applied engineering and they comprise elements of technique which were not picked out at the eleventh hour and simply slapt on the 'planes, but all of these points were under constant consideration, and in the hands of competent Navy engineers and experts for over two years. By comparison it is seen that no expense of money and brains was spared to make this trip successful—at least, if not successful, "safe" so far as humanly possible. This plan was carried out, thanks to the U. S. Government, to the extent of costing $1,000,000 before the gigantic naval 'planes "hopped off" at Trepassey Bay, on Friday, May 16, in an attempt to cross the Atlantic Ocean thru the air for the first time in history.

The Dirigible.

The illustration Fig. C shows a probable development of trans-Atlantic aircraft which has been mentioned frequently in connection with trans-oceanic travel *via* the air—i. e. the *dirigible*, or gas balloon. The U. S. Naval dirigible C-5 made one of the most beautiful non-stop aërial flights in history, when it covered the distance between Rockaway Beach, near New York City, to St. Johns, New Foundland, a distance of over 1,000 miles, in 26 hours, flying continuously night and day. The naval authorities have announced that they hoped to have another dirigible airship ready shortly to attempt the trans-Atlantic flight. England is hoping to startle the inhabitants of New York City some bright and early summer morning by a visit of one of her 5,000,000 cubic foot, giant dirigibles. With fair weather conditions, it would seem that the modern dirigible, when given a fair chance, will prove a powerful competitor of the seaplane for crossing the ocean. However, the gas balloon possesses, along with some of its advantages, a number of marked disadvantages, and we shall now consider them.

Among the advantages of the gas balloon "lighter-than-air" type of airship, especially when considering long distance flights of 1,000 to 2,000 miles or more, over water, as in crossing the ocean, we are imprest by one predominant fact, and that is that, no matter if the engines all come to a stop on the dirigible, she will still retain her buoyancy in the air and the crew is safe as long as it remains afloat in the air. Under such circumstances there are two major things which may and can happen: first, the winds would blow the balloon along at a fairly high speed and usually the crew is safe in the air and not resting on the waves. The latter, when the sea is rough, often rise to heights of 30 to 40 feet or more, and if the engines or necessary apparatus cannot be repaired, then the dirigible can hail or radio a steamer, and the crew taken off. This could be accomplisht by means of a rope ladder, as has been successfully tried by the U. S. Navy off the coast of Florida, as described in the article on page 108 of the June issue. Secondly, while the dirigible had her engines stopt, the mechanics would be endeavoring to repair them and get them in working order again. The speed of the new type of dirigible such as used by the U. S. Navy, is fairly high, viz: 50 to 60 miles an hour, and these airships have great lifting power, so that they present a very logical answer to the aërial passenger ship requirements of the future. Another advantage which they possess, and due primarily to their great lifting power and buoyancy, is their long range of operations—it being possible for them to take on board sufficient engine fuel to accomplish trips of several thousand miles. Another advantage of such an airship is that, if the engines suddenly stop, the steering gear can be maneuvered and other arrangements made whereby she can be brought to earth gently and in good order; contrary to the usual tactics when the engine of the ordinary airplane stops, which has caused many accidents, owing to the sudden loss of buoyancy of the 'plane and the rapid dive earthward, which may or may not end disastrously.

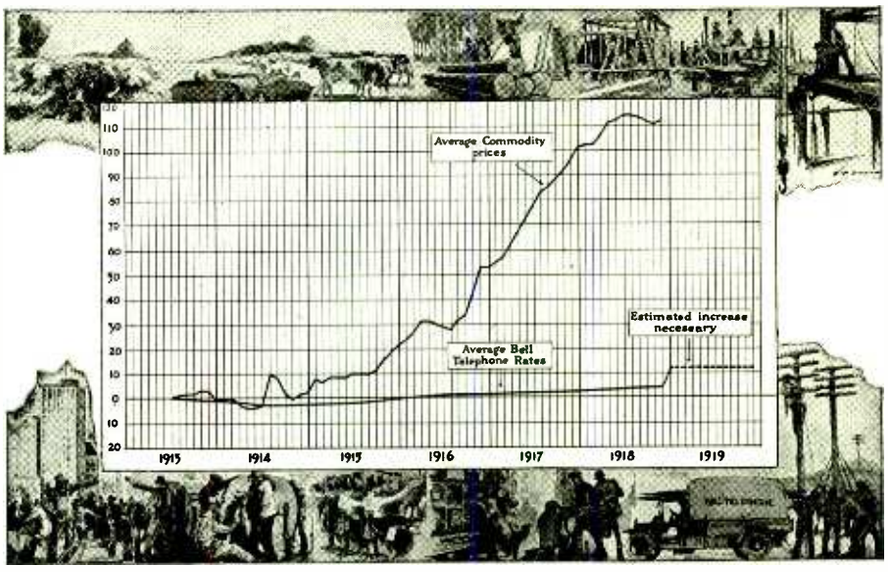
The disadvantages of the dirigible are several, and among the first and foremost we are forced face to face with the fact that they are distinctly difficult to manage and maneuver in stormy weather or high winds. It will probably take some years for our aëronautical engineers to devise means, such as by sub-dividing the gas bag of the dirigible, or by other design tactics, so that the great resistance now offered to the wind will be circumnavigated. If you have ever been up in a "blimp," such as the observation balloons used extensively during the war are called, then you will be in a position to know just what these dirigibles are up against with a heavy wind blowing against them. Even if you are up in a blimp about a thousand feet above the earth, on such a trip as the writer has in mind and which took place at Rockaway Beach about a year ago, you will be surprised, and not altogether pleasantly either, when on a clear day, with the giant gas bag floating lazily in the air, you almost have your feet fly up and shake hands with your face, for all of a sudden—woof!!! Old Mr. Blimp jumps diagonally—or was it vertically?—about fifty feet! No, fellow scientists, it was not magnetic or electrostatic attraction for another blimp which you perceive about one-half mile away, but simply the *irresistible force of the wind* exercising its full wallop against the vast hulking form of the blimp "gas bag."

Therefore, not only is the dirigible a tricky machine in high winds or storms, as was experienced countless times by Count Zeppelin, the erstwhile investigator of Zeppelin tactics when his giant cigar-shaped dirigibles 600 to 800 feet in length were destroyed one after another in storms, but they also have the disadvantage of *slower speed* as compared to the seaplanes, owing primarily to the greater bulk of the gas container or bag which has to be driven thru the air with a consequent great displacement thereof. When it comes to a forced landing on the sea, most aviators would undoubtedly rather take their chances with a seaplane of the Navy type, rather than with a dirigible of any size. For they may, if the weather is quite calm, land in a detachable life-boat carried by the dirigible and by means of a rope ladder descend into it while on the surface of the ocean. This, with the chances under ordinary conditions that they would have to make an attempt at lowering the altitude of the dirigible herself. In this case they would remain in the gondola attached underneath the dirigible, with the possibility that the "elephant of the air" would attempt to set down on them and smother them. At any rate it would require extremely skillful seamanship to carry out such a maneuver successfully. The question of fire in dirigibles has been made practically obsolete, in view of the fact that the U. S. War Department in the past few years has developed the new balloon gas "helium" to the stage where it is available at small cost, and this new gas is absolutely non-inflammable. Its lifting power is 85 per cent of that of hydrogen, the gas heretofore used in blimps and dirigibles, but which possesses the disadvantage of being inflammable.

Radio Equipment of the NC Seaplanes.

Details of the radio installation of the NC seaplanes engaged in the attempt to make the transatlantic flight, as given out by Acting Secretary Roosevelt of the Navy Department, follows:

The radio on the NC seaplanes involves two transmitters. One is a ½ K. W. spark transmitter, the main element of which is a streamline generator and accessory apparatus, which is driven by an air propeller and is mounted on the deck of the boat aft. This set weighs only forty-five pounds, but is used for the regular telegraph communications between the seaplanes and stations up to a distance of 250 nautical miles. Since this set is driven by a



A Comparison of Costs

A graphic picture of the high cost of doing business is shown by the rise in a long list of commodity prices during the past five strenuous years.

By the exercise of unparalleled economies, telephone rates have been kept almost unchanged.

The fact is, the increase in the cost of commodities has resulted in what is equal to a decrease in telephone rates. In other words: The dollar which was spent for the telephone has bought more than twice as much as the dollar spent for the commodity.

The activities of reconstruction which are now upon the nation have put a great burden upon the telephone. This condition has made necessary an advance in telephone rates.

This advance does not exceed an average of eight per cent; almost negligible as compared with the advances in other lines of industry, yet enough to cover the increase in the cost of operation.

Only through adequate revenue can there be assured the maintenance of a high standard of telephone service.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy *One System* *Universal Service*



Cut ½ Size

Stowers Testing Galvanometer

For all kinds of Testing, of powerful as well as weak currents. Has two coils, one of zero resistance, and one of 50 ohms resistance. Made of highly polished bronze. Water and dust proof.

Very handy to carry in pocket.

Sent Postpaid on receipt of $5.75

G. E. STOWERS ELECTRIC CO.
4019 Woodland Ave. Kansas City, Mo.

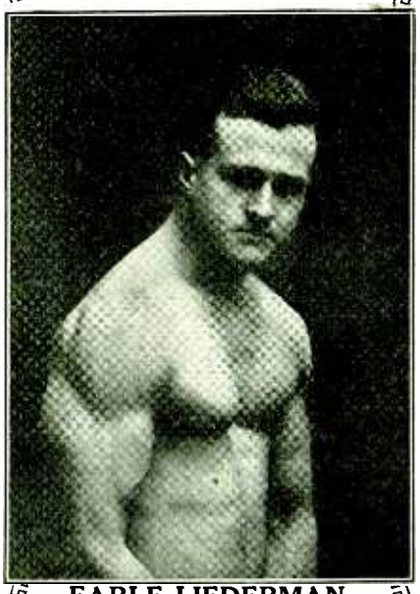


Printing Cheap Cards, circulars, labels, book, paper. Press $6. Larger $20 Job press $35 up. Save money. Print for others, big profit. All easy, rules sent. Write factory for press catalog, TYPE, cards, paper. THE PRESS CO. D-47 Meriden, Conn.

BE A C.P.A. **ACCOUNTANCY** The Highest Paid Profession taught thoroughly in a few months of home study by new system. FREE BOOK International Accountants Society Dept. 39g, 2626 S. Mich. Ave. Chicago

Have the Vitality of a Champion!

A champion must possess an exceptional and unusual amount of strength, endurance and vitality. The man with the most highly developed vitality is the man who wins. But you need not be a fighter to have all the qualities of strength, health and progressiveness of a real leader. I can show you how to make yourself a MAN. I can make you robust, develop your strength and give you an abundance of vitality and a highly developed Body and Mind.



EARLE LIEDERMAN

I have trained some of the world's strongest men. I can train you and give you a muscular development like mine above, perfect health, abundance of vitality, and great strength, as I have and as all my pupils have.

You don't wish to go through life hampered by a weak, sickly body. The man who makes a success in business is the man with energy and vitality.

I can give you these with the proper training. Your body will develop along the lines nature intended. You will notice immediately a new feeling of confidence and ambition taking hold of you—your skin will be cleaner, your eyes brighter, and instead of a despondent outlook on life, you will be filled with the unconquerable determination to win.

MY NEW BOOK

"Muscular Development"

tells how. Send 10c for it to-day. Use the coupon below. The book contains full particulars of my splendid offer, and is profusely illustrated with pictures of many of the world's strongest men whom I have trained. **Don't pass this by. Sit right down and fill in the coupon. Do it now, this minute while it is on your mind.**

EARLE E. LIEDERMAN
Dept. 210, 203 Broadway, New York

Earle E. Liederman
Dept. 210, 203 B'way, N. Y. C.

Enclosed find 10c for which you are to send me at once your new, illustrated book, "Muscular Development."

Name .....

Address .....

City .....

propeller, it can only be used while seaplanes are in flight. The antenna used for this set is a single trailing wire leading from the tail of the boat for a distance of 250 feet down and to the rear. A streamline lead weight holds the lower end of this wire down.

With this transmitter it is possible for the commanding officer to send messages from time to time regarding the progress of the flight, to be retransmitted by the nearest shore station to the Navy Department. Also communication can be held with destroyers or other craft and radio compass signals or other information requested.

The other transmitter is a combined telephone and telegraph transmitter, and operates on a small 12-volt storage battery. It is used on an antenna consisting of wires permanently stretched on the skid fins on the upper planes so that it may be used while the seaplane is in flight or on the water.

The Anti-Noise Microphone.

It is this set which is used for telephoning between the 'planes, arrangement being made so that either the radio operators or the commanding officers themselves may communicate directly by telephone while the 'planes are in flight. Such interplane telephoning may be carried on up to a distance of twenty miles. While on the water this set may be used for telegraphing or telephoning a distance of about thirty miles.

A special feature of the telephone sets is the *anti-noise microphone,* which is so constructed that the engine noises are not heard. This is accomplisht by having the back of the microphone open. The exterior sound waves strike the back as hard as the face of the diafram, and therefore the effect is neutral. The voice waves strike only the face of the diafram, and even tho the operator cannot hear his own voice, the radio sets receive enough effect to modulate the transmitted wave.

This single item has been the deciding factor in success or failure in long-distance transmission by telephone by airplane. It is easy enough for short distances to get communication with an ordinary microphone, but for long ranges it is impossible without the anti-noise transmitter.

Radio Compass Installed.

One of the most important of the radio installations on these seaplanes is the radio compass. This consists of a set of revolving coils mounted in the tail of the machine, on which are mounted many turns of enameled copper wire. The radio waves are picked up on these coils by revolving the coils until the radio signals obtained on two methods of connection are of the same strength.

The operator then knows the direction of the incoming waves. By then reading the position of a pointer on a scale on the coils, the bearing of the transmitting radio station is determined. This bearing is then communicated by the radio operator to the navigating officer by means of the intercommunicating telephone, which consists of telephone receivers built into the helmets, and the same type of microphone used by the operator.

Using the same inter-communicating telephone system, the navigator can telephone to the pilots, giving them the proper direction in which to steer the 'plane. He may inquire of the engine room regarding the condition of the engines, or he may hold radio telephone conversation with the navigating officer on one of the other 'planes.

In other words, the inter-communicating telephone makes possible constant communication between all members of the crews in spite of the terrific noise caused by the engine and the wind rush, and in spite of the fact that they are located in separate parts of the seaplane. In addition to this the radio telephone makes it possible for the commanding officer and navigators to talk directly with each other, altho their seaplanes may be flying at a distance of 20 miles apart.

The radio compass signals may be received from a destroyer at a distance of 75 miles, or from large land stations at a distance of 600 miles.

The regular receiving apparatus on the seaplanes will permit of reception from land stations of high power at distances of several thousand miles, thereby permitting the seaplanes to copy weather reports or orders directly from the Navy Department at Washington.

The main striking fact regarding this radio equipment is that, completely installed, it weighs only 200 pounds.

Radio Reply in Three Minutes.

As an example of the efficacy of the seaplane's radio communication the following will serve:

The Navy Department communicated with the seaplane NC-4 after she started on her flight to Halifax, received a reply from Commander Read, and had broadcasted to Europe and the west coast of the United States the plane's position in *three minutes* elapsed time.

The message filed by the Navy Department at 11:18 A. M. was as follows:

> What is your position? All keenly interested in your progress. Good luck.
>
> (Signed) ROOSEVELT.

At 11:20 A. M. this answer was received:

> Thank you for good wishes. The NC-4 is twenty miles southwest of Seal Island, making eighty-five miles per hour.
>
> (Signed) READ.

At 11:21 A. M. the substance of Read's message was sent broadcast from the Annapolis (Md.) and New Brunswick (N. J.) radio stations, reaching Europe, South America, the west coast of the United States, and Honolulu. At 11:26 A. M. the radio stations at Balboa, Canal Zone, and San Diego, Cal., had confirmed receipt of the message.

New Navigation Instruments.

Three new and novel instruments for airship navigation have been invented and employed for the first time by the NC-1, NC-3 and NC-4 in the trans-Atlantic flight. They are an *aërial sextant,* a drift and *speed indicator,* and a *course and distance indicator.*

No airplane has ever flown far enough out to sea to warrant the use of the sun, moon and stars for fixing a geographical position, stated the Navy Department in announcing the use of these instruments. An instrument has been designed that will enable the air navigator to locate his position, regardless of the state of weather and regardless of the very fast speed of the airplane. An equal feature of the aërial sextant, known as the *Byrd sextant,* invented by Lieutenant Commander H. L. Byrd, is that a bubble in a tube takes the place of the sea horizon and observations. A specially constructed lens is used in sighting the bubble, which is reflected in a mirror. The sun is reflected in another mirror. The observer brings the sun tangent to a line at the same time he brings the bubble tangent to the line. That gives the altitude of the sun. This is of especial value, as the aviator is often above the clouds, and even when flying at low altitudes the horizon is too dim to be seen clearly. With this new aërial sextant the curvature of the earth does not have to be taken into consideration in calculating position. *The bubble is lighted at night, so that night observations may be taken.*

New Chart Saves Time.

New methods of astronomical calculations also have been devised which enable the navigator to make his calculations in a fifth of the time that was formerly neces-

BATTERY CHARGING Will Be Your BIGGEST MONEY-MAKER

Start NOW to charge auto storage batteries. No electrical or mechanical knowledge needed. All cars need batteries charged often. Get the business—sure, steady BIG PROFITS on very small investment with HB Battery Charging Equipment.



With an HB 500 Watt Charger You Can Clear $100 to $200 PROFIT Each Month

Easy to install, economical to operate. Recharges 1 to 7 6-volt batteries at once. Costs 10c to 15c each to recharge, customer pays 75c to $1.50 No burnouts or expensive renewals. Runs 24 hours every day. Requires almost no floor space. No attention needed save occasional oiling. Hundreds are building big, permanent business with HB Battery Charging. Why not YOU?

Small Investment Puts This HB Money-Maker in Your Garage or Shop

Balance on easy monthly terms. Outfit pays for itself. Absolute Money Back Guarantee. Don't delay. Start ***now*** to get those profits. Tear out this ad and mail ***today*** for full information. Let us help you succeed. Write to

HOBART BROTHERS COMPANY
Box E71 Troy, Ohio
Successful Manufacturers Since 1893

NORMA TALMADGE says:

"It is one of my favorite magazines. I enjoy reading it every month."



"JUST to get acquainted" send a dollar and receive the next four numbers of

***The* PHOTO-PLAY WORLD**

Contributions by leading authors
Beautifully illustrated, handsomely printed
By the year $3.50—35 cents a copy

Trial Offer: 4 numbers for $1
(Foreign postage 50 cents extra)

THE DOWNS PUB. CO., Bulletin Bldg., Phila., Pa.

Telegraph Pictures

BY ELECTRICITY



Complete sets of two machines of this marvelous equipment at ridiculously low prices. Instructive, mystifying and useful. This picture of President Wilson was telegraphed by these machines. Will transmit pictures, maps, drawings and hand writing. Picture telegraphing is the coming science. Write today.

J. LEISHMAN CO., Dept. T Ogden, Utah



Swing 4 in., 11 in. between centers. 17 in. total length. Shipping weight 13 lbs. Bed of lathe is machined. Workmanship first-class. Equipped with wood turning chuck. Can be fitted with 3 in. face plate and drill chuck as special equipment. Order one today Price $5.00 cash with order. **SYPHER MFG. CO., DEPT. C TOLEDO, OHIO**

sary. A projection chart of the Atlantic Ocean has been specially constructed for this purpose. This chart, a new invention, does away with difficult mathematical calculations, enabling the aviator to determine his position in a few minutes.

Another great problem of the sea-air navigator is the calculation of the speed and direction of the wind, both day and night. In spite of the reliability of the compass it can only give the course upon which the craft heads, and in determining the true course proper allowance must be made for the sidewise drift caused by the wind. For example, a wind blowing thirty miles an hour towards the side of the 'plane will blow it thirty miles an hour out of its course. This fact alone makes the navigation of the air far more difficult than the navigation of the sea.

To overcome this difficulty bombs have been invented which ignite upon striking the surface of the water and give a dense smoke and bright light for ten minutes. An instrument is used in conjunction with this bomb which enables the navigator to determine the velocity and direction of the wind by sighting on the smoke in the daytime and the lights at night. This instrument, *called the speed and drift indicator, has proved successful.* This instrument is illustrated in one of the accompanying photographs.

When the navigator has found the speed and direction of the wind, he must then be able to calculate the course to steer towards the Azores to allow for this wind. To do this an instrument has been designed to solve the triangle of forces, thus doing away with intricate mathematical calculations.

In the Navigator's Cockpit.

The navigator's cockpit is in the forepart of the boat and is equipt with a chart board, a chart rack and lights. He also has a specially designed headgear for telephone communication with the pilots, so that he can direct them when to change course. The noise from the four big motors is so great that it is impossible to hold conversation except with specially designed telephonic apparatus.

The navigator also has instruments which show him the altitude of the 'plane and the time the sun keeps with the Greenwich meridian, because in going to the eastward so rapidly it is difficult to keep the correct time. In going from Newfoundland to the Azores over two hours is lost in a period of twenty hours, so that the navigator must be very expert in order to allow for this loss in time in making his astronomical calculations. In aërial navigation positions must be determined very quickly. The navigator sits down to work out his "sights," to fix his position, and will be far from his calculated position unless he works out his calculations very rapidly, which these instruments enable him to do.

Ocean Station Ships Bear Numbers.

Each ship had her number painted in large letters upon her deck so that the fliers can tell at a glance just where they are and how far they have progrest, since the positions of the destroyers and battleships were fixt in advance, and on one of the many charts which the aërial navigators had before them these positions were carefully marked.

When the word was flasht by wireless from Trepassey that the NC's had started off the nearest destroyers put out great black smoke smudges which the commanders of the flying boats were able to see for many miles.

At night the guiding surface ships were grouped much closer together.

The vessels had their searchlights directed aloft, had their identification numbers on the decks illuminated. and from time to time threw up star-shells of the sort which the combatants in the late war used to illuminate no man's land.

Prepare Yourself For a Better Job!

No matter what kind of work you are doing, there's a better job with better pay waiting for you if you will prepare yourself to fill it. You get paid for what you do, and that depends on what you know; learn more and you will earn more.

You will get everything needed to put you in the big pay class from these great pay-raising books. They are written in plain everyday English by some of the world's greatest experts in each line, and we give a year's consulting service FREE with each set. Pick out the books that suit your own work best and mail the coupon for free examination today. See the free offer below.

These Will Help You for 7c a Day

Carpentry and Contracting, 5 volumes, 2138 pages, 1000 pictures. Was $25.00 ..... Now $17.80
Civil Engineering, 9 volumes, 3900 pages, 3000 pictures. Was $45.00 ..... Now $29.80
Fire Prevention and Insurance, 4 volumes, 1500 pages, 600 pictures. Was $20.00 ..... Now $15.80
Electrical Engineering, 7 volumes, 3000 pages, 2600 pictures. Was $35.00 ..... Now $19.80
Automobile Engineering, 5 volumes, 2400 pages, 2000 pictures. Was $25.00 ..... Now $17.80
Machine Shop Practice, 6 volumes, 2300 pages, 2500 pictures. Was $30.00 ..... Now $19.80
Steam and Gas Engineering, 7 volumes, 3300 pages, 2500 pictures. Was $35.00 ..... Now $21.80
Law and Practice (with reading course 13 volumes, 6000 pages, illustrated. Was $72.00 ..... Now $39.80
Telephony and Telegraphy, 4 volumes, 1728 pages, 2000 pictures. Was $20.00 ..... Now $12.80
Business Library, 10 volumes, 3680 pages, 2000 pictures, forms, etc. Was $50.00 ..... Now $24.80
Sanitation, Heating and Ventilating, 4 volumes, 1454 pages, 1400 pictures. Was $20.00 ..... Now $13.80
Practical Accounting, 4 volumes, 1840 pages, 800 pictures, etc. Was $20.00 ..... Now $12.80
Drawing, 4 volumes, 1678 pages, 1000 pictures, blue prints, etc. Was $20.00 ..... Now $13.80



FREE Examination

Send the coupon and tell us what books you would like to examine and we will send them to you at once by express collect. You won't be under any obligations to buy and you don't have to send one penny. Take a whole week to decide whether or not you would like to own them, and ship them back at our expense if you don't think they will help you earn more. If you do want to keep the books, just send us $2.00. The balance of the special reduced price can be sent the same sway—$2.00 each month.

American Technical Society
Dept. X-25-B Chicago

SEND THE COUPON NOW

AMERICAN TECHNICAL SOCIETY
Dept. X-25-B Chicago, U. S. A.

Please send me set of ..... for 7 days' examination, shipping charges collect. I will examine the books thoroughly and, if satisfied, will send $2.00 within 7 days and $2.00 each month until I have paid the special price of $..... If I decide not to keep the books, I will return them by express at your expense. Title not to pass to me until the set is fully paid for.

Name .....
Address .....
Reference .....

MAKE YOURSELF A MAN



STRONGFORT The Perfect Man

You don't want to go through life a weak, ailing, sickly creature, pitied by your associates and ridiculed by women, because you haven't any of the elements of a virile, red-blooded MAN about you. *And you don't have to do it*—no matter what your present condition or what hrought you to it. You can get rid of the ailments or weaknesses that are keeping you down; you can free yourself from constipation, dyspepsia, or any other chronic disorders; you can strengthen your vital organs, every one of them; you can develop your muscles, add to your weight or take off your fat; you can get back your MANHOOD, with all it implies and be happy and successful in life, *if you go about it the right way.*

STRONGFORTISM

will show you how to do it, just as it already has shown thousands of other pitiable apologies for men, who put themselves under my care when they found that quack medicines and fake "remedies" weren't worth the bottles and boxes they were sold in. Strongfortism made them well and strong and vigorous again; it made me the strongest man in the world, and it will improve 100 per cent in a few short months ANY man who follows its principles. There isn't any doubt of it—I GUARANTEE results. You can't afford to pass up this chance of becoming what you want to be and what your wife wants you to do. Send for my *free book* **"Promotion and Conservation of Health; Strength and Mental Energy."** It will tell you how YOU can do what my pupils in every part of the world are doing every day. Send three 2c stamps to cover postage and packing and I will mail you a copy at once.

Lionel Strongfort
Physical and Health Specialist
966 Strongfort Institute Newark, N. J.

AVON INN

AVON-BY-THE-SEA, N. J.

LOCATED directly on the beach, 50 miles from New York and 2 miles from Asbury Park.

Surrounded by spacious piazzas and extensive grounds, its accessibility to the beach makes it particularly desirable for families with children.

DANCING BATHING BOATING
TENNIS GOLF FISHING

Write for Booklet and Information

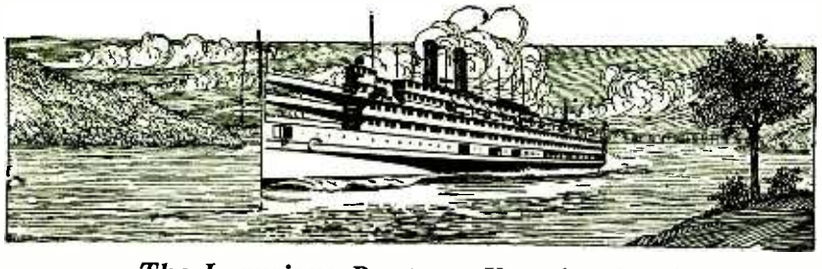
AVON INN HOTEL COMPANY

PROPRIETORS

S. THOMAS PENNA, Manager

HUDSON RIVER NIGHT LINES

NEW YORK - ALBANY - TROY



The Luxurious Route to Vacation Land

Leave Pier 32 N. R. Foot Canal St., daily 6 P. M., West 132nd St., 6:30 P. M. Due Albany 6 o'clock following morning. Direct rail connections to all points north, east and west.

Largest River Steamers in the World
Express Freight Service Automobiles Carried
HUDSON NAVIGATION COMPANY

What 15c will bring You from the Nation's Capital

Washington, the home of the Pathfinder, is the nerve center of civilization; history is being made at this world capital. The Pathfinder's illustrated weekly review gives you a clear, impartial and correct diagnosis of public affairs during these strenuous, epoch-making days.

The little matter of **15c** in stamps or coin will bring you the Pathfinder **13** weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth; now in its **26th** year. This paper fills the bill without emptying the purse; it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you would appreciate a paper which puts everything clearly, fairly, briefly—here it is. Send **15c** to show that you might like such a paper, and we will send the Pathfinder on probation **13** weeks. The 15c does not repay us, but we are glad to invest in new friends. **The Pathfinder, Box 576, Washington, D. C.**

The NC's carried flares, which could be dropt to light up the surface of the water in case a landing became necessary at night, and their commanders had "rocket-pistols," which threw out balls of varicolored fire for signalling purposes.

Electric Self-Starters Used.

The Bureau of Steam Engineering was able materially to improve the performance of the boat by the application of new propellers, designed in that bureau. The NC-1 was originally fitted with standard navy low compression Liberty engines, which were found to be entirely satisfactory, but during the period that the NC-1 was being tested with these engines the Bureau of Steam Engineering, at the experimental laboratory at the Washington Navy Yard, perfected carbureter adjustments on the high compression Liberty engines which materially improved its economy.

Since the high compression engine gave greater power than the low compression engine, such engines replaced the original installation on the NC-1. With the new propellers and the new engines, the boat got out of the water and flew easily, with a total weight of 24,700 pounds. The designed load was 22,000. Besides providing propellers and engines for the boat, the Bureau of Steam Engineering supplied a remarkably efficient *electric self-starter* to each engine.

This style of self-starter weighed only 35 pounds, and by means of this improvement it was possible for the pilot to start any engine without leaving his seat. It is believed that this constitutes the first application of an electric self-starter to the Liberty engine.

Wing span from tip to tip, 126 feet.

Upper wing from tip to tip, 114 feet.

Aileron projections beyond wing tips, 6 feet on either side.

Lower wing span, 94 feet.

Width of wings, 12 feet.

Distance between wings, 14 feet at center and 12 feet at outer tips of lower wing.

Over-all length from front end to the rear end, 68 feet 3½ inches.

Length of hull, 44 feet 9 inches.

Wing area, 2,380 square feet.

Weight full load flying condition, 28,500 pounds.

Weight carried per square foot of wing surface, 12 pounds.

Estimated speed at full load, 79 nautical miles per hour.

Estimated speed at light load, 84 nautical miles per hour.

Horsepower of four Liberty engines, 1,600 horsepower.

SAWING A 74,000-Lb. STEEL INGOT.

(*Continued from page 208*)

It is an interesting fact that in cutting steel beams and ingots with these cold saws that *the saw proper never touches the steel* or iron stock; the cutting is done by a film or layer of comprest air just in front of the teeth. This comprest air layer is formed due to the high velocity of the saw blade, which is often several thousand revolutions per minute.

Some most interesting tests were recently made with these inserted tooth saws under regular working conditions. A 24-inch diameter blade cutting rails, peripheral speed 51 feet, lateral feed 27/32 inch per minute showed, before sharpening, a total of 424 cuts; after sharpening, a total of 502 cuts.

In an endurance test of a 40-inch saw with the lateral feeds on .45 carbon machinery steel, 12-inch round stock was cut in 5 minutes and 9-inch round stock cut in 35 seconds. The lateral feed guaranteed in the latter case was 2 inches per minute.

—*By Frank C. Perkins.*

Practical Chemical Experiments

By Albert W. Wilsdon

(Continued from page 220)

with Turpentine, Benzine, Naptha, or Gasoline, but old paint spots must be softened with oil or grease, and may then be removed by the appropriate solvent. Pitch, tar, or varnish may be treated with oil, and then be dissolved out with turpentine.

Sugar spots are soluble in warm water. If acids have destroyed the color of the goods, this may usually be restored by ammonia, and dilute alcohol may be used in the same way for the stains from fruits.

Removing Ink Stains.

It would be a much simpler task to remove ink spots if we only knew the composition of the ink in advance. Fresh ink usually dissolves in cold water, tho sometimes sour milk is more efficient. Ink stains may also be removed with blotting paper or some other absorbent. On marble, these stains may be treated with turpentine, baking soda, or strong alkalies, or a paste may be made with the alkali and turpentine, and this may be left for some time in contact with the spot, and finally washed off with water. A dilute solution of oxalic acid may often be used successfully to remove either ink stains or iron rust spots.

If there is much iron in the water supply, this may be removed from bowls or other porcelain ware by the use of hydrochloric acid, then rinse with water, and finally with a solution of soda.

It has probably often been noticed that silver is readily tarnished by sulfur, either from eggs, or from rubber bands or elastic, or sometimes from the sulfur compounds in the illuminating gas. The sulfid of silver thus formed is in color from grayish to black. Silver thus tarnished should be rubbed with moist common salt before washing, thus forming a chorid of silver, which may then be washed in ammonia, in which it is soluble.

For cleaning and polishing brass and copper, nothing is better than oil and rotten-stone, and most of the good polishes on the market are made from these materials, with alcohol, turpentine, or soap. Kerosene is useful in keeping metals bright, as well as glass and wood. Aluminum may be cleaned by the use of whiting or any silver polish, but alkalies should not be used upon this metal. As aluminum does not tarnish readily, and does not rust, it is an ideal substance from which cooking utensils are made.

Iron-Rust Stains.

To remove an iron-rust spot from a piece of goods, stretch the cloth over a dish containing hot water, then as the steam arises and the goods become moist, drop a little hydrochloric acid upon the rust spot with a medicine dropper. See Fig. 3. After a moment or two lower it into the water. If the spot is not removed, repeat the operation, then rinse in clear water, and finally in a dilute solution of ammonia to neutralize any acid that might remain and injure the goods.

Iron-rust stains may often be completely removed from delicate fabrics by the use of lemon juice and common salt.

QUESTIONS AND ANSWERS

Detecting Saccharine.

Q. 10. Werner Kretschmer, of Demarest, N. J., wants to know:

(1) The test for Saccharine, and (2) Method of detecting Glycerine in foodstuffs. (3) If the "Fuller's Earth" method of testing butter for coal-tar dyes can be applied to foodstuffs.

A. 1. Saccharine is a very sweet substance prepared from coal-tar, and has been used largely for sweetening purposes in the place of sugar. It also possesses some preservative power, but is never used

Make a Bigger Income Learn Draftsmanship



Great demand for draftsmen now. Still greater demand in prospect. War over, building is to be resumed and manufacturing to expand to meet home and foreign needs—which means plenty of good positions for draftsmen. Take up this paying profession. The Chicago "Tech" method is the quickest, easiest way to become a draftsman in spare time while you hold your present position. That proved before you pay a penny. (See free lesson offer below.) Send coupon. Learn how to earn

$25 to $100 a Week or More

at interesting work with opportunities to rise to superintendent, manager, or other executive positions. Let the Chicago "Tech" engineers train you At least get the free lesson and information.

Drawing Outfit



(No Extra Charge)

Every student of the Chicago "Tech" Home Study Course in Draftsmanship receives this drawing outfit—set of instruments in case, drawing board, T square, triangles, scale, curve, drawing paper, pencils, etc., or a cash credit in case he already has an outfit. You use them while learning.—then take them right into your practical work.

NOTE: Enrolled with Chicago "Tech" you have the personal direction of practical engineers, builders and architects who teach you the methods they use in their own work. No useless theories, no time wasted. You are prepared to stand beside old, experienced men. Big advantage to learn from a staff like this—every man a specialist.

Come To the College or TRAIN at HOME

Wherever you are you can have this Chicago "Tech" training. Complete instruction by mail. Exercises, lessons, personal direction of our experts right in your own home if you cannot come to the college for a resident course. Send the coupon and get the facts.

Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Splendid opportunities open now.

Learn All This in Spare Time

All about the Principles of the Automobile.
All about Gasoline Engines.
All about Power Plants and Transmissions.
All about Carburetors and Fuel Supply Systems.
All about Lubrication and Cooling.
All about Batteries.
All about Magneto Ignition.
All about Starting and Lighting Systems.

Know How To Fix Troubles

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men.

Write Send the coupon and get catalog and all information now.

Easy Payments

The fees for Chicago "Tech" courses are very moderate—and you can pay on easy terms. And also—you can obtain in a few months what it would take several years to acquire by ordinary methods. You can get an early start. You are soon ready to take a paying position and to quickly get back the cost of your course.

FREE TEST LESSON

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything. And see for yourself just what Chicago "Tech" offers you in training which will bring a ready market for your services and open opportunities which are closed to the untrained man. The coupon will bring all the facts about the course, the small fee, and the easy terms.



Mark with X the branch you are interested in--or if in doubt about which course to take, write a letter stating facts about yourself and asking our advice which will be freely given. Mail either the coupon or the letter today.

CHICAGO TECHNICAL COLLEGE,
745 Chicago "Tech" Building, Chicago

Without obligation upon me, send your Catalog on subject indicated below. Also FREE Lesson if inquiry is on Drafting or Plan Reading. Mark X opposite work in which you are especially interested.

- ☐ Architectural Drafting
- ☐ Machine Drafting
- ☐ Electrical Drafting
- ☐ Structural Drafting
- ☐ Sheet Metal Drafting
- ☐ Builders' Course
- ☐ Plan-Reading—Buildings
- ☐ Plan-Reading—Shop Men
- ☐ Estimating
- ☐ Surveying
- ☐ Map Drafting
- ☐ Autos and Gas Engines

Name.....

Address.....

City..... State.....

College or Home Study? State which.....

Mechanical Engineering



Learn at Home!

EMPLOYERS everywhere are looking for men with mechanical ability. Splendid salaries and rapid advancement are offered.

There is an easy, delightful way in which you can learn right at home in spare time. For 27 years the International Correspondence Schools have been giving men and women just the training they need for success in mechanical engineering and more than 200 other subjects. Hundreds of thousands have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6194, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

ELECTRICAL ENGINEER	CHEMICAL ENGINEER
Electrician	SALESMANSHIP
Electric Wiring	ADVERTISING MAN
Electric Lighting	Window Trimmer
Electric Car Running	Show Card Writer
Heavy Electric Traction	Outdoor Sign Painter
Electrical Draftsman	RAILROADER
Electric Machine Designer	ILLUSTRATOR
Telegraph Expert	DESIGNER
Practical Telephony	BOOKKEEPER
MECHANICAL ENGINEER	Stenographer and Typist
Mechanical Draftsman	Cert. Pub. Accountant
Ship Draftsman	Traffic Management
Machine Shop Practice	Commercial Law
Toolmaker	GOOD ENGLISH
Gas Engineer	STATIONARY ENGINEER
CIVIL ENGINEER	CIVIL SERVICE
Surveying and Mapping	Railway Mail Clerk
MINE FOREM'N OR ENG'R	Textile Overseer or Supt.
ARCHITECT	AGRICULTURE
Architectural Draftsman	Navigator / Spanish
PLUMBING AND HEATING	Poultry Raising / French
Sheet Metal Worker	Automobiles / Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____

CORE WIRE

We have been fortunate in securing thru auction several tons of guaranteed pure, double annealed **Norway Iron Core Wire** and are selling this wire to "Experimenter" readers

At Pre-war Prices, 20cts. lb.

This wire is just the thing for spark coils, transformers, etc., and it is, of course, a very much more superior product than the usual iron wire.

We have only one size left:
24 INCHES LONG.
Thickness about No. 21 B and S

If this size should be too long we advise cutting the wire down yourself by means of shears.

As long as the supply lasts we offer this wire as described above to our customers at the very low price of 20c a pound.. Add postage or we will ship express collect. Order at once.

Electro Importing Co., 231 Fulton St., N.Y.C.

solely for this purpose, the preserving influence being only incidental. In the detection of saccharine the substance containing it, which is usually a liquid, is shaken with chloroform, which settles to the bottom and is removed by means of a medicine-dropper. The saccharine enters into solution with the chloroform while sugar if present does not. The chloroform solution is then evaporated by heating gently on the water bath, and if saccharine has been present the residue has a distinctly *sweet* taste. This method is not applicable to substances whose chloroform layer contains a flavor that would mask the sweet taste of the saccharine, for instance, ginger ale.

(2) You fail to state what foodstuffs you desire to test for the presence of glycerine. It is essential that this be given as the methods of procedure to test for this substance is too varied to give a condensed test which would be applicable to all foodstuffs.

(3) The Fuller's Earth test which you mention may be used for the detection of coal tar dyes in foodstuffs other than butter.

MUSTARD GAS

Q. 11. Clayton Doolin, of Decatur, Ill., desires information regarding "Mustard Gas" and how it is obtained.

A. Mustard Gas is obtained by volatilizing Mustard Oil (Allyl Isothiocyanate). This is prepared by distilling macerated black mustard seeds with steam. Mustard seeds contain a glucoside "potassium myronate," which is soluble in water; its solution gradually undergoes fermentation (owing to the presence of an enzyme, "myrosin"), mustard oil, glucose and potassium hydrogen sulfate being produced. Allyl Isothiocyanate may be obtained synthetically by heating Allyl Iodid with Potassium Thiocyanate; it forms a liquid slightly soluble in water, of irritating odor, inciting to tears and producing blisters upon the skin.

ATMOSPHERIC NITROGEN

Q. 12. James G. Peck, Elmira, N. Y., has heard that a mixture of Nitrogen and Oxygen, when subjected to a succession of electric sparks will form *Nitric Oxid*. He wants to know if the same result will be obtained by using a mixture of the two gases as they occur in the air; in other words, by subjecting ordinary air to a powerful electric discharge in an enclosed chamber.

A. The subjecting of Atmospheric Nitrogen to a succession of electric discharges is at the present time successfully operated, for the formation of Nitric acid and Nitrates. Fig. 4 depicts the Birkeland and Eyde furnace of a later type. The individual furnace may be described as a low, wide cylinder resting upon its side and placed between the arms of an enormous horseshoe magnet. The cylinder is made of heavy iron plate and consists of similar halves, which are bolted together. The interior is lined with refractory brick, so arranged that in the middle there is a narrow circular chamber, over 6.5 feet in diameter and about 3.9 inches in width. In this circumscribed space the reaction takes place. The huge terminal poles of the wrought iron electro-magnet, beveled at the extremes, are embedded in the chamotte lining, and are about 9.8 inches apart, their axes corresponding with that of the chamber. The electrodes are of copper, with internal circulation of water, and are .59 inch in diameter. They enter the chamber from opposite sides. and are separated from each other at its center by an interval of about .31496 inch. Air under pressure is admitted to passages between the external shell and the chamotte lining, and enters thru numerous small inlets in the latter, into the reaction chamber. The gaseous current issues, thru openings in the periphery of the chamber, into a conduit which leads to the absorption apparatus. A small



Adventures of the Auto-Wheel Coaster Club

"The Free Caps Arrive"

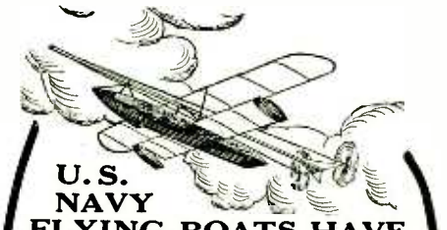
"We formed the Club last week. The caps came today and they're real class—racy looking, like the Auto-Wheel Jim's is a special one, because he's captain.

"Any kid who has an Auto-Wheel Coaster or an Auto-Wheel Convertible Roadster can join, and get one of these caps.

"We've planned several 'stunts' for this summer—things we can do with our Auto-Wheels."

BOYS—The Auto-Wheel is ***the wagon.*** Two styles: Coaster and Convertible Roadster as shown above. Color Catalog and Felt Pennant free for the names of coaster wagon dealers, telling which one handles Auto-Wheel.

The Buffalo Sled Company
163 Schenck St., N. TONAWANDA, N. Y.
(In Canada: Preston, Ont.)



U.S. NAVY FLYING BOATS HAVE CROSSED THE OCEAN

Build your own flying boat from our superior working blue prints and materials. The ONLY Biplane Flying Boat on the market that will actually rise from the water and fly under its own power. 2 sheet working blue print ½ actual size with full building and flying instructions, $1.00 postpaid in U. S. Complete materials to build this wonderful flying boat with full building and flying instructions including two special hand carved propellers, $5.00 postpaid in U. S. Canada 25c extra.

Blue prints of the following flying models, ½ actual size, with full building and flying instructions, 50c per copy postpaid in U. S.

BLERIOT RACER—600 Foot Flyer
MANHATTAN RACER—2000 Foot Flyer
MONTAUK FLYER—Flies 500 Feet
Complete set of 4 working blue prints $2

HEC AEROPLANE CO.
Flying Boat Dept. 6 W. 48th St., New York, N. Y.

Pocket Tool Chest

Strong Knife *Wire Pliers*
Leather Punch *Hoof Hook*
Sweeging Awl *Wire Cutter*
Screw Driver *Screw Bit*
Alligator Wrench

9 Tools in 1



Elican Wunderknife

Each a strong, practical tool. As easily carried as a 3-blade knife, and has no more parts. Length, 4 in. Pliers and wire cutters are drop-forged tool steel—cut barbed fence wire as easily as 8-inch pliers. Blade is tempered cutlers' steel. Each tool works independently. Once used, always carried by **Electricians, Railway Men, Motorists, Mechanics, Horsemen, Sportsmen.**

Sent postpaid in U. S. for $1.75 (add 5c if insured). Highest quality construction, fully guaranteed.

Elican Specialty Co. 874 Merchants Bank Bldg. Indianapolis, Ind.



ZIP-ZIP Patented Sept. 3rd, 1918

The Greatest 50 Ct. Article on the Market. Shipped right from the factory the same day we receive your order. The Prong is made of beautiful metal; never break or wear out; scientifically made and best workmanship. The rubbers are elastic and lasting, with plenty of pep and force. Zip-Zip, complete, only **50c prepaid.** Be sure the name Zip-Zip and our address appear on the article you buy. Order from us or any Sporting Goods Store in your city. Send Stamps, Coin or Money Order.



AUTOMATIC RUBBER CO.
COLUMBIA, S. C.

USE HB BALL BEARING ELECTRIC MOTORS

They Save Power—Increase Shop Efficiency—Uses are Practically Unlimited. HB Ball-Bearing Motors furnish ideal power for garage, machine shop or factory. They operate lathes, drill presses, grinders, air compressor, etc. Economical, absolutely trouble proof, amply designed to meet every requirement. Sizes one to 15 h.p. Make big power saving, require practically no attention. Easy to install & operate.



$20 Puts any HB Ball-Bearing Motor in Your Shop. Choose the Size You Need.

Balance on easy monthly terms. If in doubt about requirements, let our service department advise you. State what machinery you wish to run and type of current available. Pin this ad to your letterhead and mail TODAY for complete information. We also furnish Battery Charging Sets, Generators etc.

HOBART BROTHERS COMPANY
Box E72 Troy, Ohio
Successful Manufacturers Since 1893

"Hang Your Own Lighting Fixtures"

One Light Bracket $1.05—4 Light Shower $6.15 Semi-Bowls $5.85—Plate & Ball 85c, complete with glassware, Wired, Fine finishes. Send for Photos complete line.

ERIE FIXTURE SUPPLY CO.
Sta. C., Erie, Pa.

MAKE A MOTOR-CYCLE OUT OF YOUR BICYCLE



with a STEFFEY MOTOR. Easy to attach. Fits any wheel. More STEFFEY'S in use than all others. Send stamp for circulars and low factory prices.
Agents wanted.

STEFFEY MFG. CO.
Dept. E. 5025 Brown St., Philadelphia, Pa.

UMAKEM

Airplane Workchest, containing aircraft work table with mitre cutting board and length gauge, steel drill, steel hammer, Model Maker's steel square, screwdriver, sandpaper block, 10" scroll saw, together with finest quality reed and bass wood, aluminum, silk, para rubber, full set of blueprints, directions, and all fittings for building one 36" Bleriot Model flying Monoplane. Price $10.00. Other UmakeM Outfits 50c to $50.

W. R. PRICE, Inc.
No. 2 UmakeM Building, 127 Fifth Avenue, New York



DENINGER WILL SAVE YOU 25 TO 50 DOLLARS

BIG MONEY SAVINGS FOR YOU

Used and rebuilt motorcycles, single and twins. $25 to $100. Used bicycles, $5.00; tandems, $10. All machines guaranteed in good working order. New bicycles and motorcycles at Factory prices. You save dealers' profits. Motorcycle and automobile tires too, $3.00. Complete line of parts and supplies.

Deninger Cycle Co., Rochester, N.Y.

MATHEMATICS MADE EASY



The Arcascope—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 85 cents Postpaid. Order today before you forget.

Dept. J. L. J. LEISHMAN CO., Ogden, Utah

Are You Preparing

for one of the thousands of opportunities waiting for folks who get ready? Develop that "Dormant Talent" in you, to the point where you will see opportunities. Our plan (worth hundreds) costs you $5.00—send Post Office or Express Money Order now.

STUDENT HELP BUREAU Springville, N. Y.

PHOTO CRAFT

THE NEW PHOTOGRAPHIC JOURNAL

Devoted to the Art of Picture Taking and Nature Work with the Camera.
Four Competitions with Valuable Cash Prizes Leading to a Fifth.
Send 10c for three months' trial subscription.

Photo Craft Magazine, Ann Arbor, Mich.

EASIEST SHORTHAND



Learn in 5 evenings home study; then acquire speed with K. I. Shorthand. Amazingly simple, easy. Approved by experts. Write dictation, messages, etc., rapidly as spoken, after brief pleasant practice. Favorite method for personal use; make notes at lectures, meetings; keep confidential diary. Big help in any profession or business; aid in your career. Used in Army, Navy, courts, commercial schools; by public and private stenographers, teachers. Slight cost. K. I. Shorthand—for busy people, including YOU. Proof Lessons, Guarantee and Brochure with Testimonials free, postpaid. Address: KING INSTITUTE, EL 300, Station F, NEW YORK CITY



window of mica in the front of the furnace allows inspection of the operation. A direct current feeds the coils of the big magnet located immediately outside the iron shell, and an alternating current is connected with the electrodes. This current is one of 5,000 volts, 50 cycles to the second. The most striking features of such a furnace are its simplicity and its durability. There are no movable parts. When in uninterrupted operation the electrodes are changed every three or four weeks, while the refractory lining is removed once or twice a year. Repairs are easy to make.

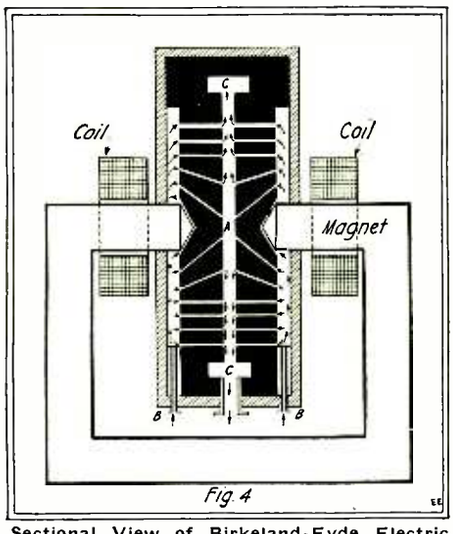
When in operation, a glance thru the window reveals the intensity of the reaction going on at a temperature of over 3,000° C. The result of the process is measured by the percentage of nitric oxid contained in the air issuing from the furnace.

Chemically, the reaction in the furnace between the oxygen and the nitrogen of the air is represented by the equation

$$N_2 + O_2 = 2NO$$

That is, one molecule of oxygen unites with one molecule of nitrogen to form two molecules of nitric oxid, a colorless gas.

The nitric oxid unites readily with free oxygen, at temperatures below 620° C., to form nitrogen peroxid, a brown gas, with the formula NO_2, at temperatures above



Sectional View of Birkeland-Eyde Electric Furnace Used in Fixation of Atmospheric Nitrogen.

140° C., and the formula N_2O_4, at low temperatures. The peroxid condenses at 22° C. to a liquid which at —30° C. congeals to a mass of colorless crystals. As the temperature falls from 140° C. the number of molecules of N_2O_4 in a given volume steadily increases, as shown by the increase in density and the change in color from a deep brown to a reddish brown, and then to a yellowish brown. At 60° C. half of the molecules in the gas are of the formula N_2O_4. At 28°C. they constitute 80 per cent.

When the peroxid comes in contact with water it is dissolved and reacts, forming nitric acid and nitrous acid, thus:

$$2NO_2 + H_2O = HNO_3 + HNO_2$$

With an excess of peroxid the nitrous acid is oxidized to nitric acid and nitric oxid is liberated:

$$NO_2 + HNO_2 = NO + HNO_3$$

The net result of these two reactions is that two-thirds of the nitrogen peroxid is transformed into nitric acid, according to the equation:

$$3NO_2 + H_2O = 2HNO_3 + NO$$

The liberated nitric oxid, in the presence of oxygen and water, repeats the cycle of changes given above, so that theoretically it is possible to change to nitric all the nitrous oxid in the current of gas issuing from the nitrate furnace.



This Is the School
Where Practical, Applied
ELECTRICITY

Is taught in all its phases, quickly and thoroughly. The faculty of Electrical Engineers and Practical Experts will enable you to

Become an Electrician Here in One Year
Or Learn an Electrical Trade in 6 Months

Laws and principles of electricity,—together with practical lectures and problems, actual training in laboratory work and electrical machine departments embracing design, assembling and operating of motors and testing apparatus of all kinds,—all these broad facilities and thorough methods of instruction prepare you to become an expert Electrician in one year, or, in six months to master one of the Electrical Trades.

Success and rapid advancement in the great electrical field will result from your training at this school. Determination and ambition are the chief requisites for entrance. Clip the coupon below and mail it NOW, for complete details and illustrated catalog.

"Earn While You Learn" if you so desire. We will secure part-time employment that will give you actual shop experience and at the same time help defray your living expenses. No interference with school hours. Our catalog explains in detail. The coupon will bring it to you.

School of Engineering
of Milwaukee
An Electrotechnicians Institute
Department of Practical Electricity
94-373 BROADWAY, MILWAUKEE, WIS.
Junior and Senior R.O.T.C. Units Established by U. S. Govt.

MAIL THIS COUPON NOW

School of Engineering of Milwaukee,
94—373 Broadway, Milwaukee, Wis.

Without obligating me, please furnish details of course (or courses) checked below.

Electrician
Electro-Technician
Electrical Engineer (3 yrs.) B.S. Degree

SPECIAL 6 MONTHS' COURSES

Draftsman
Electrical Trouble & Lineman
Electrical Wireman
Electrical Motor Repairman
Telephone Trouble & Repairman
Electrical Meterman
Extension Course

NAME .....
ADDRESS .....
CITY..... STATE.....
EDUCATION..... AGE.....

AN EASY WAY TO MAKE MONEY Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business. One man says "I made $60.00 the first day." Others average $200 to $500 a month. Very little capital needed. Jobs plentiful. Every motorist a possible customer. No experience needed. We teach you.

SHALER Tire Repair Outfit

Improved Wrapped Tread Method Used by Tire Manufacturers



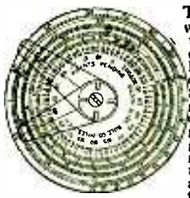
Does as good work as the big high priced vulcanizing outfits. A boy can use it. It's the only vulcanizer that has Automatic Heat Control, and can't undercure or overcure a tire. Requires no watching or regulating.

FREE Book

"How to Open a Tire Repair Shop." It tells how to make big money. Don't delay. Write quick.

C. A. SHALER CO.

2206 Fourth St. | Waupun, Wisconsin



THE MIDGET SLIDE RULE will solve any problem in addition, subtraction, multiplication, division and proportion. A Log-Log Scale gives any root or power of any quantity. Gives Logarithms, Sines, Tangents, Cosines, Cotangents and the decimal equivalents of fractions to six figures. It is grease and water proof and will give years of service. This rule is not to be compared with the paper utility rules which sell for $1.00 and are put together with paper fasteners. It is accurate, simple to operate and comparison shows that it is undoubtedly the fastest and most complete rule made. Our refund guarantee protects you from loss or disappointment. An instruction book 16 pages, 12 illustrations, is sent with each rule. Diameter of rule 4 in. Made in two models: Metal (white coated steel), $1.00; White Celluloid, $1.25. Leather Case 50c extra. Send for catalogue of Slide Rules. Your money back if you are not satisfied. **Gilson Slide Rule Co., Niles, Mich.**

Send To-day for the "Electrical Worker's Friend"

An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting A.C. motors. Special at **$3.50**

Or write for full particulars of this valuable book.

SMITH & SMITH PUBLISHING CO.
1524 LOWRIE ST., N.S., PITTSBURGH, PA.



SMALL ENGINES

Perfected Gasoline Engines—⅛, 1 and 1½ h. p.—for Farm and Shop use. Price, $27.50 and up. Also

WASHING MACHINES

We ship on trial. Send for Booklet and Special Offer.

SIEVERKROPP ENGINE CO.
1401—19th St., Racine, Wis.

STARTER for FORD CARS



Says the Master Mechanic. The Greb Automatic Grip Puller is a One-Man Puller—Quick-acting, strong and simple in the extreme. May be locked in any desired position. A combination of two or three arms. Heavy Duty Size capacity 1" to 18"—Junior size capacity 1" to 7". Two sets of jaws furnished with each size.

Ten Days' Trial If your dealer or jobber does not have them we will send you one. Try it ten days. If not satisfactory, return to us and we will refund your money. We also make the GREB RIM TYGL.

THE GREB CO., 230 State Street, BOSTON

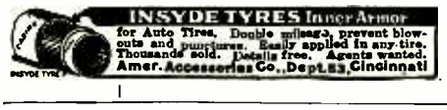
EXPERIMENTS

In—Science, Electricity and Invention
256 Pp., by P. Edelman, $1.50 Ppd.
Here is the big illustrated

how to make and do it book you want. Full of stunts, home laboratory wonders, models, etc.

Edelman Publishers, 1802 Hague Ave., St. Paul, Minn.

MARKO
STORAGE BATTERIES
ARE GOOD—TRY ONE
Paul M. Marko & Co., Inc.
1402-1412 Atlantic Ave.
Brooklyn, N. Y.



New 1 K. W. Panel Radio Transmitter

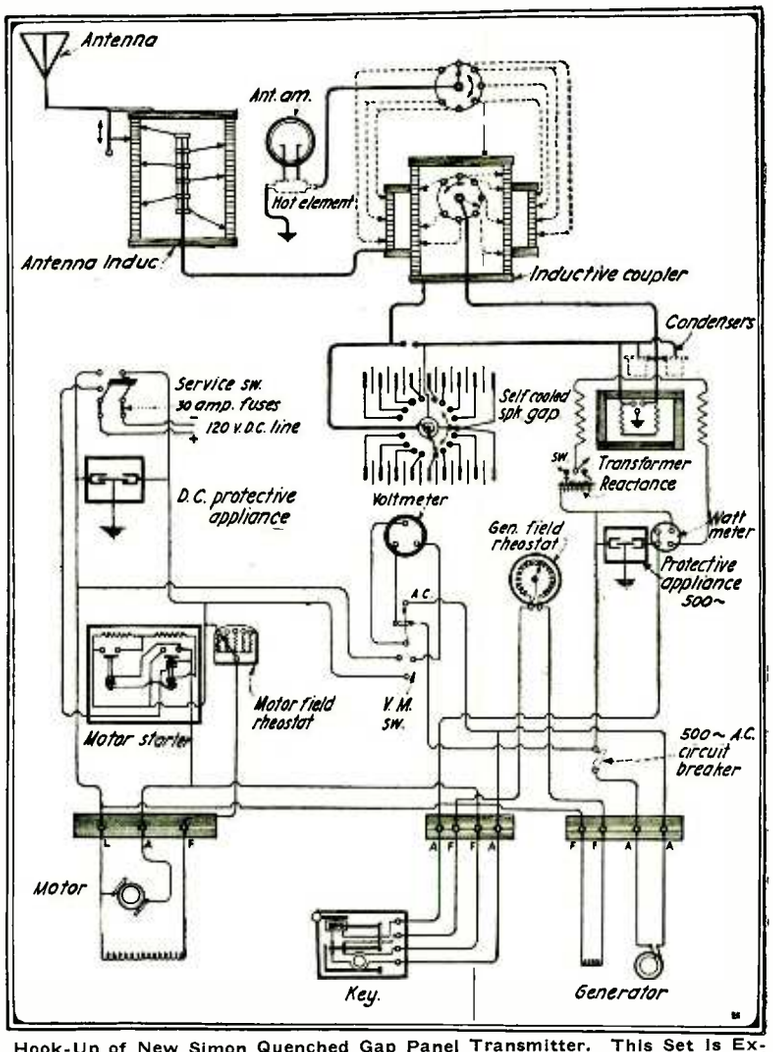
(*Continued from page 230*)

principle an insulated, two-pole circular switch for controlling 16 gap units. It permits the quenched discharge to take place between any number of gaps from 1 to 16, but allows the group of gaps used to be selected at any available part of the series of gaps, and shifted by the simple rotation of two hand wheels at once, as a unit. Each gap unit is air-tight, self-contained, and may be renewed independently of the rest by hand. The circuit is automatically and instantly closed after the break made by removal. Each gap is mounted in a vertical plane, in two horizontal rows of eight gaps each. Each gap unit consists of two brass discs with highly polished silver annular rings which are soldered to the discs. They are separated by fish-paper gaskets, each gap being set to spark at 1000 volts. One of the most important pieces of apparatus on the panel is the coupler and wave changer, consisting of a fixt primary coil and movable secondary coil. They are designed to have corresponding turns as tuning points in each, making simultaneous contacts with two rotating selector arms.

The three openings at the left-hand side of the coupler in Fig. 1 show the wave lengths, the correct wave length being read only at the center or bottom opening.

The thermo ammeter is used in connection with the Weston shunt-block, one end being grounded to the panel frame. It reads from 0 to 15 amperes.

From actual operating tests at full power, this set will radiate from 15 to 18 amperes antenna curent and has a daylight transmitting range of approximately 1000 miles, under normal conditions.—*Photos courtesy Emil J. Simon.*



Hook-Up of New Simon Quenched Gap Panel Transmitter. This Set Is Extensively Used in Naval and Commercial Ship Stations as Well as Land Stations.

AN ELECTRIC SHOOTING GALLERY

(*Continued from page 222*)

rection of rotation, thus hauling the target carrier to the rear of the range. Of course, behind the target there may be arranged the usual plank in which the bullets can imbed themselves. A piece of two-inch plank is very serviceable for the purpose, and where there is the least danger of any one passing behind the partition or behind the targets, the planking should be made about five feet high and three to four feet wide, and this in turn backed up by 1/16 to ⅛ inch steel sheeting.

Where hard-shooting pistols or rifles are used, it sometimes becomes necessary to back up a plank target such as this, backed with a wall of sand about 2 to 3 feet thick. —*Photo courtesy General Electric Co.*

GENERAL SQUIER WINS FRANKLIN MEDAL.

At a meeting of the Franklin Institute held on Wednesday, May 21, Major General George Owen Squier, Ph.D., Chief Signal Officer of the U. S. Army, was presented by the Institute with the Franklin Medal for important work which he has done during the war in the Signal Corps Branch of the Army.

In addition to this a Franklin Medal was also presented to Major General James Douglas McLachlan on behalf of His Britannic Majesty's Government for Sir James Dewar, Jacksonian Professor of Experimental Philosophy, University of Cambridge; Fullerian Professor of Chemistry, Royal Institution, London, for important work which he had done for the British Government in the World War.

"I Would Not Part with it for $10,000"

So writes an enthusiastic, grateful customer. In like manner testify over 100,000 people who have worn it. Conserve your body and life *first.*



The Natural Body Brace

Overcomes WEAKNESS and ORGANIC AILMENTS of WOMEN AND MEN. Develops erect, graceful figure.

Brings restful relief, comfort, ability to do things, health and strength.

For Children Also

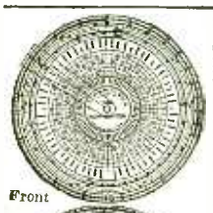
Wear It 30 Days Free at Our Expense

Does away with the strain and pain of standing and walking; replaces and supports misplaced internal organs; reduces enlarged abdomen; straightens and strengthens the back; corrects stooping shoulders; develops lungs, chest and bust; relieves backache, curvatures, nervousness, ruptures, constipation. Comfortable and easy to wear.

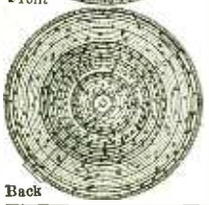
Keep Yourself Fit

Write today for illustrated booklet, measurement blank, etc., and read our very liberal proposition.

HOWARD C. RASH, Pres. Natural Body Brace Co.
286 Rash Building SALINA, KANSAS



Front



Back

SPECIAL KON-VER-TER SLIDE RULE

The Hamilton Improved circular slide rule has over 8000 graduations and over 1800 figures and letters on it, and is an engineer's hand book and slide rule combined. It is 5.4 inches in diameter.

It will subtract, divide, multiply and add fractions or decimals of an inch, can be used as a decimal equivalent table, constructed of three disks and double transparent celluloid rider. Decimal equivalents given to six places in figures, gives sines, co-sines tangents, co-tangents, secants, co-secants versed sines, co-versed sines, square, cube and fifth roots with all their powers, finds the area, circumference and diameter of circles directly.

The Log scale has 1000 graduations. The DE LUXE rule may be bent double without injury, try this with rigid material such as metal. Has no clumsy operating attachments and will work proportions.

The KON-VER-TER is artistic as well as useful. In use all over the U.S., Canada, Mexico, Cuba, Porto Rico, Panama, Bermuda, Hawaii, Philippines, Australia and New Zealand. Instructions with rule.

Beautiful gold embossed black leatherette case, 50c extra. PLAIN UTILITY RULES $1.00. SPECIAL DE LUXE RULES white ivory celluloid $2.50 P.P.

J. C. HAMILTON & Co.,
Dept. B 7 Water St., Boston, U.S.A.

35 Miles per hour Is Record of this Car



Boys, Build This Car. This nifty little car driven by gasoline motor, can be built by any boy. Parts are furnished by us and are very cheap. Send 26c for building plans and price list of parts showing how to build this lad's car.

SYPHER MFG. CO.
156 Warren Street
TOLEDO, OHIO.

NATIONAL TRADE DENTAL SCHOOL

506 S. Wabash Ave., Chicago, Ill.

LEARN MECHANICAL DENTISTRY—DEMAND UNLIMITED

A paying professional trade: You will be a trained dental mechanic and receive our diploma when competent. Students given advantage of thoroughly up to date laboratory, and services of graduate Dental Surgeons on practical cases. No effort spared to place graduates advantageously. No age limit. Day or Evening. Individual instruction. No educational requirements. No book or home study. Easy terms. Highest references. Especially attractive proposition to those who write at once for catalog H.

LEARN WATCH REPAIRING



You can learn by our modern and original system of instruction every part of the **Watch Repairing Trade** at home as good or better than at a shop. You can earn money while learning and secure a well paying position or start in business after completing our course of instruction. Good watch repairers are always in demand and earn from $20 to $35 per week. For particulars apply to the

Milwaukee School of Watchmaking 166 Mason St., Milwaukee, Wis.



SAVE 25% to 60%
on slightly used
GRAFLEX-KODAKS

Cameras and Lenses of every description. Equal to new. Save money. Write now for **Free Bargain Book and Catalog** listing hundreds of money-saving bargains in slightly used and new cameras and supplies. **All goods sold on 10 days' Free Trial.** Money back if not satisfied. You take no chances dealing with us. We have been in the photographic business over 16 years. Write now.

CENTRAL CAMERA CO., Dept. 177 124 S. Wabash Ave., Chicago



TYPEWRITERS

$10 AND UP. ALL MAKES. SAVE $25 TO $50 on rebuilt at the factory by the well-known "Young Process." Sold for low cash—Installment or rented. Rental applies on purchase price. Write for full details and guarantee. Free trial. YOUNG TYPEWRITER CO., Dept. 820, Chicago

A 100 Horse-Power Voice

(*Continued from page 212*)

speaker. Each afternoon the Navy Department at Washington sends by wireless the correct time to ships at sea. This message was picked up on several occasions and transmitted to the crowd at the "Way."

The loud speaker equipment employed at the "Way" was the same as that used aboard ships of the U. S. Navy during the war to make orders heard in every part of the ship.

The speakers' stand at "Victory Way" was in the center of the "Way." On this stand there was a small and extremely sensitive transmitter—so sensitive that it was not necessary for the orator to talk into it. It comprised a battery of three microphones. He merely talked in front of it, and the sensitive transmitter carried the electric current, whose variations represented his enunciations to the control room at the rear of the speakers' stand. There the amplification apparatus boosted the sound waves 7,500,000,000 times and shot it out to the *loud speaker* receivers, *one hundred and twelve* of which were strung above the heads of the audience, twenty feet apart, up and down the whole length of the "Way." The amplifiers comprised a large number of Audions or so-called *talking bottles.* These receivers were very sensitive telephone receivers of special design, with large megaphones or horns, to make the speech audible to those standing below. The area covered by the loud talkers was about 60,000 square feet.

The transmission of the speech from Washington, however, involved much more. The speakers at the National Capitol used a special telephone set and, of course, they also had a *loud speaker* receiver, so that they might hear the applause from New York.

In the case of the message from the Dirigible C-4, the transmitter on the speakers' platform was connected, not only with the loud speaker receiver, but with wireless as well, which transmitted waves to the radiophone aboard the dirigible.

The antennae for the radiophone communication were stretched between the Hotel Avignon and the Railroad Y. M. C. A. Building, which are on opposite sides of "Victory Way," with a wireless apparatus in the latter building, from which the messages were wired to the control room and the loud speaker circuits.

The control room was elaborate and contained a mass of wires and switches and special electrical devices, developed by engineers of the Bell Telephone System. This room contained the amplification apparatus, means for generating the electric current use, and switching devices used for connecting with the long distance wires to Washington and the wireless.

Electric locomotives past beneath the street in the tunnel of the New York Central Railroad. To avoid electrical disturbances from these, the control room was completely covered with sheet iron, which was grounded, so that the control room was isolated electrically. Also the amplifier bulb cabinets were suspended from the ceiling on rubber cords.

No loud speaker receivers were placed within eighty feet of the speaker on the platform, because in that case the speaker's voice, as it came from his throat, and as it poured down thru the loud speaker receivers, would play a race in which the sounds from the receivers would reach the auditor first, because of the fact that electrical waves travel at a far greater rate of speed than mere sound waves. If loud speaker receivers were near the orator, the result would be a bedlam of sound, as the words overlapt one another.

BOYS



Learn Drafting

Employers everywhere are looking for skilled draftsmen. They are offering good salaries to start with splendid chances for advancement.

Drafting offers exceptional opportunities to a young man because drafting itself not only commands good pay, but it is the first step toward success in Mechanical or Structural Engineering or Architecture. And drafting is just the kind of work a boy likes to do. There is an easy delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving boys just the training they need for success in Drafting and more than 200 other subjects. Thousands of boys have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you.* Choose the work you like best in the coupon, then mark and mail it. This doesn't obligate you in the least and will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6193, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

☐ MECHANICAL DRAFTING	☐ SALESMANSHIP
☐ STRUCTURAL DRAFTING	☐ ADVERTISING
☐ SHIP DRAFTING	☐ Show Card Writer
☐ ELECTRICAL DRAFTING	☐ Sign Painter
☐ ARCHITECTURAL DRAFTING	☐ ILLUSTRATING
☐ SHEET METAL DRAFTING	☐ Cartooning
☐ BOILERMAKER DRAFTING	☐ BOOKKEEPER
☐ BRIDGE DRAFTING	☐ Stenographer and Typist
☐ MACHINE DESIGN	☐ Cert. Public Accountant
☐ ELECTRICAL ENGINEER	☐ TRAFFIC MANAGER
☐ Electric Lighting and Railways	☐ Railway Accountant
☐ Electric Wiring	☐ GOOD ENGLISH
☐ Telegraph Engineer	☐ Teacher
☐ Telephone Work	☐ Common School Subjects
☐ MECHANICAL ENGINEER	☐ Mathematics
☐ Machine Shop Practice	☐ CIVIL SERVICE
☐ Gas Engine Operating	☐ Railway Mail Clerk
☐ CIVIL ENGINEER	☐ AUTOMOBILE OPERAT'G
☐ Surveying and Mapping	☐ Auto Repairing
☐ STATIONARY ENGINEER	☐ PLUMBING AND HEATING
☐ Marine Engineer	☐ Textile Overseer or Supt.
☐ ARCHITECT	☐ CHEMIST
☐ Contractor and Builder	☐ Navigation ☐ Spanish
☐ Concrete Builder	☐ AGRICULTURE ☐ French
☐ Structural Engineer	☐ Poultry Raising ☐ Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____

Delivered TO YOU FREE



Your choice of 44 styles, colors and sizes in the famous line of **"RANGER" bicycles,** shown in full color in the big new Free Catalog. We pay all the freight charges from Chicago to your town.

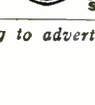
30 Days Free Trial allowed on the bicycle you select, actual riding test in your own town for a full month. Do not buy until you get our *great new trial offer* and low Factory-Direct-To-Rider terms and prices.

TIRES LAMPS, HORNS, pedals, single wheels and repair parts for all makes of bicycles at half usual prices. No one else can offer such values and such terms.

SEND NO MONEY but write today for the big new Catalog. It's free.

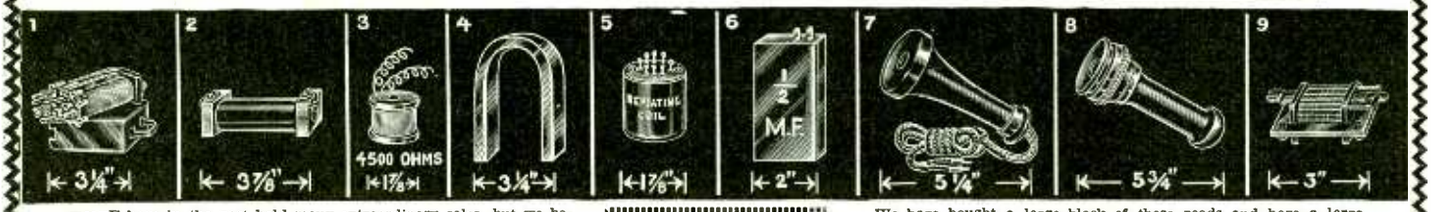
Rider Agents Wanted

MEAD CYCLE COMPANY Dept. F107 Chicago



158 Genuine Foreign Stamps—Mexican War Issues, Venezuela, Salvador and India Service, Guatemala, China, etc., only **10c.** 100 all diff., fine, 15c; 200 all diff., 25c. FINEST APPROVAL SHEETS 60% to 80%. AGENTS WANTED. Big 72-page Lists FREE! We Buy Stamps. Est. 25 years. C. E. HUSSMAN STAMP CO. Dept. 67 ST. LOUIS, MO.

FOR EXPERIMENTERS ONLY!!



WE have in the past held many extraordinary sales, but we believe that the present one eclipses all by the wonderful values we are offering. The goods which we offer on this page are all standard telephone apparatus. Every piece we are offering is equipment that for one reason or another was discontinued by the telephone companies. If you wanted to buy any of the pieces which we offer herewith, from the manufacturers, the price would at least be ten times what we are asking for it. You can readily ascertain this for yourself by looking over our wonderful prices.

RUSH

Cut out and attach to your order. It will leave us within 24 Hours.

We have bought a large block of these goods and have a large quantity of every item on hand. Immediate shipment can be made on all of the goods in practically any quantity within reason. *Shipment within twenty-four hours* will be made if you use the adjoining coupon. This coupon saves you several days and your order will then be considered a rush order. We guarantee every piece to be as represented, and we will refund the money if goods are not exactly as claimed by us.

No. 1 TELEPHONE RELAY. 1500 ohms—has two silver-contact springs and is very sensitive. Can be used wherever a sensitive relay is needed. It is adjustable and can be used for a variety of purposes.
No. 1 Relay—shipping weight, 2 lbs. Price..... **$1.50**

NO. 2 STANDARD TELEPHONE Induction Coil, primary 1 ohm, secondary 55 ohms. Used wherever you need a good induction coil. Has primary and secondary and iron wire core; fibre heads.
No. 2 Induction Coil as described—shipping weight, 2 lbs. Price..... **$0.50**

NO. 3 STANDARD RESISTANCE wound with German silver wire—4,500 ohms, can be used as a choke or plain resistance, and has many other uses that readily suggest themselves to the experimenter.
No. 3 Standard Resistance as described—shipping weight, 4 oz. Price..... **$0.40**

NO. 4 HORSESHOE MAGNET, size 3¼ inches wide x 5 inches high. Will lift about 1 lb. Quality such as used on magnetos, which means the best.
No. 4 Horseshoe Magnet — shipping weight, 2 lbs. Price..... **$0.30**

NO. 5 REPEATING COIL (Transformer). This is a standard small repeating coil and is used by all telephone companies. It has 4 different windings and eight contacts. Entirely enclosed in iron. The resistance being respectively 72 and 120 ohms, and 90 and 100 ohms. Diagram is furnished. Can be used for wireless, for boosting signals, etc.
No. 5 Repeating Coil—shipping weight, 2 lbs. Price..... **$0.50**

NO. 6 ½ M.F. CONDENSER. This is a standard telephone condenser and has ½ microfarads. Condenser comes in neat metal casing. This condenser is used in connection with spark coils to absorb the vibrator spark. Invaluable for test buzzers to absorb spark and make the sound of buzzer more steady. Is also used by every experimenter in connection with wireless where a fixed capacity is needed. Several of these condensers should be in every experimenter's laboratory.
No. 6 Condenser, ½ M.F.—shipping weight, 1 lb. Price..... **$0.50**

NO. 7 DOUBLE POLE BELL TELEPHONE RECEIVER—hard rubber casing with 4 ft. cord and tips. Standard 75 ohms—very powerful magnets. This receiver can be used in connection with any ordinary telephone work, and you will even find it sensitive enough for short distance wireless work.
No. 7 Bell Telephone Receiver—shipping weight, 3 lbs. Price..... **$0.80**

NO. 8 STANDARD TELEPHONE RECEIVER with Metal Head. This receiver is made by Stromberg Carlson Co., with genuine hard rubber handle and ear cap. A very good fool-proof as well as sensitive receiver that cannot be put out of order if you try. Used for the same purpose as No. 7 Telephone Receiver.
No. 8 Standard Telephone Receiver—shipping weight, 3 lbs. Price..... **$0.75**

No. 9 IMPEDANCE COIL (Close Core Transformer). This is a very fine little transformer and is used extensively in connection with telephone work. It is in reality an A.C. transformer for which you would pay $5.00 if you had it made to order. The primary has 0.15 ohms, secondary 2000 ohms. It can be used for a variety of purposes that will suggest themselves to every experimenter. Can be used successfully to boost wireless signals. Also in connection with audions, etc. An A-1 instrument. Size 3 x 3 inches.
No. 9 Impedance Coil—shipping weight, 2 lbs. Price..... **$0.65**



NO. 10 MICROPHONE AND BRACKET. An A-1 sensitive microphone of the carbon grain type. Has hard rubber mouthpiece and enamel steel bracket, the instrument being 10 inches long. This microphone, in connection with our No. 7 or 8 Receiver, will constitute a complete telephone outfit, good to speak 50 miles or more, at a remarkably low price.
No. 10 Microphone and Bracket—shipping weight, 5 lbs. Price..... **$1.00**

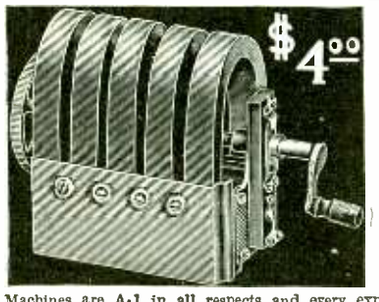
NO. 11 REPEATING COIL (Transformer). A standard repeating coil used for telephonic work. The coil windings are encased in an iron tube 2¼ inches in diameter. There are eight terminals for the four windings to connect to and the instrument is invaluable in connection with radio work to boost up signals, audion work, etc. Many interesting uses will be found for this coil. Resistances are: 100, 120, 145, 175 ohms.
No. 11 Repeating Coil—shipping weight, 8 lbs. Price..... **$2.00**

NO. 12 POLARIZED RINGER with Bells. The resistance of the two coils is 1250 ohms each. The armature is perfectly adjustable. Bell will work on any magneto. We also furnish blue print with ringer showing how *a first class polarized relay* can be made by anyone using only a few pieces of metal and screws.
No. 12 Polarized Ringer with Bells—shipping weight, 2 lbs. Price..... **$1.50**

NO. 13 POLARIZED RINGER with Bells. This is the same kind of ringer as the No. 12, except that it is not adjustable and that the resistance is less. First class in all respects. Blue print furnished with this to *make polarized relay* same as with No. 12. Solenoids on this ringer are worth more than the price we ask for the entire ringer, and do not forget a powerful magnet that goes with it.
No. 13 Polarized Ringer with Bells—shipping weight, 2 lbs. Price..... **$1.00**

NO. 14 HARMONIC RINGER. This ringer is also polarized and has a powerful magnet. It works on 66.6 cycles and any magneto will operate it if run at a certain speed. A very finely built instrument. Resistance of each coil being 200 ohms. Can be converted into a polarized relay by substituting a very fine leaf spring instead of the heavy one furnished. A most interesting instrument with which to experiment.
No. 14 Harmonic Ringer — shipping weight, 4 lbs. Price..... **$1.60**

NO. 15 RINGER without Bells—630 ohms. This also is a polarized ringer and has an adjustable armature. The adjustment is done by means of the top screw. A beautiful little instrument. With this instrument, too, we furnish a blue print showing how a *polarized relay can be built.* You should have several of these beautiful little instruments. They are worth their weight in gold; the powerful magnet alone being worth more than the price we ask for the entire instrument.
No. 15 Ringer—shipping weight, 2 lbs. Price..... **$0.80**



No. 55 5-bar magneto, 110 Volt A. C. Generator

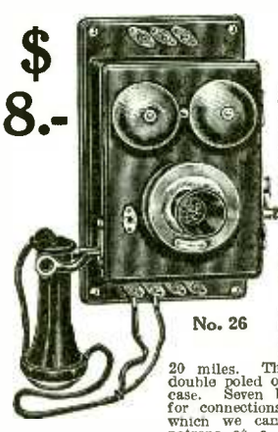
This is one of the most powerful magnetos ever built, when manufacturers could afford to put good stuff into them; equipt with transmission, make and break, etc. Transmission wheels are all brass, crank handle furnished. This magneto, as well as the other ones listed below, will light a 110-volt lamp merely by turning the crank handle slowly. While this magneto gives alternating current only, it can be rewound so it will light up a number of four, six and 10-volt lamps, all depending upon the thickness of the wire you wind on the armature. As we furnish these magnetos, they will give a powerful alternating current and you will not be able to stand the current when grasping hold of the terminals. This makes an ideal shocking machine. All our generators can be transformed into a direct current machine by equipping it with a home-made commutator. Machines are A-1 in all respects and every experimenter should have one of them in his shop. Many other experiments which can be performed with this machine will readily suggest themselves to any experimenter. The magnets furnished with these generators are very powerful, each one being able to lift one pound easily.

NO. 55 5-BAR MAGNETO GENERATOR as described—shipping weight, 25 lbs. Price..... **$4.00**

NO. 33 3-BAR GENERATOR, same as described above except that it has only 3 bars, and is somewhat smaller.
No. 33 3-bar Generator—shipping weight, 10 lbs. Price..... **$2.00**

NO. 44 4-BAR GENERATOR, same as No. 55 except that it has 4 bars, and is somewhat smaller.
No. 44 4-bar Generator—shipping weight, 15 lbs. Price..... **$3.00**

NO. 66 6-BAR GENERATOR, same as No. 55 except that it has one more magnet and the armature is somewhat larger and more powerful. This is the biggest type made and is extremely powerful.
No. 66 6-bar Generator—shipping weight, 30 lbs. Price..... **$4.50**



Complete Wall Set

This is a complete commercial telephone station. The cabinet is of polished oak, piano finish, within which is contained the powerful magneto, the 300 Ohm polarized ringer, and induction coil. The magneto is exceptionally efficient, being of the two bar type with brass gear transmission. The extra sensitive microphone, mouthpiece and two gongs are mounted on the front of the cabinet, giving the entire instrument that desirable appearance of compactness and efficiency. Guaranteed to work over 20 miles. The telephone receiver is a double poled one, and has a hard rubber case. Seven binding posts are provided for connections. The instrument is one which we can offer with pride to our patrons at a ridiculously low price. It is unobtainable anywhere else at less than $15.00 and is an instrument unequaled in value for the price we ask. Size over all 11" x 10" x 8". Shipping weight, 15 lbs.
No. 26 Long Distance Telephone Set..... $8.00

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

I enclose herewith 6 cents in stamps or coin, to cover postage, for which please send me your latest Cyclopedia Catalog No. 20 as described.

NAME .....

ADDRESS .....

STATE.....E. E. 7-19

"The Livest Catalog In America"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 176 Big Pages, 400 illustrations, 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy." 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 20 measure 7x5¼". Weight ½ lb. Beautiful stiff covers.

ELECTRO IMPORTING CO., 231 Fulton Street NEW YORK

CARBON GRAIN TRANSMITTER

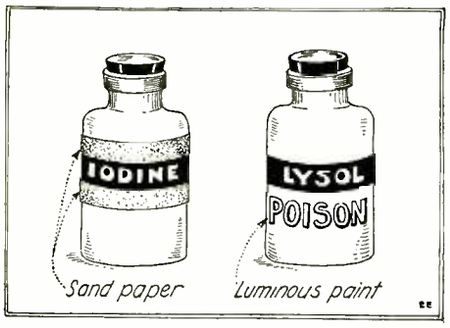


A special design of transmitter for long distance work. Is used on wireless telephone sets where a steady current of ¾ to 1 ampere is constantly required. Sizes over all 3¼ x 2½ inches. Shipping weight, 3 lbs. **No. 6080 Carbon Grain Transmitter as described..... $1.00**



In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries addrest to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are publisht here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.



Safeguard Against Taking Poison In the Dark Unknowingly, Comprising Luminous Letters and Sandpaper Ring Around the Bottle.

Safeguard for Poison Bottles.

(327) Floyd Hoskins, Pine Bluff, Ark., writes: "Many people have killed themselves with poisons taken in a dark room by mistaking them for medicine bottles. I have an idea to safeguard the bottles by putting sand paper around them as per illustration. I also think that by having the word 'Poison' placed upon the bottle by means of illuminated paint, this would be an additional safeguard. Are these ideas patentable?"

A. The sand paper idea is quite an old one which has been described in the technical press many times. Sand paper has also been placed on stoppers as a safeguard. The idea of using illuminated paint, however, is new as far as we are aware, but we doubt very much if a patent can be obtained upon it. Applying luminous paint to various articles does not make a patentable combination so far as we know. It would be a good idea to get in touch with a patent attorney.

Electric Clock.

(328) Ernest Bostwick, Louisa, Ky., says: "Please advise me whether or not you think I could obtain a patent on a clock driven by electricity register hours, days, months and years."

A. Without having the details it is impossible to state if a patent could be obtained. There are at the present time a good many clocks in existence which indicate seconds, minutes, hours, months as well as the year. Unless you have a fundamentally new device, we doubt very much if a patent can be obtained.

Aerial Torpedo.

(329) E. F. Prucha, Howells, Nebr., wants to know if his idea on an aërial torpedo and aërial bomber and navigator which he has submitted with many illustrations and drawings is patentable.

A. After carefully looking over the drawings, we have come to the conclusion that there is nothing new involved in this invention, nor do we think it is practical. There are several features shown which may be patentable, but we doubt the practicability of the invention.

Demountable Rim Tool.

(330) S. W. Snelling, Newark, Ohio, has to say the following: "I have a little device that I think would be fine for automobilists. With this tool, you can take off and put on the demountable rim more quickly than it could be done today."

A. This seems to be a very good idea, and there also seems to be a good market for a tool of this kind. We think a patent can be obtained.

IN OUR NEXT ISSUE:

"How to Develop Your Inventive Ability" By Jay G. Hobson. Author of "How to Finance and Manufacture a Patent," publisht in our June, 1919, issue.

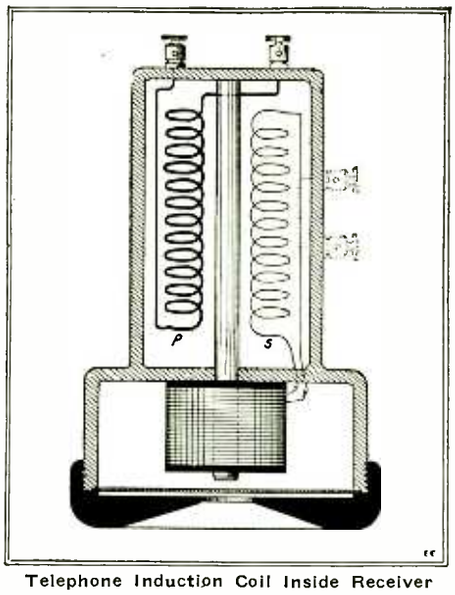
Nicotine Absorber.

(331) Philip Dubilier, New York, N. Y. submits sketch of a new device for cigarette holders which absorbs the nicotine of cigarettes. The idea in main is to have the holder in two parts to be screwed together. Between the two sections cotton can he placed which absorbs the nicotine.

A. We see nothing fundamentally new in this idea, as cotton or felt absorbers for nicotine have been made use of for many years. You might, however, obtain a constructional patent. Devices of this kind are not as a rule popular with smokers as they are very messy to handle, and the cotton gets clogged up too quickly.

Receiver-Induction Coil.

(332) Seth Card, Winthrop, Mass., says: "My idea is to have an induction coil in the handle



Telephone Induction Coil Inside Receiver

U.S. PATENTS



Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

LANCASTER & ALLWINE

255 OURAY BLDG., WASHINGTON, D. C.

PATENTS

TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
164 Owen Building, Washington, D. C.
2276-8 Woolworth Bldg., New York City

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE ON CONCEPTION." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention we will give our opinion as to its patentable nature.

Our illustrated Guide Book, HOW TO OBTAIN A PATENT, sent Free on request. Contains full instructions regarding Patents, Trade-Marks, Foreign Patents, Our Methods, Terms and 100 Mechanical Movements illustrated and described. Articles on Patent Practice and Procedure, and Law Points for inventors.

An actual search of United States patents made in all cases before preparing application for patent

Electrical Cases a Specialty **Highest References Prompt Attention Reasonable Terms**

FREE COUPON!

VICTOR J. EVANS & CO., Patent Attorneys

New York Offices: 1001 to 1007 Woolworth Bldg.
Pittsburgh Offices: 514 Empire Bldg.
Philadelphia Offices: 135 S. Broad St.
Main Offices: 779 Ninth Street, N. W., Washington, D. C.

Name..... *Address*.....

PATENTS COPYRIGHTS TRADE MARKS DESIGNS

U.S.PATENTS

Our facilities for securing patents enable us to give prompt and reliable service at reasonable rates. Inventors are invited to write to us regarding questions appertaining to securing patent protection. All matters receive prompt attention. Send sketch for preliminary examination.

Books free on request

A. M. BUCK & CO.

Patent Attorneys

205 Second National Bank Bldg., Washington, D. C.

PATENTS

LACEY & LACEY

Attorneys-at-Law—Patent Practice Exclusively
Solicitors of

U. S. and Foreign Patents
Trade-Marks, Copyrights
659 F St., N. W., Washington, D. C.
Write Us for Our Free Inventors' Book
PATENT-SENSE
Established 1869

PATENTS

INVENTORS: Send us sketches or a model of your invention and a description of the device for advice in regard to the best way of obtaining patent protection. Our practical experience covers a period of twenty years. Our hand-book on patents is sent free on request. All communications strictly confidential. Write us today.

TALBERT & TALBERT
Patent Lawyers
4287 Talbert Bldg. Washington, D. C.

PATENTS

Hand Books on Patents, Trade Marks, etc., sent free. Our 70 years of experience, efficient service, and fair dealing, assure fullest value and protection to the applicant. The Scientific American should be read by all inventors.

MUNN & CO., 622 Woolworth Bldg., N. Y.
Washington Office, 622 F St., Washington, D. C.

Patents Promptly Procured

Send sketch or model for actual search of U. S. Patents. Highest references. Personal service. Moderate fees. Write for Free Patent Book.

GEORGE P. KIMMEL, Patent Lawyer
99-V Loan & Trust Bldg. Washington, D. C.

PATENTS

Inventors Invited to Write for Information and Particulars
Highest References. Best Results. Promptness Assured.
WATSON E. COLEMAN
Patent Lawyer
624 F Street N. W. Washington, D. C.

of the telephone receiver instead of having the magnet run back into the handle as it usually does. In other words, I would have a combination telephone receiver as well as induction coil. Is the idea patentable and practicable?"

A. We take pleasure in illustrating the device on account of its originality. This certainly is a clever as well as capital idea. There is no doubt that this device will work, altho we think it would be somewhat less efficient than the regular combination by having the instruments separate.

Patents and Citizenship.

(333) Samuel Guyer, New York, N. Y., writes: "I have perfected an invention, but as I am not a citizen I dislike to ask for a patent. Do you think it is safe for me to apply for a patent?"

A. You need not be a citizen of the United States to apply for a patent. Anyone can apply and take out patents, but you will have to tell your patent attorney of what country you are a subject. This must be stated in the patent application. Otherwise, you will have no trouble in obtaining a patent, providing, of course, the idea is patentable.

Astronomical Facts for All

By Isabel M. Lewis

(*Continued from page 217*)

proximate to the total number of stars in our system. They have assumed a median magnitude of twenty-two or twenty-four, far below the reach of existing telescopes, and considering that there are as many stars below as there are above this median magnitude, they find the total number of stars to be between seven hundred million and eighteen hundred million.

2. *What proof is there that no atmosphere exists on the moon?*

There are no atmospheric phenomena visible on the moon, no evidence of storms, clouds or erosions of the rocky surface, no twilight effects, no haziness of the cusps, no signs whatever of the refraction of light by an atmosphere. When a star passes behind the moon, *or is occulted,* it disappears and reappears with startling suddenness. There is no gradual fading away of the star or change in its color such as would be noticed if its light had to travel thru atmospheric strata increasing in density toward the moon's surface. All shadows on the moon are sharp and black. There is no blurring or haziness of the outlines.

At time of solar eclipse there is no distortion of the sun's limb as the edge of the moon passes over it such as would arise if the sun's light past thru a lunar atmosphere and was refracted thereby.

Also, according to the kinetic theory of gases, the ability of a body to hold an atmosphere depends on its mass and density. Molecules of the gases are continually flying off in all directions. If their velocity exceeds a certain critical amount they may escape altogether from the gravitational control of the body in question.

For the moon this "velocity of escape" as it is called, is less than two miles per second. As the molecular velocity of all the gases of the earth's atmosphere, oxygen, nitrogen, etc., exceed this amount, it is evident that the moon could not hold these gases by its gravitational attraction.

3. *What can one expect to see with a three-inch telescope?*

The rings and three or four satellites of Saturn, the belts and four satellites of Jupiter, the snow caps and most prominent markings of Mars and, according to Prof. W. H. Pickering, a number of the canals of Mars if the condition of the atmosphere, or "seeing," is particularly good; also the craters and other markings on the moon in great detail, the sun-spots, faculae and, with spectroscopic attachment, prominences on the sun, the Great Nebula in Orion and many beautiful double and multiple stars.

If the telescope is equatorially mounted and provided with graduated circles for finding and identifying stars and nebulae, a most wonderful and valuable storehouse of knowledge is opened.

Competent Patent Service

By a Former Examining Official of the U. S. Patent Office

NORMAN T. WHITAKER

Lawyer and Engineer

480 Whitaker Bldg. Washington, D. C.
Branch Office, 87 Nassau St., New York City.
INQUIRIES INVITED



County Agents Wanted

For Our Line of
ELECTRIC FARM VILLAGE AND TOWN LIGHTING PLANTS

Good money-making proposition, liberal commission. $300 required. Write for terms.

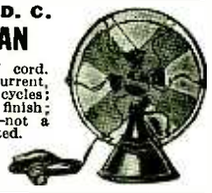
We also sell Garage Equipment, Storage Batteries, Battery Charging Generators, Motors, Tungar Rectifiers, etc.

WATSON ELECTRIC COMPANY
Dept. 17, 122 Michigan Ave., Chicago

Electricians Get up-to-date in House Wiring! Save Time, Money, Labor and Material by using our 98 Genuine Blue Print Drawings, containing all the latest diagrams and connections known in house wiring—every diagram and connection up-to-the-minute as used by first class electricians for wiring Bells, Burglar Alarms, Lights, Annunciators, Fire Alarms and Electric Gas Lighting. These drawings are bound in the form of a flexible book (9 x 12) for convenience in using on the job. Send for them, and if they don't make you more efficient as a wireman and save you many times their cost as a contractor, return them and money will be refunded—you can't afford to be without them. One Dollar postpaid. Send for circulars on other sets of drawings.

PATENT SPECIALTY COMPANY
P. O. Box No. 583 San Francisco, Cal.

Combination A. C. and D. C.
Eight Inch DESK FAN



detachable plug and 8 ft. of cord. Will operate on A.C. or D.C. current, 100 to 125 volts, 30 to 60 cycles; weight 10 lbs.; black enamel finish; height 11½ in. A real fan—not a toy. Price $6.50. Agents wanted.

THE TEWNO CO.
150 Chambers St., New York

Feldman's "Geyser" Electric Water Heater

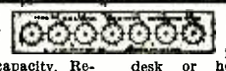
Instantaneous Hot Water

FELDMAN MFG. CO.
1500 Times Bldg. New York City

A NEW AND EASY WAY TO PAINT
SIGNS and SHOW CARDS
OUR PATTERNS DO THE WORK

No experience required. Anyone can paint all kinds of signs, banners, cards, etc., on any surface with our new and easy system of lettering. Complete outfit containing eight alphabets of letters, assorted styles and sizes from two to twelve inches high, also four sets of figures, etc., not printed but life size patterns cut out of durable tag board which can be used over and over again for years, also brushes, colors and book of instructions. $7.50
Satisfaction guaranteed. PREPAID
ACME SALES CO., Empire Bldg., Denver, Colo.

DOLLAR ADDING MACHINE $1



Adds and multiplies with speed of expensive machines. Seven columns capacity. Remarkably simple in construction. Nothing to get out of order. Weight one ounce. Made of metal and celluloid. The ideal pocket, desk or home machine. Order today. The best way not to forget is to do it now.

L. J. LEISHMAN CO., Dept. 142, Ogden, Utah

WOULD YOU KNOW WHAT TO DO?
TO HAVE YOUR WISHES COME TRUE?
TO BE HAPPY AND SUCCESSFUL?
TO FEEL THE THRILL OF NEW POWER?
TO HAVE A WINNING PERSONALITY?

Our System of Personal Efficiency has shown thousands. It can show YOU. First lesson in SUCCESS, and your Personality Sketch for 10c and birthdate.

THOMSON-HEYWOOD CO.
Dept. 350, Chronicle Bldg., San Francisco, Cal.



EARN MONEY

Stamping Names on Key Tags. $50
Either sex. Spare time. Some make
Send 25c for Tag with your name on and instructions. Returned if required. Exp. Key Tag Co., Cohoes, N. Y.

STAMPS

50 diff. Belgium (large bi-color), China, Jamaica, Portugal, Venezuela, etc., 10c; 100 diff., nice packet, 20c; 1,000 well mixed, 40c; 100 var. U. S., 50c; 1,000 hinges, 10c; Agts. wanted, 50%. List free. I buy stamps. L. B. Dover, Overland, Mo.

Electrical Oscillators

By Nikola Tesla

(Continued from page 229)

Broadly, the instruments can be divided into two classes: one in which the circuit controller comprises solid contacts, and the other in which the make and break is effected by mercury. Figures 1 to 8, inclusive, belong to the first, and the remaining ones to the second class. The former are capable of an appreciably higher efficiency on account of the fact that the losses involved in the make and break are reduced to the minimum and the resistance component of the damping factor is very small. The latter are preferable for purposes requiring larger output and a great number of breaks per second. The operation of the motor and circuit controller of course consumes a certain amount of energy which, however, is the less significant the larger the capacity of the machine.

In Fig. 1 is shown one of the earliest forms of oscillator constructed for experimental purposes. The condenser is contained in a square box of mahogany upon which is mounted the self-induction or charging coil wound, as will be noted, in two sections connected in multiple or series according to whether the tension of the supply circuit is 110 or 220 volts. From the box protrude four brass columns carrying a plate with the spring contacts and adjusting screws as well as two massive terminals for the reception of the primary of the transformer. Two of the columns serve as condenser connections while the other pair is employed to join the binding posts of the switch in front to the self-inductance and condenser. The primary coil consists of a few turns of copper ribbon to the ends of which are soldered short rods fitting into the terminals referred to. The secondary is made in two parts, wound in a manner to reduce as much as possible the distributed capacity and at the same time enable the coil to withstand a very high pressure between its terminals at the center, which are connected to binding posts on two rubber columns projecting from the primary. The circuit connections may be slightly varied but ordinarily they are as diagrammatically illustrated in the ELECTRICAL EXPERIMENTER for May on page 89, relating to my oscillation transformer photograph of which appeared on page 16 of the same number. The operation is as follows: When the switch is thrown on, the current from the supply circuit rushes thru the self-induction coil, magnetizing the iron core within and separating the contacts of the controller. The high tension induced current then charges the condenser and upon closure of the contacts the accumulated energy is released thru the primary, giving rise to a long series of oscillations which excite the tuned secondary circuit.

This device has proved highly serviceable in carrying on laboratory experiments of all kinds. For instance, in studying phenomena of impedance, the transformer was removed and a bent copper bar inserted in the terminals. The latter was often replaced by a large circular loop to exhibit inductive effects at a distance or to excite resonant circuits used in various investigations and measurements. A transformer suitable for any desired performance could be readily improvised and attached to the terminals and in this way much time and labor was saved. Contrary to what might be naturally expected, little trouble was experienced with the contacts, altho the currents thru them were heavy, namely, proper conditions of resonance existing, the great flow occurs only when the circuit is closed and no destructive arcs can develop. Origi-

Starrett Tools

have gaged the accuracy of the world's work for thirty-nine years.

Manufacturers, toolmakers, machinists and mechanics in all trades, rely upon this precision.

Illustrated catalog No. 21LE sent free upon request.

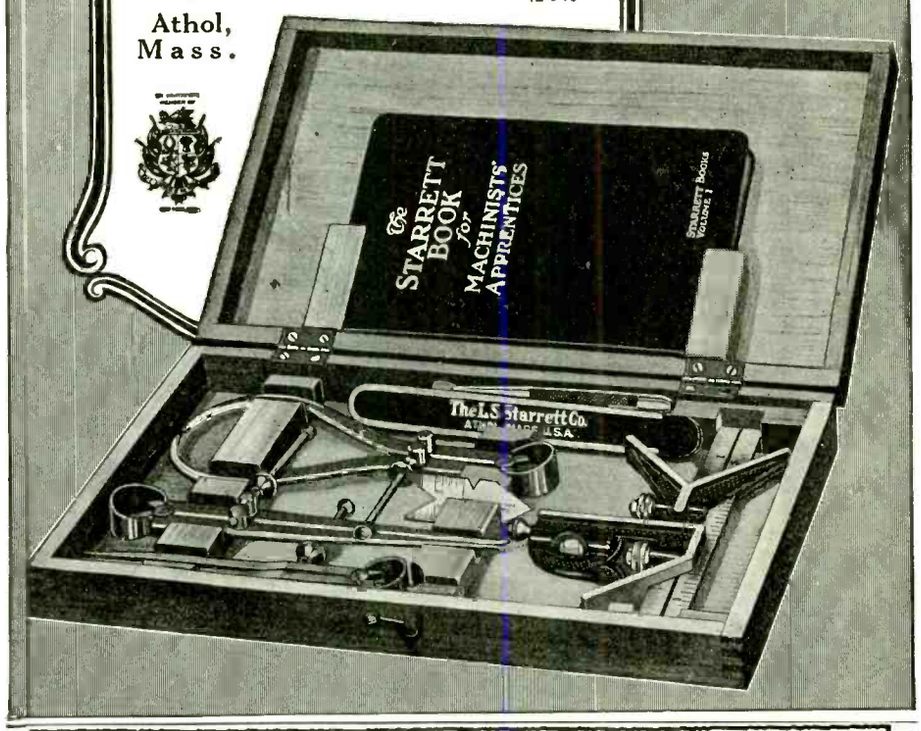
The L. S. Starrett Co.

The World's Greatest Toolmakers

Manufacturers of Hack Saws Unexcelled

42-940

Athol, Mass.

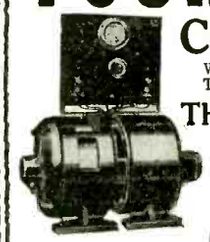


YOUR OPPORTUNITY

Canceled Government Contracts

We have secured a large quantity of Small Motors, Generators and Charging Outfits. This material is new, still in original cases and carries the full factory guarantee.

This is Your Opportunity to buy new, guaranteed Electrical Apparatus of Standard Manufacture



1/2 H. P. INDUCTION MOTOR 110 or 220 volts, A. C. 60 cycle, single phase, 1750 R. P. M. **$32.50**

ALL MOTORS COMPLETE AS CUT

Battery Charging Outfits

For use on 110 volt, A. C., 60 cycle, single phase current only.

80 watts, 8 volts, 10 amperes . **$48.50**

150 watts, 30 volts, 5 amperes . **$68.50**

150 watts, 15 volts, 10 amperes . **$68.50**

300 watts, 30 volts, 10 amperes . **$94.50**

All outfits complete with switchboard as cut shown.

Mail $5.00 cash or Money Order. We will send C. O. D. subject to full examination.

MONEY BACK GUARANTEE



1/4 H. P. 110 volts A. C., 60 cycle, single phase 1750 R. P. M.

WASHING MACHINE MOTOR

Suitable for operating Small Compressors, Coffee Grinders, Bottle Washers, Lathes Drill Presses, etc. **$18.50**

WRITE FOR CATALOGUE. BARGAINS IN MOTORS AND GENERATORS. SPECIAL QUANTITY PRICES

220 volts **POLYPHASE MOTORS** 1750 RPM.
60 cycle, 2 or 3 phase. Complete, pulley and base
1 H. P. $59.50 3 H. P. $ 84.50
2 H. P. $72.60 5 H. P. $102.50

NEW MOTORS

1 0-220 volts **REPULSION MOTORS** 1800 RPM.
60 cycle, single phase. Complete with pulley.
1/2 Hp. $44.50 1 Hp. $67.50

MANUFACTURERS' DISTRIBUTER

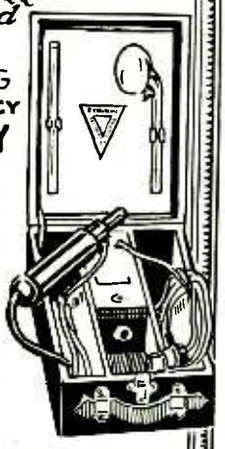
CHAS. H. JOHNSTON - West End - PITTSBURGH, PA.



Health, Strength, Vitality

Personal Appearance—All Demand

The STERLING HIGH FREQUENCY **VIOLET RAY**



Specially designed for home use—fitted to work from the ordinary lamp socket—easy to manipulate under control at all times—and contains within its covers the Services of a servant, a doctor of medicine and a nerve and beauty specialist—all in one, ready for Instant service.

The Sterling Violet Ray is invaluable in the treatment of diseases of the skin, mouth, throat and lungs, derangements of the liver, kidneys, stomach and intestines—soreness in muscles and joints—tired or "sick" brains or lack of "nerve tone." It strengthens heart action—cleanses the blood—brings the flush of youth to the skin — enlivens the hair — puts a "spring in your step" and creates a clear eye and brain.

Sterling Violet Ray Generators are based upon the original discoveries of Nikola Tesla, but have been developed to the highest state of perfection, ever reached by Mr. Anthony Longoria, whose long years of practical experience entitle him to the commanding position he holds.

VALUABLE BOOK FREE

We want to send you our book and full particulars about the Sterling Violet Ray Machines. Read how you can treat innumerable diseases and ailments, improve your personal charm, add strength and vitality and help yourself in hundreds of ways. Just mail the coupon or drop a postal. Do it now, this minute, before you forget it.

The STERLING ELECTRICAL CORPORATION

1278 West 3rd St. Cleveland, Ohio

STERLING ELECTRICAL SPECIALTIES

MAIL THIS COUPON FOR FREE BOOK.

THE STERLING ELECTRICAL CORPORATION 1278 West 3rd Street Cleveland, Ohio

Gentlemen:—As per your offer in Electrical Experimenter, please mail me at once, free and postpaid, your book and full information about the Sterling Violet Ray Generators.

NAME .....

ADDRESS .....

CITY..... STATE.....

nally I employed platinum and iridium tips but later replaced them by some of meteorite and finally of tungsten. The last have given the best satisfaction, permitting working for hours and days without interruption.

Fig. 2 illustrates a small oscillator designed for certain specific uses. The underlying idea was to attain great activities during minute intervals of time each succeeded by a comparatively long period of inaction. With this object a large self-induction and a quick-acting break were employed owing to which arrangement the condenser was charged to a very high potential. Sudden secondary currents and sparks of great volume were thus obtained, eminently suitable for welding thin wires, flashing lamp filaments, igniting explosive mixtures and kindred applications. The instrument was also adapted for battery use and in this form was a very effective igniter for gas engines on which a patent bearing number 609,250 was granted to me August 16, 1898.

Fig. 3 represents a large oscillator of the first class intended for wireless experiments, production of Röntgen rays and scientific research in general. It comprises a box containing two condensers of the same capacity on which are supported the charging coil and transformer. The automatic circuit controller, hand switch and connecting posts are mounted on the front plate of the inductance spool as is also one of the contact springs. The condenser box is equipt with three terminals, the two external ones serving merely for connection while the middle one carries a contact bar with a screw for regulating the interval during which the circuit is closed. The vibrating spring itself, the sole function of which is to cause periodic interruptions, can be adjusted in its strength as well as distance from the iron core in the center of the charging coil by four screws visible on the top plate so that any desired conditions of mechanical control might be secured. The primary coil of the transformer is of copper sheet and taps are made at suitable points for the purpose of varying, at will, the number of turns. As in Fig. 1 the inductance coil is wound in two sections to adapt the instrument both to 110 and 220 volt circuits and several secondaries were provided to suit the various wave lengths of the primary. The output was approximately 500 watt with damped waves of about 50,000 cycles per second. For short periods of time undamped oscillations were produced in screwing the vibrating spring tight against the iron core and separating the contacts by the adjusting screw *which also performed the function of a key*. With this oscillator I made a number of important observations and it was one of the machines exhibited at a lecture before the New York Academy of Sciences in 1897.

Fig. 4 is a photograph of a type of transformer in every respect similar to the one illustrated in the May, 1919, issue of the ELECTRICAL EXPERIMENTER to which reference has already been made. It contains the identical essential parts, disposed in like manner, but was specially designed for use on supply circuits of higher tension, from 220 to 500 volts or more. The usual adjustments are made in setting the contact spring and shifting the iron core within the inductance coil up and down by means of two screws. In order to prevent injury thru a short-circuit, fuses are inserted in the lines. The instrument was photographed in action, generating undamped oscillations from a 220 volt lighting circuit.

Fig. 5 shows a later form of transformer principally intended to replace Rhumkorf coils. In this instance a primary is employed, having a much greater number of turns and the secondary is closely linked with the same. The currents developed in the latter, having a tension of from 10,000 to 30,000 volts, are used to charge con-

(*Continued on page 276*)

FREE!



YES, a $15 Complete Working Outfit with instruments, drawing board, etc., and a drawing table absolutely free. It does not cost a penny.

Draw $150 to $300 a Month

Companies are calling for men to fill positions paying from $150.00 to $300.00 a month. I will give you just the training you need to hold one of the big jobs—right in your own home. I am Chief Draftsman of a large and well known company.

Write Today For my free book on drafting and my liberal "Personal Instruction" offer to a few students. A post card or letter will do. No obligations.

Chief Draftsman Dobe Engineers Equipment Co. Div. 8744 Chicago, Ill.

Send Only 12c

(Stamps or Coin)

And I will send you a copy of my valuable booklet.

"Hints to Music Loving Owners of Talking Machines"

Tells you how to take care of your machine and records, preserve the life of both, and gives many pointers to improve the tone of your instrument and increase your enjoyment of it. Instructs on the care of the motor, cleaning, speed adjusment, care of the needles—in fact every thing you should know. Send 12c today and the booklet will come by return mail.

J. H. ELLIS, Box 882, Milwaukee, Wis.

Patentee & Manufacturer. Ellis Harmonious Reproducer

Build Your Own PHONOGRAPH, SAVE OVER HALF

It's Easy With Our Help

A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fine profit building phonographs for your friends.

Write Today for Our Free Blue Print Offer. Agents wanted for our ready built Choraleons.



Choraleon Phonograph Co.

707 Monger Bldg., Elkhart, Ind.

FREE $20



Violin, Hawaiian Guitar Ukulele, Guitar, Mandolin, Cornet or Banjo

Wonderful new system of teaching note music by mail. To first pupils in each locality, we'll give a $20 superb Violin, Mandolin, Ukulele, Guitar, Hawaiian Guitar, Cornet or Banjo absolutely free. Very small charge for lessons only expense. We guarantee success or no charge. Complete outfit free. Write at once—no obligation.

SLINGERLAND SCHOOL OF MUSIC, Dept. 422, CHICAGO, ILL.

FREE! Sonora



These phonograph needles replace steel needles, play 50 to 100 times and are used on ALL MAKES of steel needle records. Economical, convenient, improve tone, and preserve records. 30c per card of 5, 40c in Canada. Write today for FREE sample.

Semi-Permanent Silvered **NEEDLES**

Sonora Phonograph Sales Company, Inc.

GEORGE E. BRIGHTSON, President

279 Broadway, Dept. G, New York Toronto: Ryrie Bldg.



CATALOG FREE!

BUILD A $100 PHONOGRAPH

Assemble your own Phonograph

Do it yourself easily. Have the finest machine. Astounding saving. We give you the phonograph secrets. Complete instructions 10 cents.

ELECTRO MECHANICAL PARTS CO.

160 N. Wells St. CHICAGO

MULTIPLYING SIMPLIFIED

By our Tabulated Multiplication Card! This is something which you do not think of until you need it. Its merit lies in its handiness. Pocket size card 2½ x 6 ins. Send for one now and be prepared! Price only 10 cents (coin). Payment with order.

TABULATED INFORMATION CARD CO.

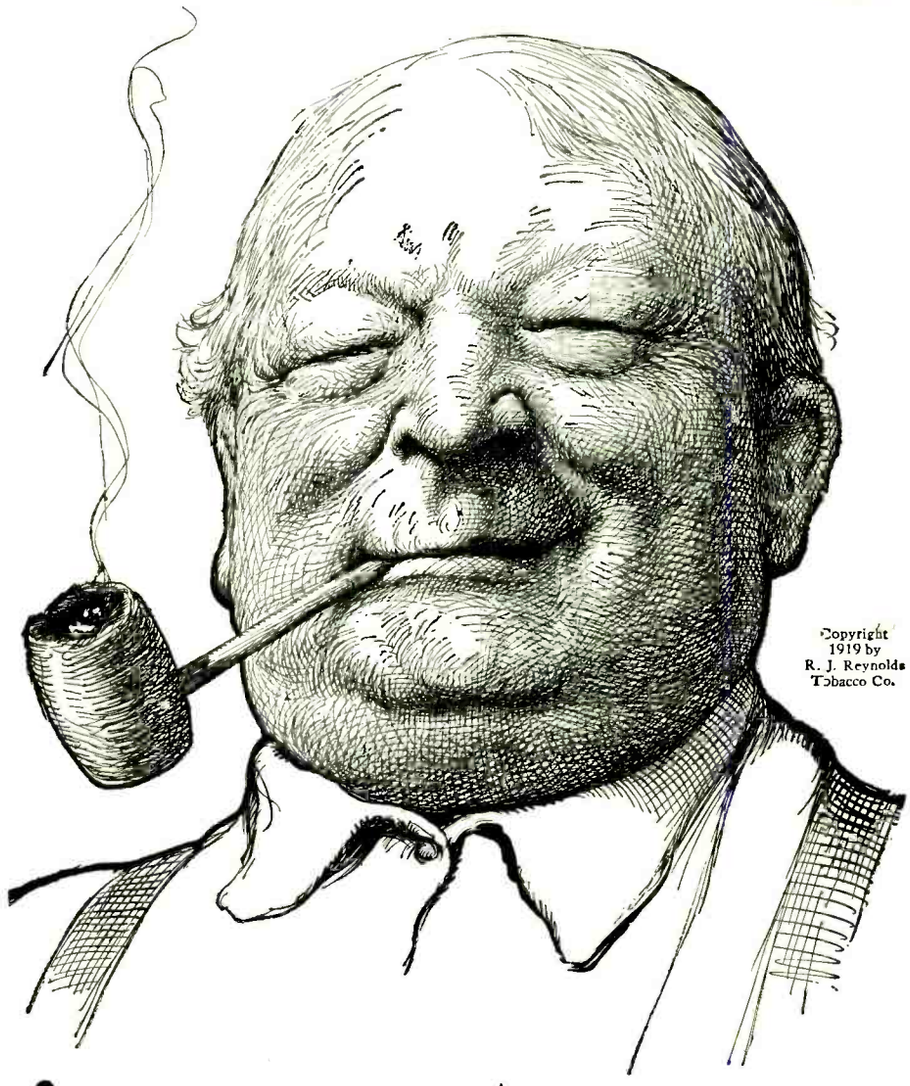
2040 Chestnut St. Philadelphia, Pa.

STAMMERER



Send 10 cents for my remarkable book, "How To Stop Stammering." Kill the fear of stammering. Re education the key.

The Hatfield Institute, 109 N. Dearborn St., Chicago, Ill.



Copyright 1919 by R. J. Reynolds Tobacco Co.

PRINCE ALBERT

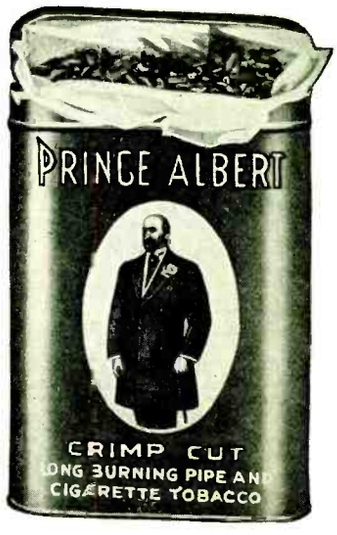
the national joy smoke

SAY, you'll have a streak of smokeluck that'll put pep-in-your-smokemotor, all right, if you'll ring-in with a jimmy pipe or cigarette papers and nail some Prince Albert for packing!

Just between ourselves, you never will wise-up to high-spot-smoke-joy until you can call a pipe or a home made cigarette by its first name, then, to hit the peak-of-pleasure you land square on that two-fisted-man-tobacco, Prince Albert!

Well, sir, you'll be so all-fired happy you'll want to get a photograph of yourself breezing up the pike with your smokethrottle wide open! Quality makes Prince Albert so different, so appealing. And, P. A. can't bite or parch. Both are cut out by our exclusive patented process!

Right now while summer's young you get out your old jimmy pipe or the "papers" and land on some P. A. for what ails your particular smokeappetite!



Buy Prince Albert everywhere tobacco is sold. Toppy red bags, tidy red tins, handsome pound and half pound tin humidors—and—that classy, practical pound crystal glass humidor with sponge moistener top that keeps the tobacco in such perfect condition.

R. J. REYNOLDS TOBACCO CO., Winston-Salem, N. C.

Get Our Prices

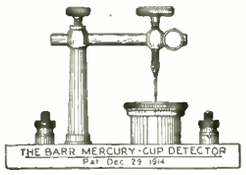
on the Wireless Apparatus you need, before buying.

We handle new and second hand instruments on which we can save you money.

All Second Hand instruments guaranteed to be in perfect working order.

Radio Equipment Co.
630 Wash'n Street, Boston, Mass.

THE BARR
MERCURY-CUP WIRELESS DETECTOR



The most efficient Detector on the market. Tested by the United States Government and Marconi Wireless Telegraph Co.

Increases the efficiency of every wireless receiving set by making the signals clear, sharp and distinct.
Instantly adjustable at a constant pressure.
For full information and price—write
THE BARR MERCURY-CUP DETECTOR
169 Columbia Heights Brooklyn, N. Y.

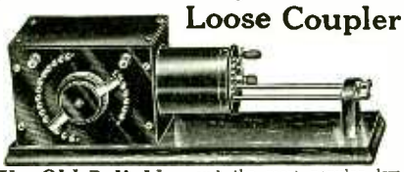
Send For

Halcun Radio Catalogue

Full Line of Amateur Requirements

HALCUN RADIO CO.
San Francisco, - California
Formerly Haller Cunningham Elec. Co.

Arnold Navy Model Loose Coupler



The Old Reliable—and the most popular low priced coupler on the market. Every detail of material and construction of the best. All knobs are of real hard rubber. Switch points, binding posts, etc., polished, plated and perfect.
Send 3c Stamp for Bulletin
giving full particulars and prices of Couplers, Condenser Dials, Variometers, etc.
J. F. ARNOLD, 2082 Lexington Avenue Near 125th St., N. Y.
Established 1910



MORSE TELEGRAPH SET
Just as the cut shows it. Fine for learning telegraphy or for a private line. With code and full instructions.....80c



WIRELESS PRACTICE SET
The first need of every wireless amateur. High pitch buzzer and key for learning wireless code. Also for test buzzer, $1.00



BLINKER PRACTICE SET
For learning the visual code.....90c
Any two of above sets may be used for a short line between nearby houses, etc. Send postage for 1 lb. Ask for catalog E.
THE WILCOX LABORATORIES. Lansing, Mich.

WIRELESS BOOKS *Send for Catalogue* BUY NOW and Save a Dollar

PRACTICAL WIRELESS TELEGRAPHY By E. E. Bucher and THE WIRELESS AGE for one year, $2.75. *Regular price, $3.75.*
WIRELESS PRESS, INC., 33 ELM ST., NEW YORK.

"Hello Europe" --Via Radio

By Charles M. Ripley

(*Continued from page* 210)

the "high tension" and "high frequency" juice of the 20th century! A party of visitors arrives by automobile.

As a member of the party offers the chauffeur a cigar, his hand touches the steel door of the motor car, and he receives a terrific electric shock! The experts smile. They are standing immediately underneath the station end of the antenna. These 32 slender wires, highly charged with palpitating currents of man-controlled lightning, here begin their dizzy climb to a height approaching that of the Equitable Building, and then stretch away a full mile, like semi-invisible cobwebs hung on catenary wire suspenders.

At the point where they stand the air pulsates with invisible electro-magnetic energy; and the jolting, nerve-wringing shock results from the fact that the automobile is equipt with RUBBER TIRES! The current caught from the air by the metal parts of the car can find its escape to the ground only thru the body of the uninitiated who may touch the car's metal framework.

What more fitting introduction could one have into the mysteries of real radio at work! Suppose we enter the station with this party.

The High Frequency Alternator.

After the incident of the automobile shock, we visitors are decidedly "wireshy," so the frequent "DANGER" signs are entirely superfluous; one man even hesitated to touch a water faucet!

From the mechanical and electrical standpoint—as well as from the laymen's viewpoint—the large high frequency alternator is the big outstanding feature of the station.

An alternator is a dynamo that makes alternating current electricity. A "high frequency alternator" is a dynamo generating an electric current that alternates, or reverses itself very frequently. Alternating current for light and power has a "frequency" of 25 to 60 cycles per second, but the alternating current used in this wireless station has a frequency of 22,000 cycles per second.

A high or rapid frequency is used for wireless work, because electromagnetic waves are thrown off from wires in which such electricity flows.

That was sufficient for us to take new interest in the big machine that was throbbing with such weird energy. Evidently, this was the last word in wireless power; for was not this the mightiest station on our hemisphere? Moreover, high frequency electricity is the *sine qua non* for wireless, and here working under our very noses was the first big and really successful high frequency alternator ever built in America. In this room, then, is where a new trail was blazed toward the supernatural; here Jules Verne himself would stand agape, and, perforce, confess that his fiction has been outdone.

"The present state of the Art!" With what force that expression strikes one today. What romantic stories will some day be written of the struggles of American wireless engineers to outdo the Germans. Energy from this monster alternator was a powerful factor in bringing peace to a frantic world.

And it is a wonder of mechanical simplicity as well as a new electrical departure. *The only thing that moves is a solid steel wheel without wires, and containing no copper whatsoever. This "rotor," as it is*

Not Toys But Real Apparatus

the same as used by all operating companies. You had better send us your order immediately to insure prompt delivery, as this equipment will not last long at these prices.

110 Volt Hand Generators....	3 bars, each	$3.00
	4 bars, each	4.00
	5 or 6 bars, each	5.00
Telephone transmitters with arms, each..		.75
Good ringers complete with bells, each....		.50
Telephone receivers, each.....		.75
Condensers, ½ to 2 M.F., each.....		.50
Induction coils, each.....		.50
Relays, each		1.50
Repeating coils, each.....		2.00
Real complete C.B. wall type telephone...		4.50
Slightly used dry cells, per dozen.....		1.25

Please send money-order or cash with your order
ELECTRICAL SPECIALTY COMPANY
Dept. E, 48-50 So. Front St., Columbus, Ohio
Dept. E, 128 So. 11th St., Philadelphia, Pa.

Mica Diaphragm Telephones

Baldwin Mica Diaphragm Phones may now be had on the Pacific Coast.

We have a complete stock, and can fill orders at once.

Send for circular and price list.

PACIFIC RADIO APPARATUS CO.
1247 Forty-seventh Ave.,
San Francisco California

Write Secret Letters With Invisible Ink



Pour seemingly plain water into three glasses and have it turn red in one, white in another and blue in the third! Make your own magic writing paper, and blue ink or ink powder. Write with plain water and have the writing turn blue. You can surprise and puzzle your friends with these and more mysterious and amusing Chemical tricks, if you have "CHEMCRAFT" Junior—the boys' miniature chemical outfit. Send 25c for your outfit right now, it's the greatest fun-maker you ever had. Send at once and get a Free copy of "The Chemcraft Chemist," an interesting magazine for boys.

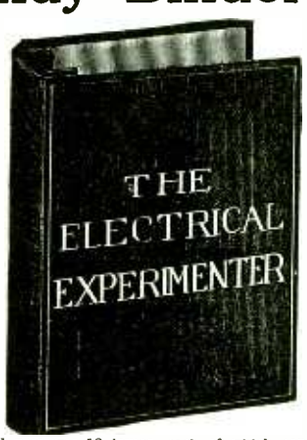
CHEMCRAFT JUNIOR
Amateur Chemist's Catalogue and Hand Book
containing much valuable information for Boy Chemists and listing many useful chemicals and apparatus, sent postpaid for 10c. None free. Regular "CHEMCRAFT" Chemical Outfits, $ .50, $2.00 and $5.00
25¢
THE PORTER CHEMICAL CO. POSTPAID
Arcade Bldg., Hagerstown, Md.

WIRELESS IS SIMPLE

when the Summers' theories of wireless are applied to wireless systems, transmitting and receiving apparatus. Will advance the wireless art by leaps and bounds. Get on the right track with your experiments. This booklet should be in every home and school. United States and foreign copyrights. Price $2.00 registered postpaid to any part of the world.
Address FRANK E. SUMMERS, Memphis, Mo.

Handy Binder

for the Electrical Experimenter



Holds and preserves 12 issues, each of which can be inserted or removed at will, without tools. Will keep your magazines perfectly for all time or just preserve them like new till you bind them permanently. Made of heavy material, extra strongly reinforced at the back and covered with handsome green cloth, suitably lettered in gold.

65c

Add postage for 2 lbs.
Experimenter Pub. Co., Inc. Book Department 233 Fulton St., N. Y.

called, weighs nearly 3 tons, with its shaft, and rotates at 2,100 revolutions per minute. This is not considered a high speed in the electrical profession, and yet if this rotating element were to roll along upon the ground at its present speed it would run from Schenectady, N. Y., where it was built, to New Brunswick, N. J., *in less than thirty minutes!*

Wonderful Regulation of 200 K.W. Alternator.

The speed of this rotating element is regulated to within 1/10 of one per cent., regardless of the amount of electrical load thrown on and off the circuit in the sending of messages.

The alternator is rated at 200 kilowatts, and weighs about 12 tons without its base. The floor space occupied by the machine, including its base, and the driving motor, is only 8 ft. wide by 20 ft. long. This 160 sq. ft. is less than 2 per cent. of the total floor area in the radio station, which is 10,800 sq. ft.

The advantages of the high frequency alternator were explained by its designer, Mr. E. F. W. Alexanderson, consulting engineer, inventor and radio specialist of the General Electric Company:—

1. As heard by the operators at receiving stations, the tone of New Brunswick's signals is a clear "whistle" of a flute-like quality.

2. The continuous wave it sends out is clear cut, *with no "harmonics."* "Harmonics" have various frequencies and different wave lengths, and interfere with other stations. Harmonics are useless wave lengths which "fringe" the message. There is no fringe or "penumbra" to the waves emanating from the new H. F. Generator.

3. It is steady in its operation, and has run for WEEKS without interruptions to service. In February it was operating 97¾ per cent. of the time.

4. It is cool, clean and quiet in operation as a motor.

5. It is of massive construction, and resembles other electrical machines in a general way—not a freakish machine.

6. It has a low power consumption. The record of one month's work, 94 per cent. time in operation, shows a power consumption averaging less than 200 K.W. drawn from the power system, including all auxiliary power demand for station and living quarters. This renders the most continuous and reliable transatlantic radio transmission. On a "freak test" a message sent by *only ½ K.W. in the antenna, reported received at a Pacific coast station* 2,400 *miles distant.*

The Magnetic Amplifier.

When a soldier pulls the trigger of his rifle and releases the energy stored in the powder, the motion of his finger is amplified; i.e., a small cause produces large effects. In the electrical world for many years we have had telegraphic "relays." These are devices which permit a small flow of electricity from one source to set in motion a large flow of electricity from another source. Here again a small cause produces a large effect; so relays are practically amplifiers.

Now in the case of both the trigger and the relay we have mechanical motion—i.e., moving parts. These moving parts introduce mechanical and electrical difficulties when it comes to handling large currents of electricity. These moving parts thus constitute the limitations of electrical amplifiers which depend upon mechanical motions. They are "the neck in the bottle."

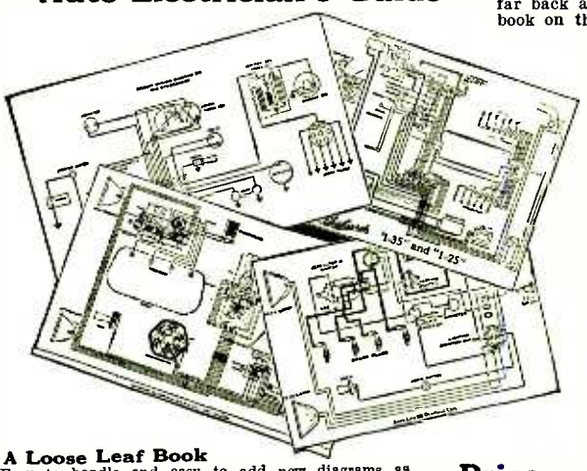
But the magnetic amplifier has no moving parts, hence it has correspondingly less limitations. Its principle depends upon the invisible and *motionless action* of magnetism within the iron.

To return to the "trigger analogy." When

(*Continued on page* 268)

850 WIRING DIAGRAMS
in the new edition of
Auto Electrician's Guide

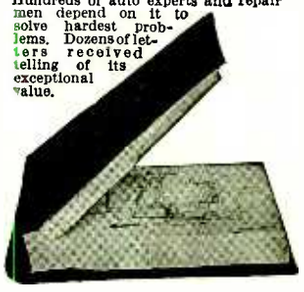
Contains wiring diagrams for every car on the market including the new 1919 Starting and Lighting Systems for Ford cars, also diagrams for Baker R & L and Detroit Electric and pipe connections for Stanley Steamers. Covers all kinds of systems from 1912 to 1919 and many as far back as 1906. Most complete diagram book on the market.



Highly endorsed by auto manufacturers, garages, service stations and auto experts everywhere.

No problem too puzzling if you have the Auto Electrician's Guide.

Any "Old Sticker" Quickly Solved with the help of this book. Saves hours of time on both old and new jobs. Impossible for even experts to know all cars but no car will "stick" you when you have this book. A practical, easily understood "guide" that will simplify all auto-electric problems and make it possible for you to quickly overcome hundreds of starting, lighting and ignition troubles which otherwise would take hours to solve. Extensively used all over the country. Hundreds of auto experts and repair men depend on it to solve hardest problems. Dozens of letters received telling of its exceptional value.



A Loose Leaf Book
Easy to handle and easy to add new diagrams as issued. Convenient to slip into the coat or car pocket and invaluable as a constant companion for repairmen. Scores of trouble cases quickly and easily corrected with the help of this guide. Send Today. Price $7.50, Postpaid. **Money refunded if not satisfactory.**

Price $7.50
Postpaid.
Money Refunded if not Satisfactory.

Michigan State Auto School
America's Most Progressive School
2887 Auto Bldg. DETROIT, MICH.

"THERE'S MONEY IN IT"
AT HOME **LEARN TELEGRAPHY** AT HOME
MORSE AND WIRELESS

TEACH YOURSELF



in half the usual time, at trifling cost, with the wonderful Automatic Transmitter, **THE OMNIGRAPH.** Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would.

Adopted by U. S. Gov't. 4 styles. Catalogue free.

OMNIGRAPH MFG. CO.
39L Cortlandt St. New York

HOME BATTERY CHARGING
means vitality and long life to your battery and anyone can do it, if he owns an

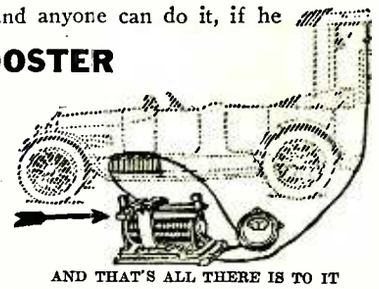
F-F BATTERY BOOSTER

Attaches to any lamp socket and fully charges a starting battery unattended over night from Alternating Current, Direct Current and Farm Lighting Plants.

Simple, Safe, Sure Acting, 3 years on the market, thousands in use and fully guaranteed. Complete with Ammeter and Battery Clips.

Price $24 for Type 166 for 110 volt 60 Cycle line and any 6 Volt battery.

Send check for prompt shipment or write for Circular 12.



THE FRANCE MANUFACTURING CO. Cleveland, O. AND THAT'S ALL THERE IS TO IT

Make Your Own Clock **$6**



Size 6x3½ inches

All you need is one of our electric self-winding movements. Run by two dry batteries. No key required. Throw away your old key-wound works. Use your present case or any special design you like. Thousands used for time switches and experimental work.

SAVE BIG PROFITS

Buying direct from manufacturers you save jeweler's profits and get a more up-to-date clock, and not only a better time-keeper but a better clock—an up-to-date self-winder. Special dials and hands to fit any case.

We also sell self-winding clocks **complete** with attractively designed mission or mahogany cases—fine workmanship, $9.00 and up. Ask for our free catalog.

ELECTRIC Self-Winding Movement

FINE TIME-KEEPER

Weight 2 lbs. Packed for Shipment

You Never Have To Wind Them
SELF-WINDING CLOCK CO.
Dept. EE, Grand Rapids, Mich.

MURDOCK No. 55



IT IS A FACT

Voluntarily certified by many owners, that these 'phones **have displaced** sets costing from **two to three times as much.**

Fourteen Days' Trial

will convince you. **Your money back** at once if they don't prove their value. Comparison with **any other** 'phones invited.

2,000 Ohm Complete Double Set	3,000 ohm Complete Double Set
$4.00	$5.00

Our PROMPT service in supplying these 'phones and other good MURDOCK apparatus is appreciated by our old customers. ORDER NOW for the best results.

Bulletin 19 is yours for the asking

WM. J. MURDOCK CO.
55 Carter St.
Chelsea, Mass.

Pacific Coast Representatives:
The Keeler White Co.
221 Second St., San Francisco, Calif.



"The Leader of Them All"

Thordarson's Flexible Wireless Transformer

Thordarson Electric Mfg. Co.
Chicago Ill.

TELEGRAPHY

Both wire and wireless, and Station Agency taught thoroughly and quickly, BIG WAGES NOW PAID, some of our recent graduates procuring $138.00 per month to start. Great opportunities for advancement. Our school the oldest and largest—annual enrollment 600 students. Endorsed by railway, telegraph, wireless and government officials. Expenses low—chance to earn part. Catalog free. Write.

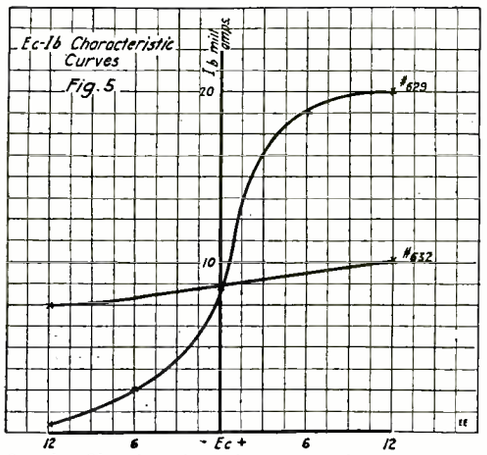
DODGE' INSTITUTE, 22nd St., Valparaiso, Ind.

The Design, Pumping and Testing of Audion Tubes

By C. Murray

(*Continued from page 235*)

The writer plotted curves on two Fleming valves; one with a cylinder ⅜ inch in diameter and the other ½ inch diameter. The results are shown at Fig. 4. During the test Eb was kept at 200 volts and Ia was varied until a saturation point was found. The grid, as aforementioned, is the principal element, and it is upon this that the main action of the Audion tube is based. The size or surface area depends entirely on what it is to be used for.



Graphs Showing Actual Tests and Space Currents for Two Different Audions. Grid in Tube No. 629 Had Twice as Many Turns as Grid In Tube No. 632.

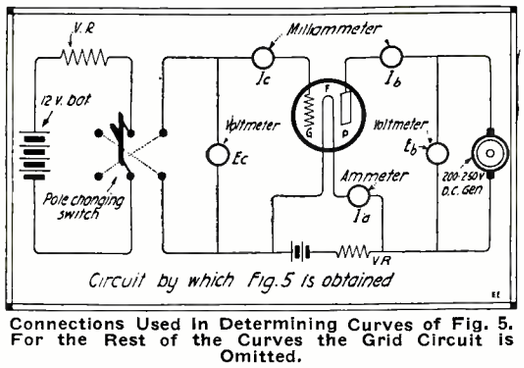
For instance, if we desire to use a tube for an *amplifier,* then we design it so that a small charge on the grid will produce a large effect on the plate current. If we wish to use it as an *oscillator* or power tube, it is not necessary or essential to have a large grid, but it must be constructed much heavier to prevent sagging during the pumping and while it is in operation as an oscillator.

The writer constructed two tubes with the grids as follows: The grid in tube No. 629 was made of .020-inch nickel wire, wound in the form of a spiral, ¼ inch in diameter, making a total of 26 turns. The grid in No. 632 tube was also the same diameter, but it only had 14 turns. The same plate spacing in both tubes was used. The results are used in graph Fig. 5. We can readily see that both tubes will give us 8 milliamperes of space current, when the grid is free, and by giving the grids a small negative charge one will drop almost to zero space current while the other only dropt to 7.5 milliamperes. We also find when we change the charge to positive that it will increase the Ib on No. 629 a great deal more than on the tube with the small grid.

By referring to the drawing of the vacuum pump, Fig. 1, the reader will see that it is constructed entirely of glass, with the exception of the mechanical pump or "backer." The *backing pump* used by the writer is of the rotary type and immersed in oil to prevent any leakage of air. With it a vacuum of from 8 to 15 mm. of mercury is readily obtained.

The *Aspirator* plays the principal part of the system and is indicated by 3, 4, 5, 6, and it is with this apparatus that we obtain the highest vacuum known to-day, which is very necessary in practically all vacuum tube work.

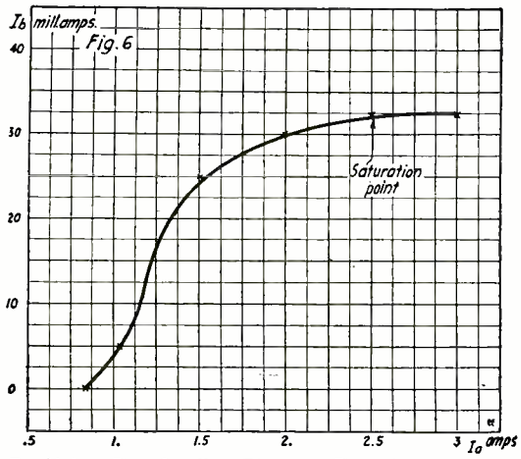
The mercury in the aspirator is used to absorb the gases which are generated by the bombarding or heating of the metal in the tube being pumped. The mercury must be heated to the boiling point before it starts its work of absorption. It has been estimated that a vacuum of 1 millionth of a mm. of mercury is obtained by the use of the aspirator.



Connections Used In Determining Curves of Fig. 5. For the Rest of the Curves the Grid Circuit is Omitted.

Liquid air is also used in the pumping process, to prevent or freeze any mercury vapor which has not been condensed on the walls of the aspirator from passing into the lamp while it is being pumped; for if we should allow a very small amount of the mercury vapor to get into the tube it would cause it to show a blue haze, thus greatly reducing its sensitiveness and it would heat up considerably.

We will here describe the pumping of tube No. 632 in detail: First the tube was sealed on the pump and an electric oven was placed around the tube. The mechanical pump was started, the current turned on in the oven and also the aspirator heater—the liquid air was placed in a "Thermos" bottle and the bottle was then placed outside the air trap. When the heat in the oven reached 150° C. the filament was connected up to a 15-volt transformer thru a variable resistance and glowed at 9 volts. Next the grid lead was connected to a 250-volt D. C. generator thru a variable resistance; the current was then turned on—the tube immediately filled with a bright blue haze—in a few minutes the grid began to get



By Using Too Small a Plate or Too Short a Filament in the Audion We Will be Limited in the Amount of Plate Current We Can Pass, as by Referring to Fig. 6 We Will Find a Point of Saturation; That is, if We Raise the Filament Temperature Still Higher the Value Ib Will Remain at a Certain Point.

(*Continued on page 266*)

Learn WIRELESS —NOW— Enter This New Field of Greatest Opportunity



NOW that peace is here wireless offers the greatest opportunity of the day to the young men of America. The experimental stage has passed. Wireless now equals in importance telegraphy and telephony, and if the present commercial wireless program is carried out, it may supplant them by the end of 1919. It has earned its place among the great commercial industries of the earth. So great has been the development and growth of Wireless in recent years that there is now a tremendous shortage of operators.

Peace Increases Demand For Wireless Operators

Actually thousands upon thousands of Wireless Operators, Inspectors, Mechanics, Electricians, and Radio Draftsmen will be needed for permanent "peace time" wireless positions at bigger salaries than have ever before been paid.

Peace means a bigger demand for men in every branch of wireless and is opening up new fields of Commercial Wireless activity which will fairly revolutionize present methods of communication.

No Previous Experience Necessary

You Can Learn Wireless In Ten Weeks In Your Own Home, through our practical home study wireless course. No previous experience or training is necessary in order to become a Successful Wireless Expert With our help you can quickly qualify for a good position at big pay. Many of our students have secured positions before completing the course. You will make rapid progress from the start because our course is based on actual practice and teaches you what you will need to know to make a big success of Wireless work.

Get Your Instructions From the Nation's Capital

(Our Course is endorsed by U. S. Government Officials.)

The National Radio Institute headed by authorities who have been closely allied with government training of students, was established in 1914 and is the first school in America to successfully teach Wireless by Mail. The work is under the direction of J. E. Smith, E. E., director of the Radio Department, Howard University, and E. R. Haas, formerly of the Radio Division of Yale University.

We now have students throughout the world. Our location in the Nation's Capital together with the standing of our officers and their wide acquaintance among government officials, connected with Wireless activities, place us in position to give our students the best instruction obtainable and to be of the utmost help in assisting them to secure good paying positions.

Travel and See the World

If you want to travel and see the world—go to foreign countries, and increase your knowledge of world affairs, Wireless offers you the chance of a lifetime. However, you are not obliged to travel, but may secure a permanent position at one of the big Land Stations, Railroad, Telegraph, or Steamship companies, if preferred.

Pay as You Go Along With Your Lessons

Our plans of payment bring a wireless education within the reach of anyone who desires to learn. A small payment down on our convenient payment plan, and small following payments, enables you to earn the cost of your tuition while actually learning to be a wireless operator.

Earn up to $250.00 per Month

In the short period of ten weeks we can make of you a wireless operator, a man with a profession, independent, and not subject to the rise and fall of wages in the labor market. Salaries are as high as $250.00 per month. We give you this training at home, by mail, in your spare time. It is not necessary for you to lose any time from your work to take the course. Then when you have received your diploma from us, we help you find a good position.

FREE INSTRUMENTS TO EVERY STUDENT

In addition to text books, lessons and personal instruction, we send you, while taking our course, a Home Practice Set consisting of a standard sending key and buzzer, and a Universal automatic wireless transmitting and receiving set. These instruments are free to every student. No other school can offer you what we do.

Announcement - - Opening of Norfolk School

The demand for our Course has grown to such an extent that we are now preparing to open a school in Norfolk, Va., which will be under the management of Mr. A. H. Van Nostand, Radio Inspector of the Third Radio District.

FREE Our booklet, "WIRELESS, the Opportunity of Today", gives you complete information in regard to our course, the quick and easy methods by which you can master wireless and other important facts you should know. It is free. Just mail the coupon. No obligation whatever on your part.

—MAIL THIS COUPON TODAY—

NATIONAL RADIO INSTITUTE
Department 77, Washington, D. C.

Send me, free of charge, your booklet, "Wireless, the Opportunity of Today," with full particulars regarding your famous 10 weeks Home Study Course, and your Special Free Instrument Offer.

Name .....

Address .....

Town .....

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

Wireless Receiving Ban Raised

MESCO WIRELESS PRACTICE SET



The Practice Set comprises a regular telegraph key, without circuit breaker, a special high pitch buzzer, one cell Red Seal Dry Battery, and four feet of green silk covered flexible cord.

The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes.

List No. Price

342 Telegraph Practice Set, with Battery and Cord $3.24

Weighs 4 lbs. packed.
Price does not include postage.

MESCO Combination Practice Set for Learning the Morse and Continental Visual and Audible Codes

This outfit is the only reliable instrument which will enable students to become proficient operators in the U. S. Naval Service, because it is equipped with a buzzer and miniature lamp enabling the user to master both the visual and audible signals quickly.



List No. 52—Practice Set with Red Seal Battery and Cord $4.05

Weighs 4 lbs. packed. Price does not include postage.

MESCO RADIO BUZZER



This buzzer maintains a constant note and is recommended as an exciter for checking wavemeters where pure note and ample energy are required.

It consists of practically a closed circuit field of low reluctance, having a steel armature to which is riveted a strap supporting a movable contact. The armature tension is adjustable by means of a screw with a milled head large enough to be easily and permanently adjusted with the fingers. The stationary contact is adjusted by means of a similar screw. The magnet coils are connected in series with a total D. C. resistance of 3.9 ohms. Shunted across these coils is a resistance having a D. C. value of 3 ohms. This shunt eliminates all sparking such as occurs at the break on ordinary radio buzzers and the energy saved thereby is transferred into any oscillating circuit connected to it, the result being that this buzzer as constructed radiates five times more energy than any other existing type. All connecting wires liable to be broken are eliminated. Contacts are of genuine platinum, which is essential in order to maintain a constant note. The parts are mounted on a Condensate base to insure constancy in operation.

Diameter 2 in., height 1¼ in. The cap is attached to the base by a bayonet joint.

List No. Price

55 Mesco Radio Buzzer $2.05

We carry a Large and Complete Line of Standard Wireless Material Recognized by Experts as such with Competent Experienced Wireless Attendants in Charge

Send for the New Edition of Our Catalog W28

It is pocket size, contains 264 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Wireless Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

Manhattan Electrical Supply Co., Inc.

17 Park Place, New York, N. Y.

CHICAGO
114 S. Wells St.

ST. LOUIS
1106 Pine St.

SAN FRANCISCO OFFICE: 604 Mission St.

INSTALL A NEW GREBE REGENERATIVE RECEIVER In Your Radio Station



Short-Wave Regenerative Receiver Type CR-2

This Receiver is intended for long distance relay work on wave-lengths between 170 and 580 meters and embodies a highly developed circuit employing continuously variable inductances of the variometer type as well as a number of new mechanical features.

Other designs for all wave-length ranges.

Send for free bulletin of this complete line

A. H. GREBE & CO., Richmond Hill, New York

The Design, Pumping and Testing of Audion Tubes

By C. Murray

(*Continued from page* 264)

red hot, and soon the haze could only be seen close to the grid. Then I changed over on the plate lead and worked it a while the same way as the grid, until it became red hot. Then I went back to the grid and finished it up. I shifted to the plate again, which had a slight haze on it, so I left it on till it was "clear." Then I connected the plate and grid together and heated them with the 250-volt generator for five minutes.

I turned off the oven and removed it and allowed the tube to cool. After it was cold I glowed the filament at 7.5 volts and connected the D. C. generator to the plate lead—it became red hot and was clear, so I sealed it off the pump with a blow torch. This completes the pumping of the Audion or three-element detector.

The pumping of the Audion in this way is very necessary, especially one on which we are going to use a "B" battery of 100 volts or more—for instance, the power tube, which requires at least 200 volts before it will give much of an output.

Next we have the glowing or aging of the filament, which stabilizes the action of the filament. It allows the coating of the platinum filament to firmly fix itself to the platinum and also burns away any of the remaining gases which might be in the tube. I trust the readers can understand how their vacuum tubes are constructed after reading the foregoing.

Operate Your Audions on A. C.

By Elliott A. White

(*Continued from page* 234)

for alternating current operation is the rheostat or potentiometer R2, and the large capacity condenser C4. The rheostat has a resistance of 8—10 ohms, or other value so long as it is not too high, nor so low as to draw too much current; connections are made to the two ends, with a movable contact covering all points. The condenser C4 is made of 6 or 8 discarded telephone condensers (1 or 2 mfds. each, thoroly tested for short circuits and leaks) with a total capacity of 8—12 mfds., the higher the better, around that figure. R3 is the usual filament rheostat if one is necessary, altho it is best to design any set with as few and as "fool proof" adjustments as possible. A fixt condenser of .015 mfd., or less may be bridged across the 'phones, tho it is not indispensable. A rheostat R4 may be added for the rectifier filaments, and numerous other modifications and improvements will suggest themselves. It is theoretically possible to have only one rectifier tube, but it might be noisy, and I should want to try it before recommending it.

The operation is simplicity itself. The stept-down A. C. heats the filaments in the usual way and has been employed for this purpose before. Cheap bell-ringing transformers can be used here just as well as winding a special transformer. The *new stunt,* however, lies in using the *rectified A. C.* for the "plate." This method has already been used for *transmitter* oscillators where the noise was not prohibitive, and even then a high frequency of 2,000 was provided. But it works very well on receiving tubes, even on the usual 60-cycle house-lighting circuits, if proper precautions are taken. (It is only a natural step from the receiving set here described to an

undamped wave radiotelegraph or radiotelephone *transmitter,* operated from the handiest lamp receptacle.) It will be seen that the rectifier tubes will pass current in only one direction, that is from plate to filament, so that during each half-cycle the current from one-half of the winding T3 T4, charges the condenser C4; the side of the condenser towards the high voltage winding being always negative, and that towards the low voltage winding always positive, as indicated in the figure. It is on account of the polarity of the condenser, that separate windings T2 and T5 T6 must be provided for the filaments of detector and rectifiers. The charge accumulates on the condenser C4 as available D. C. (voltage equal to half that of winding T3 T4) and will make a hot snappy spark if the condenser is short-circuited. The need of the large capacity for C4 is to keep up the potential when current is drawn off for the detector circuits, and to reduce the pulsations from the 60-cycle A. C. The only adjustment necessary is to locate the lever H of rheostat R2 at a point on the resistance, placed across the filament, where the hum is balanced out, an adjustment which has to be made only once. It is obvious that the whole apparatus is extremely simple, as the opening or closing of main switch S (with fuses FF to protect the transformer) controls all circuits. In the hook-up indicated in the figure, the only adjustments in tuning are of the inductances, coupling and condensers in the antenna and secondary, that is, L1 (C1) L2 C2 and coupling between L1 L2, which is delicate. Amplifiers may be added and operated from the same windings. My set oscillates "like a bird" on any setting.

With *low vacuum* tubes it might be necessary to provide for adjustment of the plate voltage as these tubes are sensitive but critical in adjustment, and this can be done either by winding T3 T4 to a higher voltage than ordinarily needed and cutting it down to the proper point by means of a variable high resistance in series with the 'phones (a potentiometer across C4 would discharge the condenser); or by means of variable taps on the transformer. In case bell-ringing transformers are used for T2 and T5 T6, the latter having no tap in the middle, a rheostat may be bridged across the whole winding and the lever adjusted as in the case of R2 H.

My experience has been that the adjustment of the rheostat or potentiometer R2 H, will cut out almost all the hum of the phones in receiving, but in case local conditions produce "cross talk" in some other experimenter's outfit, he will find that by proper insulating or grounding or balancing of transformer core, case, and windings, or by reversing the supply leads where the house wiring is grounded on one side, he can get rid of any objectional noise.

In making my transformer out of an old burnt-out 1 KW pole transformer core, I found that putting the whole transformer core and windings back in the iron case was advantageous in keeping induction from the core away from the rest of the set. The entire rectifier and associated apparatus should be kept *several feet away from the receiving set,* and all leads kept short, straight and separate, as in any other shipshape and efficient outfit. Bell-ringing transformers, if used, should have metal containing cases. The most important thing in using alternating current in this way, however, is care in the tuning adjustments, as there are certain critical adjustments which will make the set "howl" on account of audible beats between local audio-frequency beats and the 60-cycle alternations, besides other causes. For example, I find that in my set, keeping within "regions of silence" from interference depends largely on exact coupling, and that I have to keep L2 above a minimum amount, and to keep C2 at a small capacity—under .00025 mfd.,

"MATCHED TONE"

"Superior" Set 2000 ohms



PRICE $6.00

Brandes Wireless Headsets

are famous for their extremely clear, sharp tone—which is absolutely essential for *reading* very faint signals.

We achieve this by correct design, and by careful matching of tone in both receivers in the set.

This eliminates confusion to the ear which would be present if the harmonics of both receivers were unlike.

THREE TYPES— NAVY $14 TRANS-ATLANTIC $10 SUPERIOR $6

Sold Under Money-Back Guarantee
Send 4c stamps for Catalogue E

C. BRANDES, INC.
Wireless Receiver Specialists
ROOM 814 32 UNION SQUARE NEW YORK CITY

YOU NEED THESE REMARKABLE BOOKS

No. 6. Experimental Wireless Construction

An up-to-date book explaining in detail with ***working drawings*** how to build your own wireless apparatus, both sending and receiving, how to erect the aerial, connect and operate. 86 pages—93 illustrations.



No. 5. Wireless Construction and Installation for Beginners

Describes in detail with ***working drawings*** how any handy boy can make his own apparatus at lowest possible cost. Describes simpler and cheaper apparatus than No. 6 Book. 73 pages—67 illustrations.

No. 3. Lessons in Wireless Telegraphy

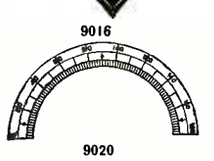
Explains in detail the principles and apparatus for wireless ***so that you can understand them.*** Everything from aerials to end losses and Audions.

Price 25 cents each, Postpaid Anywhere

You will never buy as much for 25 cents again.
Send now before these editions are exhausted.

COLE & MORGAN, Inc., Publishers
19 Park Place New York City





Whatever is worth doing,
Is worth doing well

. . . . . .

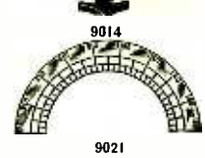
Use Bunnell Parts
Sold by all Dealers

. . . . . .

Catalog No. 40 E now ready

J. H. BUNNELL & CO.
32 Park Place New York City, N. Y.





Greatest Demand Ever Known for Wireless Operators

Our 20 weeks correspondence course qualifies you for fine positions.

All Apparatus and Text Books Free

25 Per cent of all tuition payments credited to our PROFIT SHARING PLAN for benefit of all students completing the course. Our illustrated booklet explains and will be mailed on request.

SERVICE RADIO SCHOOL

Largest Radio School in America

Dept. E, 900-2 Pa. Ave. Washington, D. C.

FOUR FAMOUS BOOKS

Wireless Course in 20 Lessons

By S. Gernsback, A. Lescarboura and H. W. Secor. E. E.

A course that tells you everything you can possibly want to know about "Wireless". The mysteries of "Wireless" are unfolded to you by the use of such simple language so skillfully used that of necessity you must understand every word. The subject is not treated superficially, however, for there is a whole lesson devoted to the Theory and Mathematics of this epoch marking subject.

Size of book is 7 x 10¼ in., 160 pages, 350 Illustrations, 30 tables.
Flexible cloth cover....per copy $.50
Stiff cloth cover.....per copy 1.00
Postpaid

Experimental Electricity Course in 20 Lessons

By S. Gernsback and H. W. Secor. E.E.

A Course of the theory and practice of Electricity for the Experimenters. This is undoubtedly one of the most complete and comprehensive treatises of this special subject ever published. The book is written by the same authors as the famous "Wireless Course in 20 Lessons".

Every Phase of experimental electricity is treated comprehensively in plain English.

The book contains 160 pages and more than 400 Illustrations.

Flexible cloth cover...per copy $.50
Stiff cloth cover.....per copy 1.00
Postpaid

No. 1. How to Make Wireless Sending Apparatus

No. 2. How to Make Wireless Receiving Apparatus

By 20 Radio Experts.

Two Remarkable Books

Book No. 1 contains 100 pages, size 7 x 5 in. and 88 illustrations, paper bound.

Book No. 2 contains 100 pages, size 7 x 5 in. and 90 illustrations, paper bound.

These two books have been written and published entirely for the wireless enthusiast who wants to make his own radio apparatus.

Book No. 1—How to make Wireless Sending Apparatus 25c
Book No. 2—How to make Wireless Receiving Apparatus.....25c
Postpaid

THE EXPERIMENTER PUBL. CO. Book Dept. 233 Fulton St., New York

or in the lower half of the scale on my small standard variable condenser. But I have not found the slightest difficulty in getting any desired adjustment of tuning or selectivity without starting "cross talk." A little practise is all that is necessary to make the set seem as silent as with *direct current*. Even if a faint hum still remains, it is never noticeable when fair signals are coming in, especially inasmuch as the A. C. hum is so low pitched compared with the signals, and quickly forgotten, like the scratch of a good phonograph. If anyone is unable to duplicate these results, it is his own fault. Of course a storage battery may be used for the filament, with rectified A. C. for the plate; or dry cells for the plate and a toy transformer for the filament.

This use of A. C. avoids all the bother and expense of storage batteries that cost much and require constant care and recharging; and of innumerable "plate" cells that cost a fortune now and last but a short time. The complete outfit can be constructed for the price of one "plate" battery renewal. I believe it to be the simplest and cheapest "stunt" yet.

"Hello Europe" --Via Radio

By Charles M. Ripley

(*Continued from page* 263)

the naval radio operator in Washington presses the key of his telegraphic instruments he PULLS THE TRIGGER. An instant later the effect is noted on the instruments and apparatus at the New Brunswick station 180 miles distant.

The tiny electrical impulse from Washington is used to strengthen the magnetism inside the wonderful new magnetic amplifier; and this, within the very same instant, releases the strange energy waiting inside the throbbing breast of the H. F. Alternator; and then, out on the high spun antennae flashes the AMPLIFIED dots and dashes which express the will of the American people to a listening world. So the magnetic amplifier receives minute impulses and permits terrific electric surges to enter the ether.

No device has ever equalled it for clear enunciation. There is a sharp staccato note to its messages. One way of expressing its achievement is, "New Brunswick does not slur its words."

Multiple Tuned Antennae.

A radio station without tuned antennae would be as short range an instrument as a violin without its "box" or a piano minus its sounding board. The volume of sound in each of these instruments is considerably augmented by their resonant wooden attachments, and so they can be heard at greater distances.

Just so the tuning of wireless antennae makes them "electrically resonant" with the vibrations, and augments the stations' powers of transmission.

But tuning does more than augment—it also refines the vibrations. The best comparison perhaps is that of an organ pipe.

Analogy of the Organ Pipe.

One refinement possest by the organ over practically every other musical instrument is that EACH TONE is provided with its own individual resonating pipe—separate and distinct. Since the *length* of the pipe is just ¼ the *wave-length* of its tone, it resonates only the pure tone desired. This refines the quality of the tone, as well as

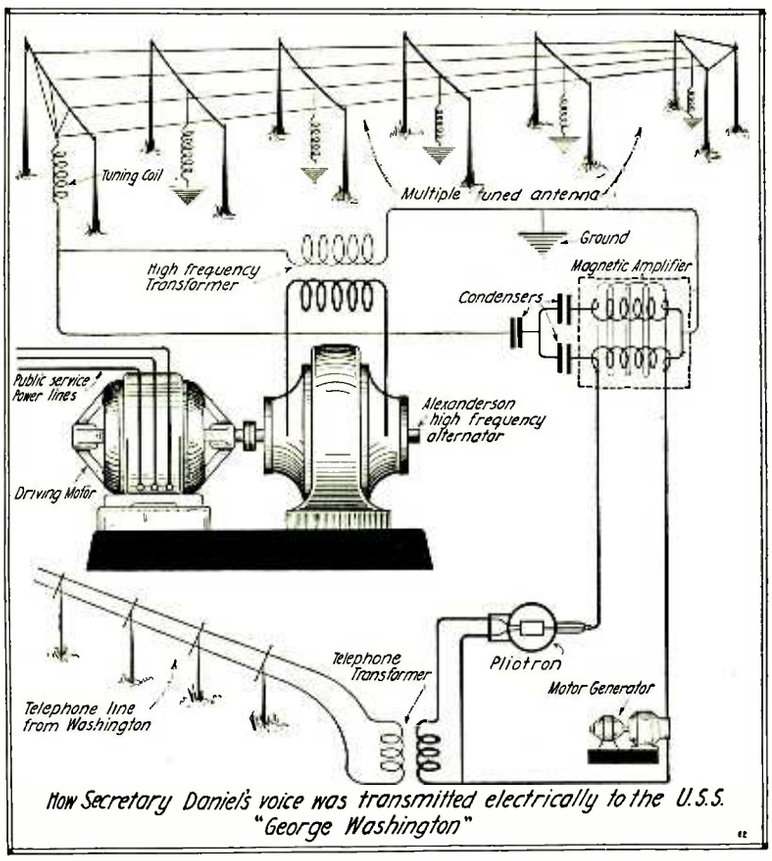


Chart-Diagram Showing the Radio Circuits at the New Brunswick Station, from Which Radio-Telegraphic and Telephonic Communication with Europe is Carried On.

amplifies its volume very markedly.

And just so the tuned antennae of a wireless station both purify as well as amplify the particular tone or vibratory frequency of the station's generator. Or putting it another way, the wires of the antennae are given electrical characteristics so that they "tingle" or "vibrate" electrically, in tune only with the particular vibrations set up by the one high frequency alternator in the station, and with no other.

Mr. E. F. W. Alexanderson explained the achievements of multiple tuned antennae as follows:

"Speaking in the simile of the organ pipe the action of the multiple-tuned antennae may be explained as follows:

"Whereas, in all previous systems the antennae may be likened to a single organ pipe, the multiple tuned antennae is six organ pipes tuned to the same pitch and sounded simultaneously in such a way that the combined sound is six times as strong as the sound emitted by each pipe. While it takes six times as much power to blow the six pipes as one pipe, the greatly increased efficiency of the new system is realized by the fact that it would require 36 times as much power to blow one pipe so strongly that it would emit a sound equally strong as the combination of the six pipes."

The six fanciful organ pipes are large "tuning coils," and as a happy by-product of their action they also serve as lightning arresters. In the accompanying illustrations these antenna tuning coils are clearly shown, as well as their relation to the antenna. One end of each tuning coil is connected to earth.

Our Heels Spark.

It was dark when we left the station, but there were two more surprises in store for me. As we walked toward the automobile under the antennae, we in the rear were astonished to *see brilliant sparks leap from the heels of those in front.* The experts explained that the electricity from the air was caught up by our bodies and discharged from our shoe nails into the ground. As an experiment one of us stooped over to touch the ground and received even a stronger shock than formerly when he stept out of the automobile that morning!

As we sped cityward, we looked back and marveled in mental perspective:

A sparkless, arcless, noiseless, wireless *of six times the earlier efficiency;* a clearer quality; complete radio silence between its radio im-

WANTED
Immediately

WIRELESS operators are in demand owing to the expansion of our Merchant Marine. Pay has increased to $110 per month plus all expenses.

THE Y. M. C. A. Radio Schools give thorough practical courses with individual instruction. Our graduates fill responsible positions.

THIS is *your* opportunity. Classes now forming. Excellent dormitory facilities. Complete laboratory equipment. Write today for illustrated booklet.

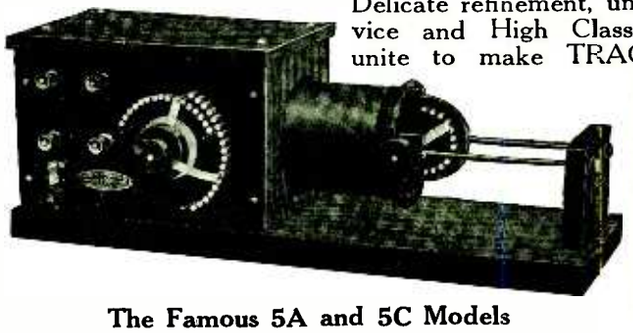
Y. M. C. A.
NEW YORK CITY

Manhattan Branch: 114 East 86th St. Tel. Lenox 6051
Brooklyn Branch: Marcy Ave. Near B'way Tel. W'msburg 3800

Be an Artist
Comics, Cartoons, Commercial, Newspaper and Magazine illustrating. Pastel, Crayon portraits, Poster and Fashions. **Earn Big Money.** *Taught by Mail or* Local Classes. Write for illustrated booklet, terms and list of successful pupils
ASSOCIATED ART STUDIOS, 13A Flatiron Bldg., N. Y.

TRACO QUALITY
NAVY TYPE RECEIVING TRANSFORMERS

Used the world over. Insist on the genuine, built by the originators. Substitutes are expensive. Irrespective of design, we absolutely guarantee our tuners to produce the maximum signal volume. Delicate refinement, uninterrupted service and High Class Workmanship unite to make TRACO tuners the standard whereby all others are judged. If your dealer does not handle them order direct from us. Get our catalogue, enclose stamps.



The Famous 5A and 5C Models

THE RADIO APPARATUS CO.
POTTSTOWN, PA. U. S. A.

110 V. TRANSFORMERS
6-12-18 Volts Output



Consumes so little current will not move ordinary meter.

$1.50 Postpaid

Ideal for experimental work—NO MOVING parts. Cannot get out of order; with cord and plug $2.00. Transformer No. 12—Heavier Output, 6, 12, 18 Volts—$2.50 with cord and plug. Order from this ad.

National Transformer Co.
Dept. 17, 3124 North California Ave., Chicago, Ill.

AUDIOTRON VACUUM TUBE PANELS
PARTS AND ACCESSORIES



Audiotron B Battery. Thirty large cells—not flashlight size—sealed in moisture proof. Eight taps to binding posts. Tests full 45 volts. Guaranteed one year. Price $6.00 delivered.

AUDIOTRON VACUUM TUBE PANEL



Panel full XX Grade Continental Bakelite Dielects. Steel cut and whitened engraving. All metal parts heavily nickeled. Switches for double filament tubes and arc or spark reception. New type Back mounted smooth running rheostat. Panel also furnished in maple with imitation black bakelite finish.

No. 8B. Full Bakeline panel assembled.....$15.00
No. 8BP. Complete set of parts..... 12.00
No. 8W. Wood panel complete..... 12.50
No. 8WP. Complete set of parts..... 10.00

Send cash with order and save all delivery charges. *Dealers: write for proposition*

AUDIOTRON SALES CO., 311 Lick Bldg., San Francisco



Type 800
Balanced Variable Cond. Supplied in three sizes. Unmounted or mounted in nickeled metal case for use with oil or other liquid dielectrics

MODERN DESIGN

Is applicable to Electrical Apparatus as well as other scientific instruments. The new CLAPP-EASTHAM balanced condenser, designed for horizontal mounting on panels, embodies the most modern designs at a cost within reach of everybody.

Send 3 cents for Bulletin Y.

CLAPP-EASTHAM CO.

131 Main Street **Cambridge, Mass.**



DUCK'S BIG 300 PP. Wireless & Electrical

Catalog is now as it always has been, the largest and most complete and dependable Wireless Catalog published. Mailed for 12c in stamps or coin which may be deducted on first order of one dollar. Catalog not sent otherwise. This catalog costs us twice the price of other catalogs.

Everything in wireless *worth while* is listed in this catalog. The experienced amateur will tell you to see our catalog before buying. You are thereby insured against an unwise purchase. It is the *Beacon Light* to guide you right in the selection of your wireless apparatus. No bigger or better values are obtainable elsewhere. Send for revised price list. It is yours for the asking.

THE WILLIAM B. DUCK CO., 230-232 Superior St., Toledo, Ohio

pulses or immense power; yet small interference with other sending stations; sending 20 words per minute regularly and 90 words in test! Surely it is a privilege to live in the 20th century and to learn about these things while in the making—for many things are more interesting in their development than when fully grown to a lusty manhood.

That night the discussion of the day's visit opened up a great vision to us. A message cabled from New York to Queenstown goes to Queenstown only; but when the wireless flashes a message from New Brunswick it goes to every point of the globe simultaneously! And when we heard that it only costs $30,000 per year for power to send words to a *thousand* wireless receiving stations—then the possibilities of wireless in the future seemed to expand without limit. Here is the point: One word from New Brunswick to all the world costs—well—ask Uncle Sam! One word from New York to Queenstown only, costs 25 cents by cable.

As a whole, it may be said that the possibilities for extension of radio as a system of world communication have barely been touched upon, but the radio technique has now reached the point where it needs only capital and business initiative to duplicate and exceed in speed, accuracy and economy the trans-oceanic cable traffic; and for each sender to extend the service to all parts of

THE CALL OF W DOUBLE I

(Mr. Webster is a wireless operator at the U. S. Naval Radio Station, New Brunswick, N. J., the most powerful radio station in the United States.)

THE winter sun has settled,
Darkness is creeping near;
The moon slips behind a cold black cloud,
Denying the world of his cheer.
A sentry stands faithful to duty,
As out through the limitless sky
Crashes the call from Loyal America,
The call of W double I.
It speaks and the whole world listens,
And in the far-off city of Rome
A happy American sailor
Hears the call of his Home, Sweet Home.
It comes to the listening German,
As the Eagle's own warning cry,
And he shudders as he hears that warning,
The call of W double I.
The Frenchman hears and is comforted,
For he knows that it speaks with power;
He knows that aid is coming,
Though he knows not the day nor hour.
The load on his heart is lighter
As he settles back with a sigh;
It comes to his ear as music,
The call of W double I.
Out on the wind-swept ocean
The sailor hears the call;
He knows it comes from America,
The grandest land of all.
He grasps its high-pitched music
As it crashes through the sky,
'Tis to him as the song of the angels,
The call of W double I.
In distant cold Alaska
A soldier's eyes grow bright
As he murmurs, "Yep, that's him calling,
And he's coming good to-night."
And he sits and listens closely,
With that stern look in his eye,
For he knows 'tis the voice of Old Glory,
The call of W double I.
The moon comes out from his hiding,
And smiles his praising cheer,
On the land of Free America,
Whose call he, too, must hear.
The clouds roll away to the southward,
The stars peep down from the sky,
And the whole world stops to listen
To the call of W double I.

—H. R. WEBSTER, U. S. N.

the globe requires merely receiving stations.

New sending stations equalling New Brunswick in power would require about a half million dollars to construct and equip.

Receiving sets of a very high grade type can be purchased for less than $100 and can be installed on a table, indoors. Messages can be sent from 20 to 90 words per minute; and with a station operating over 90 per cent. of the time, SOMEONE is going to make a fortune. Or, not thinking along mercenary lines alone, why couldn't great news gathering syndicates have their own wireless systems; or other corporations with world-wide interests might have their own private plants. Perhaps the idea of John Wanamaker with his private wireless stations may be the forerunner of a series of "jitney" wireless systems by the thousands. Who can tell in these early days along what lines the development will take place?

President Wilson's Ship Fitted With Radiophone

When the *George Washington* cleared for Brest she had installed in her wireless room a telephone transmitter which permitted the President to hold wireless conversation with the Navy radio station at New Brunswick, N. J., and with Washington direct. This was made possible by the use of the General Electric Company's apparatus designed by Ernest F. W. Alexanderson.

Wireless telephone messages were sent by this apparatus to the President thruout his last voyage to France, but the steamship was not fitted with the same apparatus and he could not reply in kind. Recent experimental work, however, perfected the answering facilities, and thus made it possible for the President to "talk back" to his Washington governmental associates.

Talking Thru the Trees

By Major General George O. Squier

(*Continued from page* 204)

another tree-antenna, and automatically returned to the sender on a wire system, thus making the complete circuit. Illustrated at Fig. 6.

Long distance reception on any wave length from all the larger European stations and from our ships at sea was easily accomplished and traffic copied on a twenty-four hour schedule by the regular enlisted operators of the Signal Corps. A small portable house serving as a field laboratory was erected in the midst of the forest area on Grant Road, Washington, D. C., between the Bureau of Standards and Chevy Chase, Maryland (see accompanying illustration), and here was assembled a collection of the most efficient vacuum tube amplifiers developed to date by the Signal Corps of the Army, the Navy, the British and the French, and of commercial radio firms in the United States. With these unusual facilities it was a matter of a few days to test out, at least in a superficial manner, a large number of proposed arrangements *using trees as the antennae.*

Fig. 7 shows how a number of trees can be connected up to give the effect of one large antenna.

In France officers of the Signal Corps, by the simple device of driving a spike into a tree-trunk to which to connect the audion set which wireless operators use to magnify the dot and dash little sounds which make up wireless messages, found it was possible to "listen in" on communications between German airplanes and the German lines. Messages were thus intercepted in spots into which it would have been impossible to transport a field wireless apparatus. See Fig. 8.



Thousands of Electrical experts are needed now. Come to the great shops of Coyne and let us train you quickly by our sure practical way backed by 20 years of success.

Earn $125 to $300 a Month

Come to Coyne where experts train you on the actual apparatus. You work on everything from the simple bell to the mighty Generators, Electrical Locomotives and Power Plants. Everything to make you a Master Electrician. Look at the picture taken from life in our shops.

Become an Expert in 3½ Months

No need of taking 1 to 4 years to become an expert. We have proved this in thousands of cases. We are the only school teaching by the original Coyne methods, which means no books, no classes—all practical training.

Earn Your Way. Our employment department will help every ambitious man to earn a part or all his expenses—without charge.

Bennett W. Cooke, Director
COYNE TRADE AND ENGINEERING SCHOOLS
Dept. 27, 39-51 E. Illinois Street
CHICAGO, ILL.

LEARN DRAFTING

The country needs hundreds of skilled Draftsmen in all lines at big salaries.

Coyne is the only school in the country that gives you the advantages of big shops full of construction and machinery. This makes our drafting courses practical, just like the job you'll have when you graduate. You can't get this in any other school.

WE TEACH ELECTRICITY, DRAFTING, MOTION PICTURE OPERATING AND PLUMBING

We teach all these professions in such a thorough, practical way that when you finish you can step right into a position of responsibility and big pay.

Fill out the coupon *now* and send it for our big free book of information. It tells what others are doing and have done, what you can do.

Be sure and check the trade that interests you. Do it now.

COYNE SCHOOLS
Dept. 27, 39-51 E. Illinois St.
CHICAGO, ILL.

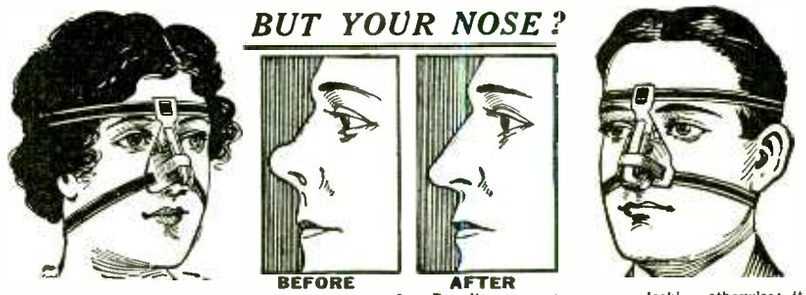
Please send me that big free book. I'm interested in:

[] Electricity [] Drafting [] Plumbing
[] Motion Picture Operating.

Name .....

Address .....

YOU HAVE A BEAUTIFUL FACE
BUT YOUR NOSE?



IN THIS DAY AND AGE attention to your appearance is an absolute necessity if you expect to make the most out of life. Not only should you wish to appear as attractive as possible, for your own self-satisfaction, which is alone well worth your efforts, but you will find the world in general judging you greatly, if not wholly, by your *"looks,"* therefore it pays to "look your best" at all times.

Permit no one to see you looking otherwise: it will injure your welfare! Upon the impression you constantly make rests the failure or success of your life. Which is to be your ultimate destiny? My new *Nose-Shaper,* "TRADOS" (Model 24) corrects now ill-shaped noses without operation, quickly, safely and permanently. Is pleasant and does not interfere with one's daily occupation, being worn at night.

Write today for free booklet, which tells you how to correct ill-shaped noses without cost if not satisfactory

M. TRILETY, Face Specialist **1162 Ackerman Bldg., Binghamton, N. Y.**

INDEX to ELECTRICAL EXPERIMENTER SCIENCE & INVENTION

For Vol. 1, 2, 3, 4, 5
15c
EXPERIMENTER PUBL. CO.
Book Dept. 231 Fulton St., N. Y.

AMPLIFY YOUR RADIO SIGNALS

With the new DETECTAGRAPH-TRANSMITTER, the amateur can amplify radio signals to such an intensity that he can hear the signals about his station without the need of the telephone head set.

By the addition of a loud talking telephone he is able to hear the messages many feet away from the instrument.

The super-sensitive DETECTAGRAPH-TRANSMITTER herewith shown is two and three-eighths inches in diameter, five-eighths of an inch thick and weighs less than three ounces. It is the most sensitive sound detecting device ever brought before the public.

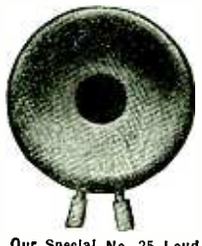
The manner in which the amplifying process is attained is by attaching with tape the DETECTAGRAPH-TRANSMITTER to the regular wireless receiver.

Not only is this instrument applicable for amplifying radio signals, but it can be used with equal satisfaction for magnifying other sounds. Phonograph music can be transmitted from one place to another by means of this instrument, and those who are afflicted with deafness will find enormous benefit by using this transmitter. It is the greatest device for building your own loud talking telephone, detectagraph and other devices. Can be used for any purpose where a sensitive detecting instrument is required.

SUPER-SENSITIVE Detectagraph MICROPHONE DEVICES



Our Super-Sensitive Detectagraph Transmitter. Price, $7.00 Complete



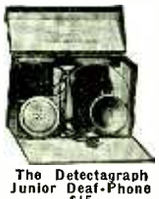
Our Special No. 25 Loud Talking Receiver. Price, $4.00 Complete



Detectagraph Rheostat, especially made for amplifying circuits. Price, $2.00 Complete



Super-Sensitive No. 40 Receivers to be used in connection with Detectagraph-Transmitters, $10.00



The Detectagraph Junior Deaf-Phone $15

Equal to any $35 instrument made. Outfit consists of Super-Sensitive Transmitter with cord connector; Super-Sensitive Ear Piece with small black cord; Black Single Headband; Black Case and Two Batteries.



Model "B" Horn, with Loud Talking Receiver, Cord Plugs and Desk Stand Base. Price, $10.00 Complete



Model "C" Horn, with loud talking Receiver, Cord Plugs and Wall Base. Price, $10.00 Complete



Detectagraph $15

This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord, Receiver, Headband, Case and Battery.

Order direct from ad.

Or write for free descriptive circular.

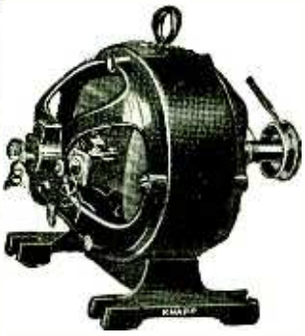
G. BOISSONNAULT COMPANY

26 CORTLANDT STREET NEW YORK CITY

Makers of Super-Sensitive Microphone Devices

DEPENDABLE KNAPP ELECTRIC SPECIALTIES

Motors and Electrical Specialties Are Best



Knapp Goods have stood the test for 29 years. No detail in construction has been spared to make them the best that money can buy. The complete Knapp line includes Toy and Power Motors, Generators and Dynamos. Specialties and Novelties that amuse and instruct. Fans, Rheostats, Compasses, etc. And Knapp prices are always lowest. Always insist on Knapp Goods.

KNAPP "LEARNELECTRICS"

A complete Electrical Laboratory, including a very valuable instruction book by H. P. Gorman, A.I.E.E. Covers all subjects clearly and concisely.



KNAPP DYNAMO MOTOR

Will electroplate, charge storage batteries, run lamps, motors, train of cars, induction coils,—in fact, the number of experiments it can be used for is unlimited. Runs on 4 to 6 Volts or can be connected to run on 110 Volts through a transformer.

Price, Complete, $7.00

Price, Complete, $3.50

Order to-day. Or your dealer can secure them for you. DESCRIPTIVE CIRCULAR and CATALOG of celebrated **KNAPP MOTORS** *and Electrical Specialties from 10c up mailed FREE on request.*

KNAPP ELECTRIC & NOVELTY CO., 523 West 51st Street, New York City

WIRELESS Apparatus, Raw Materials. Magnet wires, motors, experimenters' needs, novelties listed in our Catalogue C-3. Assure yourself of prompt service and right prices by buying from this world famed, reliable, Experimenters' Supply House. *99 of every hundred orders received shipped within 24 hours. Catalogue C-3 FREE on request.*

THE NEWMAN-STERN CO., Cleveland, O.

FOR WIRELESS SUPPLIES

See

AMERICAN ELECTRO TECHNICAL APPL. CO.

235 Fulton St., N. Y. City—Cort. 3153

BATTERIES (High & Low Voltage)
Geysler Tubes Spark Coils
Loose Couplers Veriometers
Receivers, Condensers & Detectors.
Distributors of De Forest's Mfg.

The Physics of "Tree Wireless."

We may regard the metallic electrode rigidly driven into the living organism of a tree, as described above, as a *potential earth-terminal* for the study of the potential distribution on the surface of the earth itself. It has been shown in these experiments that this metallic terminal intimately connected to the earth itself and a part thereof is subject to changes of potential representing the innumerable frequencies required by modern radio-telephony and telegraphy, as well as any other electrical disturbances which may occur on the surface of the earth or the atmosphere above the earth.

It has been also shown, as expected, *that we can select from this composite, one or more of the different frequencies by tuned electrical loop circuits suitably connected to this electrode and study each in turn,* at will, just as color screens can select a particular component of white light. We may, indeed, by means of a highly insulated conductor bring this terminal directly to the laboratory and connect it immediately to the modern thermionic tube and amplify almost at will the particular effects we are studying. This tube (Audion) is a powerful and new instrument of research for the modern physical laboratory. Has not the physicist therefore in this electrode a means of studying in detail atmospheric and earth electrical disturbances of absorbing interest and far-reaching importance?

In short, the radio Art as a whole has attracted some of the best equipt physicists in each country as perhaps no other practical engineering subject of recent years has done, with the result that the methods and means of the radio Art are now immediately applicable and available to the physical laboratory for the study of the fundamental problems of the earth itself as a charged sphere.

For four years, under the stimulus of the World War, the efforts of engineers have been expended in producing instrumentalities for the generation and reception of radio signals and there has been little time to coordinate and assimilate the information gained into a better understanding of the ether mechanism for the transmission of electromagnetic waves thru space, over the surface, or thru the earth itself.

However, from the moment an acorn is planted in fertile soil, it becomes a "detector" and a "receiver" of electromagnetic waves and the marvelous properties of this receiver, thru agencies at present entirely hidden from us are such as to vitalize the acorn and to produce in time the giant oak. In the power of multiplying plant cells, it may, indeed, be called an incomparable "amplifier."

From this angle of view, we may consider that trees have been pieces of electrical apparatus from their beginning and with their manifold chains of living cells are absorbers, conductors and radiators of the long electromagnetic waves as used in the radio Art.

For our present purpose we may consider, *therefore, a growing tree as a highly organized piece of living earth,* to be used in the same manner as we now use the earth as a universal conductor for telephony and telegraphy and other electrical purposes.

My Early "Tree Radio" Researches.

From the account of my early "Tree Wireless" experiments I quote the following selected paragraphs:*

*Reference. "On the Absorption of Electromagnetic Waves by Living Vegetable Organism." By George O. Squier, Ph.D., Major, Signal Corps, U. S. A. Official Report to the War Department on the Military Maneuvers in the Pacific Division, 1904.

(*Continued on page* 274)

EXPERIMENTERS!

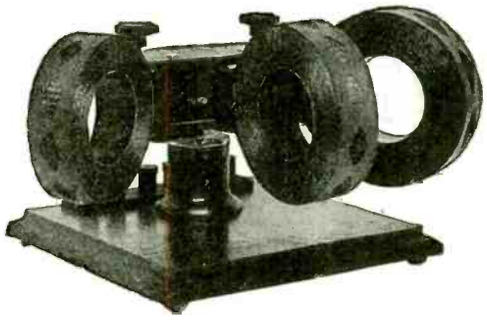
Are you listening to Rome, Lyons, Eiffel Tower, Darien and Nauen discussing matters of world interest?



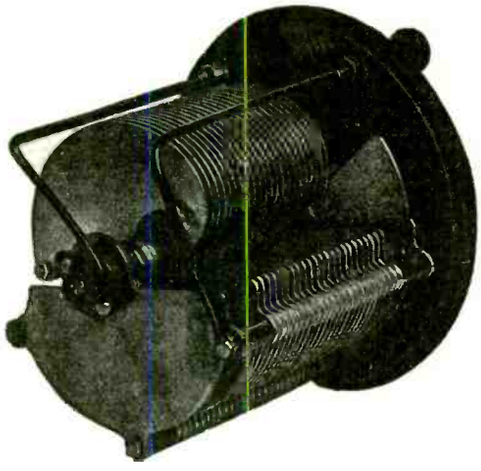
TYPE L101 COIL MOUNTING
Also Made in Other Styles

Your own Air Condenser with 3 of our new "Honeycomb" Wound Inductances makes this easily possible at a cost so low it will surprise you.

DE FOREST WIRELESS TELEPHONE AND TELEGRAPH APPARATUS



HONEYCOMB COILS
For Wave Lengths 150-25000 Meters



VERNIER CONDENSER
Made in Various Sizes. From $15 to $18

Our new VERNIER CONDENSER when used in connection with the devices illustrated above complete a long wave receiving set which cannot be surpassed for double the money.

Particulars and prices on application

DE FOREST RADIO TEL. & TEL. CO., 1391 Sedgwick Avenue, New York City

THE LIBERTY DETECTOR VALVE

is a supersensitive, detector, oscillator, or amplifier, Electron discharge tube. An absolute necessity for your laboratory. Delightful experiments, Thunder bolt Radio Signals and the heretofore impossible are achievements you can now enjoy through the famous LIBERTY VALVE. EVERY TUBE GUARANTEED, prompt deliveries. Price $5.50 post paid.

THE RADIO APPARATUS COMPANY
POTTSTOWN, PA., U. S. A.
A one cent stamp brings our Liberty detector bulletin, get it now.

MONEY *for* YOU

Add to your Salary—Make extra Pin Money
Start a lucrative business of your own

Spend an hour each day taking subscriptions for the "Experimenter." We'll pay you well and you'll enjoy the work. *Write for full particulars.*

Circulation Dept. ELECTRICAL EXPERIMENTER, 233 Fulton St., N. Y. City

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

WIRELESS MEN:

The Consolidated Radio Call Book

THE MOST NEEDED BOOK OF THE HOUR IS BEING published. A book which will be, literally, the right arm of all organizations and persons directly or indirectly connected with the ever increasing radio field

THIS BOOK HAS BEEN COMPILED AND IS PUBLISHED for the express purpose of meeting a timely and urgent necessity among radio and steamship companies, professional and amateur radio operators, and those having need of authentic and practical information on radio calls; radio, telegraph and cable rates, special signals and general radio procedure.

THE DAY HAS COME WHEN EFFICIENCY IS THE WATCHWORD in radio organizations, and this applies to the amateur as well as the professional. There is no room for guess work, either in the matter of call letters, rates or procedure.

EVERY VESSEL AND LAND STATION IN THE WORLD WILL BE represented and listed in this book alphabetically, according to names of vessels or land stations, and according to call letters; Revision of American coastal stations under U. S. Naval control, and their new calls.

THAT NEW AND GREAT AID TO NAVIGATION—THE RADIO COMPASS—will be explained and is a unique feature of this publication, and will be of special value to masters of merchant vessels.

THIS BOOK CONTAINS ALL CALLS LISTED IN THE NEW book to be published by the Department of Commerce.

PRICE IN ADVANCE OF START OF PRINTING 50c PER COPY. THIS OFFER good only when order is postmarked before July 1st, 1919. Price 75c after above date. Send checks or money orders. Act quickly as after supplying Commercial Wireless Companies with copies already ordered, individual orders will be filled in order of receipt.

CONSOLIDATED RADIO CALL BOOK COMPANY, INC.

41 Park Row, Room 1420, New York City

This book will also contain the advertisements of practically every company in the radio field.

Boys! You Can Make Your Own Electrical Apparatus with the aid of these wonderful books

Home-made Electrical Apparatus

By A. M. Powell



Three wonderful big books, chuck full of just the sort of information you have been looking for and at a price within reach of your pocket book. Each volume is printed on heavy paper, contains **75 pages and over 60 illustrations, complete working drawings for making every sort of electrical apparatus.** Written so you can understand them. **The price is only 25 cents per copy**—practically the cost of publication. See partial table of contents below and order now. The supply is limited.

Vol. I Contains *working drawings* and directions for making all sorts of Static Machines, Static Apparatus, Home-made Batteries, Storage Cells, Transformers, Rectifiers, etc.

Vol. II contains *working drawings* and directions for all sorts of Voltmeters, Ammeters, Galvanometers, Switches, Rheostats, Telegraph Keys, Sounders, Telephones, Shocking Coils, Spark Coils, Experiments, etc., etc.

Vol. III contains *working drawings* and directions for making all sorts of Dynamos, Motors, Electric Engines, Miniature Lighting Plants, Wireless Telegraph Apparatus, Tesla Coils, Wireless Telephone, Electroplating, Experiments, etc., etc.

Any of these wonderful books will be sent to you *postpaid* for **25 cents.**

COLE & MORGAN, Inc., *Publishers and Booksellers*

P. O. Box 473, C. H. Sta., New York City

Talking Thru the Trees

By Major General George O. Squier

(*Continued from page 272*)

"It would seem that living vegetation may play a more important part in electrical phenomena than has been generally supposed. We have seen that living vegetable organisms absorb and conduct electromagnetic oscillations over a wide range of the electromagnetic spectrum, beginning with sunlight, whose electrical action in the plant cell is at present little understood, and extending to waves of identical character, but of immensely greater lengths, such as Hertzian radiation, telephonic waves, and oscillations of the ordinary low frequencies used in commercial electric transmission lines. Disruptive discharges between vegetable electrodes, and electrostatic effects between vegetable surfaces are easily produced."

"In view of what has been accomplished in space telegraphy within the last seven or eight years, it is difficult to predict to what extent this means of communication may be ultimately developed. If, as indicated above in these experiments, the earth's surface is already generously provided with efficient antennae, which we have but to utilize for such communication, even over short distances, it is a fascinating thought to dwell upon in connection with the future development of the transmission of intelligence."

"Since a transmitting station is a central point for electromagnetic waves sent out in all directions over the surface of the earth, a large class of information, such as meteorological reports, crop reports, and general news items of interest to all, may in time be sent from central points, to be received at many places within the radius of influence of the signal station, and this, too, by the simplest forms of apparatus."

"It is seen that a growing tree, covered with foliage, is influenced inductively by electrical disturbances outside of itself, and in fact becomes generally responsive to induced electrical oscillations. It should offer, therefore, a promising means of studying meteorological effects of an electrical character, particularly those of lightning discharges, and electricity of the air. One of the first practical rules for the preservation of life against lightning is to avoid the vicinity of a tree."

"Our great forest areas may exercise an influence in maintaining a general equilibrium between the electrical charges of the upper atmosphere and the earth, which has not been fully realized. On this point, comparisons between observations from the interior of great desert areas devoid of any vegetation, with those from other portions of the earth's surface well covered with forests, would be instructive."

"From this viewpoint, the general surface of the earth may be considered as supplied by nature with innumerable meteorological observation towers, which possibly may be employed by means of apparatus involving principles already well known to science."

"In conclusion, it is believed that vegetation should be studied more systematically, from a distinctly physical standpoint than has been done in the past. Physics has been said to be the mother of all the sciences, and more and more the physical method of studying all science is proving to be the true one, as is evidenced by the great advance in recent years, in comparatively new branches of scientific work, such as Astrophysics and Physical Chemistry. Has not the time arrived for a more systematic study of Physical Botany, in the light of the new electric theory of matter?"

*Abstract of paper recently presented to Physical Society of America.

A-K TABLETS FOR All Pain

Headaches
Neuralgias
Colds and La Grippe

Women's Aches and Ills
Rheumatic and Sciatic Pains

Ask Your Druggist for A-K Tablets
(If he cannot supply you, write us)

Small Size 10c — Fac-Simile — **Dozen Size 25c**

See Monogram A-K on the Genuine

The Antikamnia Remedy Company, St. Louis, Mo.
Write for Free Samples

How to Get Rid of Moles



A simple, safe home treatment—15 years' success in my practice. Moles (also BIG growths) Dry Up.

Ask for Free Booklet of Full Particulars

WM. DAVIS, M. D.
4140 State Street Perth Amboy, N. J.

Fun, Magic and Mystery!

56 Feats in Magic, 250 New Jokes, 21 Puzzles, 1 Fortune Telling Tablet, 52 Money-Making Secrets, 15 Card Tricks, 71 Toasts, 58 Verses in Comic Poetry, 10 Funny Readings, 41 Epitaphs, and 11 Parlor Pastimes. You get all the above-mentioned and our big illustrated Catalog of 125 Magic Tricks for only 10 cents. Write today.

MYSTIC MFG. CO.,
909 Springwells Ave., Detroit, Mich.









STAMMER

If you stammer attend no stammering school till you get my big new FREE book and special rate. Largest and most successful school in the world curing all forms of defective speech by advanced natural method. Write today.
North-Western School for Stammerers, Inc., 2331 Grand Ave. Milwaukee, Wis.

How Don Flashed the "S.O.S."

By Mabel M. Davis

(Continued from page 236)

flashed out: — - — - — — — - — — - — — - — - — - "Come pole."

In five minutes Will Merton was dancing excitedly about on the sidewalk below "Don," yelling to his brothers to bring the extension ladder. Other neighbors were gathering and demanding of "Don" why he was up there. "Don" glanced about and saw no sign of the cat he had come to rescue. When the wire flashed the cat had acquired a little common sense and gone down the way it came up. So that embarrassing element of the situation was, thank Heaven, eliminated. At the next call, "Donald Johnson, what are you doing up there?" Don replied, "Fixing the transformer. Bring up my supper, will you?"

Donald's father took his place at the bottom of the ladder, steadying it while Will Merton's older brother climbed up, unhooked "Don," and helped him get a place on the ladder. At the bottom he was besieged with questions but evaded them all. Will picked up Don's loaded coat and the hungry, shivering "S. O. S." man was glad to slip into it. All he said was: "Let's get out of this before the company's trouble man gets here to splice that wire."

When he got home he confest rather shamefacedly to his father and mother and Will Merton, that he went up the pole to rescue "A cat!"

"But I've learned my lesson. No more 'cat rescue' work for me. Of all the ungrateful creatures, that beast is the limit."

Donald's parents had to admit that this was an occasion where a practical knowledge of electricity was of some use. Several of the neighbors grumbled at being in the dark for an hour, but as soon as the lights flashed on again they forgave Donald for the inconvenience.

A SERIES-PARALLEL BATTERY SWITCH

(Continued from page 225)

in use, all switches should be left open.

A smaller switch for taking care of a larger number of cells may be constructed by following the general proportions outlined above; each additional switch will take care of one more cell of battery. A greater number of combinations are possible the greater the number of switches used.

Contributed by ERVIN J. TROJAN.

Cells		Switch position	
Ser.	Par.	Left.	Right.
1	1	1	
2	1	4	1
3	1	2	1 4
4	1	5	1 2 4
6	1		1 2 3 4 5
1	2	1 4	
2	2	4 5	1 2
3	2	2	1 3 4 5
2	3	4 5	1 2 3
1	3	1 2 4	
1	4	1 2 4 5	
1	6	1 2 3 4 5	



The Dollar Value of Draftsmanship

THERE are no "slack periods" for the trained draftsman—no limitations to his earning power—no drawbacks to his advancement to bigger things. Why? Because the manufacturer, builder, architect and engineer must have working blueprints before they can build factories, skyscrapers, railroads, machinery and homes. Drafting also has a positive dollar value to those engaged in all branches of engineering, because it qualifies them to direct those who can't make plans and read blueprints.

Be a Master Draftsman

Whether you want to be a professional draftsman, or add drafting to your knowledge of engineering, the American School course, specially prepared by noted experts for home study, will give you just the training you need. Drafting is the A B C of all engineering work. As you learn the practical working principles of Mathematics, Mechanics and Drawing, the broader field of engineering opens up to you. You are ready for a bigger job and better pay.

Read This Guarantee —Then Act!

"We guarantee at any time during the first year of your enrollment to refund the entire amount paid if, immediately upon the completion of ten examinations, you notify the School that you are not satisfied with your Course."

AMERICAN SCHOOL of Correspondence
Dept. BD26 CHICAGO

TRAINING—THE KEY TO SUCCESS

Please send me booklet and tell me how I can fit myself for position marked X — ASC

...Draftsman and Designer	...Lawyer
...High School Course	...Business Manager
...Western Union Course	...Certified Pub. Accountant
...Telephone Engineer	...Accountant and Auditor
...Automobile Engineer	...Bookkeeper
...Automobile Repairman	...General Education Course
...Airplane Mechanic	...Com. School Branches
...Sanitary Engineer	...Electrical Engineer
...Heating and Ventilating Engineer	...Electric Light and Power Superintendent
...Master Plumber	...Hydroelectric Engineer
...Civil Engineer	...Wireless Operator
...Structural Engineer	...Architect
...Mechanical Engineer	...Building Contractor

Name.....

Address.....



WANTED — Railway Mail Clerks

Men-Boys 18 to 35
$1100 to $2000 Year
Common Education Sufficient
Sure pay. Life job.
Pull unnecessary.

Franklin Institute
Dept. G-101
Rochester, N. Y.

COUPON

Sirs: Send me, without charge, (1) sample Railway Mail Clerk Examination questions; (2) schedule showing places of all U. S. Government coming examinations; (3) list of other government jobs now open, and (4) free book describing them.

NAME.....

ADDRESS.....

WRITE THE WORDS FOR A SONG

We write music, guarantee publisher's acceptance. Submit poems on patriotism, love or any subject.

CHESTER MUSIC COMPANY
920 S. Michigan Ave., Room 313 Chicago, Illinois

Electrical Oscillators

By Nikola Tesla

(*Continued from page 260*)

densers and operate an independent high frequency coil as customary. The controlling mechanism is of somewhat different construction but the core and contact spring are both adjustable as before.

Fig. 6 is a small instrument of this type, particularly intended for ozone production or sterilization. It is remarkably efficient for its size and can be connected either to a 110 or 220 volt circuit, direct or alternating, preferably the former.

In Fig. 7 is shown a photograph of a

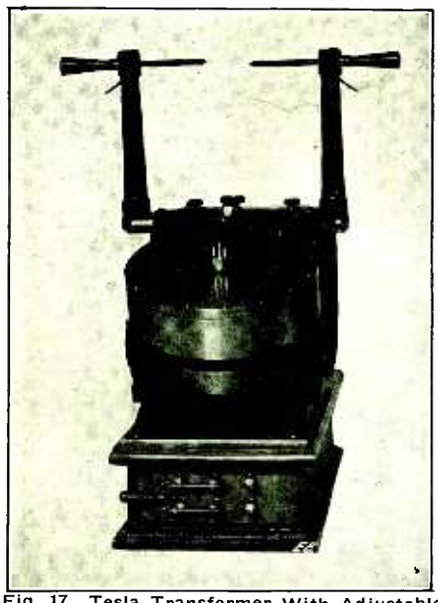


Fig. 17. Tesla Transformer With Adjustable Mercury Controller.

larger transformer of this kind. The construction and disposition of the parts is as before but there are two condensers in the box, one of which is connected in the circuit as in the previous cases, while the other is in shunt to the primary coil. In this manner currents of great volume are produced in the latter and the secondary effects are accordingly magnified. The introduction of an additional tuned circuit secures also other advantages but the adjustments are rendered more difficult and for this reason it is desirable to use such an instrument in the production of currents of a definite and unchanging frequency.

Fig. 8 illustrates a transformer with rotary break. There are two condensers of the same capacity in the box which can be connected in series or multiple. The charging inductances are in the form of two long spools upon which are supported the secondary terminals. A small direct current motor, the speed of which can be varied within wide limits, is employed to drive a specially constructed make and break. In other features the oscillator is like the one illustrated in Fig. 3 and its operation will be readily understood from the foregoing. This transformer was used in my wireless experiments and frequently also for lighting the laboratory by my vacuum tubes and was likewise exhibited at my lecture before the New York Academy of Sciences above mentioned.

Coming now to machines of the second class, Fig. 9 shows an oscillatory transformer comprising a condenser and charging inductance enclosed in a box, a transformer and a mercury circuit controller, the latter being of a construction described for the first time in my patent No. 609,251 of August 16, 1898. It consists of a motor driven hollow pulley containing a small quantity of mercury which is thrown outwardly against the walls of the vessel by centrifugal force and entrains a contact wheel which periodically closes and opens the condenser circuit. By means of adjusting screws above the pulley, the depth of immersion of the vanes and consequently, also, the duration of each contact can be varied at desire and thus the intensity of the effects and their character controlled. This form of break has given thoro satisfaction, working continuously with currents of from 20 to 25 amperes. The number of interruptions is usually from 500 to 1,000 per second but higher frequencies are practicable. The space occupied is about 10″ x 8″ x 10″ and the output approximately ½ K.W.

In the transformer just described the break is exposed to the atmosphere and a slow oxidation of the mercury takes place. This disadvantage is overcome in the instrument shown in Fig. 10, which consists of a perforated metal box containing the condenser and charging inductance and carrying on the top a motor driving the break, and a transformer. The mercury break is of a kind to be described and operates on the principle of a jet which establishes, intermittently, contact with a rotating wheel in the interior of the pulley. The stationary parts are supported in the vessel on a bar passing thru the long hollow shaft of the motor and a mercury seal is employed to effect hermetic closure of the chamber enclosing the circuit controller. The current is led into the interior of the pulley thru two sliding rings on the top which are in series with the condenser and primary. The exclusion of the oxygen is a decided improvement, the deterioration of the metal and attendant trouble being eliminated and perfect working conditions continuously maintained.

Fig. 11 is a photograph of a similar oscillator with hermetically inclosed mercury break. In this machine the stationary parts of the interrupter in the interior of the pulley were supported on a tube thru which was led an insulated wire connecting to one terminal of the break while the other was in contact with the vessel. The sliding rings were, in this manner, avoided and the construction simplified. The instrument was designed for oscillations of lower tension and frequency requiring primary currents of comparatively smaller amperage and was used to excite other resonant circuits.

Fig. 12 shows an improved form of oscillator of the kind described in Fig. 10, in which the supporting bar thru the hollow motor shaft was done away with, the device pumping the mercury being kept in position by gravity, as will be more fully explained with reference to another figure. Both the capacity of the condenser and primary turns were made variable with the view of producing oscillations of several frequencies.

Fig. 13 is a photographic view of another form of oscillatory transformer with hermetically sealed mercury interrupter, and Fig. 14 diagrams showing the circuit connections and arrangement of parts reproduced from my patent, No. 609,245, of August 16, 1898, describing this particular device. The condenser, inductance, transformer and circuit controller are disposed as before, but the latter is of different construction, which will be clear from an inspection of Fig. 14. The hollow pulley *a* is secured to a shaft *c* which is mounted in a vertical bearing passing thru the stationary field magnet *d* of the motor. In the interior of the vessel is supported, on frictionless bearings, a body *h* of magnetic material which is surrounded by a dome *b* in the center of a laminated iron ring, with pole pieces *oo* wound with energizing coils *p*. The ring is supported on four columns and, when magnetized, keeps the body *h* in position while the pulley is rotated. The latter is of steel, but the dome is preferably made of German silver burnt black by acid or nickeled. The body *h* carries a short tube *k* bent, as indicated, to catch the fluid as it is whirled around, and project it against the teeth of a wheel fastened to the pulley. This wheel is insulated and contact from it to the external circuit is established thru a mercury cup. As the pulley is rapidly rotated a jet of the fluid is thrown against the wheel, *thus making and breaking contact about* 1,000 *times per second.* The instrument works silently and, owing to the absence of all deteriorating agents, keeps continually clean and in perfect condition. The number of interruptions per second may be much greater, however, so as to make the currents suitable for wireless telephony and like purposes.

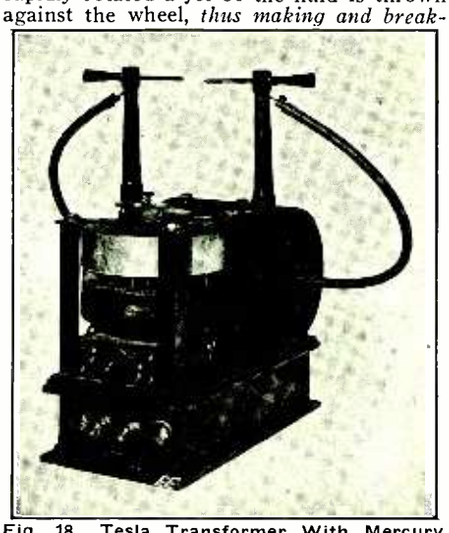


Fig. 18. Tesla Transformer With Mercury Jet Interrupter.

A modified form of oscillator is represented in Figs. 15 and 16, the former being a photographic view and the latter a diagrammatic illustration showing the arrangement of the interior parts of the controller. In this instance the shaft *b* carrying the vessel *a* is hollow and supports, in frictionless bearings, a spindle *j* to which is fastened a weight *k*. Insulated from the latter, but mechanically fixt to it, is a curved arm L upon which is supported, freely rotatable, a break-wheel with projections QQ. The wheel is in electrical connection with the external circuit thru a mercury cup and an insulated plug supported from the top of the pulley. Owing to the inclined position of the motor the weight *k* keeps the break-wheel in place by the force of gravity and as the pulley is rotated the circuit, including the condenser and primary coil of the transformer, is rapidly made and broken.

Fig. 17 shows a similar instrument in which, however, the make and break device is a jet of mercury impinging against an insulated toothed wheel carried on an insulated stud in the center of the cover of the pulley as shown. Connection to the condenser circuit is made by brushes bearing on this plug.

Fig. 18 is a photograph of another transformer with a mercury circuit controller of the wheel type, modified in some features on which it is unnecessary to dwell.

These are but a few of the oscillatory transformers I have perfected and constitute only a small part of my high frequency apparatus of which I hope to give a full description, when I shall have freed myself of pressing duties, at some future date.

The Kaiser is Canned--Can Food

By Grace T. Hadley

(*Continued from page* 219)

ples of jelly making and all the information is so clear that the work of canning and drying is no longer a mysterious problem but so simplified that school children may do it under the direction of competent teachers.

Methods of Drying.

For home drying satisfactory results are obtained by any one of three principal methods: Sun drying, drying by artificial heat and drying by air blast—using an electric fan, or other motor fan.

Sun drying has the double advantage of requiring no expense for fuel and of freedom from danger of overheating. For sun drying of vegetables and fruits, the simplest form is to spread the slices or pieces on sheets of thin paper or lengths of muslin nailed to strips of wood and expose them to the sun.

Trays should be used for large quantities. Sun drying requires bright hot days and a breeze. Once or twice a day the product should be turned or stirred and the dry pieces taken out. Care must be taken to provide protection from rain, dew and moths. During rains and just before sunset the products should be taken indoors for protection.

Drying by artificial heat is done in the oven or on top of a cookstove or range in trays suspended over the stove, or in the oven of an electric range. When drying with an artificial heat a thermometer must be used.

Air Blast—Electric Fan.

The use of an electric fan is an effective means of drying. Sliced vegetables or fruits are placed on trays and the fan placed close to one end of the box holding the trays, with the air current directed along the trays lengthwise. Insects must be kept out by the use of cheesecloth or similar material. Drying by this process may be done in 24 hours or less. As artificial heat is not used in fan drying, it is important to blanch or steam the vegetables for the full specified time. It is also necessary that all fan-dried products be heated in an oven to 180° F. for 10 or 15 minutes before storing.

Danger from Insects.

In addition to exercising great care to protect vegetables and fruits from insects during the drying process, precautions should be taken with the finished product to prevent the hatching of eggs that may have been deposited. One measure that is useful is to subject the dried material to a heat of 180° F. for from 5 to 10 minutes. By the application of this heat the eggs will be killed. Be careful not to apply heat long enough to damage the product. Store as soon as removed from oven.

Winter Use of Products.

In preparing dried vegetables and fruits for use, the first process is to restore the water which has been dried out of them. All dried foods require soaking. After soaking the dried products will have a better flavor if cooked in a *covered utensil*, at a *low temperature* for a *long time*. Dried products should be prepared and served as fresh products are prepared and served. They should be cooked in the water in which they have been soaked, as this utilizes all of the mineral salts which would otherwise be wasted.

That Wonderful Electric Action-Delayer

By Thomas Reed

(*Continued from page* 223)

ripe cantaloupe for her, but that's neither here nor there.

How about the same kind of a lock on letter-boxes? They all ought to have 'em. Put a letter in, you can, but it won't go *way* in until two minutes after you've prest a button, so you have a chance to take it back. Why, in a few years that would save more trouble than all old Bill Hoho ever made. The time you forgot to enclose the money in the mail-order. The time you just knew you'd put 'em in the wrong envelopes—and did. The sarcastic letter you wrote your wife's mother, telling her where she got off—only the place wasn't where you said, it was on your neck. Oh say, Beiler's non-mailing letter-box. Well.

Beiler himself can elaborate his invention now, all he needs is to be told what good it is. Go to it then, Al, on the biggest thing of all. Fix your machine the opposite way, so it'll *stop* something and not *let go* for those two minutes, and apply that to an electric muzzle, lip-riveter, or throat-grabber; and when you die they'll put your monument right next to Dr. Munyon's, No. 11 Benefactors' Row.

It's easy, Al, a contact just under the chin, so whenever a fellow opened his mouth to talk, he'd be muzzled, gagged, choked—or go as far as you like, rendered unconscious—for two whole minutes. Why, a guy with that apparatus on his person wouldn't have trouble enough to keep his mind occupied. Never "getting in bad," never "starting anything," always ready with those witty retorts you think of afterward, no half-baked opinions, nothing but pure wisdom. Oh hum! And if you could get your wife to wear one, think of the deep silence as you wend your way upstairs at 2 A. M., with wifie at the top struggling to get the darned thing off. Two minutes yet before she can tell you what she thinks of the poker game, and the best "thinks" of all exploding inside of her, and lost, lost!

Well, Al, I can't go on like this, I must do a little inventing myself; but you get me, don't you, and you're under full headway with your future career, yes? I'll only suggest one little handy application more, one that should be in every home, the "Safety Bargain-Shopper".

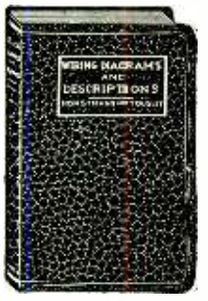
It's a common shopping-bag, containing Beiler's device, a storage battery, and a pocketbook with an electric lock. Gwendolyn sees a bargain. Instantly her hand goes into the bag for her purse, but it's locked. She presses the button of Beiler's device. Have patience, Gwendolyn, dear, in a short two minutes that filmy thing of pink batiste (is batiste right?) marked down to 79 cents, is yours. But no, Beiler is on the job, and the 79 kaplunkos are spent for one pair of fat pork chops. Does Gwendolyn change her mind? Does or rather did she have a fit of economy, prudence, far-sighted wisdom? No! Within the two minutes she is pushed away from the bargain-counter by the seething, howling mob of five thousand other bargain snappers.

Fit Yourself for the Big Job

Don't hesitate any longer. There is a greater demand for trained men now than ever before — greater opportunities — bigger pay — more rapid advancement. It's training that counts now—accurate knowledge—a complete grasp of your trade.

Drake's Practical Mechanical Books

For Home Study

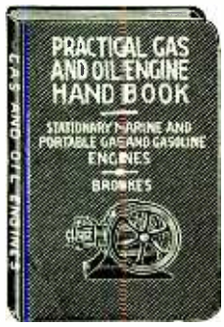


Pave the way to the fat pay envelope. Written in non-technical language that any man can grasp. Send the price of any book listed below. We will send the books postpaid — you keep them five days—if not entirely satisfied return the books and your money will be refunded in full. Order direct from this page. Use the Coupon.

Electrical Books

Electric Motor Control Systems and Methods. Leatherette.....$1.50
Electrical Tables and Engineering Data. Leatherette 1.50
Motion Picture Operation. Leatherette.. 1.50
Alternating Current. Leatherette..... 1.50
Wiring Diagrams and Descriptions. Leatherette 1.50
Armature and Magnet Winding. Leatherette 1.50
Modern Electric Illumination. Leatherette 1.50
Modern Electrical Construction. Leatherette 1.50
Electricians' Operating and Testing Manual. Leatherette..... 1.50
Drake's Electrical Dictionary. Leatherette 1.50
Electric Motors, D and A. Leatherette.. 1.50
Electrical Measurements and Meter Testing. Leatherette..... 1.50
Drake's Telephone Handbook. Leatherette 1.50

Automobile Books



Automobile Ignition. Leatherette, $2.00
Brookes' Automobile Handbook. Leatherette ..$2.00
Automobile Starting and Lighting. Leatherette ..$1.50
Ford Motor Car, Truck and Tractor Attachments. Cloth, $1.00
Ford Motor Car, Truck and Tractor Attachments. Leatherette ..$1.50
Automobile Catechism and Repair Manual. Leatherette.....$1.25
Gas and Oil Engine Handbook. Cloth... 1.00
Gas and Oil Engine Handbook. Leatherette 1.50

Modern Language Courses



French Without a Teacher, Spanish Without a Teacher, German Without a Teacher. By Professor Philip Schuyler Allen, University of Chicago. An entirely new home series of modern foreign languages. Simplest, easiest-to-master language method ever devised. French, Spanish or German. Pocket size. Each $1.25

Mail the Coupon NOW

Order on our five day money back plan.

FREDERICK J. DRAKE & CO.,
1009 Michigan Ave., Chicago, Ill.

Enclosed find ($.....), for which please send me prepaid the books checked in this adv. (or list attached). It is agreed that I may return same in 5 days if not entirely satisfied, and money will be refunded in full.

Name .....

Address .....



RADIO FREQUENCY AMMETER

4 inch Face

0 to 3, 0 to 5 or 0 to 10 Amperes. Specify Reading Required.

$11.00 Net

The Jewell Electrical Instrument Co. is prepared to fill the instrument needs of the amateur experimenter in radio and general electrical work, as well as those who desire more precise and accurate measurements of electrical quantities.

We show above our high frequency ammeter, of the thermo couple type, especially desirable for medium sized installations.

For receiving panels, we are supplying small D. C. instruments for plate voltage and filament current, at a very reasonable price.

Write for our special radio instrument bulletin.

JEWELL ELECTRICAL INSTRUMENT CO.
1640 Walnut St. Chicago

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 180 Big Pages, 500 illustrations. 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy." 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 20 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.

WIRELESS

Send 6 cents in stamps or coin for which we will send our latest Cyclopedia Catalog No. 20 as described.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

AMATEURS

Our type 5-A receiving set is ready for immediate shipment. Consists of double slide tuning coil, galena detector, 2 point switch, fixed condenser and binding posts for aerial, ground and receivers, mounted on quartered oak base. Price $4.50.
Unmounted coils, 10" long, 3" dia. each, 75c. (Wound with No. 24 enameled wire.) Radio message blanks, per pad, 35c. Tested galena crystals, each 15c.

McMAHON & ST. JOHN
56 West Ave., So. Norwalk, Conn.



$10.50

It's big value. Most selective, efficient tuner obtainable. Send 3-cent stamp for bulletin.

Colby's Telegraph School
Auburn N. Y.

AMPLIFICATION ON 180-2500 METERS

Do you know that we build a regenerative receiving set giving enormous amplification on from 180 to 2500 meters? If you want the best, better write for our catalogue. Enclose 2c stamp.

Universal Radio Manufacturing Corporation
Dept. W, Elmira, N. Y.

How to Build an Astatic Galvanometer

(*Continued from page 225*)

Next make a round base for your instrument. This, too may be turned on a lathe, but may as well be made of separate disks. Make one to fit inside the other end of the chimney, and make the other about half an inch larger all around. The second disk can conveniently be beveled. Fasten the two together. Make three wooden feet for your base, and fasten them on it, letting them make an angle with each other at the center of 120 degrees. In the ends of these feet, bore holes to receive the leveling screws. The screws themselves may be the binding screws from old dry cells. If now you cut a piece of fairly hard wood (hard rubber or fiber if you have it), which will fit around the base, and be attached to two of the feet, as the diagram shows, your base is complete. This piece of wood is to hold the three binding posts.

The two coils of wire (A) need cause little trouble. Form the bobbins of heavy card-board, or, better, from thin wood, held together with glue or shellac. The size of the bobbins naturally depends on the space available inside the glass cover. Wind them with wire varying in size according to the use for which the galvanometer is intended. If you wish it to detect extremely small currents, wind it with the finest wire you have (No. 40 B & S). Fasten the coils on the base in the manner shown, taking care that, when their windings are connected in series, the magnetic field of the two will be continuous. That is, let the wire be wound in the same direction in each. Connect them in series, and bring the two leads to the two end binding posts (C). Connect the middle binding post with the connection between the two coils. This allows the instrument considerable range. If you are working with very minute currents, let them flow thru both coils. If the currents are stronger, let them flow thru only one.

The astatic element is the next consideration. Cut a light piece of wood and push thru it two steel needles, of such length, and such a distance apart, that when the whole is suspended as shown, one of the needles will swing inside the coils, and the other just above them. Before pushing the needles thru the stick that is to support them, magnetize them thoroly. Assemble them so that the *north* pole of one and the *south* pole of the other will point in the same direction. The whole element should be made as light as possible, so that it may be suspended on a silk fiber or a silk thread. Now for the actual suspension. Make a cover for the top of the test tube (see the diagram) and thru this bore a hole large enough to allow a battery binding screw to slip freely thru it. Select a binding screw with a knurled thumb nut on it, and slip it thru the hole. To its end make fast the silk thread or fiber, passing it thru a small hole in the screw itself. Let the thread be approximately the right length before assembling the instrument. By holding the binding screw firm, and turning the thumb nut, the height of the astatic element may be regulated, while if the whole screw be turned, the magnets may be brought into their proper position with reference to the coils.

Now you have a good businesslike galvanometer. You can go further and elaborate it if you like. You can experiment with different size wire, different distances between coils, and with astatic elements of different weights. You can place a circular scale on the coils if you choose, and read the values off on it with the top needle as pointer. Or you can do this stunt: Mount a small mirror on the magnet support; next take a miniature bulb and cover the glass with a coat of white paint. Let this dry, then put on one or more coats of black, or some dark color. Support the bulb and its socket on a short piece of brass tubing, as shown, or on some other support of such height that if you scratch a hole in the paint on the side of the lamp, a ray of light will be reflected by the little mirror off onto a scale which you can hold at any distance. If you do include this feature in your galvanometer, you must add two more binding posts on the base to supply current to the lamp. This stunt works fine when the instrument is to be used merely for the detection of minute currents, but remember that the magnetic field of the lamp feed wires is going to complicate matters if the galvanometer is to be used for accurate measurements. It is needless to remind the reader that with the exception of the two (needle) magnets, no iron or steel should be used in the construction of this instrument.

Musical Radio Telegraphic Sets

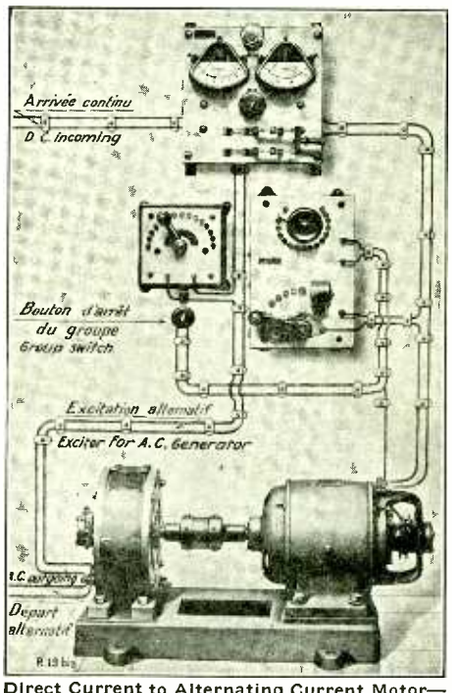
By Jacques Boyer

(*Continued from page 233*)

by means of a regulating screw.

The sending helix offers some novel points. By means of metal sliders it is possible to vary the wave lengths instantaneously. Instead of using the usual antenna switch, a special commutator is used which might be of interest to American readers.

In the sending circuit, the tuning coil has only five contacts and an air condenser. The coupling can be changed in two directions, either in series with the antenna (for short wave lengths) or in parallel with the coupler (for long wave lengths). The secondary circuit, which is a periodic, has a coil, which is regulated by means of five



Direct Current to Alternating Current Motor—Generator Used in Radio Set of French Design.

contacts for the variation of the wave length. It has the usual connections with the head receivers, and there are two detectors used, each of which can be connected into circuit by means of a switch.

GREATEST TOY SENSATION OF THE DAY!

FIGHTING DREADNAUGHT

SENSATIONALLY REALISTIC!!!



Here is a model of Uncle Sam's fighting monsters. Eight big guns, each of which flashes, at correct intervals, from twelve to twenty times. Extra ammunition always obtainable. Absolutely harmless. Can be operated indoors or out. Now boys! Here's your chance to see a battleship in action, and the best of it is you can OWN the ship and command the firing yourself! By having two or more Battleships you can arrange EXCITING NAVAL BATTLES in your own home. Price Warship and Ammunition, 15c, three for 40c, or a fleet of 1 ships for $1.50 postpaid. Extra Ammunition, 5 cents per pkg.

TOOTH-ACHE STOP

EASY TO USE



Stops the Pain; Stops the Tooth

Squeeze a little in hollow of tooth; the Ache Stops Instantly the paste hardens, forming an antiseptic Filling. Absolutely harmless. Have it ready for the next bad attack. 25c per tube, postpaid.

Mysterious Ghost



This is not a pretty object, but there is fun in it for people who like practical jokes. The Ghost, when displayed in perfectly dark place, glows with a ghastly cold bluish radiance that will cause a "creepy" sensation even when you know all about it, but a regular starter for those who come upon it unexpectedly. A great joke to play on your mother-in-law. Price only 15 cents each, or three for 40 cents.

"SAFETY 1st" PINS



A clever novelty. The National Safety First Movement has made them very popular. Wear one and show your sympathy with the movement. Also handy for wearing at amateur theatricals and the like. Two sizes, ¾ in. gold plated) and 1¼ in. (nickel-plated) 6c each, two for 10c p. pd.

INKLESS PEN



WRITES with WATER 600 words every time you dip. Makes its own ink. Writes fashionable violet color. Better and cheaper than fountain pens. Writes a long letter with one dip in plain water. No trouble—no bother—no muss. A pleasure to use. With Nickel Plated Reversible Holder 10 CENTS. 3 for 25c



SIMPLEX TYPEWRITER ONLY $2.50

Cheap But Good. So Simple a Child Can Use It. We Guarantee the Writing.

Though so marvelously cheap, this machine is a thoroughly practical Typewriter. We positively guarantee it to produce writing equa in every respect to that of any $1.00 machine. It does not seem possible at the price, but—let us send you a specimen of the work and you will be convinced. With reasonable care it will last a lifetime. It is so simple that a child just able to read can operate it with it. You can learn all there is to know about it from five minutes' study, and an hour's practice will make you an expert operator. Every business man must have a typewriter. Legible pen writing is unbusinesslike and creates the impression that the firm is a no-account and slow-going concern. We assure you that the Practical Typewriter fully deserves its name and it will do for you the correspondence of any business or profession, and to do it well. You should not miss this chance of securing a bargain. The letters of the alphabet, the numerals 1 to 10, and punctuation marks are so grouped that the letters most used are before the operator most of the time, enabling him to write rapidly. The rollers hold the paper in position while writing and at the end of each line a slight turn of the rachet which makes a click and forces the paper forward, giving the proper line spacing, so that the lines are all an equal distance from each other, so desirable in letter writing. Each typewriter packed in a strong box, with full printed instructions for use. Price complete, $2.50 sent by mail postpaid.

Johnson Smith & Co., Dept. E 9, 3224 N. Halsted St., Chicago

SQUIRT RING



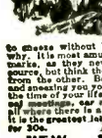
You may have a lot of fun with this Sparkling Gem Squirt Ring. It consists of a handsomely plated ring, attached to a rubber ball, so arranged that the latter is quite out of view when the ring is in the proper position. Such an attractive looking ring as this cannot fail to be the center of attraction. While the attention is absorbed in getting a closer view you just squeeze the rubber ball and the observer experiences a very great surprise. PRICE 10 CENTS. Three for 25 cents, postpaid. J. S. & CO

Wonderful X-Ray Tube



A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your arm, the lead in a lead pencil, the interior openings in a piece of wood, and many similar illusions. A mystery that no one has been able to satisfactorily explain. Price 10c each; 3 for 25 cents, 7 doz. 75 cents. Sent by mail, postpaid.

Sneezing Powder



Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real source, but think they have caught it one from the other. Between the laughing and sneezing you yourself will be having the time of your life. For parties, social affairs, or any place at all where there is a gathering of people it is the greatest joke ever. Price 15c or 3 for 30c.

By Express Only

STAGE MONEY



With a bunch of these bills, it is easy for each person of limited means to appear prosperous. Having a roll of these bills at the proper time and peeling off a genuine bill or two from the outside of the roll, the effect created will be found to be all that can be desired. Prices, postpaid: 15 Bills 10c, 50 Bills 25c, 125 for 50c, or $3.50 thousand.

NEW BOOK ON ROPE SPLICING

USEFUL KNOTS, HITCHES, SPLICES, ETC.

How Different Knots Are Made and What They Are Used For. How to Use and Knots to Avoid.



A most practical handbook giving complete and simple direction for making all the most useful knots, hitches, rigging, splices, etc. Over 100 illustrations. All about wire rope attachments, lashing, blocks, tackles, etc. 37 Heraldic Knots illustrated. Of great value to mechanics, riggers, campers, boatmen. Price 10c p. pd.

Johnson Smith & Co., Dept. E9, CHICAGO

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night

The very latest discovery in the scientific world. Harmless, practically unobtainable except at an exorbitant price, we have at last succeeded in producing this remarkable LUMINOUS PAINT, which, applied to the surfaces of any article, emits rays of white light, rendering it perfectly visible in the dark. THE DARKER THE NIGHT, THE MORE BRILLIANT IT SHINES. Quite simple to use. Anyone—you can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the push buttons or switch plates of your electric lights, match boxes, and innumerable other articles, and make your own Luminous Crucifixes, Lucifer Matches, etc. Bottle containing sufficient to coat several small articles. Price 25c. Larger sizes 50c and $1 postpaid. Johnson Smith & Co., Dept. E9,

MUSICAL KAZOO



With the Musical Kazoo you can, without previous practice whatsoever, play any tune right off, imitate any bird or animal, harpsichord, snare drum, Punch and Judy, etc. No holes to finger. It is simplicity itself. Produces excellent music. You do not blow into it, but sing, speak, laugh or make any desired imitation. Used with astonishing results at society meetings, home, club or church entertainments, dances, serenades, picnics, outings, excursions. Just the thing for choruses and shows, bicycle and marching clubs, etc. Excellent for vocal or instrumental accompaniments, either with or without other musical instruments. Price 15c. 2c. pd.

MAGIC FLUTE



Wonderfully Sweet Toned and Musical Instrument. No other instrument produces such sweet music, whether played on the lyrical notes of a quick-step or the solemn strains of a church hymn—in fact, any class of music can be played upon the Russian tone without practice, as it is almost a self-playing instrument. When played with a piano accompaniment, or any other musical instrument, the effect is charming. Full printed instructions for playing sent with each instrument.

Post Paid 15c

All the Latest Surprising and Joke Novelties

Pharo's Serpents Eggs, box	10c	Cover the Spot Trick, a scien. nov.	10c
Miniature Water Pistol	10c	X Ray Novelty	10c
Cleopatra's Snake (very lifelike)	10c	Trick Pencil	10c
False Mustache (fool your friends)	9c	Rubber Tacks (a good joke)	10c
Ford Auto Puzzle (latest)	25c	Mesmerized Penny (defies the law of gravitation)	20c
Mysterious Ghost, shines at night	10c	Mysterious Tumbler and Vanishing Coin Trick	
Rubber Razor (very formidable)	20c	Magic Mirror (take one peep)	10c
Rubber Dagger (sensational)	20c	Magic Plate Lifter	20c
Window Smashers (great joke)	25c	Imitation Gold Teeth, a set for	10c
Lookbackscope (see behind you)	15c	Great Burglar Puzzle	10c
Great Mind Reading Mystery Cds.	10c	Wire Puzzles, 10c. 22 different, $1.90	
Thornton's Mysterious Trick Cds.	10c		
Fighting Roosters, pair	10c		

JOHNSON SMITH & CO., Dept. E9, 3224, N. Halsted St. CHICAGO

Boys, you can have Movies at your own home with this latest model

MOVING PICTURE MACHINE

Uses Standard Films same as the larger machines. Very easily managed. Simply turn the handle. Good Variety of Films always obtainable

PRICE Complete ONLY $2.50 Postpaid anywhere Including Two Films

Extra Films, 15c each postpaid



THIS IS A GENUINE MOVING PICTURE MACHINE and the motion pictures are clear, sharp and distinct. The Moving Picture Machine is finely constructed, and carefully put together by skilled workmen. It is made of Russian Metal, has a beautiful finish, and is operated by a finely constructed mechanism. The projecting lenses are carefully ground and adjusted, triple polished, standard double extra reflector, throwing a ray of light many feet, and enlarging the picture on the screen up to three or four feet in area. The light is produced by a safety carbide generator, such as is used on the largest automobiles. This throws a dazzling white light on the screen.

It is a solidly constructed and durable Moving Picture Machine. The mechanism is exceedingly simple and is readily operated by the most inexperienced. The pictures shown by this marvelous Moving Picture Machine are not the commonplace and lifeless Magic Lantern variety, but are life-like photographic reproductions of actual scenes, places, and people which never tire its audiences. This Moving Picture Machine has caused a rousing enthusiasm wherever it was used.



JOHNSON SMITH & CO.

Dept. E 9 3224 N. HALSTED ST., CHICAGO

ANARCHIST BOMBS



Consists of a little glass vial, containing in liquid form a chemical which will produce most terrific odor. One dropped in a room full of people will cause more consternation than a dynamite bomb. The smell will entirely disappear in a short time. 3 Boxes for 25c, shipped by express only with a Dollar's worth of other merchandise.

ITCHING POWDER



This is another good practical joke; the intense discomfort of your victims is over everyone but themselves is thoroughly enjoyable. All that is necessary to produce the itching is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more. Sent only by express. (Must order at least One Dollar's worth of other merchandise.)

INVISIBLE INK



The most confidential messages can be written with this Ink. No one but the writing MAKES NO MARK. Cannot be seen unless you know the secret. Invaluable for many reasons. Keep your love affairs and other private memorandums away from prying eyes. Great fun for playing practical jokes. Only 15c Bottle

LOVE LETTER INK



Writing written with this remarkable ink vanishes entirely in a few weeks (sooner if desired), leaving the paper QUITE BLANK. 15c p. pd.

LUMINOUS INK Writing can be READ ONLY IN DARK ROOM; writing seems like fire. Quite invisible at daytime. Very remarkable. 15c bottle; 3 for 40c postpaid.

JOHNSON SMITH & CO.

MULTIPLYING BILLIARD BALLS

The Best Feat of its Kind



This trick is as effective as it is surprising. The performer hands around the ball for examination, and immediately it is returned to him he makes it by the tips of his thumbs and fingers and a second ball materializes, appears. The two are held in full view of the audience for a short time, and even while being placed in position, another ball unexpectedly appears. Final y the magician apparently suffers from some kind of spasm and yet another ball is the result. The feat can then be reversed, the balls disappearing one after another until none remains. It is a very interesting trick that is quite easily performed by following the directions that accompany the apparatus. PRICE, 25 CENTS. POSTPAID. JOHNSON SMITH & CO.

GOOD LUCK RING

Sealed and Never Open



A VERY striking and unusual ring, made of gunmetal. Skull and crossbones design, with two brilliant flashing gems sparkling out of the eyes. A never failing object of interest. It is said by many to bring Good Luck to the wearer, hence its name Good Luck Ring, and whether we will not positively guarantee that, it is certainly a very unique ring that you will take a pride in wearing. They were made to sell at 50 cents, but as a special bargain we will supply them to customers mentioning this paper, at HALF PRICE, viz., ONLY 25 CENTS. POSTPAID. JOHNSON SMITH & CO.

LOADED CIGARETTES

Just Like Ordinary Cigarettes, But Each Reel



A box containing ten apparently genuine Cigarettes. They contain a cap which explodes when about one-third smoked.

They appear so real, and afford so good a smoke, that they last that the victim is taken entirely by surprise. A great laugh producer and entirely harmless. Price, box of ten, 25 cents, postpaid.

Johnson Smith & Co., Dept. E9

THE "LITTLE GIANT" TYPEWRITER

A First Class Writing Machine For $1.25



A per ect little typewriter for $1.25. There are many persons who would like to own a typewriter, but whose needs and business do not warrant the expense of a machine, and to such persons we confidently recommend our Little Giant. It is simple in construction, so that any one can quickly learn to operate it, and write as rapidly as they would with pen and ink. The letters of the alphabet most frequent y used being so grouped as to enable one to write rapidly, the numerals, 1 to 10, and the punctuation marks being together. With this machine you can send your best girl typewrit ten love letters, address envelopes, make out bills, and do almost any kind of work not requiring a large expensive machine. With each typewriter we send a tube of ink and full printed instructions for using the machine. Price complete $1.25 by express only.

SERPENT'S EGGS



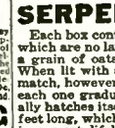
Each box contains 12 Eggs, which are no larger than a grain of oats. When lit with a match, however, each one gradually hatches itself into a Snake several feet long, which curls and twists about in a most lifelike manner. Price per box 10c, postpaid. Johnson Smith & Co.

MYSTIC SKELETON



A jointed figure of a skeleton 14 inches in height, will dance to music and perform various gyrations and movements while the operator may be any distance from it. The figure may be examined by the spectators. When handed back to the operator it is simply placed on a chair or table, when it will seemingly become endowed with life, and begin to move. At the command of the master it will sit down, stand up, dance, etc. We send full direction with each Skeleton, by the aid of which anyone can readily make it perform. 10c postpaid.

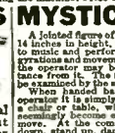
CIGARETTE ROLLER



Very neat and handy. Weighs less than a quarter of an ounce. It makes better cigarettes than you can buy and makes them easily and quickly. You can use just the tobacco you prefer and thus have nicer "smokes" than ready-made, and more of them besides saving about half of your money. It will make your cigarettes just to your own liking. Price only 10c or 3 for 25c postpaid, with full instructions for use. JOHNSON SMITH & Co.

MIDGET ILLUSTRATED BIBLE

A Great Curiosity



The Smallest Bible in its World

The Midget Bible is a perfect piece of book work of art. It is about the size of a postage stamp and contains 240 PAGES AND FIFTY PAGES of the NEW TESTAMENT, profusely illustrated. This little Wonder will be said to bring good luck to the owner. Must be seen to be appreciated. Price, only 12 cents, three Bibles for 30 cents; one dozen Bibles sent for 100 for $2.00. Good money can be made selling these Midget Bibles amongst friends, church acquaintances, Sunday schools, bazaars, etc. Send for a few and try it.

The CONJURER'S CASKET

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment

ANYONE CAN DO THEM

50c



It is great fun mystifying your friends. Get this Conjurer's Cabinet, and you will be the cleverest fellow in your district. It contains the apparatus for seven first-rate tricks, viz.: The Elusive Orange, The Disappearing Rose, that, when placed on the lapel of your coat, vanishes from sight as it will; the Magic Vase and Ball Trick, a Wooden Ball is placed inside, and upon replacing the lid has disappeared and is found in someone else's pocket. The Magic Nail with which you can apparently drive almost in two the Wonderful Card Trick (a card is placed in an envelope, and when opened an entirely different card altogether is found); The Disappearing Coin Box (a coin is placed in the little wooden barrel, and when opened again, is found to have vanished entirely; or can be made to change into a coin of another denomination); The Famous Mesmerized Penny that defies the law of gravitation; suspends from the palm of the hand, nose, cheek, wall, clothing, etc.); The Glass Goblet and Vanishing Coin Trick (a coin is dropped into a glass of water, and when the water is poured out the coin has vanished). With the seven tricks described above we send full printed instructions for performing each trick, so that anyone can readily perform all the tricks to the great amusement of their friends or the public. Any boy of ordinary intelligence with this Cabinet of Tricks in his possession, can prove a great entertainer and become the equal of magicians. Besides the tricks contained in the Cabinet, there are twenty-five other feats and illusions fully explained with full printed instructions, for which you can easily make or procure the necessary apparatus. Among them are: The Mouse in a Pack of Cards, The Hat Trick, To Knock a Tumbler Through a Table, One Cent Robbed into Two, To Find the Number Thought of, Mysterious Wedding Ring etc. We also send the secrets of performing three wonderful stage tricks, as follows: The Vanishing Woman, Walking on the Ceiling of a Room, and the Disappearing Lady, together with an article on legerdemain and valuable hints to amateur conjurers. PRICE COMPLETE ONLY 50 CENTS.

JOHNSON SMITH & CO., Dept. E9, 3224 N. Halsted Street, CHICAGO

The Newest Novelty Aerial Balloon



Flies gracefully in or outdoors. This is the VERY LATEST SENSATION IN BALLOONS. A brightly colored balloon that measures sixteen inches long is blown up in the usual way and when released, the air pressure sends the balloon SOARING UPWARD, the 3½-inch propeller SPINNING AROUND AT A LIVELY RATE. The effect is startling. It is a graceful flier that makes the youngsters WILD WITH JOY. May be used repeatedly indoors or outdoors. As immensely interesting toy. Price 10c each, 3 for 25c ppd.

JOHNSON SMITH & CO., Dept. E9, 3224 N. Halsted Street, CHICAGO

"The Baby" Double Action Hammerless Revolver

A HANDSOME AND MOST EFFECTIVE WEAPON

$5.50



Measures but 4¼ inches long

Takes regular .22 calibre cartridges

The new Baby Double Action Hammerless Revolver has been produced to meet the ever increasing demand for a revolver that would combine small size and light weight with the essential features of Efficiency and Practicability. It is small in size, yet is just as effective and serviceable as the most expensive weapon you can buy. Every lady should have a revolver and should know how to use it, and there is no safer or better one made than this. A great feature is its safety action that guards against accidental discharge, making it quite safe for young men and ladies. The illustration gives an idea of its appearance, but it must be seen and used to be thoroughly appreciated. The ammunition used is the standard .22-calibre (short) cartridge obtainable anywhere, or you may obtain the cartridges from us (cartridges can be shipped only by express). The revolver fires six shots in one loading. The operation of the trigger and hammer is extremely rapid and absolutely reliable; six well aimed shots can be fired in as many seconds. The revolver is very well constructed, with finest nickel plated fluted barrel of cylinder, and it weighs only 4½ ounces. The Price at the Factory Would be only $8.50, sent by mail postpaid to any address. JOHNSON SMITH & CO.

THE EXPO WATCH CAMERA

The most wonderful and ingenious Camera made



It is but little larger than a watch, which it closely resembles. You can carry the Expo about in your pocket and take pictures without any one being the wiser.

One Cent a Picture

The Expo loads in daylight with 25 Exposure Films, costing 25c, thus the picture taking part of a week's outing may be had for the nominal sum of 25c—One cent a picture. 10 Exposure Films also obtainable. Its simplicity itself to operate. Takes pictures through the stem, where the Rapid Fire Lens is located. The photos (0/8 x 7/8) may be enlarged to any size.

Price $2.50

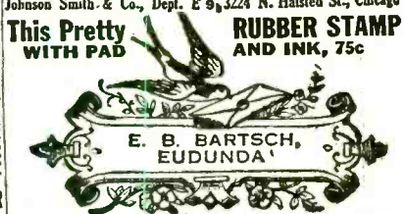
QUICK AS A FLASH

Time and Instantaneous shutters; weighs but 8 ounces; nickel plated. Never changing style of this practical camera—in daily use by printing and developing of films just the same as ordinary cameras—in daily use by the police, newspaper reporters, detectives, and the general public. Improvements have been secured with the view of pleasing enterprising reporters. Produces clear, sharp negatives indoors or outdoors equal to any camera on the market, size or price notwithstanding.

Expo Watch Camera Postage 10c Anywhere $2.50 FILMS, 10 Exposures 15c, 25 Exposures, 25c Leather Pocket Carrying Case, 35c

Johnson Smith & Co., Dept. E 9, 3224 N. Halsted St., Chicago

This Pretty RUBBER STAMP WITH PAD AND INK, 75c



Here is the Prettiest rubber stamp you ever saw. At very great cost we have had this design specially engraved for our customers, and it cannot be obtained except through us. The design is ornamental, with floral decorations, with a beautiful dove in the upper part conveying its message of love, the desired name or name and address being tastefully displayed in the center. With this rubber stamp you can brand your letter paper, envelopes, postals and other stationery, and the elaborate and unique design will be admired by all. Placed upon the outside of envelopes, packages and other mail matter it ensures their return to the sender in the event of non-delivery for any reason. It looks very pretty stamped on books, music, photographs, etc. With each stamp we include a self-inking stamp pad and a bottle of ink for re-inking the pad, and the PRICE of the COMPLETE OUTFIT, in box, is ONLY 75 CENTS, POSTPAID.

New Vamping Card

No Teacher Needed Surprisingly Simple System



Persons having neglected their Musical Education need not despair, for with the aid of our new VAMPING CARD (placing the same on the piano keyboard) you can at once Vamp away to thousands of Songs, Ballads, Waltzes, Rag Time, etc., etc., equal to a Professional Musician. No knowledge required. After using it a few times, you will be able to dispense with the aid of the Vamping Card entirely. Only 15 cts. p. pd. Johnson Smith & Co., Dept E9

Gigantic Guinea Butter Beans

New



The New Edible Vegetable Wonder

Grows to an astonishing size, the Beans measuring from 3 to 6 feet long and weighing anything from 10 to 16 lbs. and even more. One Bean is sufficient for a family for several meals. Very palatable and rich in nutritious materials. The delicate Buttery Flavor is much appreciated. The Vines are exactly like pea vines, and are a most welcome and valuable adjunct to your garden. Try them; you will find them the most delicious vegetable you have ever tasted. Imported direct. Unobtainable elsewhere. Sample package of Seeds with full directions for cultivating and cooking. 25c, postpaid.

JOHNSON SMITH & CO. DEPT E9 3224 N. HALSTED STREET CHICAGO

SHARPEN-M-ALL SAFETY RAZOR STROPPER

SHARPENS EVERY KIND OF SAFETY RAZOR BLADE

Sharpens the Gillette and Durham Duplex both edges at one time

ALSO SHARPENS THE GEM JUNIOR, EVER READY, KEEN-KUTTER, MARK CROSS, CLARK, AUTOSTROP, ST. JAH CRUSTEEL, AND ALL OTHERS



By using the SHARPEN-M-ALL STROPPER, you will not only get BETTER SHAVES, but you will SAVE MONEY on blades, as each blade will be able to get from 150 to 200 shaves from one blade, and the last shave will be as good as the first. The construction is simple and will last a lifetime. There are no parts to get out of order or get out of order. Any novice can use it just as well as the most expert barber. It is operated by simply taking the lever or handle as shown in the illustration in his two spirit levels, giving the CORRECT DIAGONAL STROKE. There are no adjustments, or nor anything tinkering necessary to operate the machine as the construction of the holder is such that STROP AND HONE the blade special receptacle at the same time. The SHARPEN-M-ALL is packed in a handsome box, with them full printed instructions. The weight of the complete machine is but eight ounces. Price, only $1.00, postpaid.

JOHNSON SMITH & CO., DEPT E9 3224 N. HALSTED STREET CHICAGO

Potmend Stops a leak in a minute



The finest repairer for Ironware, Agateware, Enamelware, etc. Good for kettles, pots, pans, boilers, and every kind of ironware, also for tin, copper, aluminum, ice boxes, iron pipes, cracks in stoves, broken china, porcelain, bric-a-brac, bisque, crockery, woodenware, marble, etc. Will not chip, fly, burn, bake or boil out. THE MEND IS THE STRONGEST SPOT ON THE POT. Could not be simpler; just mix the powder with water. HARDENS LIKE IRON. Fire-proof, Water-proof. You can fill a big hole or a small crack. Mended spot stronger than new. Replaces chipped enamel. Anyone can do it. FAILURE IS IMPOSSIBLE. Better and easier than solder. Three sizes, 15 cents, 25 cents and 50 cents.

Johnson Smith & Co., Dept. E9 3224 N. Halsted St., Chicago

FREE TO YOU!

Read this Remarkable Offer!



OFFER No. 1

Wireless Course

The most comprehensive Wireless Course ever printed. Contains 160 pages, 350 illustrations. Size of book 6¾"x10". Very fine flexible cloth cover.

FREE with a year's subscription.
Add 5c for postage

OFFER No. 2

Experimental Electricity Course

This masterpiece contains 160 pages, 400 illustrations. Size of book 5"x9". Printed on extra thin paper, so book can be slipped into pocket. Handsome flexible cloth cover.

FREE with a year's subscription. Add 5c postage

OFFER No. 3

How to Make Wireless Sending Apparatus
By 20 Radio Experts

How to Make Wireless Receiving Apparatus
By 20 Radio Constructors

These books are by far the most successful wireless books on the market. Size of each book 5"x7", well bound on good book paper. Covers in two colors. We really cannot praise these books too highly. Each book contains 100 pages and from 88 to 90 illustrations. **BOTH** books **FREE** with a year's subscription. Add 5c for postage

This is a very limited offer. It may be withdrawn at any time, due to the tremendous cost of paper, which IS JUST DOUBLE WHAT IT WAS ONE YEAR AGO. We have only a limited supply of these fine books on hand; after they are gone we cannot reprint the books until conditions become normal again. **Now is your chance.**

The publishers of this journal have earned an enviable reputation of giving more than 100 cents' worth for each dollar spent with them. Profit by this liberal opportunity NOW; it may never be made again.

HERE'S THE OFFER

Subscribe to the ELECTRICAL EXPERIMENTER for one year, at the regular subscription price of $2.00 per year (Canada, foreign and N. Y. C. $2.50) and we will send you either books shown in one of the above offers. If you subscribe for two years, two offers will be given, etc.

If you are a subscriber at present take advantage of this wonderful opportunity anyway. If you do, we will extend your present subscription.

This Offer Limited. *Act Now.*

EXPERIMENTER PUB. CO.
233 FULTON STREET NEW YORK CITY

FILL IN — TEAR OUT — AND MAIL

7-19

Gentlemen:
Please enter my subscription to the ELECTRICAL EXPERIMENTER for the term of .... year..for which I enclose herewith $.....
You will also send me at once FREE your book..... as per offer No.....
.....
.....
Name.....
Address.....



COMMERCIAL WIRELESS

Splendid opportunities now in the MERCHANT MARINE for Wireless Operators. Salaries now being paid—Junior Operators, $85 per month; Chief Operators, $110; food and quarters included. Equivalent ashore from $35 to $40 per week. Interesting and fascinating work. Our graduates in all parts of the world as operators, instructors, inspectors, etc., etc. Students from all over the country. If you are interested in Commercial Radio let the EASTERN RADIO INSTITUTE train you. Endorsed by Marconi and Government officials.
SUMMER COURSES. Day or evening start June 30th. Enroll for this date if possible or any Monday thereafter. Send for prospectus.

EASTERN RADIO INSTITUTE
899B Boylston St. Boston, Mass.



Western Experimenters

Buy your apparatus and parts in the West and save money. We have the largest stock on the Pacific Coast and sell at Eastern Prices. A Full stock of HALCUN and MURDOCK apparatus always on hand. BRANDES wireless receivers, etc., in addition to our own line of highgrade, long and short wave tuners, Regenerative receivers, and Wireless Telephone apparatus for amateur use. Our part list contains everything for the man who desires to build his own equipment.

Complete sets of any type or size built to your own design. Just send us a rough sketch and let us quote you prices. We can save you money.
SPECIAL INTRODUCTORY OFFER — Complete parts for our $15.50 Audion Panel ready to assemble consisting of genuine Bakelite panel cut to size and all holes drilled, switches, contacts, stops, binding posts, back-mounted rheostat, wire, and blue-print of instructions. Arranged for reception of damped and undamped signals.
Complete parts $5.85

Send stamp for our complete catalog.

WESTERN RADIO LABORATORIES
New Call Building,
74 New Montgomery St.,
SAN FRANCISCO, CALIF.



WIRELESS!



Fine black composition base suitable for detector, fixed condenser, etc. The bottom has a cavity 3" x 1½" x ⅜". Over all dimensions 4¼" x 2" x ½". Two holes for binding posts and for fastening down to table. Post paid 30c



Knob with 8/32 brass bushing, size 11/16 x 21/32. Post paid, 20c
Knob, as in upper corner, 1¼ x ¾, with hole for mounting. Post paid 20c

Bakelite-Dilecto panels, about

9½ x 19 x ¼	Black XX	$4.00
19 x 19 x ¼	Black XX	8.00
9½ x 19 x 3/16	Black XX	3.00
19 x 19 x 3/16	Black XX	6.00

A. H. CORWIN & CO.
924 Kinney Building Newark, N. J.

Learn Watchwork, Jewelrywork and Engraving A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL Department, Bradley Institute, Peoria, Ill., for our latest catalog.

Talking From 'Plane to Earth

(*Continued from page 203*)

ciated distinctly to them by Lieutenant Metcalf. They craned their necks to see the 'plane soaring far above bearing the officer, whose words came down to them so distinctly thru the ether.

A few minutes later Admiral Sims, from the platform, addressed the same audience *thru the amplifier*. He praised the work of the American Army in France, saying the navy was really an auxiliary of the army. More than 100 crippled soldiers from Walter Reed Military Hospital listened attentively to Admiral Sims' address and applauded his references to the navy, every word of which was distinctly heard, thanks to the remarkable amplifying properties of the new telephonic amplifier used on this occasion.

Billie Burke, the actress, sold bonds to the audience after the address of Admiral Sims, who bought the first bond.

All of which was made possible by the use of radiotelephony on the 'plane and at the ground station, coupled to the "Magnavox," a brand new telephone amplifier thru which the crowd in front of the Treasury heard President Wilson's Victory Loan appeal. Lieutenant Metcalf of the Military Aeronautic Service, delivered the message while flying 2,600 to 3,000 feet (about one-half mile) above their heads. Altho relayed at this great height, every word of the message could be distinctly heard.

The Magnavox (i. e. magnifying voice) is the invention of Messrs. D. S. Pridham, O. B. Moorehead and P. L. Jensen of San Francisco. It was connected with the airplane by means of the wireless telephone apparatus. One of the photos shows Mr. Pridham using the anti-noise transmitter speaking to the aviator.

The first question the layman naturally asks is: "How is it done?" The effect is wonderful, to be sure, yet it seems so simple. By the aid of the accompanying illustration the successive actions taking place in transmitting the aviator's voice from airplane to earth will be understood. The uninitiated are wont to think that, by some mysterious means or other the voice itself is actually projected thru the air, and that they are actually listening to the original speech. But such is not the case. The original vocal air waves set up in close proximity to the person speaking, in this case the aviator, are imprest on a sound-sensitive instrument, known as a *microphone*.

The microphone faithfully follows every intonation of the spoken voice and modulates or varies correspondingly a weak electric current passing thru the microphone, which modulations or variations of current are caused to affect in turn an audion or "talking bottle," as it is popularly called nowadays. The modulations of current in the microphone circuit are of low or audio frequency, about 1,000 cycles per second, and when these act upon the audion the electrical condition of the circuit connected with the antenna, which is in turn connected with the audion, causes oscillations or currents of high frequency of about 50,000 to 100,000 cycles per second, or higher, which are set up and pass into the antenna. The antennæ or aërial wires from which the radio frequency energy or waves radiate on the modern airplane provides for the use of two of these antennæ, one secured at either extreme of the wings. These wires are made of the toughest phosphor bronze strands, a large number of which are cabled together to give greater strength, and at the lower end of the antennæ, which may be 100 feet or more in length, there are placed lead weights weighing about two pounds. The airplanes arise and descend to and

(*Continued on page 283*)

Typewriter Sensation



FREE TRIAL
Use as You Pay

Only $4.00 a month until the low total price of $53.15 is paid, and the machine is yours.

This is absolutely the most generous typewriter offer ever made. Do not rent a machine when you can pay $4.00 a month and own one. Think of it—Buying a $100.00 machine for $53.15. Cash price, $50.35. Never before has anything like this been attempted.

Standard Visible No. 10 Smith Premier

Perfect machines, Standard size, full 84 character one motion keyboard. The entire line of writing completely visible at all times, has the tabulator, the two-color ribbon, with automatic reverse, the back spacer, ball bearing type bars, ball bearing carriage action, in fact every late style feature and modern operating convenience. **Comes to you with everything complete; tools, cover, operating book and instructions, ribbon, practice paper—nothing extra to buy. You cannot imagine the perfection of this beautiful reconstructed typewriter until you have seen it.** I have sold several thousand of these perfect latest style Model No. 10 machines at this bargain price and every one of these thousands of satisfied customers had this beautiful, strictly up to date machine on five days' free trial before deciding to buy it. I will send it to you F. O. B. Chicago for five days' free trial. It will sell itself, but if you are not satisfied that this is the greatest typewriter you ever saw, you can return it at my expense. You won't want to return it after you try it—you cannot equal this wonderful value anywhere.

You Take No Risk—Put in Your Order *Now*

When the typewriter arrives deposit with the express agent $9.15 and take the machine for five days' trial. If you are convinced that it is the best typewriter you ever saw, keep it and send me $4.00 a month until our bargain price of $53.15 is paid. If you don't want it, return it to the express agent, receive your $9.15 and return the machine to me. I will pay the return express charges. This machine is guaranteed just as if you paid $100.00 for it. It is standard. Over one hundred thousand people own and use these typewriters and think them the best ever manufactured.
The supply at this price is very limited, the price will probably be raised when my next advertisement appears, so don't delay. Fill in the coupon today—mail to me—the typewriter will be shipped promptly. There is no red tape. I employ no solicitors—no collectors—no chattel mortgage. It is simply understood that I retain title to the machine until the full $53.15 is paid. You cannot lose. It is the greatest typewriter opportunity you will ever have. **Do not send me one cent. Get the coupon in the mails today—sure.**

Harry A. Smith, 738, 218 N. Wells St., Chicago

H. A. SMITH, 738, 218 N. Wells St., Chicago, Ill.
Ship me a No. 10 Smith Premier F.O.B. Chicago, as described in this advertisement. I will pay you the $44.00 balance of the special $53.15 purchase price, at the rate of $4.00 per month. The title to remain in you until fully paid for. It is understood that I have five days in which to examine and try the typewriter. If I choose not to keep it I will carefully repack it and return it to the express agent. It is understood that you give the standard guarantee for one year.

Name .....
Address .....
.....

ADVERTISING PAYS

It pays the man who advertises and it pays the man who answers ads. For advertising rates in the E. E., address **Advertising Dept., 233 Fulton St., N. Y.**

TIRES at WHOLESALE



Not Seconds—Fully Guaranteed

Genuine "Capitol" or the new "Rib-Skid" Beacon Tires $13.60 up. Red Tubes or "Inside Armor" $2.90 up. Write at once for full description, samples of material, and "Direct-To-You" wholesale prices on these absolutely First Quality Fully Guaranteed 5000 mile Tires, Tubes, Armor, etc. Avoid tire trouble, and save one-third your Tire expense by sending size of your tires and name of car today.

MODERN TIRE CO.
659 7th St., Racine, Wis.



BUSH CAR—FREE

This Five Passenger 37 H. P. car, 116 in. whl. base. All bearings Timken. Delco Ign.—Dyneto Stg. and Ltg. Write at once for my great Free Offer and 48-page catalog. Agents wanted to drive and demonstrate. Territory open. Prompt shipments. Big money. Cars guaranteed or money back. 1919 cars ready.

BUSH Address J. H. Bush, President. Dept. C15 MOTOR CO., Bush Temple, Chicago, Illinois

Learn Autos and Tractors



Wonderful opportunities constantly offered trained men; we train you thoroughly to start your own business or make good money as motor expert, driver, shop foreman, etc.

5000 Graduates making good. Catalog Free.

Cleveland Automobile School, 1807 E. 24th St., Cleveland, O.



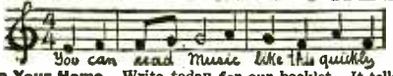
Free Book! Write today for the book which tells about the greatest of all industries—

AVIATION

Big demand for trained men. Passenger and mail service soon to all cities. Write for this FREE book, which tells ambitious young men how to get a start and win. Don't delay. Write TODAY. Address

NATIONAL AERO INSTITUTE
Dept. 744X, 916 So. Michigan Ave., Chicago, Ill.

MUSIC TAUGHT FREE



In Your Home. Write today for our booklet. It tells how to learn to play Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced pupils.

American School of Music, 57 Lakeside Bldg., Chicago

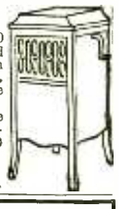


ARTIST

Earn $25 to $100 per week. Cartooning, Illustrating, Designing successfully taught by mail through new instruction method. Entire outfit free to new students. Write today for beautiful new book, "HOW TO BECOME AN ARTIST" and special free offer.

Washington School of Art, Inc.
1424 H St., N.W. Washington, D. C.

CLEARTONE PHONOGRAPHS
$4.00 to $200.00 Retail



Needles 45c per thousand in lots of 500,000 Motors $1.35 to $14.75 each. Tone Arms and Reproducers $1.30 to $5.75 per set. Main Springs 20c to 90c each. Records, Needles, Sapphire Points and Parts at reasonable prices.

Write for our 84 page catalogue, the only one of its kind in America, illustrating 33 different styles of Talking Machines and over 500 different Phonographic Parts.

LUCKY 13 PHONOGRAPH COMPANY
Export Dept. 46B E. 12th St., N. Y., U.S.A.

HANDY BINDER
for the Electrical Experimenter

Holds and preserves 12 issues, each of which can be inserted or removed at will, without tools. Will keep your magazines perfectly for all time or just preserve them like new till you bind them permanently. Made of heavy material, extra strongly reinforced at the back and covered with handsome green cloth, suitably lettered in gold.

65c

Add postage for 2 lbs.

Experimenter Pub. Co., Inc. Book Department 233 Fulton St., N. Y.

You can be quickly cured, if you

STAMMER

Send 10 cents coin or stamps for 70-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering for 20 years.

Benjamin N. Bogue, 756 Bogue Building, Indianapolis

AGENTS $60 WEEKLY



Robinson Folding Bath Tub. Big seller. Costs little, no plumbing, little water. Weight 15 pounds, folds into small roll. Full length baths, far better than tin tubs. Guaranteed 10 years. $10 a day easily made. Write for free tub offer.

Robinson Cabinet Mfg. Co., 4981 Factories Bldg., Toledo, O.

STORAGE BATTERY TESTING

(*Continued from page 224*)

For example, a battery develops 100 amp. hours at the eight hour rate. At the five hour rate (see table) it will develop 86.5% or 86.5 amp. hours in a five hour discharge. Since amp. hours = amps. × hours, then 86.5 divided by five will = 17.3, the current in amperes that the battery will deliver for five hours.

The graphic curve, Fig. 3, showing the voltage of a pasted plate at the five hour rate will apply to any battery of pasted plates, discharged at the five hour rate.

When the battery is put on discharge readings should be taken at the following intervals: 0 hrs., ¼ hr., ½ hr., 1 hr., 2 hrs., 3 hrs., 3½ hrs., 4 hrs., 4½ hrs., 4¾ and 5 hrs. If the voltage should fall more than that shown in the curve between the 3 and 3½ hr. readings the voltage and cadmium readings should be taken at shorter intervals. When the cell voltage reaches 1.8 the pos. cadmium should read 2.00 volts and the negative about .20. Of course, these readings will vary somewhat, depending on the condition of the battery, but if the pos. cadmium falls below 1.9 volts or the negative rises above .25 it shows a lack of capacity in that group and the battery should be sent out for repairs.

A voltmeter reading on *open circuit* is of no value, since the voltage of a battery after standing a few hours is the same whether charged or discharged, approximately 2.1 volts.

Due to the fact that the *gravity* of the electrolyte changes with the temperature, the amateur very often spoils his battery in this way.

The following table will be of assistance in overcoming the above mentioned trouble. The standard temperature for all commercial testing is 70 deg. Fah.

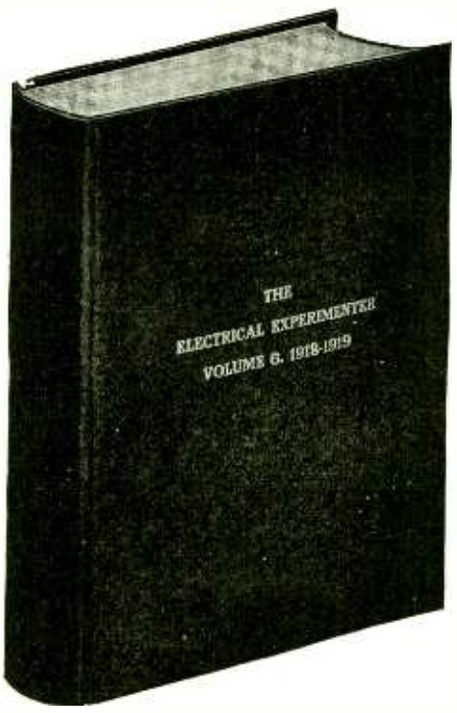
Table I

Degrees F.	Specific Gravity
100	1.275
97	1.276
94	1.277
91	1.278
88	1.279
85	1.280
82	1.281
79	1.282
76	1.283
73	1.284
70	1.285
67	1.286
64	1.287
61	1.288
58	1.289
55	1.290
52	1.291
49	1.292
46	1.293
43	1.294
40	1.295

The temperature of the battery should be kept as near 70 deg. as possible, as the capacity increases and decreases with the temperature. *A starting and lighting battery should not go above* 100 *deg. under any conditions. To do so will loosen the active material from the grids, and after a few cycles the battery will be completely ruined.* However, other batteries containing heavier plates will stand as high as 120 deg., depending on the thickness of the plates, but will be ruined if constantly operated at that temperature. It is therefore a good practise to always keep your battery below 100 deg. If it should be impossible to do this, the next best thing is to lower the specific gravity of the electrolyte.

RADIO ENGINEERS' MEETING.

The Institute of Radio Engineers held a meeting on Wednesday evening, May 7, at the Engineering Societies Building, New York City. A paper was presented on "The Detecting Efficiency of the Thermionic Detector," by Dr. H. J. van der Bijl, of the Western Electric Company. The paper presented described several different methods for measuring absolutely, or by comparison, the true detecting efficiency of vacuum tubes.



This Book Cost $34,000

1200 Authors Contributed

Our Bound Volume No. 6 contains a goldmine of electrical and scientific information. No such value has ever been offered before for so low a price. A marvelous cyclopedia of electricity. A reference book of authentic information not found in any other book in print.

Volume contains twelve numbers of the "Electrical Experimenter" magazine — May, 1918 to April, 1919, inclusive. There are 984 pages, 2,110 complete articles, 1,908 illustrations, 369 questions and answers. Sizes, 12" high; 9" wide; 2" thick.

A world of electrical information; the entire electrical Progress for one year; the greatest reference book on current "Wireless"—all at a price within reach of everybody. Mind you, the book is durably bound in attractive green linen with heavy covers. Letters stamped in gold. You will be proud to have it in your library. We have only 600 copies, therefore be sure and order to-day. Shipping weight 8 lbs. Add a sufficient amount for postage, otherwise we must ship by express.

$3.00

add postage for 8 lbs.

Positively the Greatest Electrical book bargain in the World. We ship AT ONCE. Order today to avoid delay.

EXPERIMENTER PUBLISHING COMPANY, Inc.
Book Department
233 Fulton Street - New York, N. Y.

Fill in--Tear out--and Mail

7-19

Gentlemen:

Please send at once your Volume No. 6 as advertised, for which I enclose herewith $.....

I also enclose $.....extra for postage.

.....

.....

Name .....

Address .....

.....

Talking From 'Plane to Earth

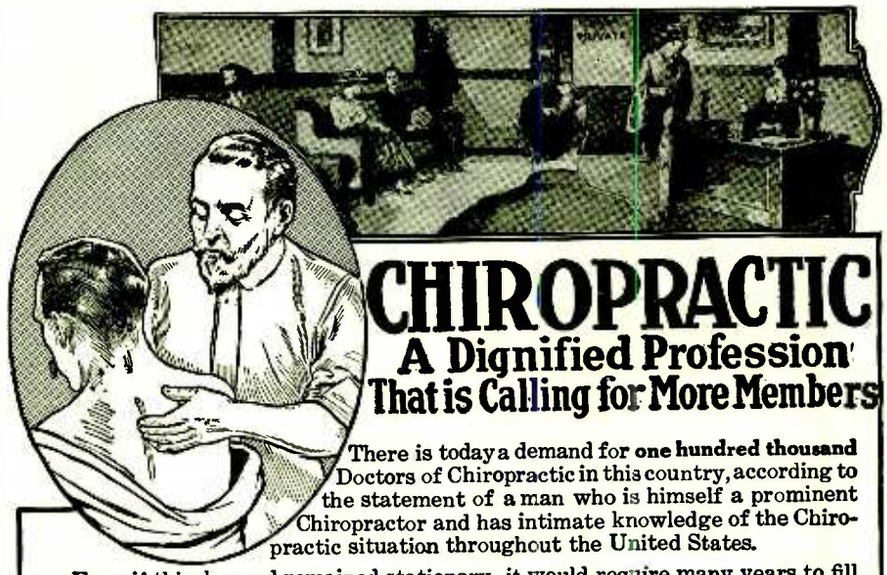
(*Continued from page* 281)

from the ground with these aërial wires outstretched. They need not be reeled up as was the previous practise.

Picking up the thread of transformations taking place in the voice from the airplane and by referring to the accompanying diagram-illustration, we see that the high frequency electric currents are shot off from the airplane antenna and proceed to set up electric oscillations or waves in the ether, *not in the air.* These waves radiate spherically in the same manner as the ripples on a small mill pond when you throw a stone into it—the ever-expanding ripples finally reaching the shore, and if a little float or tippet rests on the water it will be rocked by the wave when it reaches its position. The very same thing takes place when the aviator's voice, now transformed into extremely high frequency and inaudible waves, which may pass thru our very body or thru the building in which we may be; and these rapidly traveling waves, speeding onward with the velocity of light, or 186,000 miles per second, eventually reach the receiving antennæ, located in this case on the earth. These waves also move outward from the transmitting airplane station in all directions, and other stations may pick up the message or signals when desired, even at distances of 20 miles or more.

When in an extremely small fraction of a second the radio-telephone etheric waves reach the receiving antennæ, there are at once caused to be set up in the wires comprising these antennæ, minute electric currents corresponding in frequency to the etheric waves of, let us say, 100,000 cycles per second, which are, of course, *inaudible.* This receiving antenna, in the present instance located on the Treasury Building at Washington, D. C., was connected up with a sensitive wireless telephone receiving set, in which we find some more audions, or "talking bottles." In this case the audions or vacuum tubes containing the various electrodes for controlling the stream of electrons or minute electric charges passing thru the audion, are used inversely to their action in the airplane as described above—here they have imprest upon them the *inaudible* radio-frequency oscillations or currents coming to them from the receiving antenna and set up in the manner aforementioned. Of course, these oscillatory currents are carefully tuned by means of the usual tuning coils and metal plate condensers, so that the message comes in with maximum *resonance.* The audions transform these antenna currents into *audi-frequency* currents, which may be then past into an ordinary pair of wireless telephone receivers strapt to the head, or as in the present case, they may be past into a *sound amplifying apparatus.*

An amplifier of this type and suitable for powerfully intensifying wireless telephone or telegraph messages as well as the regular telephonic speech over the usual telephone circuits from Washington to New York, etc., is shown in the accompanying photographs and is known as the *Magnavox.* This instrument comprises a diafram and electromagnet very cleverly arranged and delicately balanced, so that when a medium strength telephone or radio current passes into it, the diafram or sound reproducer of the device responds with greatly intensified effect, and in this way it proves a wonderful advance for the purpose of public speaking, amplifying radio signals under certain conditions where more than one may wish to hear them, such as in lectures, and for a hundred and one other requirements, including train announcing, theatrical purposes, ad infinitum.



CHIROPRACTIC
A Dignified Profession That is Calling for More Members

There is today a demand for **one hundred thousand** Doctors of Chiropractic in this country, according to the statement of a man who is himself a prominent Chiropractor and has intimate knowledge of the Chiropractic situation throughout the United States.

Even if this demand remained stationary, it would require many years to fill it. But the demand is constantly increasing because more and more intelligent people—those who do their own thinking—are becoming convinced that Chiropractic (the advanced Science of Spinal adjustment) is the common sense and really scientific way to relieve pain and disease.

A Real Opportunity

Do you realize what this means to you if you are really ambitious? It means that never has there been a more opportune time for you to align yourself with the members of a great profession that is forging rapidly to the front. Today Chiropractic is receiving the serious consideration and hearty endorsement of even many doctors of the old schools of medicine, of clergymen and of large numbers of scientific thinkers and investigators. And Chiropractic is a profession of rich financial rewards.

$3000 to $5000 a Year

Many Doctors of Chiropractic earn that much and more. Some upwards of $10,000. Dr. M. D. Moore, of Kentucky, reports an income of $9,000 a year. Dr. L. H. Roche, New Jersey, $5,000. Dr. Hanna, of Florida, over $5,000 yearly.

The success of Chiropractors, in many cases, has come so quickly as to be almost startling. And yet, it is not to be wondered at when you consider the scientific accuracy of Chiropractic methods and the comparatively few Chiropractors that are now in the field.

Become a Doctor of Chiropractic In Spare Time AT HOME

The American University method enables you to study by mail or in class and obtain a complete mastery of Chiropractic in the shortest time consistent with thoroughness, while you hold your present position. Easy terms. A splendid faculty will personally instruct you in the basic principles and in the most approved methods of relieving Headache, Indigestion, Lumbago, Epilepsy, Pleurisy, Constipation, Rheumatism, Asthma, Neuralgia, Neuritis, Catarrh, Fevers, Jaundice, Dyspepsia, Paralysis, etc. No special preliminary study is needed. You graduate with the degree of Doctor of Chiropractic and are ready at once to open your office.

22 Charts Free!
Send Coupon

We have prepared 22 remarkable Anatomical and Pain Area and other Charts—a total value of $31.50. Our special offer places all of these 22 Charts FREE in the hands of ambitious men and women. We will send all particulars and our 72-page book free on request.

We know what the opportunities are and we see no reason why you should not "cash in" on these opportunities just as fully as others have done and are doing. A postal or the coupon will bring complete information about course, easy payment plan and the Free Charts offer.

AMERICAN UNIVERSITY
Manierre Bldg., Dept. 505 Chicago

Gentlemen:—Without cost or obligation, send me by mail, your new illustrated, 72-page book and details of your easy payment plan and Free Charts offer.

Name.....

Address.....

City..... State.....

CARNOTITE

(Radium Mineral.) The American Pitchblende found in Colorado, from which *Radium* is extracted.

A generous piece, enough to conduct experiments, such as affecting photographic plates thru opaque material (similar to X-Ray pictures), first made by Sir W. Crookes and Mme. Curie, is furnished in neat, wooden box.

URANIUM ORE (*Radio-Active*)

Containing about 35% of pure Uranium; also Radium and Vanadium. One of the most rare and interesting minerals. Twenty milligrams are furnished in glass vial protected by lead cover.

One box of *Carnotite* and one vial of *Uranium Ore* as described above $0.50 sent prepaid.

SIDNEY SPECIALTY CO.
233 Fulton Street New York City

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section seven cents a word for each insertion. No advertisement for less than 50c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency.

Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the August issue must reach us not later than June 22.

The Circulation of the Experimenter is over 115,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Automobile Accessories.

Save Money. It is a conservative estimate that 75% of the money spent for tires is wasted. One bad blowout or rim cut means a tire cast aside. This problem has been overcome by the new McDaniel Process, which gives 5,000 more miles out of old tires. The cost is insignificant compared to the many dollars saved. Drop us a card today and let us send full details. We want to tell you how to double your tire mileage. Leo McDaniel Rubber Co., 806 Commercial Ave., Cairo, Ill.

Ford Car Repair Book sent free. This valuable, complete, well illustrated, book explains in a simple way the Causes and Cures of Overheating; Repairing Ford Timer; Curing Piston Ring Troubles; Carburetor Adjustment and Repairs; Connecting Rods; Transmission Troubles; Care and Repair of Rear Axle; Stopping Axle Grease Leaks; also covers practically every other phase of Ford car repairing. Another feature is a chart showing exactly how much to pay for work done by repair men. Send 25c. coin for three months' trial subscription and get the valuable repair book free. Ford Owners' Magazine, 417 Montgomery Bldg., Milwaukee, Wis.

Ford Owners are discarding all light devices for "Slow Speed Bright Lights." Retail $1. 300% profit. Guy Cox, Golden, Ill.

Auto Motors and Supplies. Buick, Hupp, Franklin, Michigan, Everett, Hudson, Chalmers. Both water and air cooled motors, $40 each and up. Bosch Magnetos, $15 each and up. Presto Tanks, $5. Coils, Carburetors, Head Lamps, Horns, Air Compressors, Generators, Starters. Write for bargain bulletin second-hand auto accessories. Johnston, West End, Pittsburgh, Pa.

Fords run 34 miles per gallon with our 1919 carburetors. Use cheapest gasoline or half kerosene. Start easy any weather. Increased power. Styles for all motors. Runs slow high gear. Attach yourself. Big profits for agents. Money back guarantee, 30 days' trial. Air-Friction Carburetor Co., 270 Madison St., Dayton, O.

Tools.

Welding Outfits for all purposes. Get our prices before buying elsewhere. Fesco Mfg. Co., Sutherlin, Ore.

Personal.

Are You Self-Conscious, embarrassed in company, lacking in self-control? These troubles overcome. C. E. Veritas, 1400 Broadway, New York City, N. Y.

Music.

"American Girl" and 4 big song hits, 50c guaranteed. Magbee Co., 403 13th Ave., Columbus, Ohio.

Wireless.

Complete Receiving Sets $8.50, $9.50 and up. Instruments, parts, minerals. Circular for stamp. Inquiries invited. Jenkins, 923 Purchase St., New Bedford, Mass.

Radio Apparatus of Quality. Manufactured to your own specifications. Radio Engineering Company, Baltimore, Md.

Primaries and Secondaries for loose couplers $2.50 per set. Complete instrument $4.50. Coil for tuner $1.50. Complete $2.50. Goods prepaid. Leon Pennell, 75 Ellsworth St., Brockton, Mass.

Amateurs! Attention! Have you received our Weekly Bargain Bulletin? If not, write now! All Standard Apparatus at prices that cannot be duplicated. Special rates to radio clubs. Modern Radio Equipment Co., 27 So. Broad St., Elizabeth, N. J.

Amateurs! Special seamless cardboard tubing for receiving transformers. 5" and 5½" outside diameter, 25c. per foot, 6" diameter, 30c. Any length. Maier & Co., 335 E. 93rd St., New York.

Wireless Apparatus. Detectors, couplers, phones, aerial wire, brass and copper strip, switch points, knobs, bakelite. List 3c. Klaus, Eureka, Ill.

Switch Points. Binding posts, switch levers, and small parts, send 2c. for catalogue describing these and other goods. A. W. Bowman & Co., 23 Church St. (Harvard Square), Cambridge, Mass.

Agents Wanted.

Insyde Tyres, inner armor for automobile tires, double mileage and prevent punctures and blow-out. Quickly applied. Costs little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, O.

10 to $25 a day profit. Biggest summer seller. Concentrated fruit drinks. Just add water. Delicious drink in a jiffy. Six popular flavors. Bestever Products Co., 2426-SE-7, Polk St., Chicago.

Agents. Toledo Inventor makes wonderful discovery. Puzzles, yet pleases auto world; next to gasoline most needed, fastest selling auto accessory in world; one man sold 10 gross first month; wonderful chemical cloth works like magic; one rub over rain or snow blurred windshield, street car or locomotive window, presto! glass stays clear 24 hours; can't blur; exclusive territory free—worth fortune. Security Mfg. Co., Dept. 146, Toledo, O.

Big Money Made every day selling our automobile accessories. Every autoist a customer. Most remarkable inventions in the accessory line. Demonstration proves every claim. Particulars free. Exclusive territory if you act quick. The Embee Co., Wilkinsburg, Pa.

Install Farm Lighting and Power Plants. Our exclusive agency and special demonstrating offer insure big profits at a small investment. Get our plans at once. Acme Engineering Co., Louisville, Ky.

Beginners. Complete "Mail Order System." C, Box 1005, Atlantic City.

Agents. Big returns, fast office sellers; particulars and samples free. One Dip Pen Co., 12 Daily Record Bldg., Baltimore, Md.

$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Ave. D, Decatur, Ill.

Signs for store and office windows. $50 a week easily made. Chicago Sign System, G 326 River St., Chicago.

Printing.

Gummed Labels! Rubber Stamps! Samples Free! Edward Harrison, "Printing," Baltimore.

100 Engraved style visiting cards, 50c.; 100 emblem cards, 70c. H. Gregory, Warwick, N. Y.

200 Bond Note Heads $1. Money back guarantee. Ferndale Printery, Cherrydale, Va.

Motors, Engines & Dynamos.

Gas Engines. Marine, stationary and cycle motors for bicycle attachment, rebuilt and guaranteed. Don't fail to get our price list before buying. Prices 50% lower than others. Write. United Motor Repair & Supply Company, 305-309 Broadway, New York.

Gasoline Engine. ¾ horse. Set of castings $8. 4 Horse $15. Send 12c. for blueprints. Speed lathe castings $1.85, blueprints 12c. M. & J. Specialty Co., 252 Parke St., Pontiac, Mich.

Small Motors and Generators from bankruptcy and receivers' sales. Motors for all phases of current. Immediate delivery. Less than one-half regular prices. See display ad on page 259. Johnston, West End, Pittsburgh, Pa.

For the Hair.

I Was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have good hair-growing results. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E. 32nd St., BA-300, New York.

Postcards.

Join the Largest post card exchange in the world. Members everywhere. Membership 15c. 3 months 25c. "Wide World," Box 532, E, New Glasgow, Nova Scotia, Canada.

Join a Post Card Club. Have friends everywhere. Membership 10 cents. John Miller, 1430 H Street, Sacramento, Calif.

Five Prettiest Woman Cards. Hand colored, 25c.; camera bargain list free. Chas. Durso, Dept. 41, 25 Mulberry St., New York City.

Exchange Ads.

Cheap. Selling all my photographers stuff. All new. Write for list. Earl Wright, Cole Camp, Mo.

Former Amateurs. Where are you? What doing? Write me. Let's get busy. Whatcha got, sell or trade. Radio Amateur, Marion, Ill.

Standard Type Corona and Case. Perfect condition. Want 1 KW Thordarson and rotary or other apparatus of equal value. Harry Wright, Fire Island Radio Station, Bayshore, N. Y.

Wanted. Used motorcycle engine, preferably a twin. George Weitz, Boonville, Mo.

3000 Meter Coupler, Tron Bulb. Bargain. L. B. Wilcox, 113 E. 6th, Erie, Pa.

Attention! We have something you want! See our advertisement in main columns. Tabulated Information Card Co.

Sell. Complete receiving set and 5-dial omnigraph. E. Schuessler, 2209 Wheeler St., Cincinnati, O.

Selling My Amateur Wireless. Bargains. "Wireless," Str. Huron, Marine Post Office, Detroit.

Trade. 3-inch spark coil for good phones, audion bulb or loose coupler. Roy Schilling, 2476 W. 29th St., Denver, Colo.

For Sale. ¾ kilowatt transmitter and regenerative receiver, perfect condition. Myrl Priest, St. James, Minn.

For Sale. Official Boy Scout supplies. Send for list. Carl B. Mayo, Orleans, Mass.

Regenerative Cabinet Receiver. Other wireless, electrical and chemical apparatus. Send stamp and state wants. Ray Keogh, 328 Larel Ave., Chicago.

Radio Apparatus for Sale. Receivers, condensers, sending keys, switches, storage batteries, wall telephones, high frequency apparatus, etc. Send for list. George Holmes, 164 W. 146th St., New York City.

For Sale. Wavemeter 100 to 20,000 meters, $25. List of other apparatus for stamp. Gebhard, 1127 Ellicott St., Buffalo, N. Y.

For Sale. New cyclopedia of applied electricity, $16. Claude Grace, Princeton, Ind.

Practically Giving Away wireless instruments amounting $100. List for stamped envelope. Fliegel, 4535 N. 17th St., Philadelphia, Pa.

Sell or Swap wireless apparatus and little of everything else. Send for list. All inquiries answered. Ellsworth Erickson, 3005 Cedar Ave., Minneapolis, Minn.

For Sale. Correspondence course in wireless. Earl C. Brown, Martinsburg, W. Va.

For Sale. Experimental chemical lahoratory. Bert Emerson, 704 N. Haydon St., Hannibal, Mo.

Sell. New 5-record Morse omnigraph, key, sounder, $12. Wm. Ericksen, Exchange Bank, Spokane, Wash.

For Sale. Mignon R. L. C. 5 receiving cabinet. Fine condition, wave length, 9,000 meters. Price $30, or will exchange for Paragon regenerative in good condition. Enclose stamp. Harold Smith, Charleroi, Pa.

Typewriter. Oliver and Royal. First class condition. Your choice $25. Emerson Tanner, West Vine St., Canton, Ill.

For Sale. Complete transmitting set, 3 in. receiving apparatus and electrical supplies. Heiges, Wheatland, Pa.

Sacrifice $300 worth Radio and high frequency apparatus all new. Write for description. G. Dunfee, Shenandoah, Iowa.

Must Sell. Send stamp for list electrical books, chemicals, microscope, cameras, phonograph records, etc. T. H. Blacknall, Raleigh, N. C.

Exchange, Buy, Sell. Wireless, electrical goods, etc. Large list 6c. State what you have and want. Zehrbach, Box 500, Hiram, O.

Kodak No. 1-A. Like new with film. Eight dollars. Edward Wilson, Spangler, Pa.

Typewriter. Like new. For sale or exchange. John Galhreath, Rogers, O.

For Sale. Blueprints for connecting A. C. motors. See ad under "Blueprints." Charles L. Chittenden.

Wanted. Electrical or mechanical instrument that will locate buried treasure, from three to five feet underground. I. A. Blalock, 614 Parker St., Jacksonville, Fla.

Exchange Ads (Cont'd)

For Sale or Exchange. 8 H.P. kerosene engine, dynamos, motors, magnetos, switchboard meters, musical instrument and a lot of other things, for list and particulars write at once. F. J. Bretzke, Brownsville, Wis.

Sell or Trade—Toward good wireless receiving apparatus, Westinghouse A. C. ammeter 0-200 amperes and busbar. Ladies' violin, $45. Duncan Eader, Shelby, Mich.

For Sale—Apex Electric Cleaner $43. Never been used. Edw. Juselius, Safepack, Millis, Mass.

For Sale—1 gasoline engine, 4 h.p. complete with new coil plug, piping and tank $19 also 6-100 storage battery $15 and 4-40 storage battery $6.50. Write for list of electrical things. Herman Silber, 166 S. 3rd St., Brooklyn, N. Y.

For Sale—Grebe, DeForest, General Radio and other apparatus. Please enclose stamp. Natalish, 68 West 56th Street, New York City.

For Sale—Clapp-Eastman type E, 5 K. W. transformer, slightly damaged, $100.00. K. M. Briggs, 26 Albemarle St., Rochester, N. Y.

Motion Picture Plays.

Photoplays Wanted. Big prices paid. You can write them. We show you how. Free particulars. Rex Publishers, Box 175, E-3, Chicago.

Blue Prints

Blue Prints. ½ H. P. gas engine, 30c.; ¼ H. P. steam engine, 50c.; ⅛ H. P. boiler and engine, 70c.; all 3 for $1. Circulars on castings and engines for stamp. Universal Gas Motor Co., 364 Monadnock, Chicago.

Blue Prints, 236 A. C. diagrams, 2 to 12 poles, contains 54 single phase, 42 two phase, 50 three phase Star, 40 Delta, 12 Star-Delta. Appendix 38, changes of voltage, phases, speed, cycles etc. Easily understood. Price reasonable. Terms. Write for particulars, or send 25c. for 10 full size samples. Charles L. Chittenden, 811 West 18th St., Kansas City, Mo.

Salesmen Wanted.

House-to-House Salesmen, why not the line that sells and repeats every 90 days? Our Sanitary brushes, mops and dusters pay big commissions, and we protect you in good territory. Only live ones wanted. Early promotion for producers. If you know and admit that you're good, write us. North Ridge Brush Company, 114 Clark Ave., Freeport, Ill.

Stammering.

St-Stu-t-t-tering and Stammering cured at home. Instructive booklet free. Walter McDonnell, 105 Potomac Bank Bldg., Washington, D. C.

Rubber Stamps.

Rubber Stamps Made to Order. McCaddon Company, Zanesville, Ohio.

Dogs.

Airedales, the classy kind. Write your wants. Oak Crest Kennels, Liberty, Mo.

Roots—Herbs.

$5 a Day gathering evergreens, roots and herbs. Ginseng, $14 lb.; Belladonna Seed, $64 lb., or grow it yourself. Book and war prices free. Bontanical-D, New Haven, Conn.

News Correspondents.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

For the Home.

Wonderful! Chemically prepared cloth—makes ice last twice as long. Cuts hills in half. Guaranteed, sanitary, odorless, easily cleaned. Prices, 30c., 60c. E. D. Romig, Pottstown, Pa. Agents Wanted.

Tricks, Puzzles and Games.

Tricks, Puzzles, Jokes, toys, games, novelties, doll and cane racks, plays, wigs, stage supplies, escapes and illusions. Large 1917 catalogue free. Oakes Magical Co. Dept. 549, Oshkosh, Wis.

Black Art Hindoo experiments. 1919 edition, 25c. Invisible ink. Free trick. Catalogue each order. Linhorst Magic X Shop, St. Louis.

"How-Zit-Dun"? The latest and most mystifying novelty! Only 25c. D. S. Schindler, 661 Washington Ave., Brooklyn, N. Y.

Magic Entertain at home. Tricks, puzzles, novelties. Big catalogue A 25c. Martinka & Co., Inc., Harry Houdini, President, 493 Sixth Ave., New York City.

Mind Reading Cards. Accurate, mystifying. Price 50c. Card and rose trick 25c. Disappearing spots card trick 15c. Leland Lund, 913 Pacific Ave., Tacoma, Wash.

Magic—Card Tricks. Sensational escapes, jokes, novelties. Everything in the amusement line. Large illustrated catalogue of a thousand tricks free. Write today. Largest amusement goods manufacturers in the world. Heaney Magic Co., Desk 200, Berlin, Wis.

1000 Stage Tricks with 500 illustrations. Catalogue, 10c.; small catalogue free. Hornmann Magic Co., Sta. 6, 170 Eighth Ave., New York.

Business Opportunities.

Problems and Advice in radio, mathematics, electricity, chemistry, etc., answered by experts for $1 and up. Paragon Technical Bureau, 329 E. 5th St., New York City.

Many Suggestions for starting profitable home business, 60c. Central Company, 599 Ninth Ave., New York.

Make Die-castings. Sketch, Sample, Booklet and Proposition, 12c. Byrd & Blair, Box 227-E, Erie, Pa.

Victory. Mechanical Toy Soldier window attraction. 30 inches high. Salutes, turns head, points with finger, etc., as set. Well made, nicely dressed officers, privates, Uncle Sam, etc. Electrically operated. Does some stunt every half minute or oftener as set and will salute soldier and pay no attention to other if desired. Representative wanted in each city and town. Write for prices. The John M. Biggs Co., Box 324, Chattanooga, Tenn.

Start a Profitable Business manufacturing "Puffed Crisp." Delicious confection. Whirlwind money-maker. Machine, Instructions complete $6.50. Samples 10c. Bestever Products Co., 2426-PE7 Polk St., Chicago.

Dollars Yearly in Your Back Yard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. Metz, 313 East 89, New York.

Enter a New Business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks at small expense; no further capital required; no goods to buy; job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston, Mass.

$30 a Week Evenings. I made it with a small mail order business; continued my regular job daytime. Free Booklet tells how, 2c postage. Albert W. Scott, Cohoes, N. Y.

Build Up an Income in Oil. Others are doing it—Why not you? Today is the opportunity. Join our easy monthly payment plan now—it may mean hundreds in profits. Write for information. National Oil Drilling Co., Dept. K, Houston, Texas.

Install Farm Lighting Plants. Big Profits. Get our Agency Plans at once. Wolkee Co., Louisville, Ky.

Anyone Interested in making $100.00 month in spare time at home? Send 25c. (coin). L. Stutz, Middletown, Md.

Mail Order Business may be your opportunity. Can be started in spare time on small capital. "The Mail Order Man's Magazine" gives inside facts how big profits are made. Contains latest money-making schemes and plans. Valuable suggestions for beginners. Articles by experts. Illustrated. Sample copy, 10c. None free. Mail Order Man's Magazine, Dept. M, Cambridge, Mass.

"Quick-Action Advertising—How It Is Building Business for the Progressive Advertisers of America"; A little story of results told by the advertisers themselves—not the publishers. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 W. 39th St., New York.

Health.

Tobacco or Snuff Habit Cured or no pay; $1 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

Pyorrhea. H. E. Kelty, D.D.S., M.D., pyorrhea specialist for 15 years, has developed a successful home treatemnt for pyorrhea. Purifying, healing, preventative. Full month's treatment and booklet $1. Circular free. Dr. H. E. Kelty, 106 Gladwin Ave., Leonia, N. J.

Cigarette, pipe or chewing habit conquered. Nature's method. Guaranteed. Write for free brochure. Edw. J. Woods, TA-300 Station — New York.

Telegraphy.

Telegraphy (both Morse and Wireless) and Railway Accounting taught thoroughly and quickly. Big salaries now paid. Great opportunities. Oldest and Largest School—est. 45 years. Catalog free. Dodge Institute, 7th St., Valparaiso, Ind.

Automatic Telegraph Transmitters. Must dispose of fifteen at once. Brand new. Never used. Works like typewriter type used by Chicago Telegraph Institute. Real bargain. Photograph. Byron Cook, Wilson Y. M. C. A., Chicago.

Formulas.

500 Formulas, resilvering mirrors, renewing dry batteries, luminous paint, mechanics' soap, 25c. Catalogue 2c. Ideal, 5501-E North Robey, Chicago, Ill.

Guaranteed Directions for preserving eggs, 25c. McLardie Box 467, Dayton, Ohio.

Patent Attorneys.

Inventors. Send sketch of your invention for advice regarding patent protection. Twenty years' experience. Handbook on patents sent free. Talbert & Talbert, Patent Lawyers, 4820 Talbert Bldg., Washington, D. C.

Patents Procured, Trade Marks Registered. A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C., or 2278-T Woolworth Bldg., New York.

John M. McLachlen, Atty. at Law, Patents, Trade Marks, Copyrights, 410 McLachlen Bldg., Washington, D. C.

M. F. Miller, Ouray Bldg., Washington, D. C. Patent Attorney, Mechanical and Electrical Expert. Best quality of work and results. Moderate charges. Advice free.

Patent Your Own Inventions. Save attorney's fees; we prepare applications; furnish full instructions and give satisfaction. Free information. Carl Larsen Co., Park Row Bldg., New York City.

Protect Your Rights. Write for "Record of Invention" which contains forms to establish evidence of conception of your invention. Prompt personal service. Preliminary advice without charge. J. Reaney Kelly, 732-C Woodward Bldg. Washington, D. C.

Millions Spent Annually for Ideas! Hundreds now wanted! Patent yours and profit! Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. 212 Patent Dept., American Industries, Inc., Washington, D. C.

Patents. My fee payable in monthly installments. Send sketch for advice. Booklet free. Frank Fuller, Washington, D. C.

Patent Attorney. Electrical engineer, mechanical expert; thorough personal service. Frank Ledermann, 21 Park Row, New York.

Save Money. I will work out your complete patent application, including drawings for $25. Ready for filing. H. E. Serner, Consulting Engineer, Patent Expert, 1431 Broadway, New York.

Patents promptly procured by personal expert service. Information on request. James D. Lyles, Washington, D. C.

For Inventors.

Inventions Commercialized. Cash or royalty. Adam Fisher Mfg. Co., 205 St. Louis, Mo.

Inventors. Protect yourselves. Record your idea before exposing it to anyone, even to me. Paul Klein, M.E., Consulting Engineer, Registered Patent Attorney, 21 Park Row, New York.

Inventors join National Institute of Inventors, 118 Fulton St., New York City; membership society 1,900 strong; will help protect, develop, finance and market your invention. Absolutely no charge. Write for booklet.

Inventors' Adviser. Sent free on request. Wm. C. Linton, 918 F St., N.W., Washington, D. C., 363 University St, Montreal, Canada.

Sell or Finance Inventions. Send dime for sample copy of Money-Talks Magazine. 70-B Park Place, Newark, N. J.

Inventors. If you have an article of merit, I will mail you a picked list of buyer manufacturers. These concerns on lookout for meritorious articles, novelties, specialties, etc. Enclose quarter (no stamps). P. O. Box 14, North End Station, Detroit, Mich.

600 Mechanical Movements, also illustrations and explanations of 50 perpetual motions. My book, Inventors' Universal Educator, 4th edition, tells how to procure and sell a patent for your new invention. Government and other costs. Covers the matter from A to Z. 140 pages elegantly bound. Contains noted Court decisions on Patent cases. Mechanical Movements greatly assist inventors—suggest new ideas that might prove of great aid in perfecting inventions. Tells how to select an attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers. Price $1. Postage free. Fred G. Dieterich, 603 Ouray Bldg., Washington, D. C.

Old Money Wanted.

We Buy and Sell Old Coins. $2 to $500 each paid. Keep All Old Money; you may have valuable coins. Send 10c. for New Illustrated Coin Value Book, 4 x 6. Guaranteed prices. Get posted. Clarke Coin Co., Box 110, Le Roy, N. Y.

Song Poems Wanted.

Write the Words for a Song. We write music and guarantee publisher's acceptance. Submit poems on war, love or any subject. Chester Music Co., 920 So. Michigan Ave., Room 265, Chicago, Ill.

Write the Words for a Song. We revise poems, write music and guarantee to secure publication. Submit poems on any subject. Broadway Studios, 1970 Fitzgerald Bldg., New York.

Continued on page 286

Scenery for Hire.

Collapsible Scenery for All Plays. Amelia Grain, Philadelphia, Penn.

Electrical Supplies & Appliances.

Pocket Tester for Electricians, trouble-shooters and maintenance men. For use in place of lamps on 90 to 500 volt lines for locating shorts, grounds, opens and blown fuses. Sizes 2½ x 5", in neat leather case with leads for testing. $1.50 postpaid. Falls Electric Shop, Cuyahoga Falls, O.

Motor Winders. See ad under "blue prints." Charles L. Chittenden.

Battery charging and repairs are big profit makers. Get our special offer. Wolkee Co., Louisville, Ky.

Amateurs Take Notice. Just your chance. Everybody tells you it is impossible to make a practical electrical generator without an expensive layout of equipment, but send for our latest booklet entitled, "A Practical Home-Made Alternator," containing complete instructions and drawings for the construction of any size generator of any phase. No castings or machine work required. Made in the simplest way with the simplest tools. Price 50c. postpaid. Practical Science Shops, Utica, Kan.

Electrical Photographic and chemical apparatus, motors, fans, switches, spark plugs. Advise what you want or have for sale. H. C. Hancock, Bogota, N. J.

High Voltage Batteries. Famous "Eveready" 20 volts. $1.65 postpaid. H. Wien, 554 Nye Ave., Irvington, N. J.

I can show you how to make an efficient electric furnace for less than $2. Send 20 cents for instructions. Box 1788, Los Angeles, California.

Miscellaneous

Mansfield's Automatic water and oil finder a proved success, silver medal awarded. Particulars from Edwin A. Mansfield & Co., 94 Victoria Road, New Brighton, England.

Mark Your Tools with a steel name stamp, and stop theft. 1/10 inch and smaller. 15c. per letter. Harman Stamp Works, 264 Main St., Springfield, Mass.

Wanted. Small gasoline and steam engines, small lathes, drill presses and other light machinery. Will pay high cash prices for good material. Johnston, West End Pittsburgh, Pa.

Multiplying Simplified! For further information see our advertisement in main columns. Tabulated Information Card Co.

Traveling Stoves of Pure Aluminum. Do not rust. Cooks quickly and retains the heat for a long time. Is light in folding. Burns alcohol. Price $1. C. Stelmach, 1318 Crittenden St., Chicago, Ill.

Penmanship Taught by Mail. Short practical course. Special offer. C. G. Prince, 130 W. 104th St., New York.

Get Vital Strength. Retain youthful vigor. Wonderful results. Intensely interesting booklet free. Winslow H. Chase, Washington, D. C.

Traveller. Starting soon on a round the world trip will do all kinds of errands, and is offering his services to collectors of post cards, photographs, postage stamps, etc. Pictorial post cards with views of different parts of the world, each sent by mail from the country of its origin. 10 for $1, 25 for $2.25. Original photographs (post card size) of places of interest (principal buildings, monuments, etc.) which will be taken by myself and sent by mail from the country of origin. 10 for $2, 25 for $5. With all inquiries please send a 3c. stamp to cover return postage. No postage stamps accepted for payments; kindly send a P. O. money order. Mr. P. Hoppen, 181 W. 88th St., New York City.

Rubber Air Pillows. For outdoor sleeping. Could be put in pocket when folded. Price $1.50. C. Stelmach, 1318 Crittenden St., Chicago, Ill.

Julian's Liquid Fishing Lure. Doubles your catch. Trial bottle, $1. George Julian, Albany Bldg., Boston, Mass.

The Wonderful Gas Lighter. No matches to use. Every home should have one. C. Stelmach, 1318 Crittenden St., Chicago, Ill.

Chemicals.

Chemicals. Special, 35 different chemicals, one ounce of each, containing mercury, acids, etc. Sent express prepaid $2.50. Jos. Simpson, 3880 Windsor Place, St. Louis, Mo.

Standard Chemicals and laboratory apparatus, cheap and reliable. June list, 5c. Frane, Eureka, Ill.

Chemicals. Amateurs and experimenters. We can supply you with any chemicals or apparatus that you need. At the lowest prices. Write for our price list. Jos. Simpson, 3880 Windsor Place, St. Louis, Mo.

100 Chemicals—Young Man $6—Complete chemical laboratory. 100 chemicals, as mercury, iodine, silver, molybdenum, together with 96 others, generous quantities, also chemical glassware, blowpipe, etc. Prepaid anywhere $6. C.O.D. terms accepted. Full list on request. Borough Chemical Co., Successors to the Swimmer Chemical Co., 1904 Park Place, Brooklyn, N. Y.

Must Sell Chemicals! Particulars 3c. Pray, 102 Heath, Somerville, Massachusetts.

Books.

"Sincere Words," 1919 wonder booklet. Be healthy. Know the surest way to success. 20c. postpaid. "Success," 1943 Patten St., Philadelphia, Pa.

What Every Draftsman Should Know. Very useful booklet. Price 12c. postpaid. Wack Booklet Co., 1943 Patten St., Philadelphia, Pa.

Applied Electricity. Electroplating, motors, X-Ray, wireless telegraphy. 350 pages, 214 illustrations, 60c. Ask descriptive circular. J. Perez, 729 McKinley St., Elizabeth, N. J.

Dear Reader. If Occult, New-Thought and Scientific books appeal to you, send for my catalog, it's free. I have books on Personal Magnetism, Concentration, Spiritualism, Clairvoyance, Seership, Will, Mind, Hypnotism, Messmerism, Character Reading, Healing, Mysticism Success, Salesmanship, Mechanics, Entertainment, etc. A. W. Martens, J-49, Burlington, Iowa.

Books. Osteopathic, Chiropractic, Sex, etc. For practitioners. Circulars sent. Murray Publishers, Elgin, Ill.

World-Romic System. Masterkey to all languages. Six textbooks, $1.44; French chart, 37c.; Spanish, 37c.; aviation dictionary, $1.50; French-English aviation dictionary, 61c. Languages, 143 W. 47th St., New York.

Crucified Anne Cath. Emmerich and visions, nativity. Egypt, Cana; 4 books, 20c. Klein Co., Brandon, Minn.

Are You Bashful? Then you should read The Blunders of a Bashful Man. It will make you scream. Contains 170 pages for 25c. postpaid. Don't fail to read it. Order right now. Guarantee Sales Co., Dept. 2-A, 468 117th St., Cleveland, Ohio.

Chicago Mysteries Illustrated Book, 25c. Catalogue, 2c. Paul Duff, 2713 Mozart, Chicago, Ill.

To Get Better Pictures. Read the amateur photographers' weekly; illustrated; weekly prize competitions; print criticisms; many unique features; $1.50 per year; three months' trial subscription 25c. Abel Publishing Company, 401 Caxton Bldg., Cleveland, O.

Nature Laws every married and engaged person should know. Two volumes complete, 50c. Over 200 practical suggestions for starting your own business, 50c. Central Company, 599 Ninth Ave., New York.

Twelve easy Wireless Lessons, $.50. Order yours Now. Stratton Electric, 215 Federal, Greenfield, Massachusetts.

Old E. E. Back Numbers. We have some valuable old E. E. back numbers on hand as follows: 1915—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec., price each 35c. 1916—Jan., Feb., March, May, June, Nov., Dec., price each 35c. 1917—Jan., April, May, June, Aug., Nov., Dec., each 35c. 1918—March May, June, July, 35c. Aug., Sept., Oct., Dec., each 20c. 1919—Jan., Feb., Mar., Apr., May, June, 20c. We can fill orders at once upon receipt of your remittance, and if you have not these numbers already, now is your chance to get them, as they probably will be snapped up very quickly. Experimenter Publishing Co., 233 Fulton St., New York City.

Instruction

Over 100 Branches thoroughly taught by mail. For "Free Tuition," apply Carnegie College, Rogers, Ohio.

Problems and Advice in Radio Mathematics, Electricity, Chemistry, etc., answered by experts for $1 and up. Paragon Technical Bureau, 329 East Fifth Street, New York City.

Cornetists, Trombonists. Send for "Free Pointers" on "Good Lip-High Tones." Virtuoso Cornet School, Buffalo, N. Y.

Make Patent Drawings. Big demand. Big pay. Complete instruction book only $1. Patent Drafting Syndicate. Post Box 858 Schenectady, N. Y.

Study Bacteriology, Public Health, Hygiene, and Sanitation. Positions pay $3,000 to $5,000. Interesting home study course. Previous experience unnecessary. Degree granted. We help secure positions. Write for Prospectus. American College of Bacteriology, Dept. 11, Chicago.

Stamps & Coins.

Bon Accord one cent approvals South Americans. J. W. Taylor, 3122 Westmont St., Philadelphia, Pa.

California Gold. Quarter size, 27c.; Half dollar size, 53c.; dollar size, $1.10; large cent, 1820, and catalogue, 10c. Norman Shultz, Kings City, Mo.

Stamps—61 All Different Free. Postage, 3c. Mention paper. Quaker Stamp Co., Toledo, O.

100 Different Stamps 12c.; 200, 27c. Michaels, 5600 Prairie, Chicago.

Fortunes in Postage Stamps. Start stamp business of your own. Send 50c. for sample stock, worth $1.50. M. Shedel, 29 Collahie St., Toronto, Canada.

Best One Cent Approvals in America. F. P. Hand, 1117 So. 60th St., Philadelphia, Pa.

Coins, Medals, Paper Money, antiques, firearms, swords, Indian relics, historical engravings, stamp collection. Lists free. Antique Shop, 33B S. 18th St., Philadelphia, Pa.

Stamps & Coins (Cont'd)

50 Different Stamps 3c. Approvals. R. Buckey, 412-B Bowen, Dayton, O.

Rare Coin Over 100 Years Old, 12c. Bohn, Crafton, Pa.

Help Wanted.

American Citizens, 18 to 60, including women, investigate immediately your rights to Government employment. Let me send you Form RK 2081 for free advice. Earl Hopkins, Washington, D. C.

Make Die-Castings. Sketch, sample, booklet and proposition, 12c. Byrd & Blair, Box 227F, Erie, Pa.

Homeworkers on Small Scale, manufacturers on large scale wanted to make toy soldiers, Army, Navy, Marines, cannons, machine guns and other toys and novelties. This new American industry stands out conspicuously since the war stopped all importation of German toys. Greatest chance for industrious people for an independent business. Some people started small, own factories now. Fortunes are made in toys. Enormous demand and future in "American Made Toys." Millions needed this year. We buy these goods all year, paying fixed prices. Experience or tools not necessary. Hundred and more made complete per hour. Casting form outfits $3 up. Booklet and information free. Toy Soldier Manufacturing Company, 32 Union Sq., New York.

Men—Women Wanted. U. S. Government Jobs. $1,000-$1,600 year. Write immediately for list positions obtainable. Franklin Institute, Dept. G26, Rochester, N. Y.

Thousands Automobile experts needed. $35 week. Earn while learning. Write Franklin Institute, Dept. G, 806, Rochester, N. Y.

Wanted. Ambitious workers to start collection bureaus. Be independent, make big income yearly. We train and refer business to you. "Scientific Facts" free. National Collection Bureau, Dept. 20, 65 Maynard, Columbus, O.

$18 to $36 Weekly in your spare time doing special advertising work among the families of your city. No experience necessary. Write today for full particulars. American Products Co., 1286 American Bldg., Cincinnati, O.

Phonographs.

Build Your Phonograph. "Perfection" high-quality spring and electric motors, tone arms, reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Ind.

Build Your Own Phonograph and manufacture them for profit. Drawing instructions, parts, price list, blueprints, etc., complete, sent free upon request. Write today. Associated Phonograph Co., Dept. E-1, Cincinnati, Ohio.

For Advertisers.

Free Advertising. Send dime for sample copy of The Trading Post, and details of free advertising. Trading Post, Box 24, Hiram, Ohio.

It Pays to Advertise when Jacobus prepares the copy. Sales letter $1. Jacobus Advertising Service, 1073 Sanford Ave., Irvington, N. J.

"Quick-Action Advertising—How it is Building Business for the Progressive Advertisers of America"; A little story of results told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th St., New York.

Cameras, Supplies—Photo Developing.

Clean, Neat, Perfect Kodak Finishing at the lowest prices. Work returned the same day received. Send film for sample print and copy of catalogue on developing, printing, enlarging and hand coloring, also copy of Photo Craft Magazine, which will help you make better pictures. Photo Craft Co., Box 69, Ann Arbor, Mich.

Special Trial Offer. Your next Kodak film developed, 5c. Prints 2c. each. Moser & Son, 1919 St. James Ave., Cincinnati, O.

Any Six or Eight exposure film up to post card size developed and printed, 10c., or enlargement, 8 x 10, your favorite negative, 20c. Special introductory offer to show high quality work. Associated Photo Co., Dept. 12, Cincinnati, Sta. A.

Slightly Used Cameras. Bargains. Send for list. Cameras exchanged and repaired. L. Huber, 1146 Stebbins Ave., Bronx, New York.

Mail us 15c with any size film for development and six velvet prints. Or send six negatives any size and 15c for six prints. Or send 35c for one 8 x 10 mounted enlargement. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke, Va.

Print Films in Color, green trees, lawns. Instructions 25c. Simple double exposure attachment made in two minutes. Instructions 15c. Arthur Malley, 6514 Clinton St., Cleveland, Ohio.

The Pliotron Oscillator

By William C. White

(*Continued from page 232*)

maximum value of about 2.5 milli-henries. They should preferably be of the variometer type, continuously variable in the range 0.5 to 2.5, altho a variation by a dozen to fifteen steps is fairly satisfactory.

The object of having L_4 variable is for the purpose of applying the high-frequency energy from the pliotron to the resonance circuit at the correct voltage, so that the energy available is used most advantageously in the resistance of this circuit.

The inductance L_3 is made variable so as to supply to the grid just the right amount of high-frequency energy to make the system self-exciting and to excite it in the most efficient manner.

As in the case of the arrangement for heavy currents, a suitable range of potential for the direct-current source is from 200 to 750 volts.

With such values of inductance and capacity that a frequency of 100,000 cycles is obtained, a voltage of 12,000 may be produced from one pliotron tube operating from a direct-current source of 500 volts.

Pliotron tubes may be operated in parallel for the production of a voltage higher than that obtainable from a single tube.—*Photo Courtesy G. E. Co.*

BATTERIES LIGHT HOUSES IN SWEDEN.

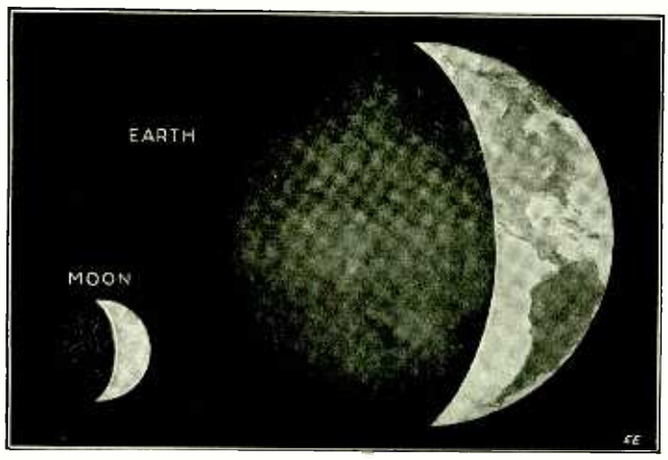
A recent fair held in Sweden brought out the shortage of oil and the many substitutes and methods of economy displayed. The efforts of the lighting industry to find a substitute for the kerosene lamp were shown at the fair in the form of carbid lamps for use in places where there is no electric current—a battery lamp called the "Mercal," and also the Jungner primary elements intended for the electric lighting of entire buildings.

This Is How We Look in Arabic

(٢٣٥) الروضة

بسهولة من سكان الزهرة بمساعدة التلسكوب الذي نستعمله نحن هنا لرصد السيارات

فمتى كان المريخ في مركز مناسب للرصد عن الارض يكون قطر الدائرة من قرصه ما بين خمسة عشر او خمسة وعشرون ثانية من القوس حسب تعديل مسافته عن الارض في اوقات الرصد وعندما تكون الارض بنقطة موافقة لرصدها من الزهرة فقطر دائرة قرصها يكون ثلاثة وستون ثانية من القوس وقطر دائرة القمر سبعة عشر ثانية من القوس وحتى ان قرص القمر الذي نراه فانه يبان للزهرة في اوقات خصوصية اكبر مما يبان قرص المريخ



(الرسم الرابع)

هذا الرسم يظهر هيئة الارض كما تبان للمريخ في وقت لمعانها وهي بهيئة هلال ولزيادة التوضيح انظر شكل ٢ وه فالارض لا تظهر لسكان المريخ الا كما هي ظاهرة في هذا الرسم اي هلال ومتى اضيئت بنور الشمس تختفي ولا تعود تظهر للمريخيين

Articles from the ELECTRICAL EXPERIMENTER Have Been Reprinted in Almost Any Language You Could Think of. Last Month, However, Was the First Time That We Were Quoted in an Arabian Publication. We Reprint Herewith Mrs. Lewis's Article "The Planet Earth" Taken from "Ar-Raudat" — (The Meadow), a Semi-monthly Arabian Magazine, "Ar-Raudat" Republisht the Entire Article from Our April, 1919 Issue.

Electrical Engineering



B. S. Degree in Three Years

Your opportunity to gain a thorough, technical training in Electrical Engineering, leading to a Bachelor of Science Degree awaits you here.

The field is unlimited right now for Electrical Engineers who can direct and carry out the great industrial and commercial projects soon to be under way, both in America and abroad.

Our experienced faculty of 33 practical engineers and electrical experts will guide you surely and carefully to attain success. Actual shop practice, combined with exhaustive laboratory, drafting room and recitation room instruction, prepare you fully to enter the Electrical Engineering profession.

"Earn While You Learn" if you so desire. Full provision for making up all deficient High School credits.

New Term Begins July 2d.

A limited number of students can be accommodated. Insure yourself a place by arranging to enroll Now. Clip the Coupon Without Delay. It will bring you catalog and complete particulars.

School of Engineering of Milwaukee
College of Electrical Engineering
96-373 Broadway Milwaukee, Wis.

CLIP HERE

School of Engineering of Milwaukee
Milwaukee, Wis.

Gentlemen:—Without obligation, send me catalog and particulars concerning your 3 Year Electrical Engineering Course with B.S. Degree.

Name .....
Address .....
City ..... State .....
Age ..... Education .....

SCHOOL OF ENGINEERING OF MILWAUKEE
College of Electrical Engineering
96-373 Broadway Milwaukee, Wis.

DON'T FOOL WITH PHYSIC



STRONGFORT
The Perfect Man

Don't try to doctor yourself back to health and strength with so-called "remedies" for constipation, biliousness, loss of manhood or any other chronic ailment or weakness. **It can't be done.** No real MAN was ever made by anything that came out of a bottle—booze or any kind of patented "restorative." Look the facts squarely in the face; **You can't go on indefinitely,** if you feel like a wreck each morning and want a bracer before you go to work; you can't get anywhere in your business or profession if the poison from constipation is infecting your vital organs and beclouding your brain; you can't win out if any chronic ailment or weakness has a grip on you.

God made you and God made Nature—and Nature is the only doctor who can restore your vitality if it is gone; it makes no difference whether it was lost through overwork or worry or illness, or wasted away in errors and indiscretions of your own.

STRONGFORTISM IS NATURE'S WAY

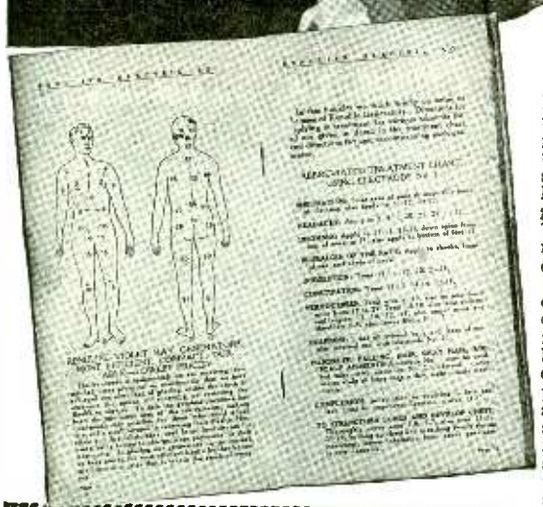
Strongfortism is simply taking advantage of the marvelous power of recuperation implanted by Nature in every human organism; the force that healed frightful wounds in France, when surgeons simply helped Nature to do the work; the power that has made strong, healthy, vigorous men out of thousands of my pupils, who came to me, many of them, broken down human derelicts, hopeless that anything could ever restore their lost virility. Learn about this wonderful force within yourself; you can't afford not to know about it. Send for my FREE BOOK, **"PROMOTION AND CONSERVATION OF HEALTH, STRENGTH AND MENTAL ENERGY."** It will tell you how Strongfortism will enable you to COME BACK; how to improve yourself 100 per cent—I GUARANTEE IT. Send 3 2c stamps to cover postage and packing and I will mail you a copy at once.

LIONEL STRONGFORT
Physical and Health Specialist
967 STRONGFORT INSTITUTE — NEWARK, N. J.

TREAT YOURSELF With The Wonderful *Health Restorer* VIOLET RAY

Now made simple and perfectly safe





You Can Have Bodily Vigor, Success-Attaining Energy, Attractive, Healthful Beauty

All at practically no cost—The great benefits of the ***Violet Ray treatments*** heretofore only procurable at big expense from physicians and beauty specialists are now available in your own home. Look over list of treatments below. Send for particulars.

How Violet Ray Benefits

Electricity from your light socket is transformed into health and beauty-giving Violet Ray—powerfully effective, yet gentle, soothing, perfectly safe. Voltage is raised from ordinary lighting current to *thousands of volts*, giving tremendous penetrative force. The irresistible, revitalizing powers of *Renulife Violet Ray* are carried at once to every nerve cell, fibre and part of body. Blood is enriched and purified by a flood of oxygen, giving added vitality and strength. Assimilation and digestion improved—functions restored to normal—extra supply of fresh blood quickly brought to area treated, removing congestion and supplying nourishment. While relieving pains and aches, the manifest results of disorders, it removes the deep-seated cause; combines the benefits of electricity, vibration, exercise, stimulation and oxidation.

Painless Electricity

Science has modified electricity that the weakest may stand its force without fear or pain. Every tissue and fibre is saturated, patient experiencing only a sensation of relief, as if standing in a ray of sunshine. *Violet Ray high frequency* has no comparison with old, crude, electrical batteries and shocking current. Every jar and shock is removed. The effects are marvelously rapid. Relief can be given in one or more treatments. Often cures are accomplished in that time. It is positive and certain in action. If you value your health, and want to keep or restore your good looks and gain vitality, throw away medicine bottles—take this sensible, scientific means. *Violet Rays* work with nature. Every day's delay makes relief more difficult.

Renulife Violet Ray
HIGH FREQUENCY GENERATORS

Offered on a Most Liberal
TRIAL PLAN
Learn the Wonderful Benefits by Actual Use

Send for Booklet, "Health via Violet Ray."

COUPON FOR BOOK and Special Information

RENULIFE ELECTRIC CO.,
1207 Marquette Bldg., Detroit, Mich.

Please send without obligation, your book "Health," explaining Violet Ray treatments with Renulife Generators; also give full particulars as to its application for ailments checked below

TREATS SUCCESSFULLY

- Abscesses
- Anemia
- Asthma
- Arteriosclerosis
- Baldness
- Blackheads
- Brain Fag
- Bronchitis
- Bunions
- Bruises
- Catarrh
- Colds
- Chilblains
- Dandruff
- Deafness and Ear Diseases
- Eczema
- Enlarged Prostate
- Facial Neuralgia
- Falling Hair
- Female Complaints
- Goitre
- Gout
- Haemorrhoids
- Hay Fever
- Infantile Paralysis
- Insomnia
- Lameness
- Locomotor Ataxia
- Lumbago
- Nervous Affections
- Neuralgia
- Neuritis
- Obesity
- Pain in Abdomen and Chest
- Paralysis
- Piles
- Pimples
- Pyorrhea
- Rheumatism
- Scars
- Sciatica
- Skin Diseases
- Sore Throat and Throat Diseases
- Sprains
- Toothache
- Weak Eyes
- Wrinkles
- Warts and Moles

Name.....

Address.....

RENULIFE ELECTRIC CO., 1207 Marquette Bldg., Detroit, Mich.

CANADIAN RENULIFE ELECTRIC CO.
1207 Netting Bldg., Windsor, Ont.

SALES REPRESENTATIVES WANTED



Unequaled for scalp and hair



Brings beauty parlor to your home



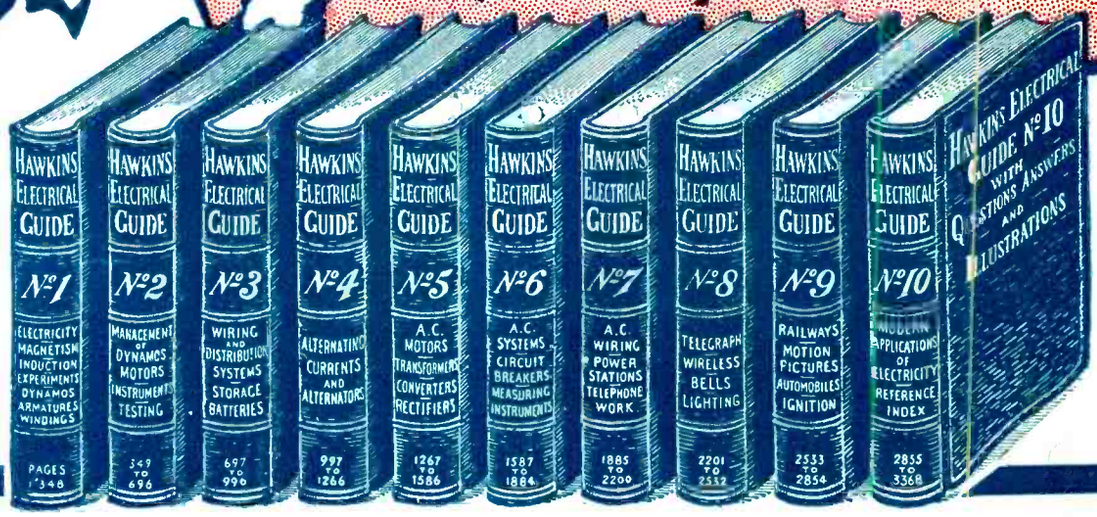
Inhaling ozone. For Catarrh, throat and lungs. Marvelous local results with general tonic effect



Treatment for general debility, nervousness, etc.

Every Electrical Man Wants These Books and we ship them for your inspection FREE





Flexible Covers — Handy Pocket-Size Volumes

10 Volumes — 3500 Pages — 4700 Pictures

$1 Per Volume

$1 Per Month

Just what you need to know to succeed in ELECTRICITY

EVERY electrician, every engineer, every mechanic should know about these wonderfully helpful instructive books, which give in plain words a complete working knowledge of electrical engineering in all its phases.

You run into some new electrical problem almost every day. The information you need to help you in your every day work is in

HAWKINS ELECTRICAL GUIDES

These books place electricity at your finger ends. They cover every imaginable subject, principle, theory, problem, trouble, and way of doing things electrically. Every subject is indexed so that you can turn right to it. They are a study course and a reference guide in one, written in plain every day language—no wasted words—only what you need to know—chock full of up-to-the-minute electrical knowledge. The guides are a complete course in electrical engineering. They will help you in every detail of the day's electrical work. You can't ask an electrical question that Hawkins Guides can't answer.

What Electrical Men Say

Helped Him Make Good

"It is only right for me to recommend highly the Hawkins Guides, for they have been of the greatest assistance to me in placing me in my present position as Superintendent of Construction Department of one of Ohio's largest Electrical Companies. I would like to see every man have a set of Hawkins Guides."
Geo. Knecht, Columbus, Ohio.

In the Naval Electrical Dept.

"The Hawkins Guides are great help to me in the Naval Electrical Department, which they cover very thoroughly."
C. J. Cornell, U. S. Receiving Ship, Brooklyn, N. Y.

Superintendent

"I am now superintendent of the Dunnville Hydro-Electric Systems, and Hawkins Guides were a great help to me in holding down a responsible position."
W. E. Swartz, Dunnville, Ontario.

Wireless Operators

"I have worked wireless for ten years—but I wish I had these books years ago, as they have saved me a great deal of trouble." H. Marshall, Steamer M & H No. 2, Walkerville, Ont.

Pocket-Size Flexible Covers

The books are small enough to slip into your coat pocket—handsomely bound in flexible black covers.

You can carry each volume with you until you have mastered its contents. 3,500 pages of actual information and 4,700 illustrations. Once you see these books and put them into actual use you will never again want to be without them. Try it at our expense.

SEND NO MONEY

It will cost you nothing to receive these books—to look them over—ask them all the questions you can think of—use them in your work—study them—pick up some information that will increase your earning ability. We will ship you the entire set of 10 volumes entirely FREE.

This is a sign of our confidence in the guides. Pure gold does not object to being tested. Keep them for seven days and if you do not decide that you can't get along without them, return them to us and owe us nothing.

When you decide to keep them you only have to pay $1.00 down and remit the balance of $9.00 on the easy payment of $1.00 a month till paid for.

Use this coupon to get the books. It will pay you many times over.

THEO. AUDEL & CO.
72 Fifth Ave. New York, N. Y.

SEND NO MONEY - USE THE COUPON

READ THIS PARTIAL LIST OF CONTENTS

No. 1 Contains 348 pages, 385 illustrations. Electrical signs and symbols—static and current electricity—primary cells—conductors and insulators—resistance and conductivity—magnetism—induction coils—dynamo principles—classes of dynamos—armatures—windings—commutation—brushes, etc.

No. 2 Contains 348 pages, 394 illustrations. Motor principles—armature reaction—motor starting—calculations—brake horsepower—selection and installation of dynamo and motors—galvanometers—standard cells—current measurement—resistance measurement—voltmeters—wattmeters—watt hour meters—operation of dynamos—operation of motors, etc.

No. 3 Contains 300 pages, 423 illustrations. Distribution systems—wires and wire calculations—inside, outside and underground wiring—sign flashers—lightning protection—rectifiers—storage battery systems, etc.

No. 4 Contains 270 pages, 379 illustrations. Alternating current principles—alternating current diagrams—the power factor—alternator principles—alternator construction—windings, etc.

No. 5 Contains 320 pages, 614 illustrations. A.C. Motors—synchronous and induction motor principles—A. C. commutator motors—induction motors, transformers; losses, construction, connections, tests—converters—rectifiers, etc.

No. 6 Contains 298 pages, 472 illustrations. Alternating current systems—switching devices—circuit breakers—relays—lightning protector apparatus—regulating devices—synchronous condensers—indicating devices—meters—power factor indicators—wave form measurement—switch boards, etc.

No. 7 Contains 316 pages, 379 illustrations. Alternating current, wiring power stations—turbines; management, selection, location, erection, testing, running, care and repair—telephones, etc.

No. 8 Contains 332 pages, 436 illustrations. Telegraph—simultaneous telegraphy and telephony—wireless—electric bells—electric lighting—photometry, etc.

No. 9 Contains 322 pages, 627 illustrations. Electric railways—electric locomotives—car lighting—trolley car operation—miscellaneous applications—motion pictures—gas engine ignition—automobile self-starters and lighting systems, electric vehicles, etc.

No. 10 Contains 513 pages, 599 illustrations. Elevators—cranes—pumps—air compressors—electric heating—electric welding—soldering and brazing—industrial electrolysis—electro plating—electro-therapeutic—X-rays, etc.

Also a complete 126-page ready reference index of the complete library. This index has been planned to render easily accessible all the vast information contained in the 10 electrical guides. There are over 13,500 cross references. You find what you want to know instantly.

THEO. AUDEL & CO.
72 Fifth Ave.
New York, N. Y.

Please submit me for examination Hawkins Electrical Guides (price $1 each). Ship at once, prepaid, the 10 numbers. If satisfactory I agree to send you $1 within seven days and to further mail you $1 each month until paid.

Signature.....

Occupation.....

Employed by.....

Residence.....

Reference..... E. E. JULY

The Rise of A Man Who *Wouldn't* Stay Down



Now Chief Engineer

HE was putting in long hours at monotonous unskilled work. His small pay scarcely lasted from one week to the next. Pleasures were few and far between and he couldn't save a cent.

He was down—but he *wouldn't stay there!* He saw other men promoted, and he made up his mind that what they could do *he* could do. Then he found the *reason* they were promoted was because they had special training—an expert knowledge of some one line. So he made up his mind that *he* would get that kind of training.

He marked and mailed to Scranton a coupon like the one below. That was his first step upward. It brought him just the information he was looking for. He found he could get the training he needed right at home in the hours after supper. From that time on he spent part of his spare time studying.

The first reward was not long in coming—an increase in salary. Then came another. Then he was made Foreman. Now he is Chief Engineer with an income that means independence and all the comforts and pleasures that make life worth living.

It just shows what a man with ambition can do. And this man is only one out of hundreds of thousands who have climbed the same steps to success with the help of the International Correspondence Schools.

Are you satisfied merely to hang on where you are or would you, too, like to have a real job and real money? It's entirely up to you. You don't *have* to stay down. You *can* climb to the position you want in the work you like best. Yes, you can! The I. C. S. is ready and anxious to come to you, wherever you are, with the very help you need.

Surely when you have an opportunity that means so much, you can't afford to let another priceless hour pass without at least finding out about it. And the way to do that is easy—without cost, without obligating yourself in any way, mark and mail this coupon.

Mark and Mail the Coupon NOW



Made Foreman



Studies at Home

Start TODAY for a Better Job



Marks the Coupon

TEAR OUT HERE

International Correspondence Schools

BOX 6192, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

[ ] Advertising	[ ] Electrical Engineer	[ ] Mechanical Draftsman
[ ] Salesmanship	[ ] Electrician	[ ] Machine Designer
[ ] Traffic Management	[ ] Electric Wiring	[ ] Machine Shop Prac.
[ ] Business (Complete)	[ ] Electric Lighting	[ ] Boilermaker or Des.
[ ] Commercial Law	[ ] Elec. Car Running	[ ] Patternmaker
[ ] Cert. Public Account.	[ ] Heavy Elec. Traction	[ ] Toolmaker
[ ] Higher Accounting	[ ] Elec. Draftsman	[ ] Foundry Work
[ ] Railway Accountant	[ ] Elec. Machine Designer	[ ] Blacksmith
[ ] Bookkeeper	[ ] Telegraph Engineer	[ ] Sheet Metal Worker
[ ] Stenog. and Typist	[ ] Telephone Work	[ ] Steam Engineer
[ ] Good English	[ ] Architect	[ ] Stationary Fireman
[ ] Window Trimmer	[ ] Architect'l Draftsman	[ ] Marine Engineer
[ ] Show-Card Writer	[ ] Contractor and Bldr.	[ ] Gas Engine Operating
[ ] Sign Painter	[ ] Building Foreman	[ ] Refrigeration Eng'r
[ ] Civil Service	[ ] Carpenter	[ ] Civil Engineer [ ] Spanish
[ ] Railway Mail Clerk	[ ] Concrete Builder	[ ] Surveying and [ ] French
[ ] Mail Carrier	[ ] Plumb. & Steam F't'r	Mapping [ ] Italian
[ ] Cartoonist	[ ] Heating & Ventilation	[ ] R. R. Constructing
[ ] Illustrator	[ ] Plumbing Inspector	[ ] Bridge Engineer
[ ] Perspective Drawing	[ ] Foreman Plumber	[ ] Ship Draftsman
[ ] Carpet Designer	[ ] Chemist	[ ] Structural Draftsman
[ ] Wallpaper Designer	[ ] Analytical Chemist	[ ] Structural Engineer
[ ] Bookcover Designer	[ ] Mine F'man or Eng'r	[ ] Municipal Engineer
[ ] Teacher	[ ] Coal Mining	[ ] Navigation
[ ] Common School Subs	[ ] Metal Mining	[ ] Motor Boat Runn'g
[ ] High School Subjects	[ ] Metallurgist	[ ] Agriculture
[ ] Mathematics	[ ] Assayer	[ ] Fruit Growing
[ ] Automobile Operat.	[ ] Textile Overseer	[ ] Vegetable Growing
[ ] Automobile Repairing	[ ] Cotton Mfg.	[ ] Live Stock & Dairying
[ ] Auto. Elec. Work	[ ] Woolen Mfg.	[ ] Poultry Raiser
	[ ] Mechanical Engineer	

Name .....

Occupation and Employer .....

Street and No. .....

City ..... State .....

THE CAREY PRINTING CO. INC.
NEW YORK

Bigger Pay for YOU

LIBRARY JUL 26 '19 U.S. PATENT OFFICE

You Can Now Know ELECTRICITY As Experts Know It

"See them first--pay afterwards"

Small Monthly Payments if you're satisfied



8 Vols.

Flexible binding

Pocket size

3000 pages

2100 illustrations

When we observe the ever-increasing applications and usages of electricity, we wonder if all the present openings and the newly created positions in the electrical world can ever be filled.

The ending of the war lends a new and mighty impetus to the electrical end of American industries. Salaries are soaring. There is practically no limit to the earning power of the man who educates himself in the finer points of electrical work.

Actual working facts

With the advent of the new Library of Practical Electricity, by Terrell Croft, a new era is marked in the production of self educational electrical literature. This library satisfies a demand never heretofore met—the demand for a home study course which would bring out in detail the actual working facts. This great undertaking has been accomplished. It is a seven-year task completed.

No previous electrical training necessary

Three thousand pages, with twenty-one hundred of the clearest illustrations ever put into book form. Each of the eight volumes is indexed so that everything you want to know about electricity is at the finger's end. And when you find what you want, there is not merely a short question and a short answer. You are told everything you want to know. The explanation is clear to you, regardless of whether you have had a previous knowledge of electricity or not.

Know electricity as the highest paid engineers know it

When you are studying the Croft Library of Practical Electricity, you are studying electricity as experts know it. You are acquainting yourself with the methods employed by the highest paid electrical workers and engineers in America.

This Library of eight volumes sent to you FREE for 10 days' trial

So positive are we that you will be pleased with the Croft Library of Practical Electricity that we offer to send the entire ten volumes for ten days' free use. All you need do in order to have the books sent, charges prepaid, is to fill out the attached coupon and return to us. Keep the books ten full days. Then if you are not satisfied, return them at our expense. On the other hand, if you find that they will help you, as they are helping thousands of others, send us the small sum of $2 per month for eight months.

A letter that means something to every man in America who is interested in electricity

McGraw-Hill Book Company, Inc.
239 West 39th Street, New York, N. Y.

Gentlemen: In an attempt to express myself about CROFT'S NEW LIBRARY OF PRACTICAL ELECTRICITY, I have never seen and do not believe there was ever printed in the English language, a more comprehensive set of books. It is a library that is just as valuable to the novice as to the expert, because it is all practice.

Respectfully,
GUY H. PEIFER,
Chief, Doplan Silk Corporation, Hazleton, Pa.

McGraw-Hill Book Co., Inc.
239 W. 39th St.
NEW YORK

ACT NOW

FREE EXAMINATION COUPON

Gentlemen:
Please send me the Library of Practical Electricity (shipping charges prepaid) for 10 days' free examination. If satisfactory, I will send $2 in ten days and $2 per month until $16 has been paid. If not wanted I will write you for return shipping instructions.

Name.....
Home Address.....
City and State.....
Name of Employer.....
His Address.....
Your Position..... Ex. 8-19

McGraw-Hill Book Co., Inc.
239 West 39th Street, New York, N.Y.

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

Electrical Experimenter

233 FULTON STREET, NEW YORK

Publisht by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer; R. W. DeMott, Sec'y;) 233 Fulton Street, New York.

Vol. VII. Whole No. 76 **Contents for AUGUST, 1919** **No. 4**

WHEEL-LESS TRAINS GLIDE ON WATER FILM.....Front Cover
From a painting by George Wall
RADIOPLANES WATCH FORESTS AND RANCHES..... 295
BOMB EXPERT EAGAN, SPECIAL INTERVIEW TO ELECTRICAL EXPERIMENTER 296
PEACETIME USES FOR WAR INVENTIONS..... 298
By H. Winfield Secor, E.E.
CHANGING NATURE'S FACE..... 300
MAN'S GREATEST CURSE—INFECTED TEETH..... 301
The work of Henry A. Cotton, M.D., How X-Rays of Teeth may Prevent Disease and Insanity.
SOLVING THE TRANSPORTATION PROBLEM.—A WHEELLESS ELECTRIC RAILWAY PROPELLED BY MAGNETS ON A FILM OF WATER, by H. Gernsback..... 302
THE "TORPEDOPLANE" AND "SUB" SPOTTER..... 306
By George Holmes
THUNDERSTORM ELECTRICITY 307
By Rogers D. Rusk, M.A., Late of the Meteorological Section, U. S. Army Signal Corps.
ELECTRIC HAIR BRUSH CONTAINS DYNAMO..... 308
INSIDE OF A U-BOAT—DETAILS OF MACHINERY FOUND IN SURRENDERED U-BOATS 309
LOCATING AIRPLANES IN NIGHT FIGHTING..... 310
POPULAR ASTRONOMY,—THE NATURE OF COMETS..... 312
By Isabel M. Lewis, of the U. S. Naval Observatory
STEINMETZ'S OWN SHORTHAND..... 314
EXPERIMENTS IN PHYSICS, NO. 1—PERPETUAL MOTION... 315
By John J. Furia, M.A., Dept. of Physics, New York University
FIFTY DOLLAR PRIZE CONTEST—USES FOR OLD PHONOGRAPH RECORDS 316
HOW TO MAKE PHOTO-MICROGRAPHS, by G. D. Laudermilk... 317
FARADIC CURRENTS—HOW TO APPLY THEM—SEQUEL TO "BUILDING A MEDICAL COIL SET"..... 318
X-RAY EXPERIMENTS, by Ivan Crawford..... 319
HEAT ENGINES—GASOLINE, STEAM, HOT AIR..... 320
By John J. Furia, M.A.
EXPERIMENTAL MECHANICS, LESSON 13, REGARDING REAMERS, by Samuel D. Cohen..... 321
HOW I INVENTED THE CRYSTAL DETECTOR, SPECIAL ARTICLE, by Dr. Greenleaf Whittier Pickard..... 325
CONCENTRATED OR LOOP AERIALS..... 328
By Prof. Lloyd Knoll, A.M.
TO WAR ON AN AMERICAN DESTROYER, by A. H. WHEDON.. 329
HOW TO DEVELOP YOUR INVENTIVE ABILITY..... 330
By Jay G. Hobson
SCIENCE IN SLANG—WHAT MAKES THE STORAGE BATTERY STORE? By Emerson Easterling..... 333



EDITORIAL

Speeds

IF you had read twenty years ago that it was considered probable and very possible that in 1919 some one would fly across the Atlantic Ocean on canvas wings, propelled by a gas engine, at a speed of 100 miles an hour, you naturally would have turned away impatiently at such childish nonsense. Moreover, you probably would have doubted the sanity of the writer; but even Jules Verne with his most prolific and prophetic mind never prophesied the 1919 trans-Atlantic flight in a heavier-than-air machine.

This naturally brings us face to face with the future. Tho prophesying, as a rule, is bad business, there are certain scientific subjects that can be predicted safely, basing the prediction on mathematical as well as purely scientific grounds.

The question before us is: How fast is it possible for man to travel thru the air? Theoretically at least, there is no limit to the speed at which a human being can travel.

Airplanes already have covered over 200 miles an hour without discomfort to the aviator. At this point we venture to say that should the speed be increased over 300 miles per hour, the aviator will probably be very uncomfortable, due to the terrific rush of air. Even at 100 miles per hour the air lashes the face of an aviator badly. Therefore, flying above 300 miles per hour, he will have to sit in a cabin surrounded by glass, where the rush of the air cannot be felt. Suppose we increase the speed to 500 miles. What happens? Nothing. This speed is so probable that it will no doubt be reached before 1925; possibly much sooner. But we think such speeds will not be reached near the surface of the earth where the density of the air, and consequently the greater resistance to an airplane, is too high. In order to travel at 500 miles per hour, the future airplane must offer as little surface to the air as possible. It should have no struts, wires, or stays. It probably will fly at a height of 5,000 feet or more, decreasing its speed as it approaches the earth. 1,000 miles an hour? Yes, man will do it. It is not only possible, but very probable. It will be accomplished in a machine which bears but little resemblance to our present-day airplane. Moreover, it will be absolutely necessary to rise at least to 25,000 feet above the earth, as otherwise the dense air will tear the machine apart, unless it were constructed entirely of metal. But because very much less power is required at the level of 25,000 feet, future express airplanes will prefer the high altitudes.

We might mention, *en passant,* that if you were in a machine flying at a steady speed of 1,039 miles per hour, also supposing you had enough fuel to stay up 24 hours, the following historical event would take place. Starting at noon and flying due West along the equator, with the sun above your head, the sun will not set for you on that memorable day. It will be directly overhead, as long as you keep on going, *for you will now be flying at the rotational speed of the earth,* which is 1,039 miles an hour. Looking down you will see the earth make one complete revolution; you will have seen every point and every continent along the equator. But 1,000 miles per hour is very tame. The earth in its orbital motion around the sun rushes thru space at the terrific rate of 65,533 miles an hour; Venus at 77,054 and Mercury at 105,325 miles per hour. So let us be hopeful!

H. GERNSBACK.

The ELECTRICAL EXPERIMENTER is publisht on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions. Canada and foreign countries, $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 20 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. **A green wrapper indicates expiration. No copies sent after expiration.**

All communications and contributions to this journal should be addrest to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

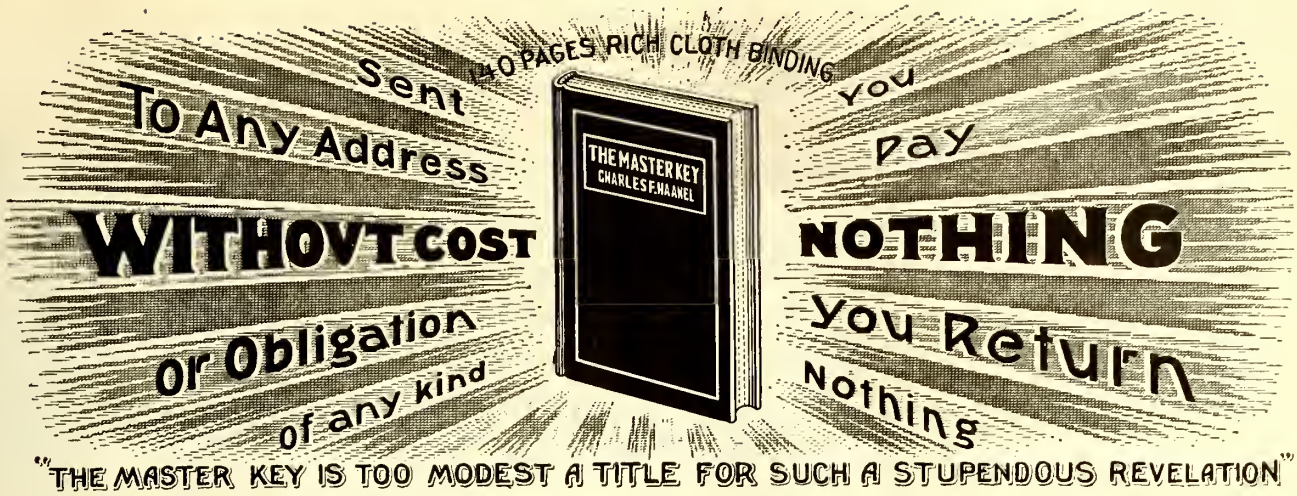
ELECTRICAL EXPERIMENTER. Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered U. S. Patent Office.

Copyright, 1919, by E. P. Co., Inc., New York. **The Contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.**

The ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris.

Member of the Audit Bureau of Circulation.

www.americanradiohistory.com



SOME men and women seem to attract success, power, wealth, health and attainment with very little conscious effort; others conquer with great difficulty, still others fail altogether to reach their ambitions, desires and ideals. Why is this so?

"The Master Key" will tell you why. No one can read it and not be a changed man or woman. None but who will emerge from its magic pages with a firmer grasp of the future—a sure understanding of what he can do.

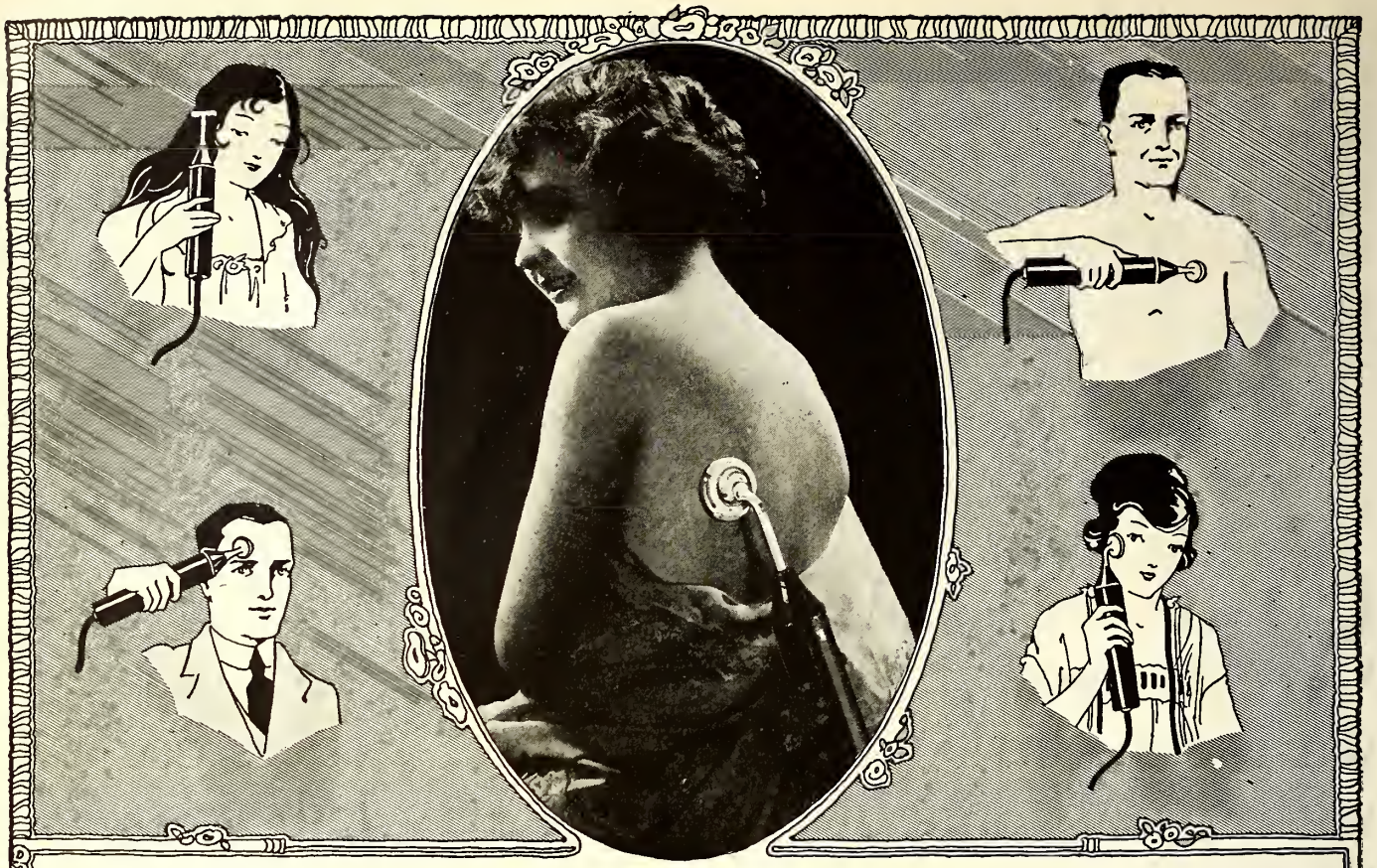
"The Master Key" is a key with which many are converting loss into gain, fear into courage, despair into joy, hope into fruition.

A MASTER-KEY will be sent to you, without cost or obligation of any kind if you address

Charles F. Haanel, 423 Granite Bldg.. St. Louis, Mo.

This advertisement *contains a message of such transcendental importance that every reader of Electrical Experimenter, whether man, woman, or child, should answer it immediately.*

www.americanradiohistory.com



VIOLET-RAYS

The Magic-like Reliever of Pain. The Marvel of the Age for Rheumatism, Neuralgia, Neuritis, Arteriosclerosis, Hemorrhoids, and Practically Every Other Ailment to Which Flesh is Heir. A Wonderful Beautifier Too! Amazing in the Treatment of Eczema, Blackheads, Wrinkles, Falling Hair, Dandruff, and Every Other Faulty Condition of the Skin and Scalp!

10 DAYS FREE IN YOUR OWN HOME

See for yourself the miraculous results of Violet-Rays. Get the wonderful Violetta Violet-Ray Machine for 10 days' free use in your own home. Give yourself exactly the same Violet-Ray treatments for which eminent physicians and beauty specialists charge big fees. Note the marvelous relief that comes even with the first treatment. See how you can virtually feel the Violet-Rays reaching to the very root and cause of any ailment with the great curative forces of Heat, Light, Electric Energy, and Ozone. See too how Violet-Rays youthifies the skin, purifies the scalp and stimulates hair-growth. Note above all how refreshing the effect of Violet-Rays to mind and body—how invigorating and vitalizing—how much better you work, eat and sleep. Prove all these benefits to yourself without obligation. Try the Violetta for 10 days free, and if you are not more than amazed and delighted, simply send it back.

BLEADON-DUN CO., Dept. 2G,
326 W. Madison St., Chicago, Ill.

Please send me your free book and 10 days' free trial offer on the Violet-Ray Machine. Also full information as to treatment for ailments marked below.

Asthma	Earache	Piles
Barbers' Itch	Eczema	Paralysis
Boils	Eye Diseases	Pimples
Blackheads	Headache	Pyorrhea
Bunions	Hay Fever	Rheumatism
Callous	Goitre	Skin Diseases
Chilblains	Insomnia	Sore Throat
Colds	Lumbago	Sprains
Corns	Nervousness	Tonsilitis
Constipation	Neuralgia	Whooping Cough
Dandruff	Neuritis	Warts and Moles
Deafness	Obesity	

Name .....

Address .....

City..... State

BOOK FREE

Write today without fail. Mail coupon or just a postcard. Let us send you our beautifully illustrated free book, describing the Violetta in detail. Read the amazing phenomena produced by Violet-Ray High frequency current. Why it produces stimulation and sedation. How to give spinal treatments with the Violetta, how to treat various ailments, including nervous troubles, rheumatism, obesity, hay-fever, skin treatments, facial treatments. With the free book we will also send you particulars of our special free trial offer. Mail coupon or postcard now.

BLEADON - DUN CO.

Dept.2G326 W.Madison St.,Chicago,Ill.

Electrical, Drug and other Jobbers and Dealers: Write us today for our Co-operative Selling Plan.

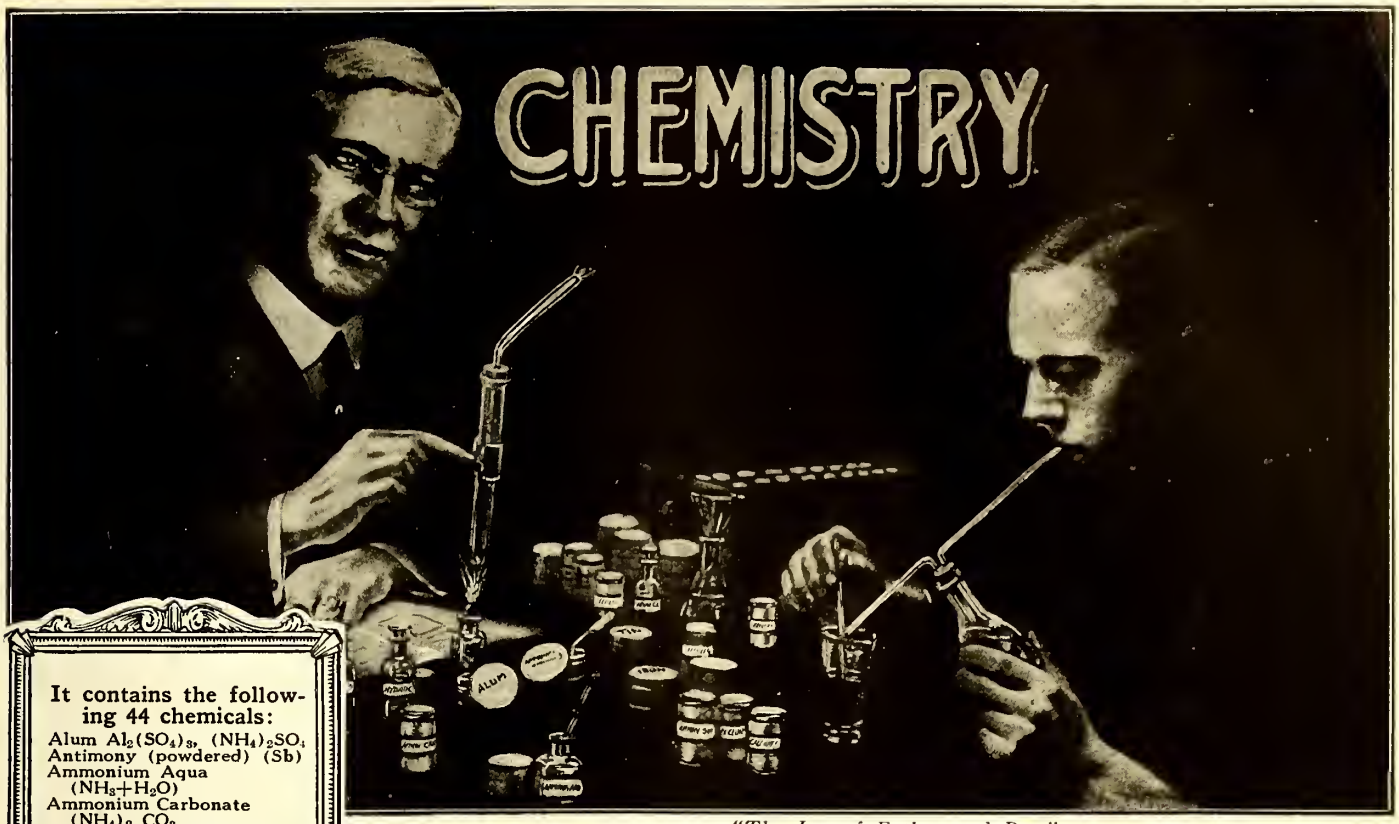


Not a Vibrator

The Violetta is not a machine that contracts the muscles—it does not shock, it does not pound the muscles—it is absolutely painless. Violet Rays administered by the Violetta are wonderful even for infants!

This advertisement copyright 1919, by Bleadon-Dun Co.

www.americanradiohistory.com



"The Joy of Father and Boy."

It contains the following 44 chemicals:

Alum $Al_2(SO_4)_3$, $(NH_4)_2SO_4$
Antimony (powdered) (Sb)
Ammonium Aqua (NH_3+H_2O)
Ammonium Carbonate $(NH_4)_2\ CO_3$
Ammonium Chloride (NH_4Cl)
Ammonium Sulphate $(NH_4)_2\ SO_4$
Barium Chloride ($BaCl_2$)
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride ($CaCl_2$)
Calcium Oxide (CaO)
Calcium Sulphate ($CaSO_4 2H_2O$)
Charcoal (Carbon) (C)
Chloride of Zinc ($ZnCl_2$)
Copper Sulphate ($CuSO_4$)
Ferrous Sulphate ($FeSO_4$)
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5(OH)_3$
Hydrochloric Acid (HCl)
Iodine (I)
Iron Chloride ($FeCl_2$)
Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
Magnesium Carbonate ($MgCO_3$)
Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
Nickel Chloride ($NiCl_2$)
Oxalic Acid ($H_2C_2O_4$)
Sodium Bicarbonate ($NaHCO_3$)
Sodium Borate ($NaBO_2$)
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate ($NaNO_3$)
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride ($SnCl_2$)
Sulphate of Nickel ($NiSO_4$)
Sulphate of Zinc ($ZnSO_4$)
Sulphuric Acid (H_2SO_4)
Tin (Granulated) (Sn)
Zinc (Metal) (Zn)
Zinc Carbonate ($ZnCO_3$)

The following apparata are furnished:

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube
Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure
Glass Tubing
One book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

"ELECTRO"

Chemical Laboratory

We present herewith to our friends our new **E. I. Co. Chemical Laboratory** which contains **real** chemicals and apparata to perform **real** chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a **Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.**

DESCRIPTION OF THE OUTFIT:

The outfit consists of forty-four (44) Chemicals all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) enough to make dozens of experiments with each. See list of Chemicals herewith.

The apparata furnished are all of the best obtainable make and of standard laboratory size and shape. A list of the 17 pieces of apparata furnished with this outfit is printed also herewith.

The Instruction book is a real **Chemistry Course for the Beginner.** Some of the Contents are: **Division of Matter:** This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. **Chemical Nomenclature.** This explains in simple language the derivation of the chemical names of the Elements and their compounds. There is a chapter on **Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms,** etc.

A good part of the book is devoted to Weights and Measures. The Metric System, the English system and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights, Volume, Capacity and Length; Per Cent solutions; Conversion of Measure expressed in parts; Poisons and their antidotes; Technical and common name of chemical substances; Formulas for Cleaning various substances, etc., etc.

Among the **100 Experiments** are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to Make Chlorine Gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

The price is still $5.00

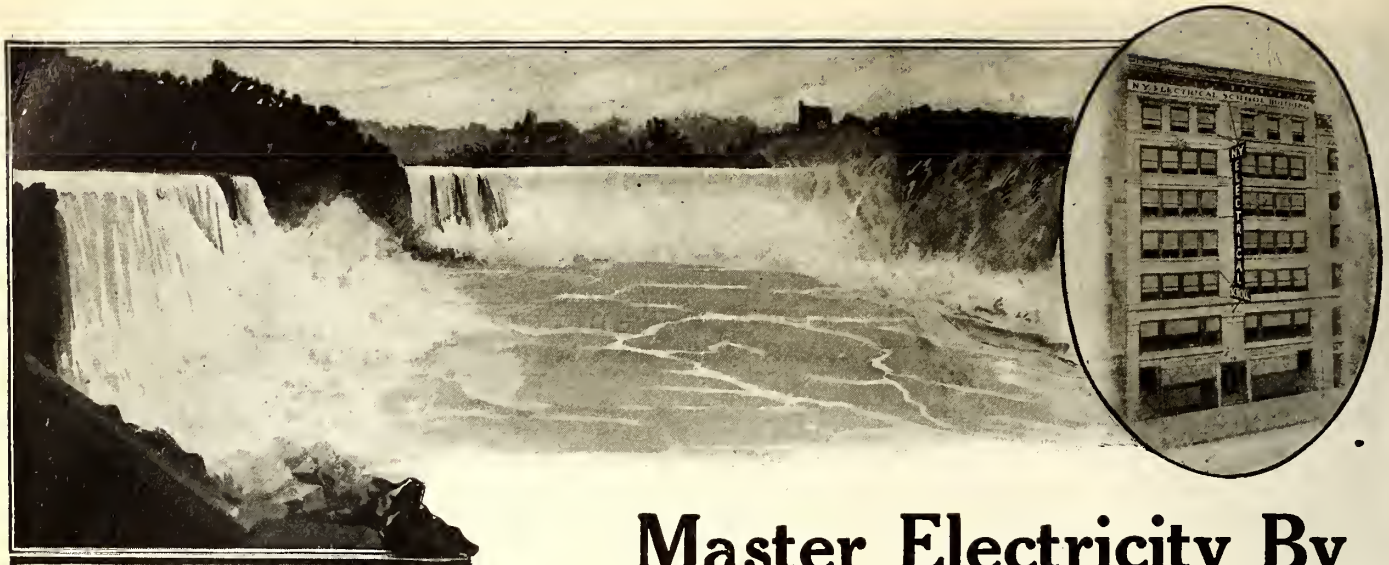
Shipping Weight 10 lbs.

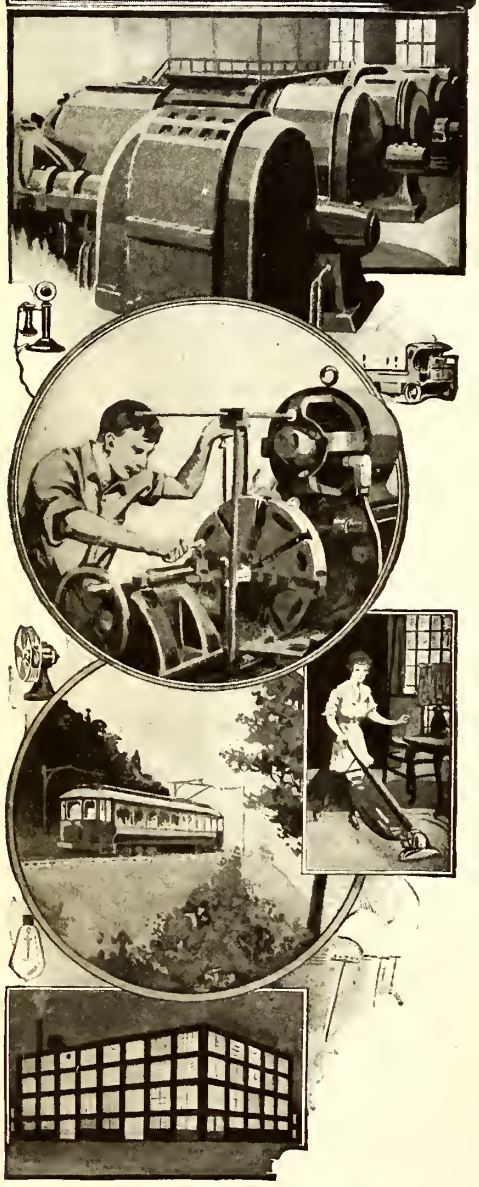
(Can be shipped by Express only.) Send your order today to:

TRADE MARK **THE ELECTRO IMPORTING CO., Mfrs.** TRADE MARK
231 FULTON STREET NEW YORK CITY

See our full page Ad, on page 346 for Free Cyclopedia

www.americanradiohistory.com





Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 5,500 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Special Automobile Ignition Course

We have just installed a special automobile ignition course for auto mechanics, garage men and owners. The course covers completely ignition, starting, lighting and other electrical equipment in connection with automobiles, motor boats, etc.

Let us explain our complete courses to you in person. If you can't call, send now for 64-page book—it's FREE to you.

New York Electrical School
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

_____(NAME)

_____(ADDRESS)

New York Electrical School

29 West 17th Street, New York

www.americanradiohistory.com

ELECTRICAL EXPERIMENTER

H. GERNSBACK – EDITOR
H. W. SECOR – ASSOCIATE EDITOR

Vol. VII. Whole No. 76 AUGUST, 1919 No. 4

Radio-Planes Watch Forests and Ranches

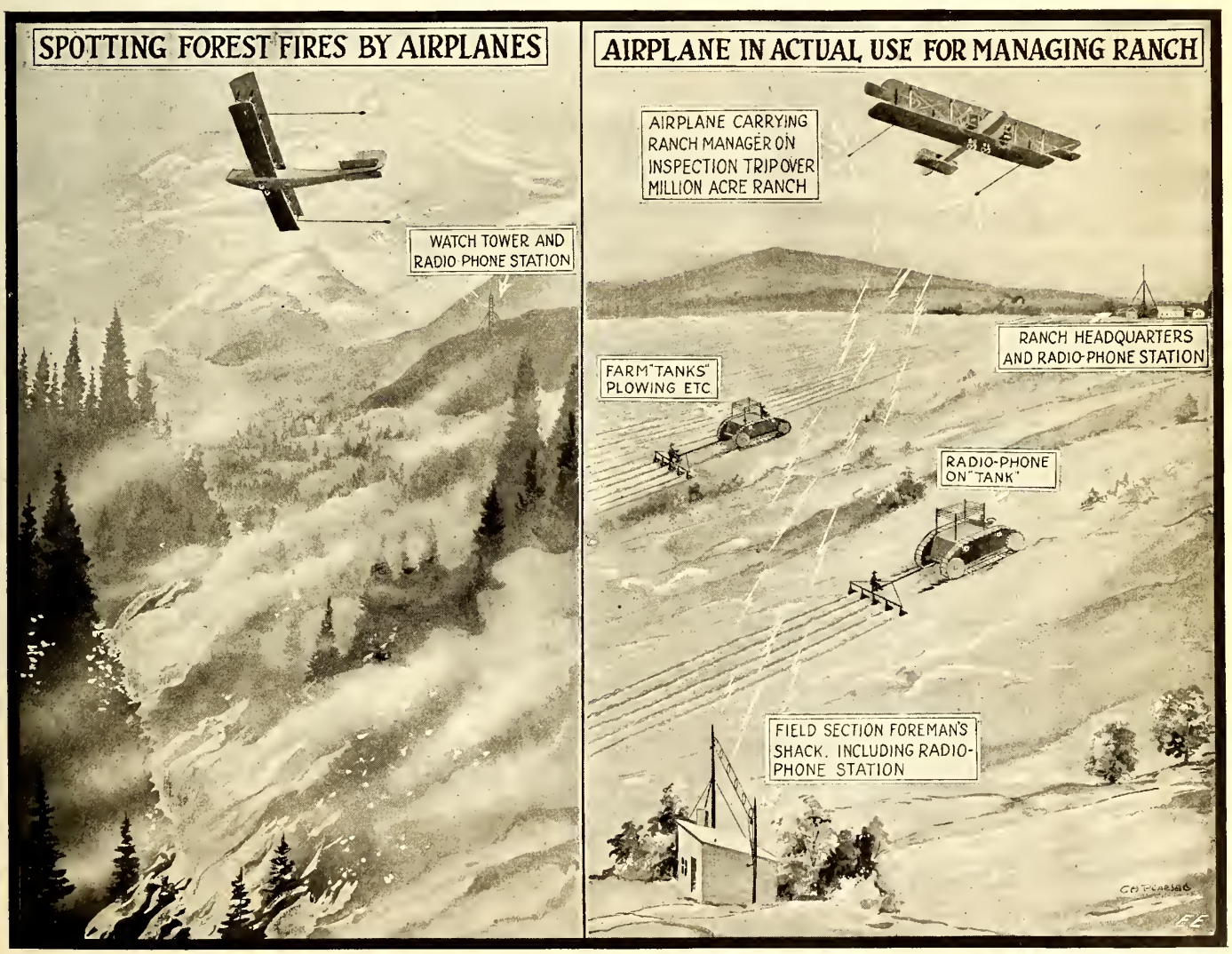
AIRPLANES, plus radio-telephone equipment, have found a brand-new peace-time utility—watching for forest fires in the vast government timber preserves, and also for supervising the operation of large ranches, such as those embracing thousands of acres and found frequently in the great Western farming regions. Some of these farms and ranches are so large that it takes a superintendent all day to make an inspection trip across the ranch, even with a high-powered automobile.

How the Airplane Plus Radio Is Used to Watch Great Forests and Ranches

The airplane as part of a farm equipment is now a reality. It makes its appearance at Hardin, Mont., on the wheat ranch owned and controlled by John Pierpont Morgan and other New York capitalists. Erhardt Schmitt, former American army aviator, has been employed to operate the machine. His duties are to carry the ranch manager from one part of the 250-mile, 100,000-acre wheat ranch to other fields. A wireless telephone in the airplane enables the manager to keep in constant communication with the ranch headquarters.

Not only can the manager or superintendent immediately report back to the ranch headquarters, by radio-telephone, but he can give local orders to gang or section foremen by means of small radio receiving

(*Continued on page* 364)



Copyright, 1919, by E. P. Co.

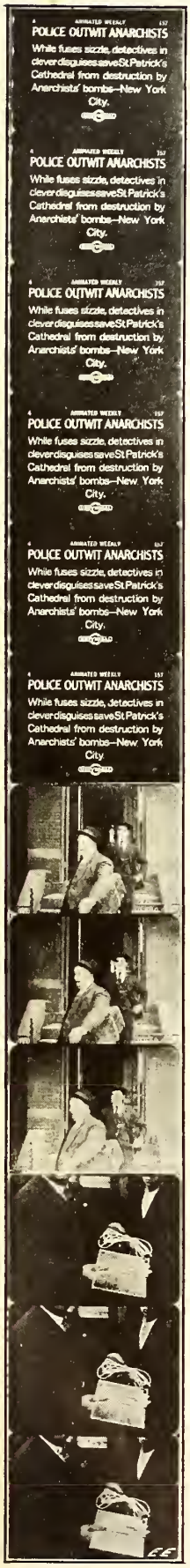
Two New and Important Peace-time Uses for Radio-equipt Airplanes—Watching for Forest Fires and Inspecting Large Farms and Ranches.

www.americanradiohistory.com

Bomb Expert Eagan

SPECIAL INTERVIEW TO THE ELECTRICAL EXPERIMENTER

Types of Bombs and How to Handle Them



Section of a Film Story of Mr. Owen Eagan's Exploits in "Bombland." For Years Inspector Eagan Has Inspected Infernal Machines by the Hundred and Still Lives to Tell the Tale.

"OWEN EAGAN"! At the mention of his name, the thought of bombs, anarchistic plots and explosives flood the mind. Seated at his desk, I found a man of sixty years, of medium height and massive proportions; head covered with curly gray locks. His eyes are of piercing steel gray and he has an ever-ready smiling countenance. A firm hand clasp told of a man of power, youthful in spirit, a believer in the great out-doors, a staunch American who cherishes a long and lasting friendship with that Great American, Theodore Roosevelt.

Mr. Eagan Classifies the Bombs.

We will now let Mr. Eagan tell of his bombs. Among other things. Mr. Eagan said:—

Bombs may be classified into four types, according to the explosives used: Nitro-cellulose, Nitro-glycerin, Nitro-benzol, Alkalin metallic nitrat mixtures.

These explosives permit of many combinations and varied means of igniting them. Bombs may be further classified according to the method of ignition used: Manual, Mechanical Electrical, Chemical.

The container or envelope of a bomb may be anything from a newspaper wrapt around the explosives to iron pipes, ice cream freezers, violin cases, cigar boxes, bottles filled with concrete and all imaginable kinds of wrappers.

RULES FOR HANDLING BOMBS

By INSPECTOR OWEN EAGAN,
Bureau of Combustibles,
NEW YORK FIRE DEPARTMENT.

If you should receive what you believe to be a bomb or infernal machine thru the mails or by messenger

1. **LEAVE IT ALONE,**
2. **DO NOT PLACE IT IN WATER,**
3. **CALL THE FIRE DEPARTMENT, OR IF IT IS NOT CONVENIENT, CALL THE NEAREST POLICE OFFICER, WHO WILL AT ONCE NOTIFY THE FIRE DEPARTMENT, AND HAVE THE EXPERT COME TO INSPECT THE SUSPICIOUS PACKAGE IMMEDIATELY.**

It is a common but fallacious rule among the general public, that in order to be safe with a bomb or infernal machine, it should at once be placed in a pail of water. If the bomb or infernal machine has a fuse attached to it, and the fuse may be seen burning or sputtering, then drop the bomb in water, which method usually is efficacious in making it harmless, as the lighted fuse is at once extinguished, but the best advice is to leave the house.

However, when this lighted fuse is NOT PLAINLY EVIDENT on the bomb or infernal machine, IT SHOULD NOT BE PLACED IN WATER, as many of these hellish devices are chemically or electrically operated. Another possibility likely to occur, if the suspected bomb or package is placed in water, is that some of them are made up in part of certain chemicals which will explode as soon as the water reaches them. There is an added probability that if the package or bomb is immersed in water, the reaction between the water and the chemical may give rise to a violent and persistent combustion, the flames of which will set fire to the house. In some of these contrivances there is a second compartment containing a high explosive, which can be ignited by heat, and where such a condition as outlined may occur, it is at once apparent that the heat due to the combustion of the initial chemical may generate sufficient heat to detonate the explosive, with possibly fatal results.

Every bomb presents a new problem as regards its envelope, contents and construction, and the best means of opening it without causing it to explode and send me "West." Everything is filled with uncertainty at this stage. The task requires ingenuity, nerve, precision and firmness of hand, which is essential to a surgeon in performing a very delicate operation. In both cases, a life is in the balance. These qualities cannot be gained by study, but must be secured by experience covering many years.

We now enter the second phase of the work. It is now necessary for me to classify and analyze the layout, materials, methods and plan of the bomb maker. What's in the vial? Why the wire? Where is it attached? What's this powder? Is it a mixture of several chemical substances? Why this and why that? Two, four, seven compartments, everything interlocking! Can't see the battery, detonating cap! Can't pull its "teeth"!

The scene is set in someone's home or office, sometimes it is my laboratory; every one has gone; the windows have been raised, doors opened to relieve the compression in the event of an explosion. There are two opponents, a bomb and Eagan, but Dame Experience is always with me.

The hellish combination has been broken down and then the "guests" are called and there on the table before them in various groups are explosives, timing devices, detonators, ignition mixtures, acids, vials, batteries, wires, fuses and the "bomb-maker's camouflage". Now the wheels of Justice are set in motion and the search for the bomb-maker begins.

Since the discovery and use of gunpowder, bombs of various types have been used.

The First New York Bomb Outrages.

The first series of bomb outrages in New York, from 1902 to 1910, known as the "Blackhand Bombs," occurred in the Italian section, and these were chiefly of the nitro-glycerin group, manually ignited. Dynamite was placed in olive oil cans and ignited by a time fuse which the "dynamiter" lighted and walked away to await developments.

A large number of bombs of the alkalin metallic nitrat group were made during this period. These consisted of various nitrats and chlorats and were exploded by time fuses manually ignited. Some were of the grenade type and were hurled at the victims.

Most of the bombs of this period were of a crude design and were made from articles of every day

(*Cont. on page* 341)

Another view of the "Animated Weekly" Film Story of Inspector Eagan's Great Work—that of Official Bomb Opener to the City of New York. His is the Only Job that Has no "Waiting List" of Future Aspirants.



www.americanradiohistory.com

A Few "Samples" of Eagan's Bombs



(Exclusive Story of Mr. Eagan's Bomb Exploits on Opposite Page.)

Copyright 1919 by E. P. Co.

www.americanradiohistory.com

Peacetime Uses for War Inventions

By H. Winfield Secor

"SCIENCE moves in mysterious ways, her wonders to perform"—to paraphrase the well-known biblical passage, and never was this demonstrated more pertinently than at the present time, when we find many of the great World War's deadly inventions being converted to peacetime uses. Everybody is being benefited by the industrial application of some of the greatest inventions yet perfected by man, and many thousands more will live to reap the benefits accruing from the as yet undreamt-of applications for both business and pleasure, of airplanes, tanks, wireless devices, submarines, and a thousand and one other attainments of the world's master scientific minds.

A semi-humorous application of the Meissner *airfone*, described elsewhere in this number, is shown in Fig. 1. This device, which is very simple in construction, resembles a speaking tube in form, but incorporates several novel and distinct improvements, among others, an acoustic amplifier, making the device very efficacious for carrying on conversation between the pilot and observer in an airplane, where it is extremely difficult to hear under ordinary conditions, due to the great noise of the engine. A new application of this device is here suggested, namely, to muffle the ever-present and detestable "movie pest." Not only do we find these miserable atoms of humanity in the dark quiet of the movie theater, but also in all of the regular theaters. These brilliant insects must have seen some of the shows which we happened to frequent, about 999 times,—so replete is their knowledge of the "star" and "staress" and all the lesser satellites appearing in the play. They will tell you loudly the climax half an hour before it comes off and so on. So, thanks to the Meissner *airfone*, it should not be so very long before "us ordinary mortals" shall be able to go to the theater and enjoy a performance without having one of these human dramatic compendiums racing along two knots ahead of us, all the way thru the play and telling his sweetheart every move just before it happens. Some of you may like your entertainments served up that way—as for us, we object!

A very good use for the Boche's far-famed *Poison Gas* is shown in Fig. 2. What better application than to annihilate the rats by asphyxiation—"sauce for the goose is sauce for the gander." The Germans thought they had something brand new in strictly war inventions when they tried poison gas on the Allies, but among other recent applications of this invention to peacetime utilities and requirements was that of killing rats. Of course it goes without saying that before injecting a few dozen cubic feet of mustard or chlorin gas into a rat hole, that you had best provide yourself with a guaranteed gas mask and also buy a few dozen corks with which to plug up the other openings in the walls or floor boards. Give it a trial, ladies and gents—it's the "kaiser" of all rat killers.

Embryonic *Tanks* were already in use for agricultural and other purposes long before the World War, and in fact the first tanks used by the British Army on the battlefields of France were reconstructed agricultural tractors, built in the United States. These tractors were armed with steel plates and fitted with rapid-firing guns. The illustration, Fig. 3, shows another application besides that of the usual plowing and cultivating operations—that of hauling large logs in the lumbering districts of the great West. In these localities it is difficult to build even small railroads, and it doesn't pay to build any extensive trackage for such log railroads, as they are not apt to be used for any great length of time. Therefore, the tank tractors should prove very useful, as they can travel over practically any kind of ground, including ditches and even over logs. It will be remembered that during operations in the World War the tanks could crawl over great shell holes, trenches and brooks. This application should provide some fine chances for those of our Tanks Corps soldiers who are aching for army life and the ups and downs met with in the everyday career of a "tank rider." These tanks can haul tremendously heavy loads and resemble in their operating characteristics the work of the famous elephants of India, who pick up with their trunks giant timbers 30 to 40 feet long and measuring 8 to 10 inches square.

Airplanes—oodles of them—will soon be flying over our heads every day all over America. Many people have an idea that the airplane is a peacetime luxury, not to mention a wartime necessity. But such is not the case. If for no other reason the airplane has come to stay in its everyday application to the transportation of mail and the lighter classes of merchandise as by multiplying its everyday utilities, the practical development of aircraft is bound to result. This country, as well as every other power, is keen, of course, to develop aircraft to the highest pinnacle of practicability. The U. S. Army, as well as the Navy Department, has only recently put up a stiff fight for many millions of dollars with which to carry on much-needed airplane developments. One of the best ways to train fliers, especially in this country, where a large standing army or navy personnel is never maintained, will be without a doubt to encourage in every way possible the commercial application of flying machines of all types. Already in England a piano has been transported across the English Channel by airplane, and airplanes are at present available which can lift very heavy loads, and, morever, they are daily becoming more reliable and less liable to accident, should any part of the machinery fail while in the air. Hundreds of people of course take one look at an airplane, especially when it is ascending or descending in flight, and are satisfied to keep both feet on old *terra firma*. However, some of the latest types of airplanes are guaranteed to right themselves and land safely, even if the engine stops in mid air and the control cables become tied or ruptured. See Fig. 4.

Liquid Fire, as shown in Fig. 5, should prove efficacious for several industrial uses, such as burning off paint from iron and steel structures, vessels, etc., and, according to H. Gernsback, also for blazing a path or hole thru ice jams, which frequently prove extremely dangerous during the American winters, when they clog rivers and streams, as well as dams. Under certain conditions it might also be used to blaze paths thru jungle brush.

The *Geophone* is a remarkable physical instrument greatly improved and perfected during the war by the engineers connected with the Allied technical staffs, and used with great success for the purpose of locating enemy artillery and other military operations. Now it has found a distinct peacetime use. See Fig. 6. The saving of many miners' lives has been made possible, thanks to the Geophone, which can detect sound vibrations thru the earth at surprisingly long distances. It has been used successfully in some Government mine tests to pick up the sound of a pick-axe at a distance of about one-quarter mile. There is nothing electrical about the Geophone. It is purely mechanical and acoustic in its function. It operates on the principle that the inertia of a small lead weight within the instrument, and which is secured to a set of diaframs, will tend to hold its initial position whenever an earth-borne sound vibration, for instance, happens to affect it. The other part of the instrument moves and the lead weight tends to remain stationary in the same manner as your body sways forward due to its inertia when a car suddenly stops. The relative movement of the diafram to which the weight is attached with respect to the movement of the casing sets up an air wave, and this is transmitted to the ears thru a rubber tube, in the same way as a physician's stethoscope works. By means of this wonderful instrument, therefore, it is now possible to actually locate entombed miners at considerable distances. Communication with them is also possible by this means. Knowing the location of the entrapt men, it becomes much more expeditious to carry on rescuing and excavating operations in order to save them.

(*Continued on page* 365)

September Number of the Electrical Experimenter

Sir William Crookes' Psychical Researches, by Hereward Carrington, Ph.D., Scientific Proof of the Existence of Psychic Force, as investigated by one of the world's foremost scientists.

Paris Letter—the Latest Electrical and Scientific News from French Scientific Laboratories. by Jacques Boyer.

Practical Experiments in Chemistry, by Albert W. Wilsdon—An everyday plain English talk on the cleansing of clothes.

Thermo-Electricity, by Thomas W. Benson.

The Mystery of Atmospheric Electricity, by Rogers D. Rusk, M.A.

How to Make a Machine for Telegraphing Pictures, written especially for our young readers by America's greatest tele-photographic expert, Leroy J. Leishman.

Experiments in Physics—Illusions, by John J. Furia, M.A.

New American Salvage Device for Raising Sunken Ships—A most timely and important article, by Joseph H. Kraus.

Latest Amateur Radio Receiving Apparatus, by Charles W. Noller.

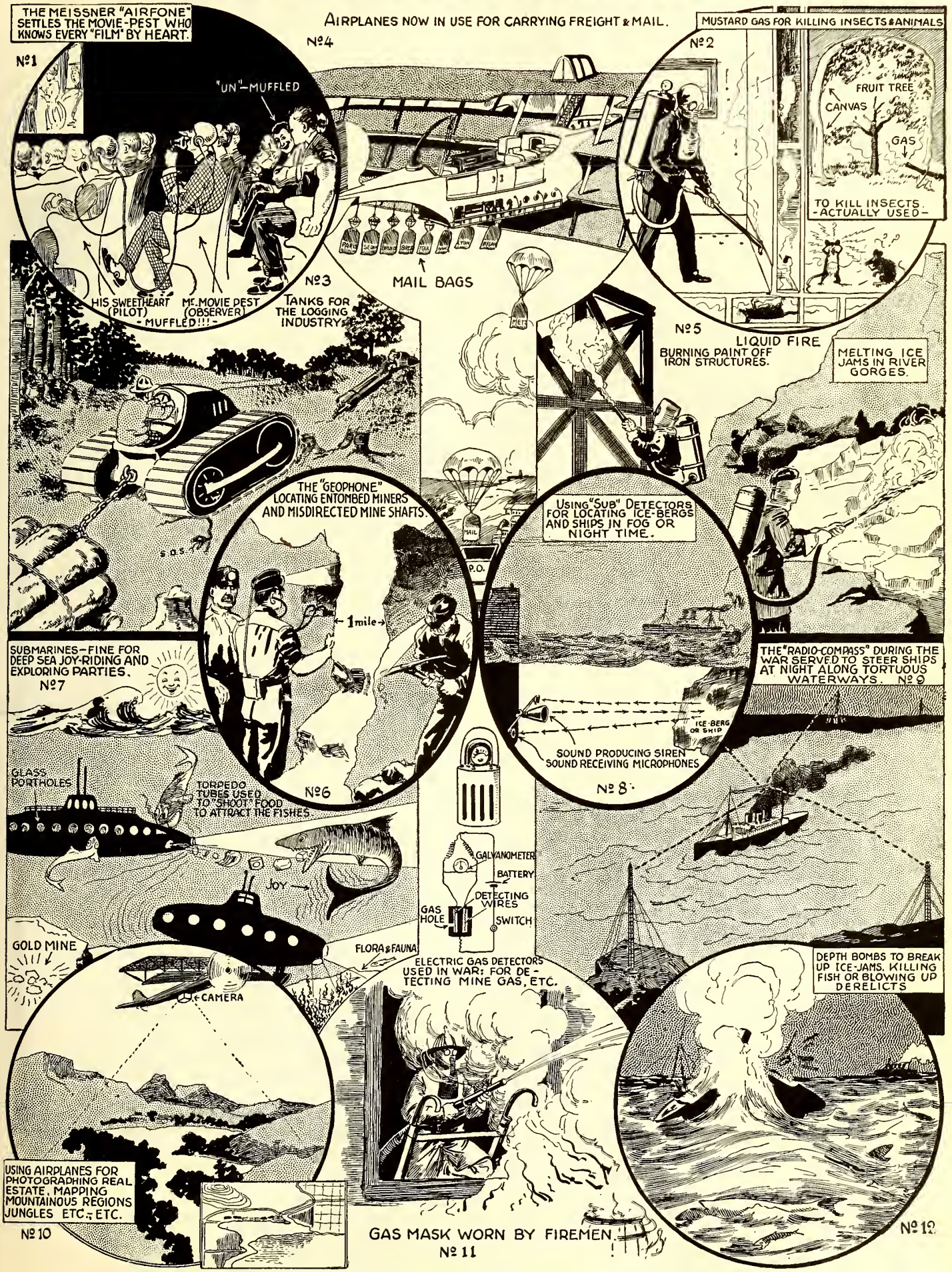
Light Houses—How They Signal, by A. H. Whedon.

Electrical Detective to Register Your Chauffeur's Joy Rides, by Thomas Reed.

Latest Developments in Flying.

www.americanradiohistory.com

Peacetime Uses for War Inventions



Full description on opposite page.

Copyright, 1919, by E. P. Co.

www.americanradiohistory.com

Changing Nature's Face

How Electricity Plus Dynamite Makes Brooks, Removes Stumps and Breaks Up Rock

THE World War has, if nothing else, brought to light the great flexibility and usefulness of explosives such as *dynamite,* not for the purpose of annihilating men and cities, but for the more human, utilitarian purpose of leveling uneven and rocky ground, blasting out stumps from previously wooded ground, and breaking up rock. Again, brooks and irrigating streams are rapidly "dug" in a single day by the use of *dynamite plus electricity,* under the highly developed methods now available for applying explosives, and even the course of a river has been changed in the twinkling of an eye.

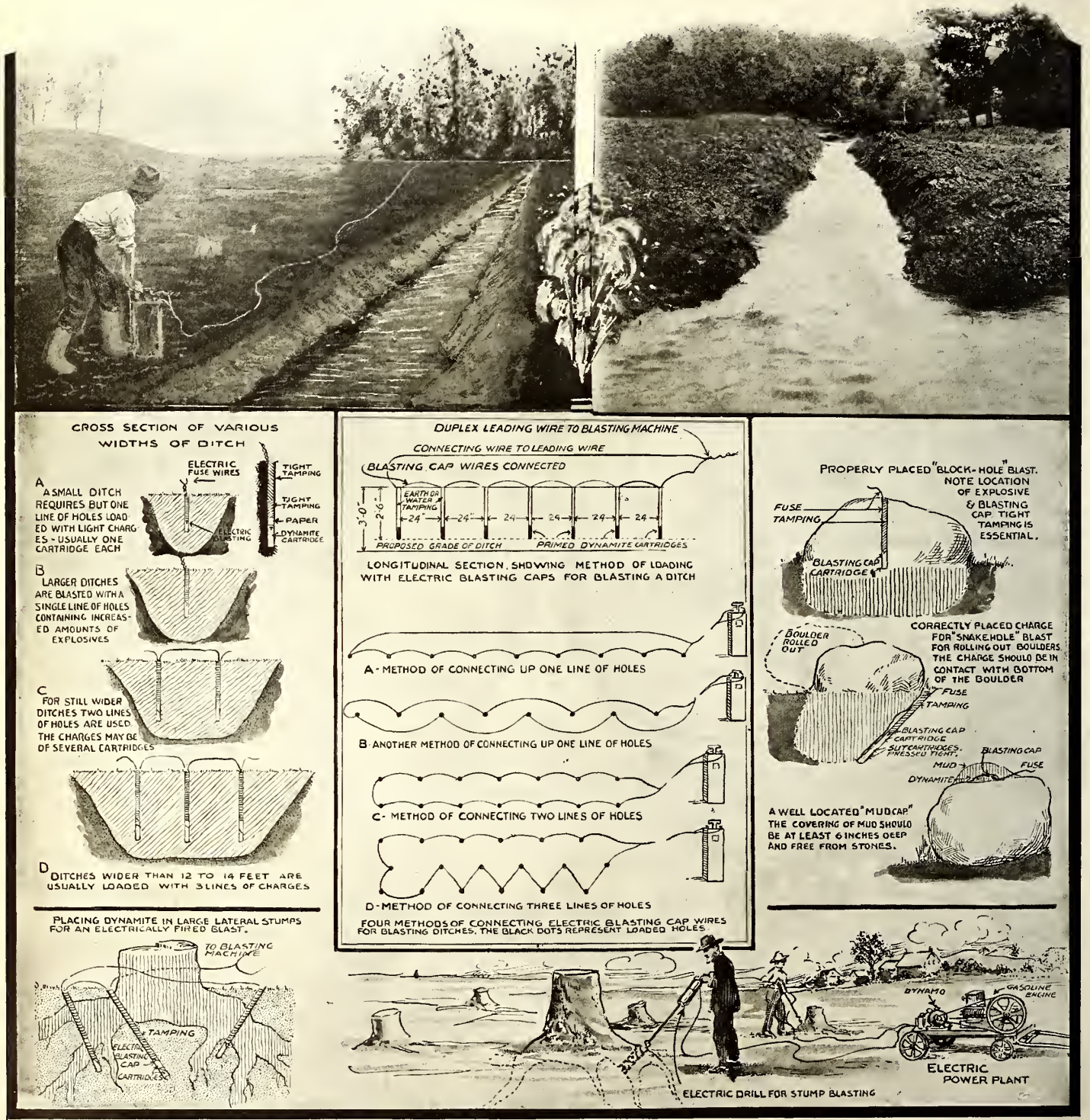
What we are interested in, in the present discussion, is the practical application of explosives to the everyday requirements of the tiller of the soil and those who are interested in improving wooded or rock strewn property.

The Electrical Detonator.

In "blasting by electricity," use is made of a slight electric current usually generated by a hand-operated dynamo of the magneto type. The dynamo is placed in a substantial cabinet to stand hard usage such as is encountered in blasting work, with a handle protruding from the top of the box containing it. This handle is attached to a gear rack and pinion, the pinion being secured to the shaft of the dynamo, so that when the handle is drawn up and then quickly deprest, the armature of the dynamo will be spun rapidly, thus generating a current of fairly high potential.

The *electric detonator* used in blasting, comprises a small copper shell, in which an explosive charge is placed. Two insulated

(*Continued on page* 351)



Illustrating a Few of the Wonders Which Dynamite Plus Electricity Accomplish Every Day All Over America. Stumps Are Cleared Out—Boulders Shattered—Ditches Constructed and Even the Courses of Rivers and Streams Altered. Verily the Face of Nature is Changed By Man.

www.americanradiohistory.com

Man's Greatest Curse--Infected Teeth

The Work of HENRY A. COTTON, M. D.

MEDICAL DIRECTOR NEW JERSEY STATE HOSPITAL, TRENTON, N. J.

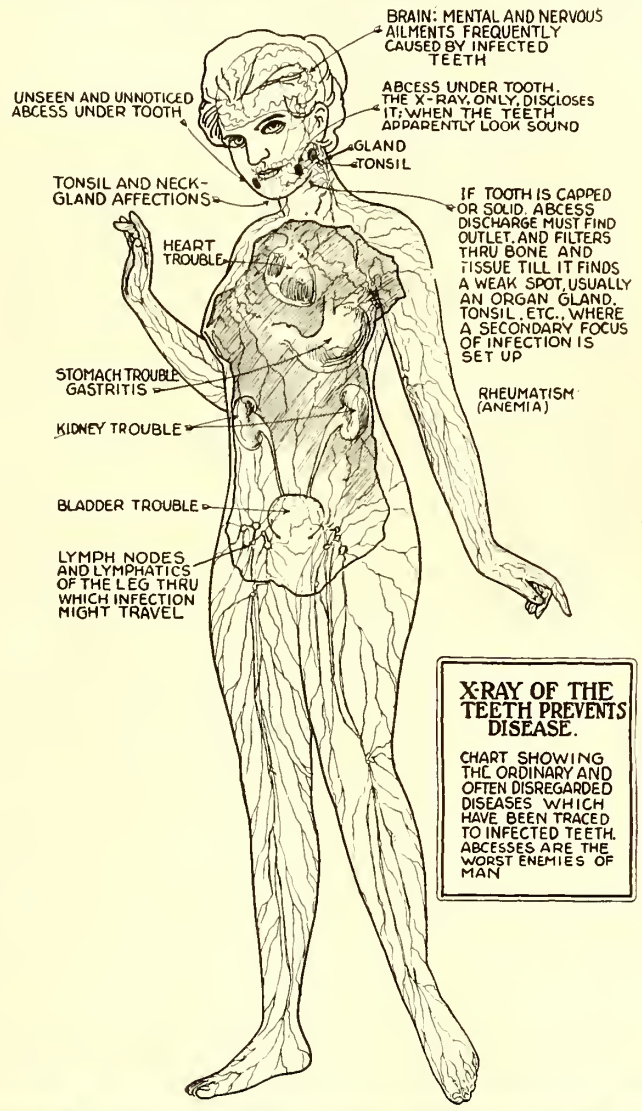
How X-Rays of Teeth May Prevent Disease and Insanity

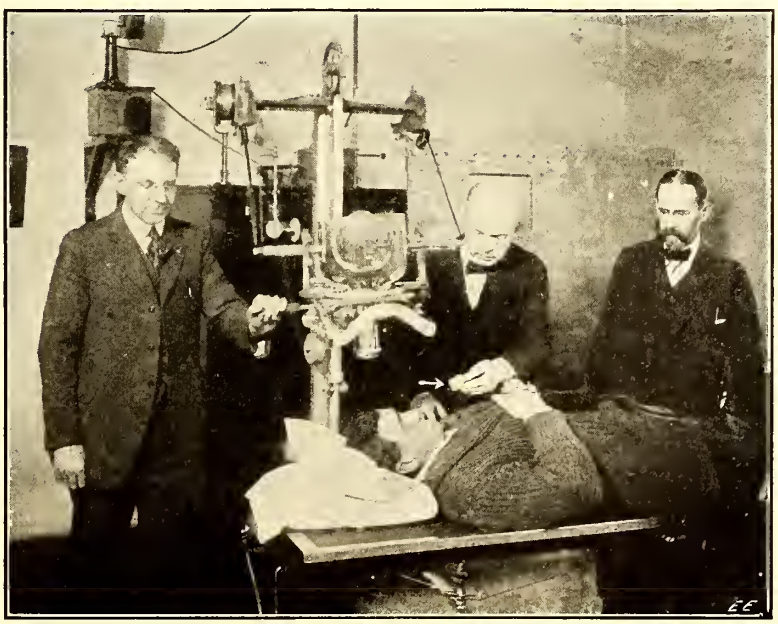
INVESTIGATIONS in the last few years, by both dentists and physicians, have shown conclusively that the greatest menace to the health of the human race today is to be found in the bad condition of the teeth of a large majority of the populace. The instinct of the individual is directed toward saving the teeth, and, unfortunately, a large proportion of the dentists foster this instinct, and in consequence, teeth are capt and otherwise repaired by expensive *bridgework* in order to save the teeth, when from the standpoint of the patient's subsequent ill-health, these teeth should be extracted. Happily,

MAN'S greatest danger, the biggest curse of humanity today, are infected teeth. Millions of people are dying of all sorts of diseases, caused directly by infected teeth. Inflammatory rheumatism, insanity, chronic stomach diseases, Bright's disease, nervous diseases, all these are now attributed to infected teeth. The work of Henry A. Cotton, Medical Director of the State Hospital of Trenton, N. J., is of such epoch-making and tremendous importance that every human being ought to know of it.

the best dentists have realized for some years that serious results frequently follow such procedures and have warned the profession against this danger. This subject has received special attention by Dr. Henry A. Cotton, Medical Director New Jersey State Hospital, Trenton, N. J., who in a recent statement on the importance of X-raying the teeth, has the following to say:

"Unfortunately for the patient, infected teeth may not and often do not cause any symptoms which would lead one to believe that anything is wrong with his teeth. This type of infection is what is known as *chronic* in contradistinction to an *acute* infection, and does not cause pain, pus or swelling, and frequently no rise in temperature. Hence, there are no symptoms which direct the patient's attention to this condition, and often they are amazed when they are told that they have infected teeth and that they must have a certain number extracted if they wish to recover from their particular illness. The question is often asked, 'How are we to know that teeth which give no evidence to the patient of serious and often dangerous infection, and externally give no evidence to the dentist of such condition, are infected'? The answer to this is the *X-ray*, and a more general use of this very simple and harmless procedure will reveal to the dentist as well as to the patient the existence of infected roots, *when to casual inspection the teeth may seem to be healthy and worthy of saving!* Naturally, these should immediately be extracted.





Taking X-Ray Photos of the Teeth at New Jersey State Hospital Laboratory. Arrow Indicates the Small Plate Holder About to Be Placed in the Mouth.

"Each individual should know whether or not he is harboring dangerous infection, which may not only undermine his general health but may endanger his life if it be not eradicated. With this knowledge of the danger of infected teeth, all persons should insist upon a thoro examination of their teeth by means of the X-ray and not take the word of a dentist who merely inspects the teeth and pronounces them all right. The failure of the dentist to recognize the existence of root infection and the practise of putting in pivots, gold crowns and bridge work, without first taking *radiographs* of these teeth to be sure that there are no infected roots, has sounded the death knell of many people, for when the infection has invaded other organs it is often too late for extraction of the teeth to be of any benefit. No matter if the teeth give no trouble or if one feels perfectly healthy at the present time, if he has had any dental work done at any time, *he should insist upon his dentist radiographing his teeth* so that he will not be the victim of a false security and finally succumb to a fatal disease, which might have been prevented if he had taken the precaution mentioned.

Dr. Cotton proves to us that it is wrong to cap or crown devitalized teeth as they will positively make serious trouble sooner or later. Such teeth should all be extracted immediately; they are the seat of nine-tenths of all our modern diseases.

This article is one of the most important we have publisht for a very long time, and we urge every reader not only to carefully read it, but to spread its gospel among friends. It will save thousands upon thousands of lives.

—EDITOR.

The Cause of Infected Teeth

"The public naturally inquires: 'Why do we have such bad teeth today when our parents and grandparents did not have these conditions, or, at least, did not have these fatal diseases?' There are several reasons for this. In the first place, our forefathers did not bother with dentists except to have an offending tooth extracted. In the second place, modern dentistry had not developed to the point of expensive repair and preservation of the teeth as we know it today. It has been estimated that 80 per cent. of the people who have had repair work done, even in the most expensive and latest manner, *have infected teeth which may become a menace to their health at any time.*

(*Continued on page* 345)

www.americanradiohistory.com

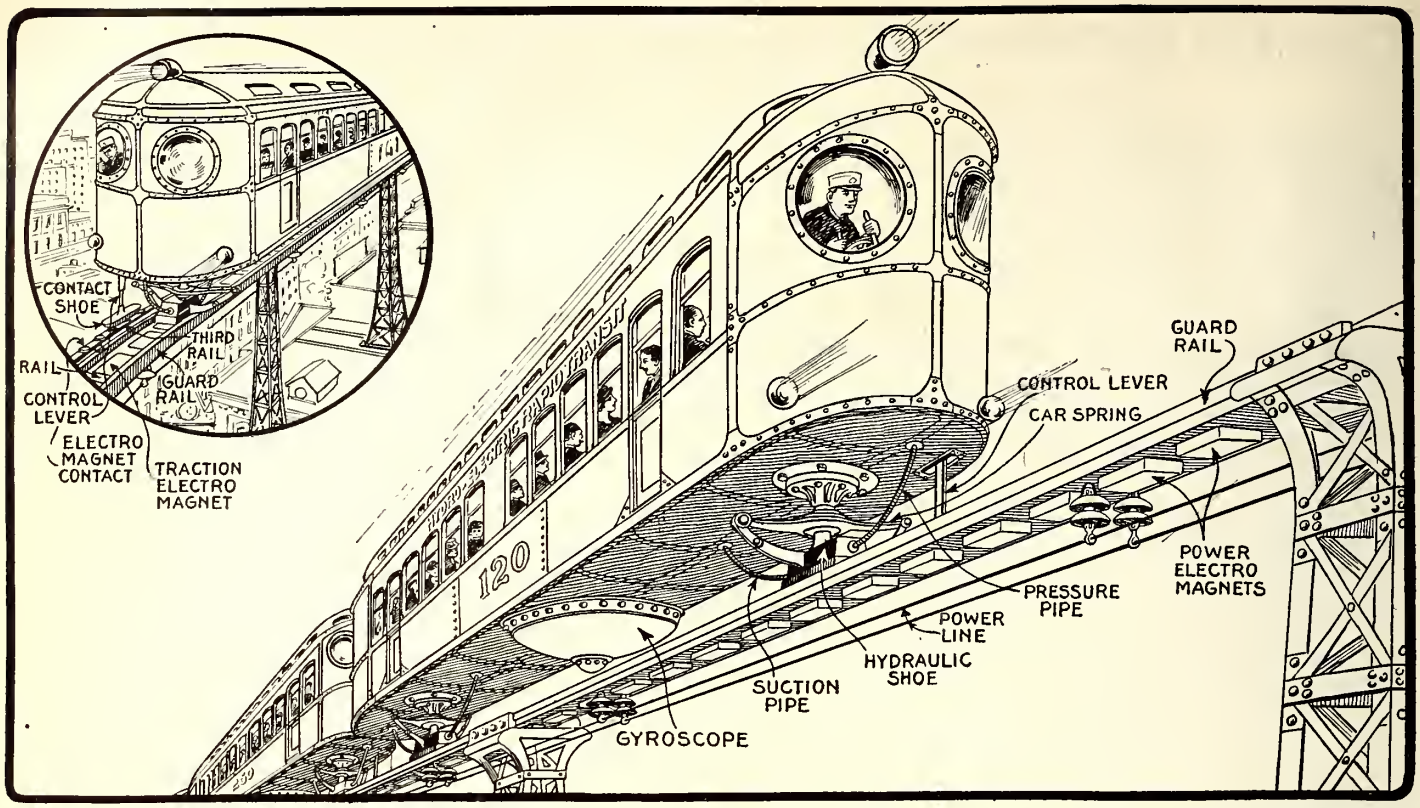


Fig. 5. This Illustrates the Propulsion of the Wheelless Gliding Train. The Two Hydraulic Shoes Glide On a Film of Comprest Water Squirting from Underneath the Shoes. The water Is Recovered by Suction from the Same Shoe So None is Lost. (See Fig. 3.) The Train Itself is Kept Upright On a Single Track by Means of a Gyroscope, While the Cars Are Propelled by Powerful Electro-magnets, the Contacts of Which Are Closed Automatically by the Train as It Moves Along. These Gliding Railroads, Having No Friction, Work So Easily that a Child Can Push Along a Car With Its Passengers.

Solving the Transportation Problem

By H. GERNSBACK

A Railway Which Actually Existed In France

THIS is the story of a most extraordinary railway which at one time existed in France. Its inventor was killed by the invading Germans in 1870. A railroad that is practical and which has demonstrated its successful operation. It is practically frictionless and can move SAFELY with a speed of one hundred miles an hour. It will be in use thruout the world.

SINCE the advent of the steam locomotive in the early 50's of the last Century, no progress whatsoever has been made as far as speed of our railways is concerned. We are today not riding faster either in our electric or steam railways than our grandfathers did 60 years ago. It is true that we have greatly improved everything else as far as comfort, safety, etc. is concerned, but the speed has not been increased whatsoever. Sixty miles an hour was an everyday occurrence sixty years ago, and was attained by many trains. Today, the average speed of the steam or electrical railways does not approach more than 50 miles.

Present Disgraceful Conditions.

What are we to do? In our big cities we are running street-cars on the surface, trains on elevated railroads and down in the subways. The more roads we build, the more acute becomes the shortage of transportation as far as passengers are concerned, and in any big city transportation facilities are always woefully behind the actual demand. In the morning everyone goes to business about the same time and in the evening everyone must ride home—our so-called rush-hours. The density of travel thus become enormous, particularly in cities like New York or Chicago, where conditions, as is well known, are intolerable, and in many cities, disgraceful. If it were possible to operate our railroads with safety only two or three times as fast as they are running now, it stands to reason that everybody would have a seat, an impossible condition now.

We cannot run our trains faster than they run now without encouraging accidents such as collisions, derailments, etc. As far as the present day railroad is concerned, it is not possible to increase its speed at all. There is, however, one solution, an invention which dates back to 1852. we refer to the *Gliding Railroad* which actually had been tried in France, and had been perfected in a small way. At that time, however, many technical obstacles made the project impossible, but all of these objections have now been overcome by new inventions and methods which we will discuss more fully.

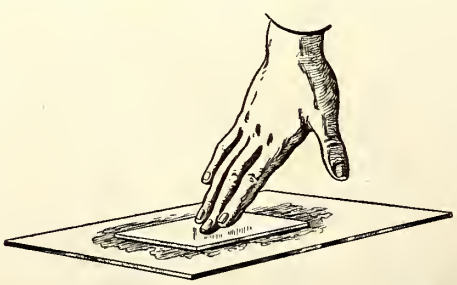


Fig. 1. The Principle of the Gliding Railway. Two Glass Plates Are Dipt Into Water. The Upper Plate Will Glide With Astonishing Ease. The Two Plates Do Not Touch. A Thin Water Film Separates Them.

Principle of Gliding Railroads.

Let us turn to Fig. 1 which gives us the principle of the gliding railroad. Take two smooth pieces of glass, such as are used for photographic plates. Boil them in water, until the gelatin comes off and clean thoroly. Use one large plate and one small plate as shown in illustration. Dip the two plates into water, and place the small plate on top of the larger. It will be seen that the small plate will *glide* with remarkable ease over the large plate. The important thing to note is that *the two plates do not touch.* They are supported by a thin film of water, *hence the top plate glides on an exceedingly thin water film.* As we move the plates back and forth we squeeze out the water little by little, and as soon as the plates touch, the free movement will stop. Were we to drill a hole in the top plate and attach a small tube to it containing water under pressure, we could then for a long time move the plate back and forward with very considerable ease; we would then always maintain a good water film on which our top plate could glide.

Exactly this is the principle of the gliding railroads, first invented by L. D. Girard, a great French engineer. Already in 1852 M. Girard proposed to replace the ordinary railways by means of hydraulic propulsion. He was quite successful with

www.americanradiohistory.com

his first models and in 1854 he conceived the idea to replace the wheels by means of *hydraulic skates* gliding over flat rails. By means of this method, he did away entirely with all friction for the reason that *he interposed between the skate and the track a film of water under pressure.* At first M. Girard was using comprest air, but he found that it was necessary to use water under pressure because air did not give satisfactory results.

Railroad was Actually in Use.

He actually constructed on his property de la Jonchère, near Paris, such a wheelless railroad which had no locomotive, the cars of the train gliding on a film of water. The propulsion of the train itself was affected by a sort of turbine arrangement whereby a stationary water jet was hurled against stationary vanes mounted under the cars. In other words, the train acted as the stationary part of a turbine, while water jets placed alongside the road, and operating automatically, pushed the train along. This railroad worked very well and actually transported passengers in a limited degree. In 1869 M. Girard obtained a concession from the French Government to run a wheelless railroad line from Paris to Argenteuil. Unfortunately, the Franco-Prussian War in 1870 then broke out and his experimental railroad at de la Jonchère was ruined by the Germans and Girard himself was killed. Nevertheless, the principle had been proven sound by actual practise. There is no reason why with modern methods and improvements it cannot be made a huge success.

In our Fig. 2 is shown one of Girard's hydraulic skates or shoes and its operation. M. Girard's train had two *flat* rails, and each car had four hydraulic skates or shoes which replaced the usual wheels. Fig. 2 shows three views of the shoe. It will be noted that water pressure is supplied to the shoe which fills the interior fully. As soon as the pressure becomes high enough, it is obvious that the water must escape by raising the shoe clear from the rail, providing enough pressure is used. While the water escapes, it will be readily understood that the shoe itself can nowhere touch the rail proper. In other words, *the shoe floats on a thin film of water.* If no other means were provided, it can be seen that an enormous quantity of water would be needed to supply the hydraulic shoes, while the train was moving, or even standing still. The water would squirt out incessantly.

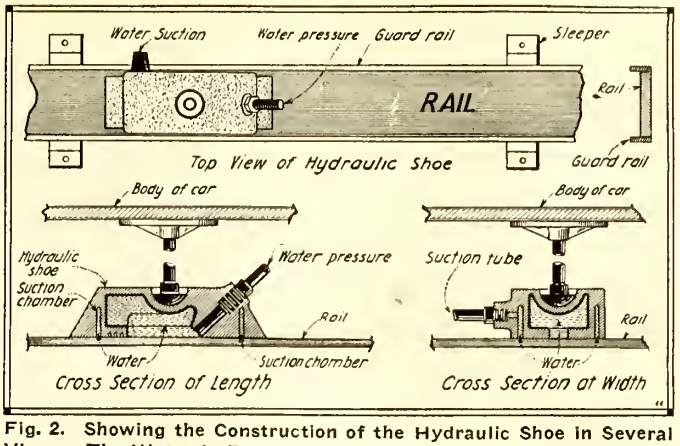


Fig. 2. Showing the Construction of the Hydraulic Shoe in Several Views. The Water Is Pumped Into the Shoe Under High Pressure. As the Water Leaves the Shoe, It Is Sucked Back Thru the Suction Chambers. The Hydraulic Shoe Cannot Leave the Track On Account of the Guard Rails. (See Upper Right Hand Detail Sketch.)

No Water Is Lost.

However, another French engineer, M. Barre had the happy idea to recover nearly all the water, and this arrangement is also shown in Fig. 2. Running near the edge of the hydraulic shoe will be found an annular suction chamber which is connected to a suction tube. It will be realized that as quickly as the water is prest out from under the shoe, it must pass the suction chamber, *and here it is sucked back to the water reservoir* of the train to be used all over again. With this ingenious arrangement, it will be readily seen that practically no water is lost except a minute quantity used in wetting the rail, and this loss per train amounts to only a gallon or two per mile, even for a heavy train.

A very important, and as a matter of fact, the most important part of this railway is, that as the cars glide on water they *can be made to run with marvelous ease.*

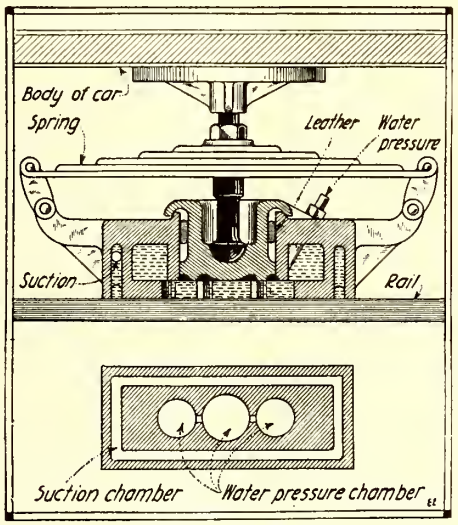


Fig. 3. A Modified Form of the Hydraulic Shoe. It Works Similarly to the One In Fig. 2. Note the Piston Arrangement Which Gives the Train a Feathering, Cushion Effect.

Child Can Pull Train.

M. Girard already demonstrated that *a six year old child could move a standard railway car* rapidly over a track, so easily does such a railway operate. The reason is of course that no metal of the train touches the track, therefore nearly all friction is suppressed. By actual experiments it has been shown that M. Girard's cars could be moved with a weight *one half of one thousandth of the weight of the car.* In other words, a railroad car weighing several tons can be pushed along rapidly with an expenditure of a few pounds of energy. The water film itself is of course exceedingly thin, measuring only from one-half to three-quarters of a millimeter. In other words, not much thicker than six sheets of paper on which this story is printed. Nor was the water pressure as high as one might think at first:—10 lbs. per square centimeter.

M. Girard found his greatest trouble in two points. First, he had trouble with his rails at the point where the latter connected. It is of course necessary that a railway of this kind should have an exceedingly smooth metal rail which must not have any uneveness whatsoever. Also where the rails join, it was found necessary to interpose pieces of leather or soft rubber, otherwise the water would squirt out between the rails. Of course, we would not have this difficulty today because we would simply weld the rails together, making them a uniform piece of metal. This source of trouble, and it was M. Girard's greatest one, would be unknown today. The other great difficulty was to propel the train.

How to Propel Wheelless Trains.

There was used in Paris at one time an arrangement as shown in Fig. 4. Inasmuch as no wheels are used, and because the hydraulic shoes have no tractive effect themselves, entirely new means must be provided to move the train. The old French idea is shown in this illustration where a rail rack was run all along between the (*Cont. on page* 336)

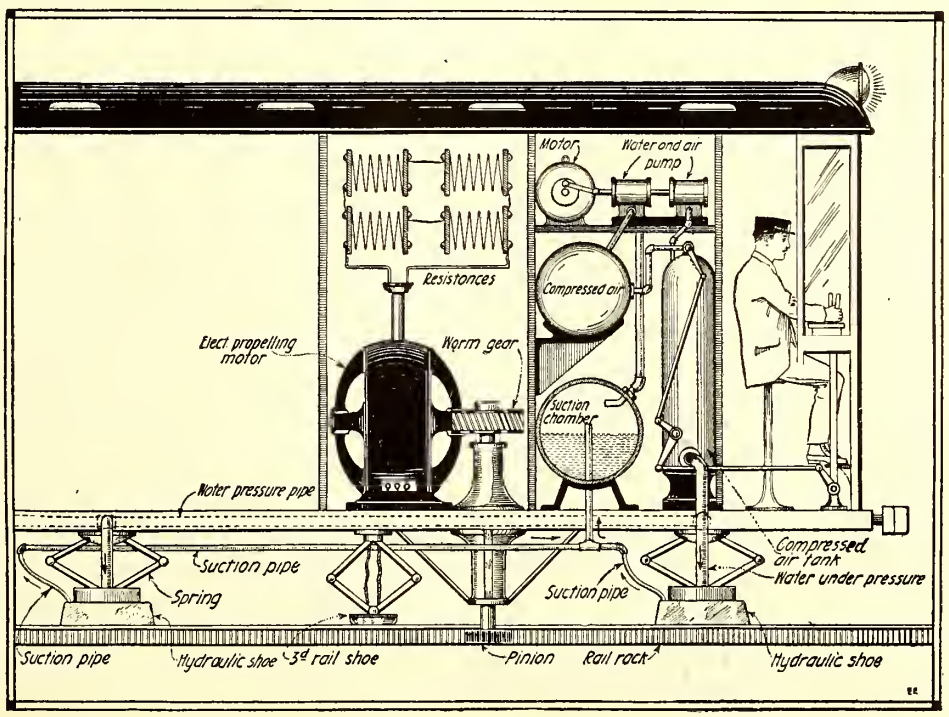
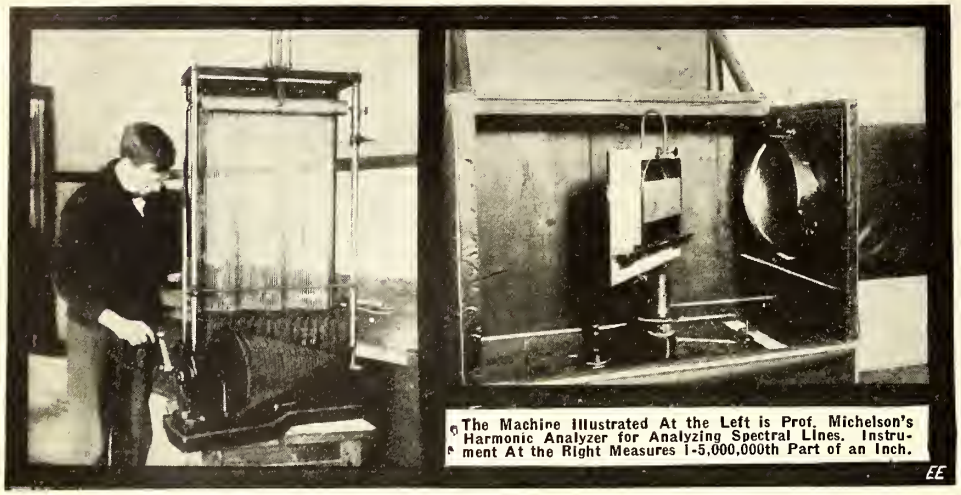


Fig. 4. Showing the Propulsion Used in the early French Gliding Wheelless Trains. A revolving Pinion Engages with a Rail Rack, Thus Pushing the Train Along. Illustration Also Shows the Method of Hydraulic Shoe with Comprest Water, and How the Lost Water Is Sucked Back.

www.americanradiohistory.com

Measuring 1-5,000,000 of An Inch



The Machine Illustrated At the Left is Prof. Michelson's Harmonic Analyzer for Analyzing Spectral Lines. Instrument At the Right Measures 1-5,000,000th Part of an Inch.

The wonderfully precise measuring machine here illustrated measures down to 1-5,000,000 of an inch. It was invented by Prof. G. Michelson. Prof. Michelson's grating (on the stand to the left) contains 50,000 parallel, equally spaced lines to the inch.

Precision to the 1/1,000,000th part of an inch has until recently seemed only to be within the realm of ultra-science, as we might say. However, during the war, mechanical precision instruments were improved so markedly that it was quite common, especially in Government ordnance specifications and requirements which called for an accuracy of 1/1,000,000th of an inch.

The photo at left shows Prof. Michelson's Harmonic Analyzer, for analyzing spectral lines into their constituent parts. By means of this device an assistant can do in a few minutes what would require many weeks for a skilled computer.

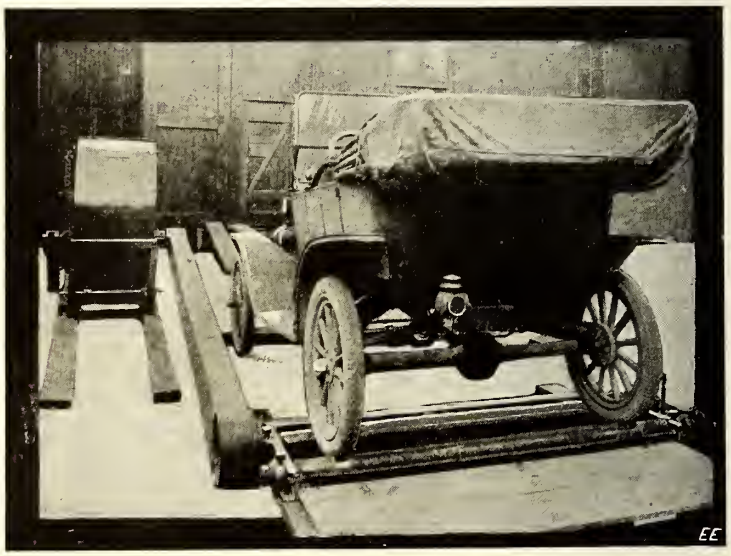
Farmers Drive Machinery from Automobile

Herewith is illustrated the latest in automobile power transmitters for driving farm or other machinery. A recent invention of the proprietor of a Colorado machine shop promises to become very popular with farmers who own autos. The invention is an apparatus for transmitting power from an automobile to run the machinery of the farm, but unlike most contrivances of its kind, nothing is removed from the auto, and the auto can be driven off within a minute of the time it is used on this new invention.

The device consists of two four-inch rollers set parallel to each other in a frame and long enough to run the automobile onto them. These rollers are connected by a chain belt, and on one of them is a pulley to run a belt to the machinery. The rollers are locked against turning while placing the auto on the machine, by putting an iron pin thru the links of the drive chain. When the rear wheels of the auto are resting squarely on the rollers, pin is removed and the engine started. This turns the rollers as the wheels revolve, and the belt runs the machinery, the same as any other power would do.

The inventor claims to develop half the rated horsepower of any automobile engine on the belt of the machine, which is very good indeed, considering that the power is transmitted by friction only, with a consequent loss by slippage. The device should find wide favor among farmers everywhere.

Here's How to Put Your Henry Ford to Work and Make It Drive Farm or Other Machinery—even Down to Cutting Up Fire Wood. The Inventor of the Automobile Power Transmission Scheme Here Illustrated, Claims to Develop Half the Rated Horsepower of an Automobile Engine on the Belt of the Machine, Which is a Very Good Efficiency Indeed, Considering That the Power is Transmitted by Friction With a Consequent Considerable Loss, Due to Slippage. The Device Comprises Two Four-Inch Diameter Rollers, Set Parallel to Each Other, in a Frame Long Enough to Permit the Rear Wheels of the Automobile to Rotate In Contact With Them.



"Movie" Sign Works by Colored Lights



This Picture is not Quite so "Infantile" as it Might Seem At First Glance, Altho the Subject Illustrated Happens to Be. By Painting Two Objects Such as a Hobby-Horse as Here Shown, in Two Different Colors, Say Red and Green, a San Antonio, Texas, Inventor, Richard M. Craig, Has Found That When a Set of Red Lights Are Flashed on the Sign by a Special Electric Flasher Switch, the Red Image Stands Out Plainly; and When the Green Lights Are Lighted and the Red Extinguished, the Green Image Stands Out. By Rapidly Switching the Lights On and Off a "Movie" Effect is Obtained.

One of the lastest and cleverest advertising devices is that covered in a patent recently granted to Richard M. Craig of San Antonio, Texas. The inventor arranges two figure positions on the sign, one position of the figure for illumination by red lights and the other by green lights. Next he arranges red and green lights for illuminating the display with a device for alternately switching the current from one set of lamps to the other, the switching device being motor-driven. In the present illustration, we at once perceive that the subject is painted twice in two extreme positions, each position being painted in a different color, such as *red* for the extreme position and *green* for the second extreme position. These two positions in red and green under ordinary daylight conditions show plainly, but when they are lighted alternately with red and green lights, then the sign becomes alive and animated, giving a very near approach to a moving object.

www.americanradiohistory.com



Two Views in Paris, Showing the Famous "Camelots" or Street Fakirs, Who Have Here Elected to Tell the Good French People Their "Past, Present and Future" by Wireless. Only it Isn't Wireless!

Paris Letter

By JACQUES BOYER

THE Parisian "camelot" is more than a street peddler, he is a business man and an actor, sometimes even an acrobat, but always he is a marvelous talker and a humorous entertainer.

A good "camelot" will sell anything on the asphalt of the good town of Paris, be it an old sponge, a pocket-book, a collar button, or ice-cream. We have no intention to give in the following, a history of this so interesting specimen of human being, but we will show, with the help of the photographs herewith, that the renown of the "camelots" is by no means exaggerated and that they keep abreast with the developments of science and are not at all indifferent to the particular trend of public attractions. These peculiar peddlers, instead of meddling with ordinary merchandise have put the fairy Electricity at work to attract their clients.

Here for instance, one of them detects your thoughts by means of the *"Teleradio"*; the other one uses the *"Radiograph"* to discover the past, present and future.

Of course we don't need to tell you that the instruments which they exhibit have only a very vague resemblance to the ones attributed to Tesla, Marconi or Branly.

Most of the time these apparatus consist solely of a bell connected to a few dry batteries and other formidable appearing scientific apparatus. The answer to the question concerning the past, etc., of the victim, is printed in advance, of course, and glides out of a box by means of a clockwork.

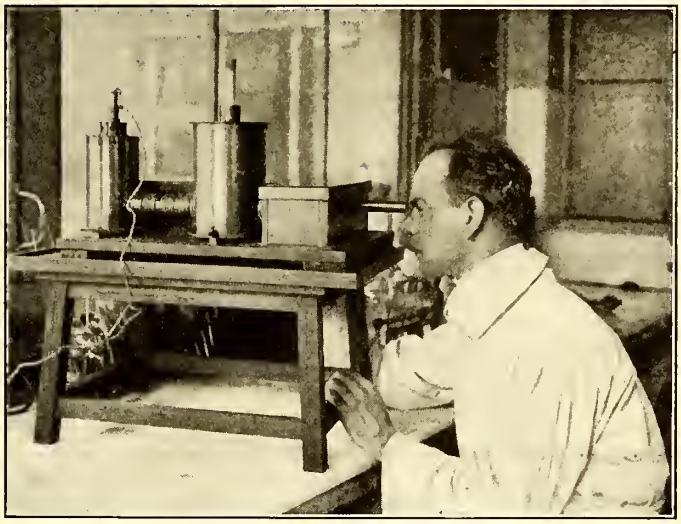
The rest is *camouflage. Scientific camouflage.* But some one always falls for the fakes. P. T. Barnum was right. The public wants to be fooled—and gladly pays for it.

New Electrical Apparatus to Count the Microbes.

The Opacimeter.

This new instrument invented by Messrs. Lambert, Vles, and de Watteville, who have given it the name of *Opacimeter*, makes it easy to count rapidly the microbes in an emulsion prepared for vaccination purposes.

It is composed principally of a photometer made up of two parallel light circuits, coming from one source, the one traversing the phial containing the emulsion, the other subject to a system of dimmers, capable of modifying the intensity of light, after a determined law. The two circuits produce, in the field of an eye piece, two light-spots opposite each other and the other realizes their equal value by adjusting the dimmer system.



New French Instrument for Rapidly Counting the Microbes in an Emulsion. It is Called an "Opacimeter."

A very ingenious system of gauges, lenses and microscopes, the detailed description of which it is not possible to give in this limited space permits the observer to establish with the aid of Spectrophoto-Metric Measures the actual number of microbes contained in the emulsion. The laboratories of the French Army are using the Opacimeter to determinate rapidly and accurately the dose of bacteria to be contained in a vaccinating emulsion.

SHELL LOCATER FOR FRENCH FARMERS.

The shell locating apparatus here illustrated was invented by M. Gutton, Professor of Physics at Nancy, and is akin to one used by surgeons for locating bullets in the body. It consists of two wooden rings each fitted with a pair of electric coils, one traversed by a variable current and the other connected with a telephone. If there is a metal object under the soil in fairly close proximity to the apparatus, the telephone signals the fact; if not, it remains silent. Unexploded hand-grenades are more dangerous than shells, as they are nearer the surface, and liable to burst at the least touch. This apparatus operates on the principle of the Hughes Induction Balance.

The Hughes induction balance is composed of four coils, two in the primary and two in the secondary circuit. When the relative positions of the coils are adjusted correctly, the inductances neutralize each other and no current flows in the secondary circuit. If, however, the slightest change is made in any of the coils, such as by the insertion of any metal object, the mutual induction is unbalanced and a sound is made in the telephone receiver. A detailed description of this device appeared in the February, 1918, issue of this Journal, where a diagram is given of the coil connections. The secondary coils may be connected in series with a galvanometer or 'phones. An experimenter who has no galvanometer can purchase an inexpensive Weston ammeter. When the shunt has been removed, this will serve as an excellent galvanometer. Some form of interrupted primary circuit is necessary to induce currents in the secondary. An interrupter, mounted on the armature of a buzzer, serves the purpose.



The Fields of France Are Strewn with "Dud" Shells. To locate them Before Plowing, the Electrical Instrument Here Illustrated Has Been Perfected to Detect Their Presence, Even When Buried Several Feet.

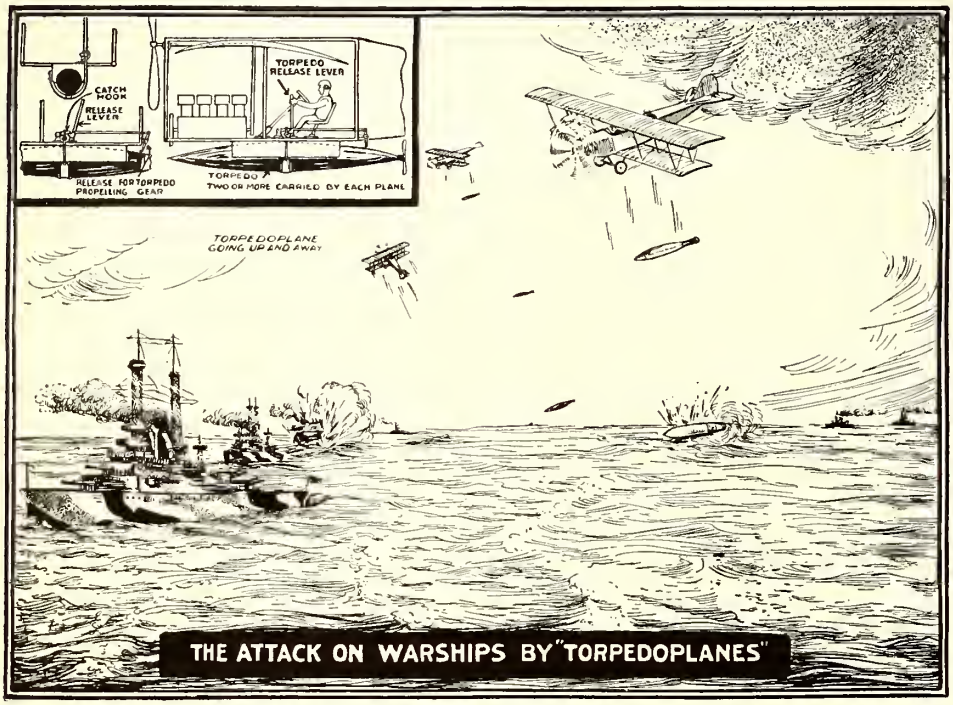
www.americanradiohistory.com

The "Torpedoplane" and "Sub" Spotter

By GEORGE HOLMES

TWO important and novel war inventions are here illustrated and described—the torpedo-carrying seaplane or dirigible, and the microphonic submarine locater, both of these naval warfare improvements being the inventions of an American naval officer, Rear Admiral Bradley A. Fiske.

Two Revolutionizing Naval Inventions of Rear Admiral Fiske



The Naval Engagement of the Future as Rear Admiral Fiske, U. S. N., Sees It. His Powerful "Torpedoplanes" Will Provide New Ways to Repulse Landing Parties and Attack Warships That Are Worrying Naval Experts of Foreign Powers.

The torpedo-airplane or "torpedoplane" as it is called, is a development of the torpedo-carriers, which were first successfully employed in action by the R. N. A. S. at the Dardanelles in 1915, and were subsequently used against us by the Germans in 1917, when they were thus enabled to sink three of our merchant ships off the Southeast Coast. The torpedo carried by the torpedoplanes is of a small size as modern torpedoes go, and weighs about half a ton.

The Mystery Plane or "Torpedoplane"

The "mystery airplane" was designed to perform from the air more effectively and more swiftly the work formerly allotted to our torpedo-boats. The enemy had devised such successful protection of harbors and ships against our torpedo-boats and submarines that it was only with the gravest risk that we could approach within 30 miles of Kiel and other German fortified ports. But for the newest peril, the torpedoplane, the enemy had no reply.

The news of our discovery of a means of attack that was immune from mine dangers and too swift in its operation to be held off by gunfire reached the ears of the enemy, and is believed, in one quarter at least, to have hastened the Germans in their decision to accept the surrender terms.

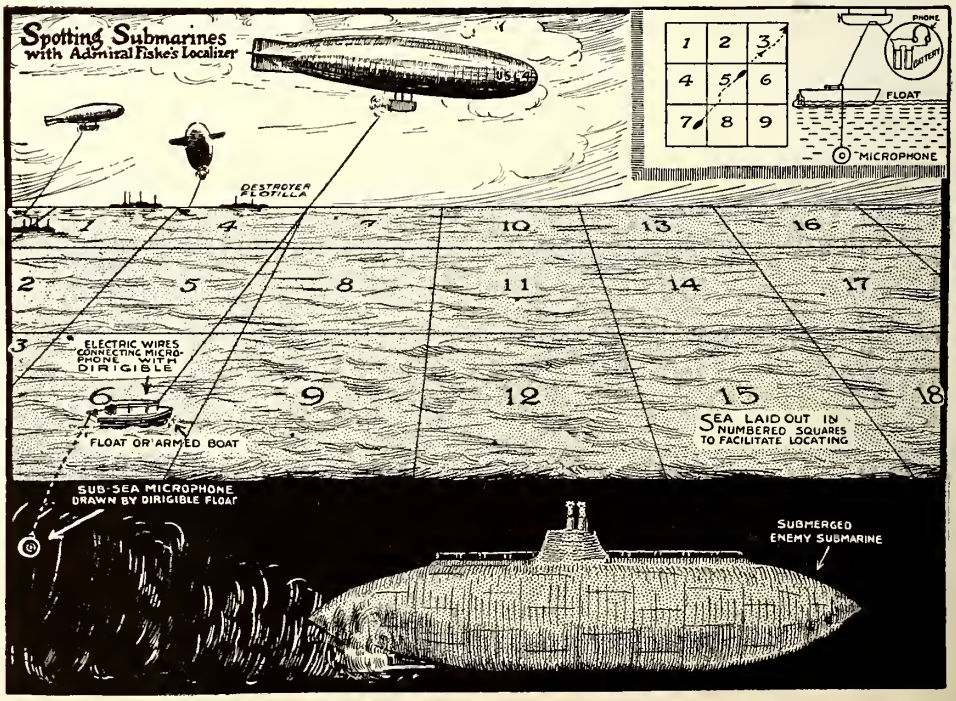
Had not hostilities ceased so suddenly these machines would have operated effectively against Kiel harbor and the German warships in their very lair. The efficacy of the weapons will be realized when their operation is explained. One of these mystery airplanes, espying its target, makes a sudden dive from the clouds, at a speed of 150 to 200 miles an hour, levels out at 50 feet above the surface, discharges a torpedo directly at the enemy ship at the right moment, after which the pilot pulls back his control stick and disappears into the clouds as suddenly as he appeared. The operation is so swift that the enemy has little if any chance of training a gun on the assailant. The "smoke cloud" produced by modern war planes is excellent for this purpose. In one of these attacks a British airman torpedoed and sank a Turkish troopship containing 3,000 troops.

When the idea was first conceived of having an airplane to carry an ordinary torpedo such as is used on the submarine, technical difficulties almost defeated the project, until an American designing firm got hard at work in conjunction with the Air Ministry. The difficulty was not so much of lifting a torpedo as of ensuring that the action of discharging the torpedo be carried out with accuracy of aim and with safety to the pilot. Experiments were carried out in the face of great difficulties and perils.

On the occasion when the initial experiment of discharging a torpedo from an airplane was made, the lightening of the airplane had such a serious effect on the latter that the wings collapsed and the pilot was hurled to sudden death. In another case when the torpedo had been discharged, it hit the water at an awkward angle, and ricocheting over the surface, rose and demolished the airplane, which had not risen out of the way. This discharging of a torpedo was no light risk when the torpedo was of full size, weighing anything up to a ton—three times the weight of the machine in which Blériot first crost the English Channel.

These wonderful planes can ascend from land or from the deck of a ship, and can descend on the sea and float until help is brought by wireless. When the German fleet surrendered, a seaplane "mothership" with 20 of these machines in its bosom met the Germans 50 miles out at sea, and had any tricks been tried, it would have been simple work for a score of "mystery airplanes" to have leapt into the air and torpedoed the major part of the enemy fleet. This mystery or "cuckoo" airplane—so

(*Continued on page* 348)



The "Fiske" Submarine Spotter. The "Sub," Once It Is Picked Up by Sound Waves Impinging on a Microphone, Is Trailed Along From Square to Square. The Aircraft Can Attack It With Depth Charges or Signal Instructions to Destroyers.

www.americanradiohistory.com

Thunderstorm Electricity

By ROGERS D. RUSK, M. A.

Late of the Meteorological Section, U. S. Army Signal Corps.

ONE hundred and fifty years ago the famous Voltaire said: "There are some great lords whom we should always approach with extreme precaution, and lightning is one of them." This is perhaps one reason why we know so little about lightning at the present time, for it certainly is not a very safe subject for close laboratory investigation. For a long time after the electrical nature of lightning was demonstrated by Benjamin Franklin, very little more of any scientific importance was discovered about it, and only today are we learning how the great charges of atmospheric electricity are generated in a thunder-storm. It is a significant fact when we think that a thunder-cloud is the most stupendous and powerful generator of electricity of which we know. A single lightning flash may carry *twenty thousand or more amperes at a pressure of millions of volts.* Moreover it is Nature's own method, the simplicity of which makes it the more wonderful, for it involves no intricate and complicated machinery. It is not too much to think that the future will sometime see Man harnessing and making use of this tremendous source of energy and bidding it do his will instead of holding it in awe, as he so long has done in the past.

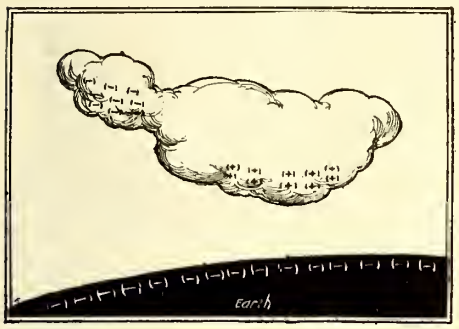


Fig. 1. Showing How a Cloud Is Charged by Electro-Static Induction. The Negative Charge on the Earth Induces an Opposite Charge in the Cloud.

During the war lightning and thunder-storms proved a serious menace to balloonists and aviators, and on this account they were made the subject of special study by the *Meteorological Section of the Signal Corps.* Their results, in connection with the latest discoveries of scientists in general, are now beginning to throw light on the long hidden mysteries of thunder-storm electricity.

In recent years many theories have been advanced to explain the cause and nature of lightning, but all of them have been more or less vague and indefinite and for the most part they have been unsatisfactory one way or another. Electricity is now recognized as being one of the important factors in the determination of weather conditions, and conversely, weather conditions are very definitely known to determine the electrical state of the atmosphere at any particular time. *Sometimes rain produces electricity, and sometimes electrical phenomena cause rain.* The place where the two, rain and electricity, are most closely related is in the thunder-storm. Here the rain drops condense primarily about small electrically charged particles called *ions,* and then again the motions of these particles cause the growth of the lightning charges in a manner to be explained more in detail.

The Physics of Thunder and Lightning Simply Explained

How Thunder-Clouds Form.

In a thunder-cloud the almost inconceivably large charges of electricity are often generated in a very short space of time, and sometimes a complete reversal of sign from *positive* to *negative,* or vice versa, may occur in a *thousandth of a second or less.* It is usually thought that lightning discharges occur from one cloud to another or from a cloud to the earth, but this is not necessarily the case. Quite frequently discharges *as long as a mile in length* will take place in the interior of a single cloud itself. For these reasons it must be explained just what a thunder-cloud is, and how it differs from other clouds which seldom carry charges of electricity of any great magnitude, or act in the capacity of electric generators.

WHAT TO DO IN A THUNDER-STORM

If you are out of doors in a very severe electrical storm, it is well to observe the following rules for your own protection:

1. Keep away from wire fences. They may carry a dangerous electrical charge long distances. Cattle in pastures are frequently killed thru the neglect of farmers to ground the wire of the fence.

2. Keep away from hedges, ponds and streams.

3. Keep away from isolated trees. Oak trees are frequently struck; beech are seldom struck. It is safe in a dense forest.

4. Keep away from herds of cattle and crowds of people.

5. Do not hold an umbrella over you.

6. It is safer to sit or lie down in an open field than to stand.

7. Drivers should dismount and not stay close to their horses.

8. Do not work with any large metal tool or implement.

If you are indoors:—

1. Keep away from the stove and chimney. The hot gases from the chimney may conduct the lightning to and down the chimney.

2. Do not take a position between two bodies of metal, as the stove and waterpipe, for example. An exception to being near metals is the case of an iron bed. One of the safest places is on a mattress in an iron bed, provided you do NOT touch the metal. The metal surrounding you makes a safe cage, which will prevent the lightning from reaching a person inside.

3. Do not stand on a wet floor nor draw water from the well or faucet.

4. Do not stand directly under a chandelier, near a radiator, nor on a register.

5. Do not use the telephone in suburban districts. In cities there is practically no danger, as the wires are placed underground.

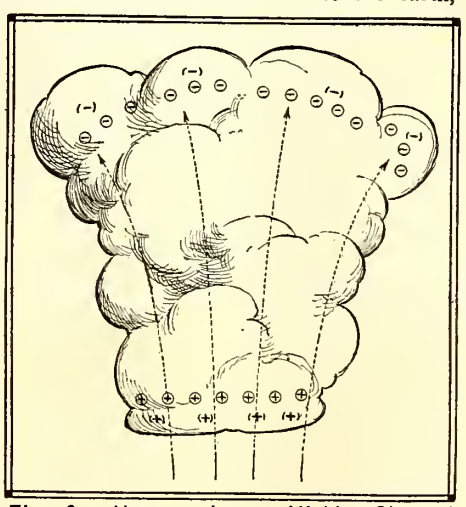


Fig. 3. How a Large Highly Charged Thunder-Cloud Forms by a Continual Shifting of the Oppositely Charged Particles Composing It. The Negative Charges Tend to Move Toward the Top, and the Positive Charges Toward the Bottom of the Cloud.

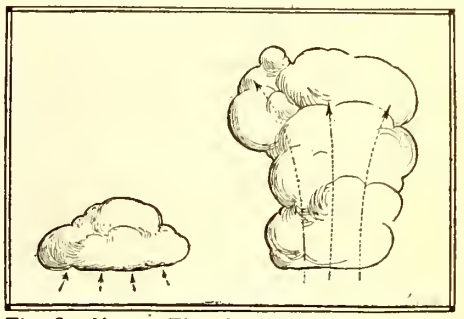


Fig. 2. How a Thunder-Cloud Grows. The Larger Cloud Is the Result of Intense Local Heating and a Strong Up-Rushing Current of Air. Its Height May Be a Mile or More from Base to Top. The Smaller Cloud May Measure Only a Few Hundred Feet in Height.

Everyone is familiar with the huge rolling, billowy clouds (cumulis) so common on a warm day, but not everyone knows how they are formed. In reality each cloud represents a column of heated air which has risen by convection from the earth's surface, due to the heating effect of the sun, and has carried moisture up with it. When the top of this column has risen to such a height that it begins to cool, and the moisture to condense, the cloud is formed. This may seem unimportant but in reality it is the beginning from which a thunder-storm may develop, if conditions are just right. As moisture in the air does not condense in the form of drops unless there are dust particles or electrically charged particles (ions) in the air to act as centers of condensation, the cloud may already have received a charge from these ions, providing there was a majority of ions of one sign present.

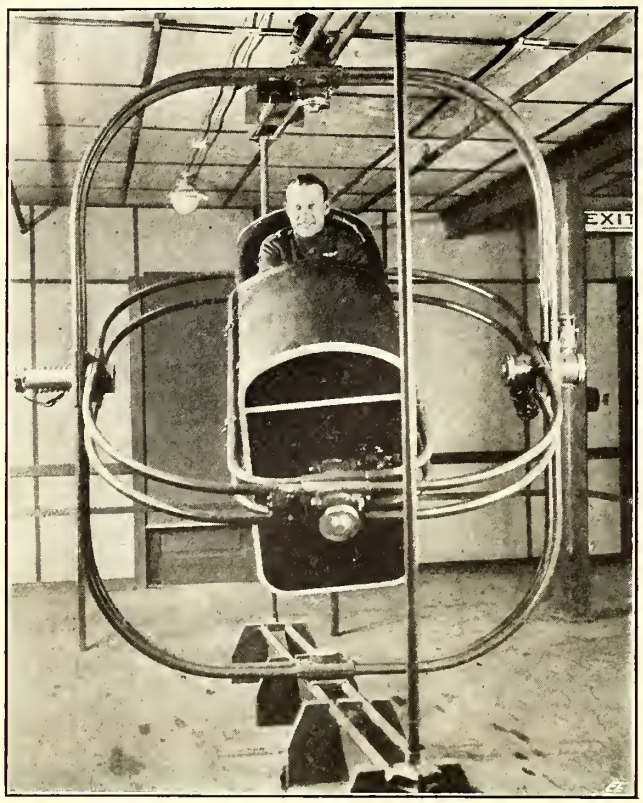
How Clouds Receive Charge.

A cloud may also become charged by *induction.* If a cloud which has approached the earth as shown in Fig. 1, is of a form which may divide into two parts, the charge of the opposite sign which has been attracted to that portion nearest the earth may be carried away by it at the time of division, and the other portion of the cloud may carry away a charge of the same sign as the earth. Neither of these two ways in which a cloud may become charged, explains however the production of the enormous charges which are present in a thunder-cloud. These are produced in another way, due to the forces at work when a thunder-cloud is formed.

If the heating is intense and there is much moisture present, when the billowy clouds mentioned above are formed, the result is a thunder-cloud. The process is shown in Fig. 2, where the smaller cloud is the common type visible on most any warm summer day. The larger cloud is the result of intense local heating and a strong up-rushing current of air, and its height may be a *mile or more from base to top,* while the smaller type may be *only a few hundred feet in height.* The bulging tops of the larger clouds are the common-

(*Continued on page* 376)

www.americanradiohistory.com





Above:—The Meissner "Airfone" for Talking Between Pilot and Observer. It Amplifies as Well as Localizes the Speech Waves. At Left:—The Ruggles "Orientator". It Is Electrically Operated and Gives All the Thrills of Real Flying.

"Ground Flying" for Aviators

This machine is used to familiarize the student aviator with the various loops, turns, cuts and dives that every flier must know. One can loop the loop, take a nose dive, make a tail spin and execute the "falling leaf" by simply operating the various electric controls. The invention is now being used with greatest success by the young army officers learning the elements of the flying art at the Army's flying school at Washington, D. C. The Orientator may be controlled by a switch-board at the side but on the floor, so that when desired the instructor may put the student thru various flying maneuvers at unexpected moments.

How Pilot and Observer Talk

The airfone is a form of speaking tube designed especially for service as inter-communication device between pilot and observer, instructor and student, or any airplane occupants, during full power flight. It consists essentially of a flexible speaking tube provided with a mouthpiece and a neck band, and of a helmet to which two earpieces are attached, suitable connections between the speaking tube and the earpieces being provided. For two-way conversation, two such head gears and tubes are used. Its present design is based on a very close and detailed study of aircraft noise conditions and in the application of acoustics.

Electric Brush Contains Dynamo

We are all more or less familiar with the various faradic electric appliances such as massage rollers, brushes, et cetera, which can be used in connection with medical coils and the like, but one of the most interesting and withal extremely efficient electric devices recently brought out is the Electro-dynamo Brush shown in the accompanying illustrations. It is claimed for this brush that it will rejuvenate the hair, and the makers cite the testimony of experts that it will in many instances help the scalp and also aid in the treatment of a great many ailments. In treating other parts of the body than the scalp, use is made of a flexible conductor and various electrodes which can be quickly attached to the brush. No batteries are required and a powerful current is generated as soon as the projecting finger lever is gently prest. This brush was tested by one of the leading New York electrical testing laboratories, and their report states that it develops an average potential of about 50 volts, and a peak value of from 100 to 200 volts. It is therefore impossible to receive an injurious shock from this unique device.



Young Lady Using the Newest Electric Hair Brush. On the Back of This Brush Is Mounted a Tiny Dynamo Operated by Pushing the Trigger.

A New York physician, Dr. H. J. Lowbringer, expresses his opinion on the electric brush as follows: "This little dynamo is therefore more than a scientific curiosity, because it generates currents of very high voltage with an amperage of infinitesimally low strength; consequently the results of application are similar to one of high frequency current, and thoroly superior to the ordinary faradic battery or the galvanic current, in instances where either diathermic or catalytic results are intended." With this electric brush and the attachments furnished with it, it is possible to give an excellent face massage, the current passing thru the hand of the massager. Also electric foot baths may be taken, or the current, in fact, past thru any part of the body, such as in the treatment of rheumatism, nerve disorders, etc. There is nothing in the device to wear out. The strength of the current may be varied by a regulator on the back of the brush, and it is also controlled by the rapidity with which the finger lever is prest and released. The device is well built.

Application to the Scalp With This Electric Hair Brush Is Said to Revitalize the Hair Roots and Tone up the System.

www.americanradiohistory.com

Inside of a U-Boat

Details of Machinery Found in the Surrendered U-Boats

OWING to the extent and the manner in which it was used by the Germans to attack commerce, the submarine emerged from the war a rather discredited weapon. This is not to say that it was discounted as a legitimate fighting instrument, and the question is being discust in Allied naval circles as to whether, and to what degree, the type will be included in the plans of naval constructors for the fleets of the future.

An answer to the question has its importance because of the possibility of the peace conference being asked to consider the desirability of abolishing submarines altogether. Even if the conference did not touch the matter, it was expected to be one of the first plans for the general reduction of armaments which, in accordance with schedule 111 of the League of Nations covenant, the council would suggest to the member states concerned.

Professional opinion, in all the nations engaged in the war on the side of the Allies, so far as it is confined to the men concerned in the actual fighting, inclines to the view that the submarine was beaten. There have been clear expressions on this point in Britain, America, France, Italy and Japan. Admiral Sims, for instance, declares that 205 U-boats were sunk by the Allies during the war. Altho this was not known until information had been obtained from German sources after the surrender. He also says that the grand fleet, when cruising in the North Sea, was surrounded by a screen of destroyers so intimately placed that it would have been suicidal for any submarine to attempt to penetrate it.

When such a screen was out, a submarine had to go down and stay down on penalty of being "depth-charged."

Altho the German high command to the end profest faith in the submarine war on merchantmen, Captain Persius has declared since the armistice that this faith was built up on "lies" spread about by the naval chiefs, as to the powers of the U-boats.

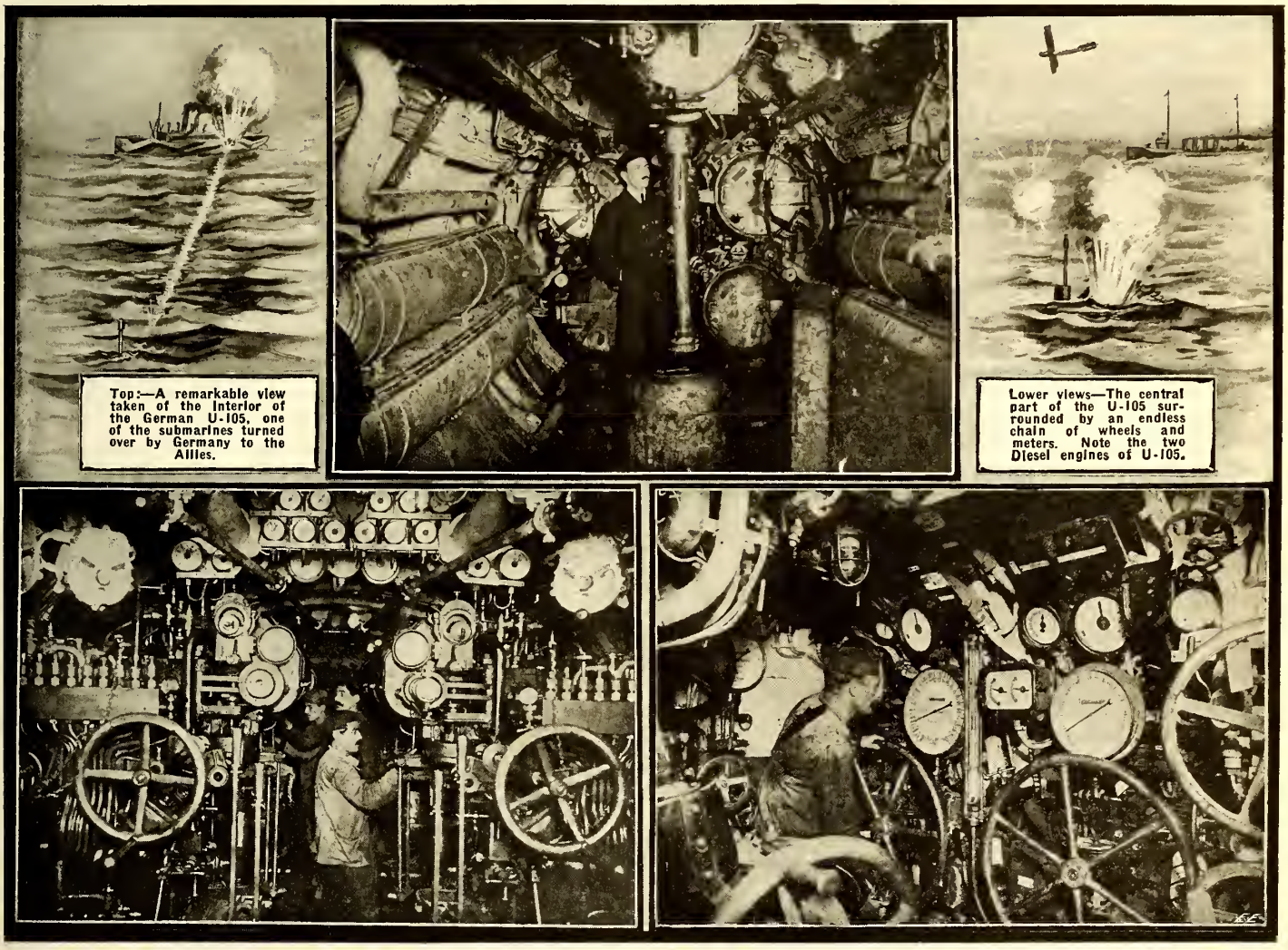
Submarines Have Advantages, Say Naval Experts.

On the other hand a significant indication of the utility of submarines for scouting duty has been afforded by Lord Jellicoe's recent book. He shows therein that not until June, 1916, was it possible to maintain a regular submarine patrol off the Horn reef (Denmark), by two or three submarines. By that time, the range of wireless equipment in the British submarines had been increased from 50 miles to 300-400 miles. "It was a vital matter," says the commander-in-chief, "to install efficient wireless apparatus in the only class of vessel that could carry out a watching patrol in the vicinity of German bases."

While, therefore, there are many strong reasons for desiring the abandonment of submarines as they were used by the Germans, yet equally strong is the professional opinion that under-water craft have not been rendered entirely useless by the inventions directed against them in the war, and that in any case they form a necessary adjunct to any complete naval organization of the future.

What the inside of a German U-boat looked like was a complete mystery to the layman until quite recently when several of the Ex-Kaiser's *unterseeboote* "visited" this country under the guidance of American crews. These sub-sea craft were piloted 3,000 miles across the Atlantic to aid in putting over the Fifth Liberty Loan. The first captured U-boat to reach these waters, flying the American flag, was the U-111. A few days later the mother ship "Bushnell" arrived at New York with several other

(*Continued on page* 359)



Top:—A remarkable view taken of the interior of the German U-105, one of the submarines turned over by Germany to the Allies.

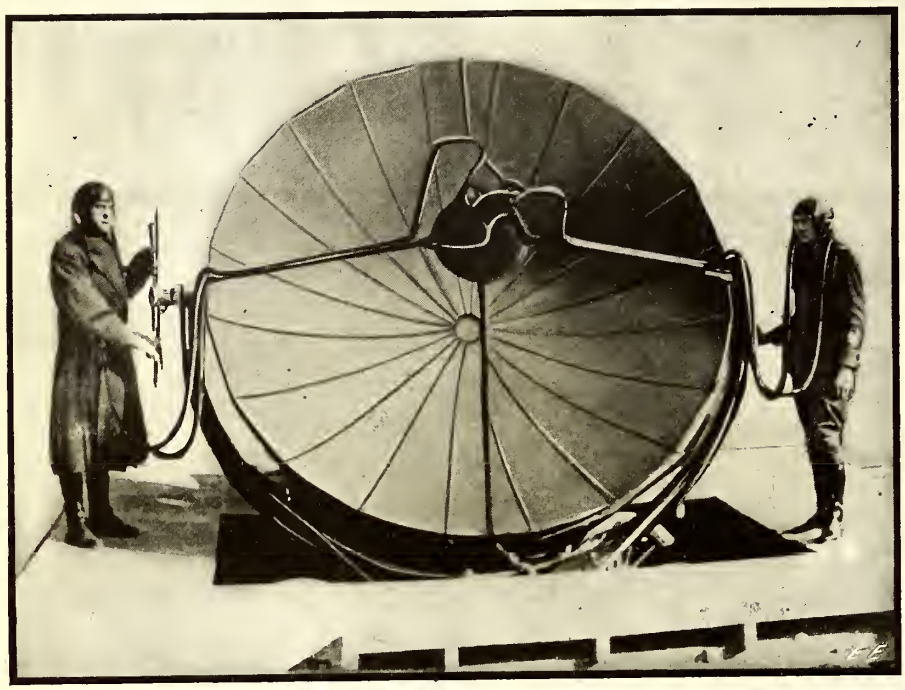
Lower views—The central part of the U-105 surrounded by an endless chain of wheels and meters. Note the two Diesel engines of U-105.

Photos © by Underwood & Underwood

www.americanradiohistory.com

Locating Airplanes in Night Fighting

THE photograph herewith of the large Paraboloid reflector with two soldiers standing at either side, and equipt with special head phones, which are connected with the sound detecting apparatus mounted in the central focus of the reflector, is employed for locating the direction of approaching hostile aircraft at night. The reflector is balanced and pivoted so that it can be rapidly swung to any angle desired. When the approximate location of the approaching aircraft is determined by means of this sound wave catcher, then powerful searchlights are suddenly flashed on, and their beams pointed in the direction previously indicated by the sound detector. The range of this sound detector, owing to its efficient design, is said to be about 3½ times that of the unaided ear. It is extremely light and portable, and can be rapidly transported to any place desired.



Here Is the "Paraboloid"—the Clever Sound Focusing and Detecting Device Used by the Allied Armies in Locating Enemy Aircraft While They Were Yet Several Miles Away. The Sound of the Airplane Engine Carried Far, and by Carefully Focusing the Collected Sounds and Concentrating Them onto a Sensitive Microphone, the Trick was Done.

Five-Foot Searchlight Added to Terror of Night Fighting.

The accompanying photograph illustrates one of the remarkably light, yet extremely powerful, electric searchlights developed for use in the war. Searchlights of this type were built by the thousand by all of the leading powers, and both sides used them for various purposes, including night battles, the discovery of hostile aircraft, trailing the movements of enemy troops and freight trains, and automobile freight lines.

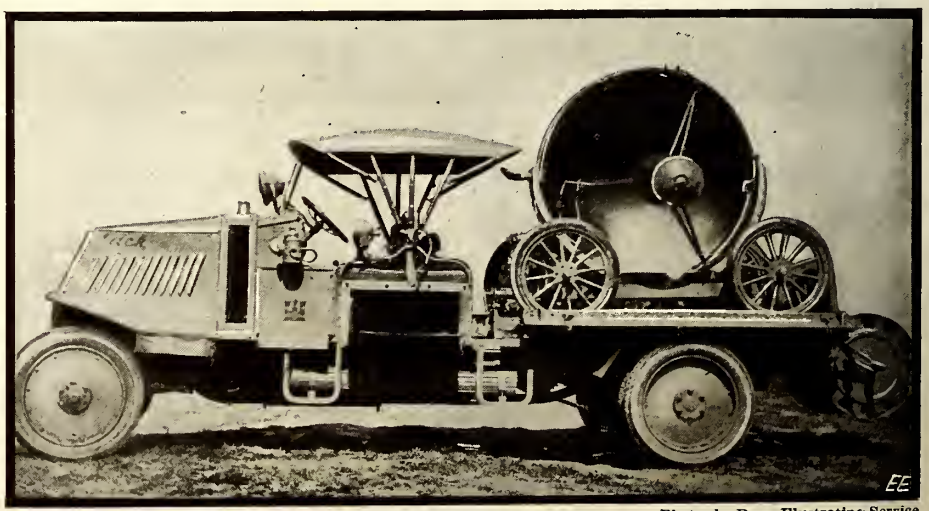
The searchlight here shown requires about 15 K. W. or 20 H. P. to light it to full brilliancy, and its powerful light will carry from 10 to 15 miles easily. The searchlights that we are usually accustomed to seeing on vessels and in the neighborhood of forts are usually cumbersome affairs, but the exigencies of wartime, where such vast amounts of paraphernalia had to be hauled over by train, horse, or auto-truck, called for the very lightest weight in all such apparatus as these, where there was no real necessity for making such an apparatus of great weight, as is the case with many pieces of machinery, such as guns, dynamos, motors, gasoline engines, et cetera. The searchlight is mounted on light wheels, similar to small auto wheels, fitted with rubber tires. It can be hauled to any desired spot in a short time.

During the period of the war, many novel and startling inventions have come to the fore, especially means for locating hostile airplanes and dirigibles. The majority of these operate on the simple sound wave principle, the waves being transmitted thru the medium of the air from the propellers of the hostile aircraft. Some of these devices have been made in the form of large tubes, provided with a simple microphone method of detection, but they were rather unwieldy, and to a certain extent never gave full satisfaction, due to the fact that too great a dependence was placed on the amplifying of the hum of the airplane engine by means of microphones alone. This new form of locater—the Paraboloid—has several novel improvements over previous apparatus of this type, one of the best features being that it can readily detect the hostile aircraft at great distances, especially valuable when the enemy tries to make a surprise attack at night.

Spotting the Enemy.

Imagine a peaceful village, such as are numerous in the sparsely settled sections on the coast of England, seemingly defenseless. Yet there seems to be an air of mystery about some of these places—and there is, for thru underhand means, the enemy "spies" learn that secret research work is being carried on in this unassuming little hamlet. It would be suicide upon the part of these "spies" to personally attempt to carry out any large exploitation or even to think of attempting to blow up the place with any hope of success. The nearest recourse that they could have would be to get in touch with a squadron of enemy planes, and notify them where these operations are taking place. On a dark night, these enemy planes issue forth and swoop down, like a nest of hornets, upon this defenseless little village. But one thing they have overlooked. Altho they have come unheralded, it is true, the watchful *electrical eyes and ears* of the engineer corps are prepared for any such surprise, thanks to the fact that they have this marvelous invention on hand, whereby it is possible, no matter how dark the night, to quickly and positively locate the approach of enemy aircraft. To their sensitive ears comes the hum of the engines. Word is flashed to every little town, fort and hamlet within the vicinity, and especially planned advance action is arranged. Ere the fliers have reached their destination, the heavens are being explored by gigantic searchlights for the enemy marauders. Trained gunners, using the very latest types of anti-aircraft guns, are soon popping away at the enemy, and what was hoped to be a great surprise and success on the part of the enemy, turns out to be one grand fizzle, much to his discomfiture.

These powerful searchlights, besides being available for enemy spotting, are also much used as a means of signaling. This is one branch of the signal corps work which has proven one of the big factors in helping to win the war. Searchlights of this type mounted on warships helped to protect the American sea coasts.



Photos by Press Illustrating Service

Gigantic Electric Searchlights of the Portable Type Were Used to Expose the Enemy Flier as Soon as the "Paraboloid" Had Succeeded in Spotting Him. The Anti-Aircraft Guns Then "Saluted" Him—and the Allied Planes Finished the Rest.

www.americanradiohistory.com

Jeweled Portal Welcomes N. Y. Fighters

NEW YORKERS, who openly boast "there is nothing new under the sun," had an agreeable surprise in the "jeweled portal" of electric lights erected in Fifth Avenue at Sixtieth Street, on the occasion of the grand review of the Twenty-seventh Division returning warriors. It was designed and erected under the direction of Walter D'A. Ryan, lighting expert.

So magnificent was the illuminated arch that it drew forth the unstinted praise and commendation of everyone who saw it. Frank L. Dowling, President of the Borough of Manhattan, when he first saw the beautiful spectacle, exclaimed: "Like the entrance to Heaven!" And no better description could be given of this handsome testimonial to the bravery, sacrifices and triumph of the sons of the Empire state. The details of the "portal" were worked out by Captain J. W. Gosling, under the direction of Mr. Ryan, who was chief of the department of illumination of the Panama-Pacific International Exposition which took place in San Francisco in 1915, and the success of which became one of the wonders of the world.

Mr. Ryan carried the same style of decoration here as was used at the Panama-Pacific Exposition. The same jewels, to the number of 31,000, were used in this jeweled portal as were used at the Panama exposition. This is really the first time the people of New York had an opportunity to see something that was really new, and it was the second time these jewels were used, the same ones that hung on the tower at San Francisco for one year.

The "Jeweled Portal" is really a gigantic curtain of jewels draped between two obelisk forms, and spans the street at a height of twenty-five feet at its lowest point, and fifty feet at its highest.

The architecture is simple, bold Roman, and is the kind of thing which might have been built on a street in Rome on the return of their victorious legions, but instead of painted and embroidered banners the modern jewels have been substituted and the whole portal has been given a most modern touch by bringing out upon it the delicate flashings of thousands of points of true light, not the color of pigment but the pure colors of the spectrum, the colors only seen in the rainbow, a bubble or in the sky at dawn or sunset, by illuminating it with arc projectors.

The obelisks stand at either side of the roadway and arc flanked by Roman altars, each of which is twenty-six feet high. The jeweled curtain is draped from altar to obelisk across the avenue and down to the

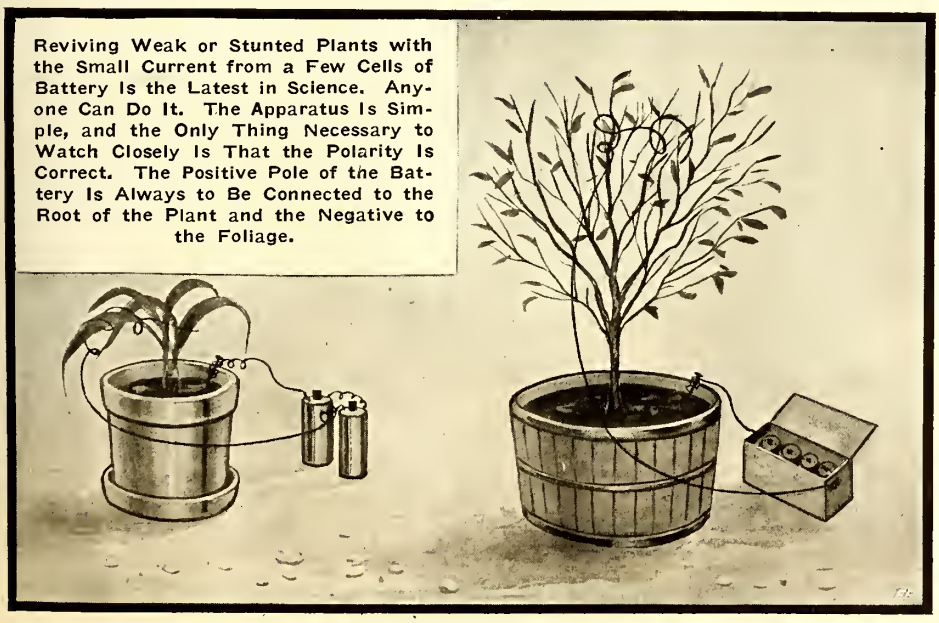
(*Continued on page* 377)



One of the Most Handsome and Bewitching Electrical Decorations New York Presented to Its Home-Coming Troops. The "Jeweled Portal"—a Mass of Shimmering Cut-Glass Jewels, Illumined by Reflected Spot Lights.

Reviving Plants With Electricity

The accompanying illustration shows a clever scheme devised by a Connecticut flower grower for reviving almost lifeless plants, by the application of low-voltage direct current, such as that supplied from a dry or other battery. One of the experiments was tried on a small cactus plant which had been sent from Mexico, and which seemed to pine away rapidly. The cactus was about dead when the experiment of applying electric current was first tried. Two cells of dry battery were connected up with some fine copper wire, the positive pole being connected to a nail placed in the soil of the flower pot, while the negative pole was secured delicately around the upper branch. The cactus brightened up very sprightly after one week of this treatment, and in two weeks it was plump, green, and growing nicely. Further experiments were tried on a rose bush and a fuchsia with good results, care being taken to see that the positive wire from the battery is applied to the root of the plant and the negative pole to the foliage, so as to promote the flow of sap upward.



Reviving Weak or Stunted Plants with the Small Current from a Few Cells of Battery Is the Latest in Science. Anyone Can Do It. The Apparatus Is Simple, and the Only Thing Necessary to Watch Closely Is That the Polarity Is Correct. The Positive Pole of the Battery Is Always to Be Connected to the Root of the Plant and the Negative to the Foliage.

It may be thought at first that the battery would soon be exhausted, but the resistance of the plant is of considerable value, so that the flow of current is but a small fraction of the ampere, and the cells will thus give quite a lengthy treatment before being entirely exhausted. Those having access to a storage battery will find it very useful for the purpose. The current in this case should be regulated by means of a small rheostat, such as the rotary, porcelain base 10-ohm rheostats available on the market. Several other interesting experiments were tried by the Connecticut florist, notably on a small plum tree, which was electrically treated with 6 cells, with the result that it blossomed out fully, several days ahead of the other adjacent trees. Another experiment was that conducted on an ever-bearing strawberry plant, which was treated with 2 dry cells. This plant was left in the same row with other berry plants, and its increased size and fruit production was very striking.

www.americanradiohistory.com

Popular Astronomy

By ISABEL M. LEWIS
Of the U. S. Naval Observatory

The Nature of Comets

COMETS, along with shooting stars and meteors, are to be clast as part of the debris of the solar system. According to prevailing theories they may have been originally tenuous outer portions of the primitive solar nebula that escaped being swept up by the nuclei of the planets and their moons owing to the fact that they did not share in the general rotation of the system, or they may, possibly, have been the lighter gases ejected from one or the other of two closely approaching suns that furnished, by the disintegration resulting from their close approach, the material wherefrom our present solar system was formed.

The orbits of comets are inclined at all angles to each other and to the orbits of the planets which, on the other hand, lie very nearly in the same plane.

The larger members of the sun's family, the planets and their satelites, revolve from *west* to *east* around the sun. Comets on the contrary frequently *retrograde* or back around the sun in the opposite direction, from east to west.

The paths that these erratic visitors follow in their journeys around the sun bear not the slightest resemblance to the paths of the planets, which are almost perfect circles. The cometary orbits are ellipses of such high eccentricity that it is customary in computing a preliminary orbit of a comet to assume that its eccentricity is unity, *i.e.*, that it is travelling in a parabola. If the eccentricity is less than unity the orbit is a closed curve or ellipse, and if it is greater than unity the orbit is an hyperbola. In the latter case the comet would make one and only one visit to the sun, coming from interstellar space and returning thereto after a brief sojourn within our solar system. Since no cometary orbit has ever been found to be hyperbolic in form it has been assumed that the eccentricity of the orbit is less than unity in all cases and that the comets are all travelling in elliptical orbits and therefore are permanent members of the solar system. The nearer the eccentricity of the orbit of a comet approaches to unity the greater is the path described and the less frequent the comets return to the sun. Since it is very unlikely that the eccentricity of an orbit is exactly unity there are probably no comets that have parabolic orbits tho, for the preliminary computation of the orbit of a newly discovered comet the unknown eccentricity is assumed to be unity. This is generally a safe assumption for the majority of all comets travel in ellipses whose eccentricities approach closely to unity and their periods of revolution around the sun consequently run into the hundreds or thousands or even hundreds of thousands of years. A wonderful study, indeed.



Giacobini's Comet, December 29, 1915, Photographed with 10" Bruce Telescope, Yerkes Observatory, by E. E. Barnard. Note the Unique Sharply Defined Tail With Convex Edges. The White Dashes Are Stars Leaving a White Trail on the Photographic Plate as the Telescope Followed the Comet During Its Exposure of Several Hours.

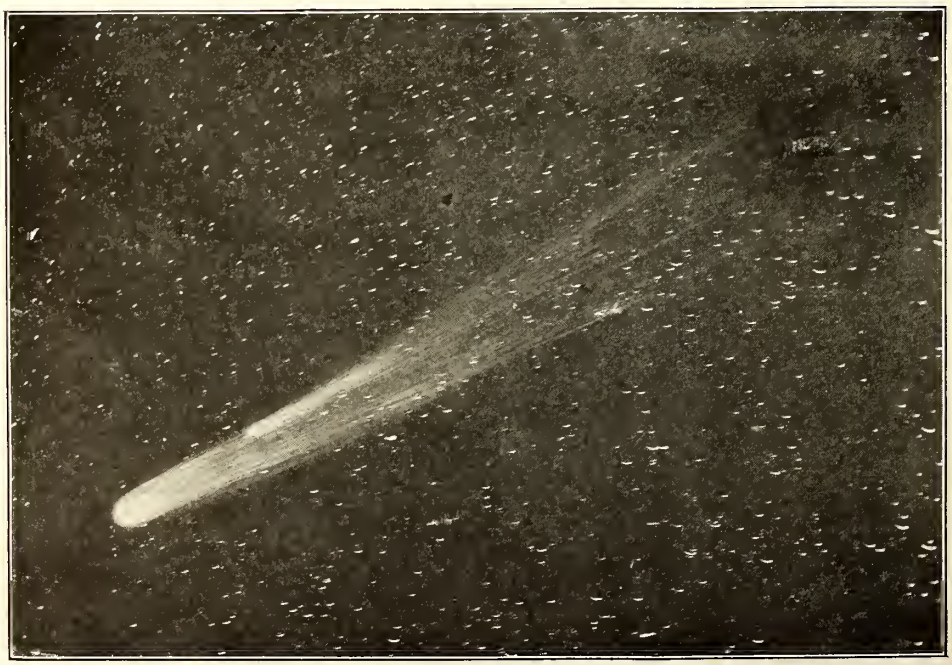
Donati's comet of 1858, one of the greatest comets of the nineteenth century, had a period of more than two thousand years and its aphelion (the point in its orbit farthest away from the sun) was five times more distant than the orbit of Neptune.

There is, however, a class of comets known as *periodic* comets that are characterized by extremely short periods of revolution around the sun. To this class belongs Halley's comet whose period of seventy-five years exceeds that of any other periodic comet. Encke's comet, on the other hand, has a period of three and a third years which is the shortest cometary period known. Most of the periodic comets are inconspicuous and only visible telescopically even when comparatively near to the earth. Halley's comet is the only one of this class that lays any pretensions to remarkable size or brilliancy and it also is showing the effects of disintegration resulting from too frequent visits to the sun.

Comets are bodies of *great bulk* or volume and *small total mass.* Their tails, which only develop in the vicinity of the sun, are formed of the rarest gases and the best vacuum that man can produce would not be in as tenuous a state as the material existing in the tails of comets. There are many proofs of the extreme tenuity of comets. The earth has on a number of occasions past directly thru the tails of comets without experiencing the slightest visible effects. Stars shine undimmed in lustre even thru the heads of comets. If the earth should encounter a comet "head on" it is doubtful if it would experience anything more serious than a shower of meteors which would be consumed by friction with the earth's atmosphere. It is possible, however, that matter in the nucleus, the star-like condensation in the head of a comet, may consist of individual particles weighing in some instances a number of tons surrounded by a gaseous envelope and held together by the loose bonds of their mutual attraction.

Since the total mass of a comet is so small a close approach to one of the planets, especially Jupiter, produces great changes in the form of the comet's orbit tho the motion of the planet is not disturbed in the slightest degree by the encounter.

The majority of all the periodic comets have been "captured" by Jupiter, that is, the original orbits have been so changed by the perturbations produced by close approaches to the giant planet that their aphelia lie in the vicinity of Jupiter's orbit. Several of the other planets have also "captured" comets in this sense, and the fact that the aphelia of a number of comets are grouped at certain definite intervals beyond the orbit of Neptune has been considered by some astronomers to be an indication that there are two or more additional planets in the solar system revolving around the sun at these distances.



Halley's Comet, June 6, 1910, Photographed at the Yerkes Observatory by E. E. Barnard, Taken With 10" Bruce Telescope, Exposure Two Hours. The Most Remarkable Part About This Comet Is That It Disintegrated. Photograph Shows Upper Part Leaving Main Section

The most interesting feature of a comet is its characteristic tail which develops and increases in size and brilliancy as the comet approaches the sun. As the tail is always turned away from the sun it follows the comet as it draws near the sun and precedes as it departs. Its origin is due, it is believed, both to electrical repulsion and *light pressure* acting upon minute particles of matter in the coma or head of the comet.

It is believed that the curvature of the tail depends upon

www.americanradiohistory.com

the nature of the gases of which it is composed.

Long, straight tails consist chiefly of hydrogen, it has been found, curved tails of hydrocarbons and short, bushy tails of mixtures of iron, sodium and other metallic vapors. At times the same comet will have two or more tails of different types.

Since the material driven off from the nucleus or head of a comet by electrical repulsion and light pressure is never recovered, it is evident that comets are continually disintegrating. Also, comets that have past close to the sun at perihelion passage have frequently been so disrupted by tidal forces that one nucleus has separated into several parts and the newly formed nuclei have pursued paths parallel to the original orbit, each nucleus developing a tail of its own.

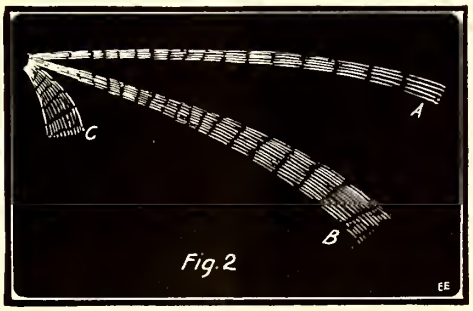


Daniel's Comet, August 6, 1907, Photograph Yerkes Observatory by E. E. Barnard. This Photograph Shows the Full Length of Tail About 12°, Taken With 3" Lens.

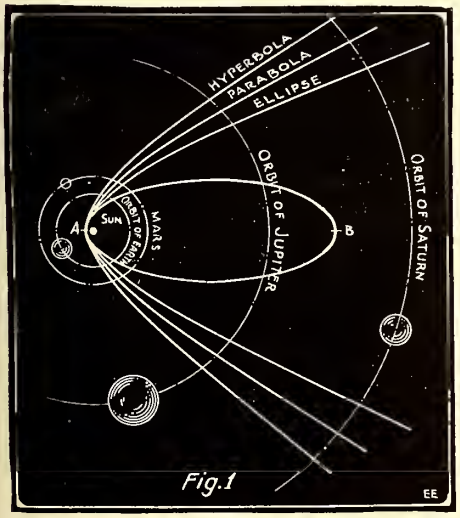
Many periodic comets, it is now known, have gradually been broken up and dissipated into periodic swarms of meteors as a result of the disruptive effect produced by too frequent returns to the vicinity of the sun.

The luminosity of comets is due not only to reflected sunlight, but to certain unknown causes that produce sudden and erratic increases or decreases of brilliancy. The causes of these sudden changes in luminosity are unknown, possibly electrical discharges or chance collisions between fragments of considerable size may account for some of these sudden flashes of brilliancy.

The peculiar behavior of the tails of comets at certain times has frequently been noted and suggests the existence of quantities of finely-divided meteoric or gaseous matter within the solar system that have no appreciable effect upon the huge planetary masses, but offer sensible resistance to the passage of the tenuous gases of which the tails of comets are composed. The fact that the earth daily encounters meteoric dust, meteorites and fire balls also indicates that meteoric matter exists in considerable quantities within our solar system. Tails of comets appear at times to be twisted or brushed aside as if they had encountered some unknown force or some resisting medium.



Different Types of Tails of Comets. A—Hydrogen; B—Hydrocarbon Gas; C—Iron and Other Metallic Vapors. The Majority of the Tails of Comets Belong to Type B and Are Therefore Chiefly Composed of Hydrocarbons.



This Diagram Shows a Typical Cometary Orbit of Short Period. A Marks the Perihellon, or Closest Approach to the Sun, and B the Aphelion, or Point Most Distant From the Sun. The Great Difficulty of Determining Whether a Comet of Long Period Is Moving in an Ellipse, Parabola or Hyperbola Is Evident When One Considers How Closely the Three Curves Coincide in the Vicinity of the Sun.

Up to the present time several hundred comets have been discovered. Nearly three-fourths of this number travel in orbits that are sensibly parabolic with eccentricities approaching closely to unity. Of the remaining number there are about forty that have been "captured" by the major planets, Jupiter, Saturn, Uranus and Neptune, tho Jupiter possesses the lion's share of these captured comets. Scarcely a year passes by that several comets are not discovered. Most of these are telescopic, however, even when they are near the sun and at their greatest brilliancy. Naked-eye comets of great splendor and brilliancy are comparatively rare and there has been a particular dearth of such unusual comets during the past thirty years or so.

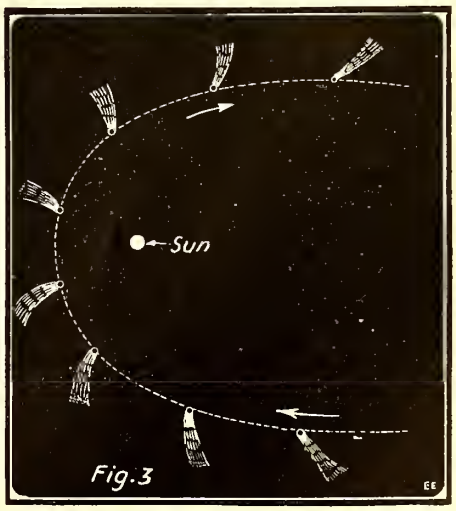
The last spectacular comet, unless we make an exception of Halley's comet, which made its return according to prediction in 1910, was the great comet of 1882 which was visible in broad daylight close to the sun and at its perihelion passage swept thru the solar corona with a velocity that exceeded two hundred and fifty miles a second and carried it thru one hundred and eighty degrees of its orbit in less than three hours.

Some comets approach much closer to the sun than others. The majority of all comets observed have come within the earth's orbit and no known comet has its perihelion distance beyond the orbit of Jupiter. It is, of course, possible that there may be a number of comets that never come within the orbit of Jupiter, but it is very unlikely that any such comet would ever be discovered. The majority of comets are simply small, fuzzy points of light that are only visible telescopically and the greater the perihelion distance of the comet the less likely is it to be seen with the naked eye.

Since comets as well as planets obey Kepler's first law, known as the law of areas, and sweep over equal areas in equal times it is evident that when a comet is at perihelion or nearest to the sun it is moving at maximum speed and when it is at aphelion or farthest from the sun it is moving at minimum speed. Moreover, its speed at these two points in its orbit varies tremendously since the orbits of comets are ellipses of very high eccentricity. The speed with which the planets are travelling is, on the other hand, remarkably uniform since their orbits are nearly circular.

The leisurely speed with which a comet travels thru the frigid outer regions of the solar system is gradually accelerated as the comet draws nearer and nearer to the sun until it has acquired near the time of perihelion passage a velocity that occasionally exceeds two hundred miles a second. Here, also, the great increase in light and heat and the strong magnetic field of the sun produce complex changes in the gaseous and meteoric substances of which the comet is composed until the character-

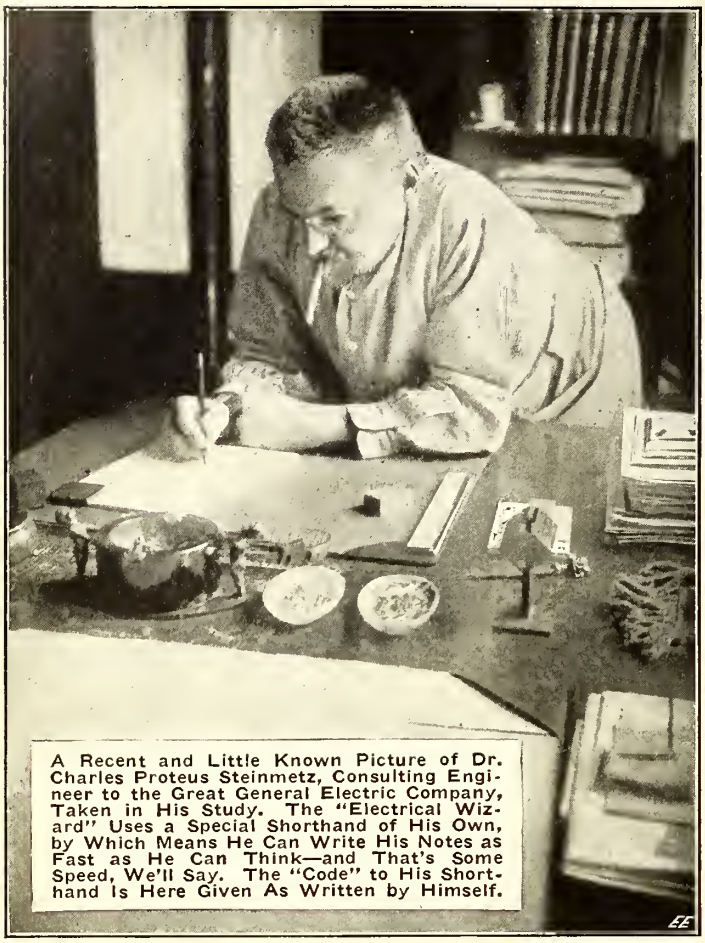
(*Continued on page* 350)



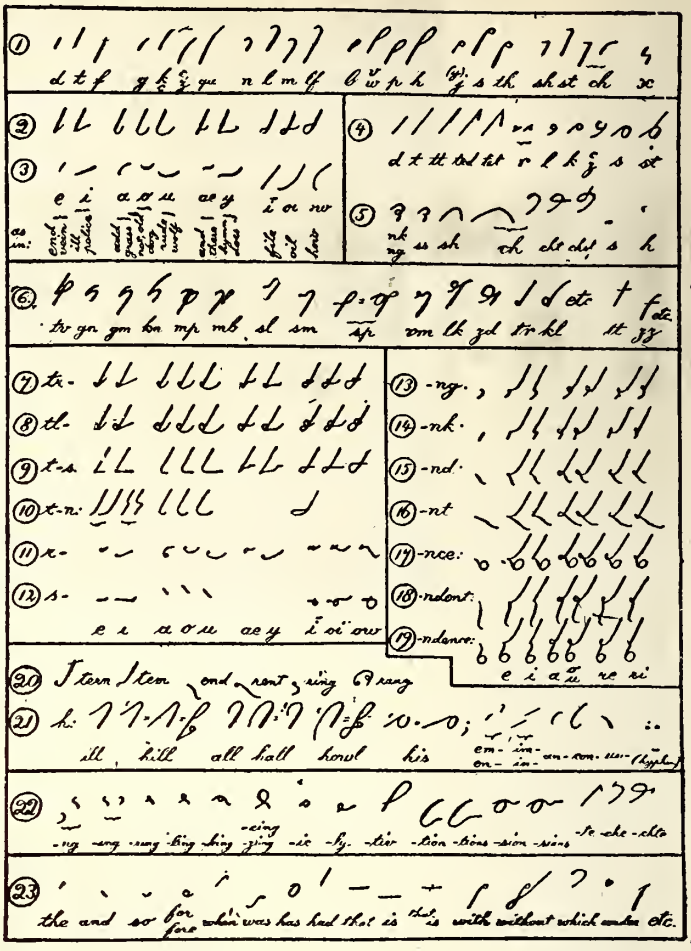
How a Comet Behaves at Perihelion (Closest Approach to Sun). The Tail of a Comet Is Invariably Directed Away From the Sun, No Matter What Its Position in the Heavens.

www.americanradiohistory.com

Steinmetz's Own Shorthand



A Recent and Little Known Picture of Dr. Charles Proteus Steinmetz, Consulting Engineer to the Great General Electric Company, Taken in His Study. The "Electrical Wizard" Uses a Special Shorthand of His Own, by Which Means He Can Write His Notes as Fast as He Can Think—and That's Some Speed, We'll Say. The "Code" to His Shorthand Is Here Given As Written by Himself.



Can you write as fast as you can think? If you cannot, then your efficiency is impaired; and the difficulty of putting down your thoughts at the proper speed constitutes a real stumbling block in your onward march toward your goal.

Dr. Steinmetz, one of the greatest authorities on matters electrical that the world has known, and who is an author of many volumes of useful knowledge which he has given to the scientific world, possesses no "neck in the bottle" when it comes to jotting down the results of his researches in his wonderful laboratory at Schenectady. In a recent interview upon this subject he said:

"With this shorthand I can write as fast as I can think. The only other way in which I could put down my thoughts as fast as I could think would be to dictate to a phonograph, but I have not always a phonograph with me.

"I learned this shorthand while I was in high school in Europe, and took all of my notes while in college in shorthand. All of these notes I have preserved and had bound, and I can read them as well after thirty-five years as I could thirty-five minutes after taking the notes down.

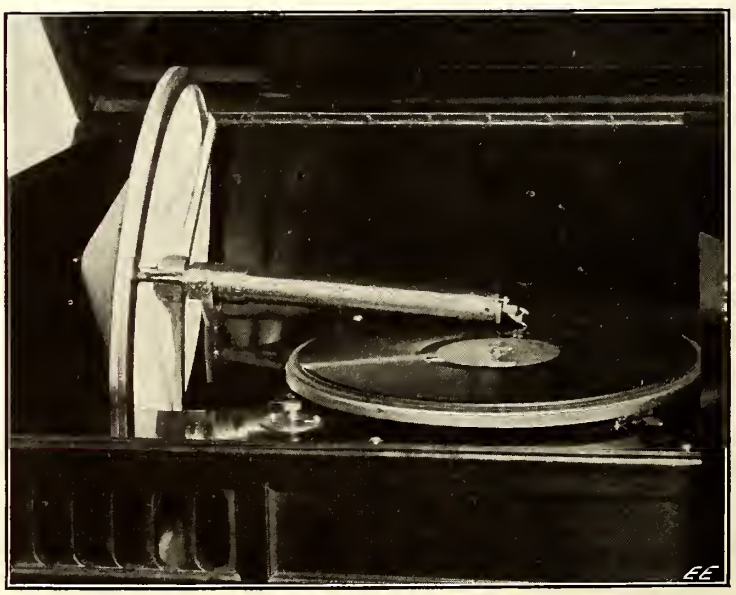
(*Continued on page 373*)

A Hornless Phonograph

This talking machine eliminates the usual tone-arm, sound-box, and horn. Instead of these we have a large cone-shaped diafram of parchment fitted into a large circular aluminum frame. The center of the diafram is connected by a wire, under tension, with the needle holder. The sound as it comes from the record sets up vibration in the wire, and the vibrations are released in the form of recognizable sound directly from the diafram. The volume of sound is controlled by a special attachment on the arm protecting the wire, for those who desire this method, but is more readily controlled by the opening and closing of the doors of the cabinet. There are two doors in front, each of which may be closed separately, and a large door on the side which also gives control to the tonal volume.

The circular frame holding the diafram is constructed of aluminum, heavily gold plated, as is the tube thru which the wire runs from the needle to the diafram as well as the other metal parts of the attachments. The simple twist of the needle holder permits the playing of either hill and dale or lateral cut records on the same machine, and it therefore makes the new reproducer practically universal in its application. It is claimed for the Pathé "Actuell" that, inasmuch as the sound comes in its full volume direct from the reproducer to the ear, it does not suffer from the overtones or conflicting vibrations that sometimes devlop when the sound is carried thru an amplifying chamber and likewise by reducing the number of factors incident to tone reproduction.

Thru the use of this large diafram surface, noise, if not entirely eliminated, is reduced to a point where it is not audible.



The Newest in Talking Machines—No Horn, Just a Large Vibrating Diafram That Radiates the Sound in All Directions Equally.

www.americanradiohistory.com

Experiments in Physics

By JOHN J. FURIA
DEPARTMENT OF PHYSICS, N. Y. UNIVERSITY

1--Perpetual Motion

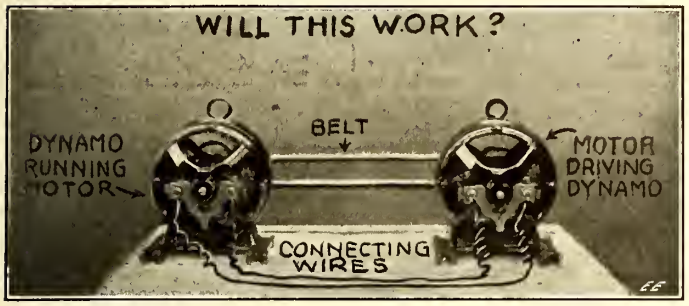


Fig. 5. The Electrical Student's Dream: Belt a Dynamo and a Motor Together. Connect Their Windings Electrically and—Presto! You Have Perpetual Motion! But Do You? Read On, Macbeth, Read On!!

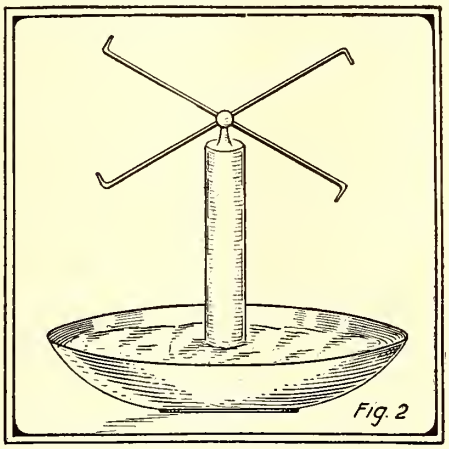
IT is a well known fact that more Time, Energy and Money have been spent and wasted in searches for a machine capable of producing *Perpetual Motion* than for all other scientific pursuits combined. The impossibility of perpetual motion can be demonstrated by the simple elementary laws of Mathematics and Mechanics, and consequently the *truly* scientific mind wastes no time in such a search. Perpetual motion is a direct violation of that fundamental law of Physics, the law of *conservation of energy;* hence in order not to waste time in argument with a perpetual motion inventor, to show him the fallacy in his reasoning (?) one has but to say "it contradicts the law of conservation of energy." The U. S. Patent Office has a sure-fire means of disposing of these would-be inventors—it asks them to produce a working model! That settles it, for if the inventor cannot make the proposed scheme work, who can?

Perpetual motion and perpetual motion machines are defined in many ways, all the definitions conveying the idea of *getting something for nothing, indefinitely.* The getting something for nothing idea, of course, will appeal to the general public ignorant of science, and the natural consequence is "swindling schemes." One definition is—a perpetual motion machine is one which will go on moving without assistance from any external force, except possibly gravity, until the parts of which it is made wear out! The inventor usually adds that his machine will evolve more power than is required to run it. The efficiency of such a machine would therefore be *greater than* 100 *per cent.!* Perpetual motion machines fall naturally into two classes—the *absurd class* and the *frauds.* The second of these classes hold no interest for us scientifically. In general a perpetual motion machine would be invented (the inventor being backed up by publicity specialists). A glowing account of the operation of the machine before a distinguished audience from "Podunk" would appear, together with front page photographs of the machine and of the handsome and distinguished looking inventor—who always spent a life-time and several fortunes in perfecting the ninth wonder. The inventor having spent all his money and all he could borrow would therefore be willing to *sacrifice* a major share in his invention for a few thousand dollars, and some fortunate young heir or widow would perchance acquire an expensive education. Nowadays, if an account of a perpetual motion machine should appear in the papers, some secret service men would keep in touch with the "benefactor to mankind" and in a short time, or as soon as his "gilt edge stock" began to sell, said benefactor would shortly rest behind prison bars.

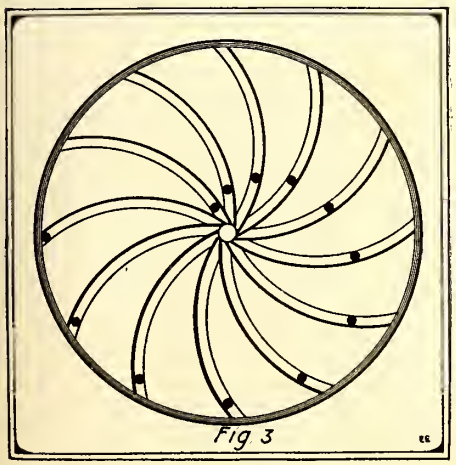
The first class of machines is of considerable interest. Most of us have at some time or other spent much time in thinking up perpetual motion machines and still more time in trying to fathom the reason why our schemes *would not work.* Which one of us has not at some time or other hooked up a small toy dynamo and motor with the intention of causing the dynamo to supply current to run the motor and some lights, bells, trains, etc.—while the motor in turn, belted to the dynamo, drives the latter machine. See Fig. 5. What a great disappointment it was to find that the scheme wouldn't work. To be sure, on connecting the hand drive to the dynamo, we get enough "juice" from it to run our motor and our lights and other things. Also we can run our motor from some cells and by belting cause the dynamo to run. Why then does our perpetual motion machine fail us? The answer is simple—the *law of conservation of energy.* Let us assume that our motor and dynamo were identically made and practically frictionless. The machines of Fig. 5 are of this type. A current of 1/10 ampere is used by each when acting as a motor, at a potential of 10 volts; therefore, 1 watt of power is consumed. Since the efficiency would have to be less than 100 per cent., due to friction and eddy current losses, etc., then when acting as a dynamo *less* than one watt power is given off. Hence one of the machines *can never be made to run the other, let alone do other work besides!*

Another electrical type of perpetual motion machine familiar to most of us depends for its operation (or rather for its failure to operate) on the action of points.

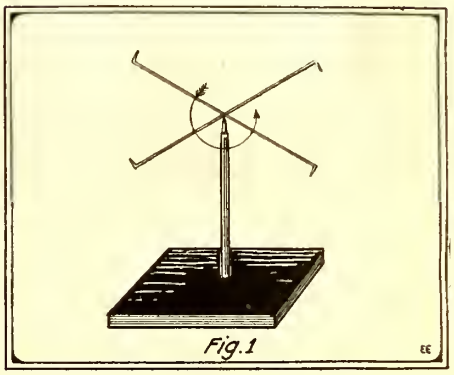
(*Continued on page* 377)



It Should Go on Forever, They Say—This Hydrostatic Marvel. The Atmospheric Pressure of 15 lbs. per sq. Inch on the Water in Bowl Forces It UP Thru the Revolving Arms. The Water Shoots from the Nozzles Back Into the Bowl—Ad Nauseam.



See the Little Balls in the Hollow Spokes of This Wheel? Their Constantly Changing Center of Gravity Was Supposed to Keep the Wheel Revolving—Only It Didn't!



The Static Electric Motor. A Metal Wire Cross with Pointed Ends Pivoted on an Insulated Upright. Connect It to a Static Machine, Fig. 6, and You Have Perpetual Motion—Perhaps?

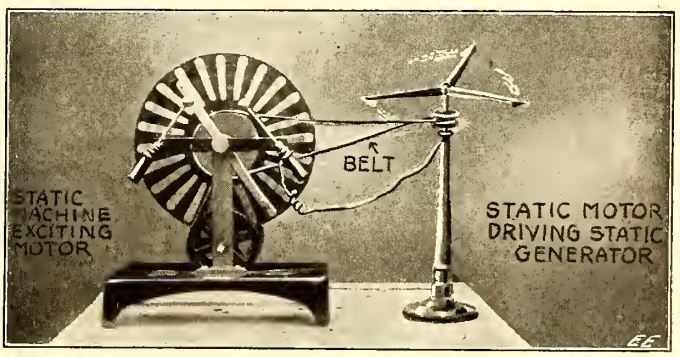


Fig. 6. An Electro-Static Nightmare! The Static Machine Charges the Motor—the Motor, Thru Its Belt, Drives the Generator! Quick, Watson, the Needle.

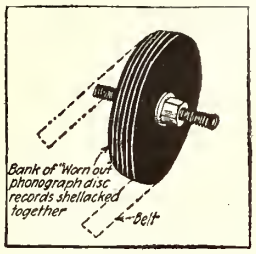
www.americanradiohistory.com

$50.00 Prize Contest

Uses for Old Phonograph Records

NOT so long ago we ran a "Burnt-out Lamp Contest" giving prizes for the best ideas what to do with the old burnt-out lamp globes. Thousands of suggestions were received from every part of the world, and we all had a lot of fun. We publisht the best ideas and we know that many of them are now actually being used daily.

Your average experimenter is happy only when he can take a lot of antiquated old "junk" and put it to a new use——he'd take an Egyptian mummy and convert it into a rotary spark plug, if it were possible!



Want a Small Belt Pulley? Procure a Few Old Phonograph Records, Shellac Them, Place in a Vise Until Set, and You Have a Fine Pulley.

So the other evening when we stumbled over a lot of old phonograph records that had been played so long that they would "phono" no longer, we said—Ah, what can we do with them? Too good to throw away! So we thunk awhile and ended by making a fine Wimshurst static machine, using two plates to generate the juice. Of course that's old stuff, every "bug" knows that trick.

But we felt we had stumbled into a veritable gold mine. Now we admit that our editorial think-tank becomes clogged up once in a while, so we thought we'd put it up to EXPERIMENTER readers—they have us beat forty different ways as a rule. True, in our younger days ye Editor once made a very serviceable pulley by shellacking eight, old, cracked 7" disks together which made a pulley about one inch thick, and which did gallant work. True, that he also once made a rotary variable condenser from a dozen 10 cent records (tin foil shellacked to one side of the records). True, also, that he once constructed an emergency rotary spark gap using two 7" records shellacked together with zinc plugs screwed to the face of the records——but really all such stunts are commonplace.

Of course you can do much better than this. Somewhere there is a "bug" who will turn in a really good idea. And we're out to find that "bug." Yes it will cost us $25.00 for that prize idea, but we think it will be cheap at that.

Now, then, boys, let's see how much ingenuity there is around. I promise you lots of fun and your fellow-bugs will bless you for generations, because your ideas will be of tremendous value to them.

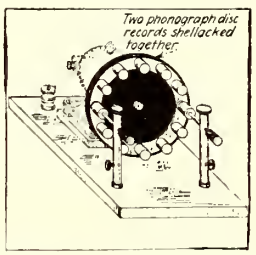
Now listen!

$50.00 IN PRIZES

1st Prize
$25.00 in Gold

2nd Prize
$15.00 in Gold

3rd Prize
$10.00 in Gold



Rotary Spark Gaps Are Quickly Made From Old Phonograph Record Discs.

OLD PHONOGRAPH RECORD CONTEST.

This contest is open to every reader whether subscriber or not.

These prizes will be paid by the publishers of the ELECTRICAL EXPERIMENTER for the best useful ideas what to do with old phonograph records.

The two important conditions are that the idea must be a useful and original one. It is not necessary that the record or records be used with electrical devices, *any* use is satisfactory as long as the resulting device is useful and, of course, therefore practical.

Any amount of records, and any and all sizes can be used. Records can be sand-papered, turned down, bent in hot water, etc., it matters not, as long as they are actually used. The final shape does not matter.



Two Old Phonograph Records Make a Good Static Machine, When Drest Up a Little With Some Tinfoil Sectors, and Then Rotated In Opposite Directions.

We shall try and award the prizes to those *who actually have built or made the device which they describe.* Therefore those contestants sending actual photographs of the ideas stand a better chance to win a prize.

Description is limited to 200 words. Use one side of paper only. Use ink or typewriter. No pencilled matter considered. Sketches must be on separate sheets of paper.

Contest closes in New York, September 15th. Prize winners will be announced in our November issue.

Address all letters, photographs, etc., to: Editor: "Old Phonograph Record Contest."

Airplane Parachute a Success

Lieutenant Jean Ors, of the French Army, demonstrated the usefulness of his "aërial life preserver" recently at Atlantic City. This device is an adaptation of the parachute to airplane use, and toward the end of the war was widely employed by the Allied armies, greatly reducing the mortality when machines were shot or caught fire. The test of the device was before a committee of American and foreign experts, and after Lieutenant Ors had proved the worth of the life preserver, he received a special prize of $500.

The aërial device, contained in an oil-cloth packet, is only fifty inches in diameter and four inches thick. It weighs about fourteen pounds. For the test it was affixt to the underbody of the airplane with a rope running into the cowl, so that the lieutenant could make the release at the proper moment. When it was in place "Eddie" Stinson, America's leading fancy flier, tuned up his craft and he and the Frenchman hopped in.

Stinson and his passenger rose well above 1,000 feet, and swinging in a giant circle made two trips around the airport. Then, dipping down to about 500 feet, Stinson ran his machine southeast, directly into the wind, so that the parachutist could gage his distance. As Stinson shot in a 200-yard spurt at eighty-mile speed, the watchers saw the lieutenant crawl cautiously over the cowl of the machine, poise there a second, and raise an arm as he ript the fastenings of the parachute, and then plunged earthward from the streaking airplane.

For the fraction of a second he was enveloped in the smoke of the exhaust. Then he came hurtling at the field. Quick as a flash the life preserver opened, the fall of the Frenchman being checked without perceptible shock *within fifty feet after he made the jump.* Slowly the wide-spreading white silk umbrella, with the army officer dangling at the end of the ropes, swung to earth, the landing being as gentle as the arrival of a raindrop. The descent was made in forty-six seconds.

In August "Radio Amateur News"

Radio-telephoning from Your Auto
By A. H. Grebe

A 15,000 Cycle Radio Frequency Alternator for Radio-Telephone Work

Construction of An Audion Control Panel

Multiple Conical Loose Coupler
By John G. Merne

Loop Antenna and Direction Finders for Amateur Use
By David S. Brown

Low Potential Radio Frequency Arc
By Charles W. Noller

Is the Antenna Doomed?
By E. T. Jones

Developments in Wireless Telephony
By Dr. F. B. Jewett

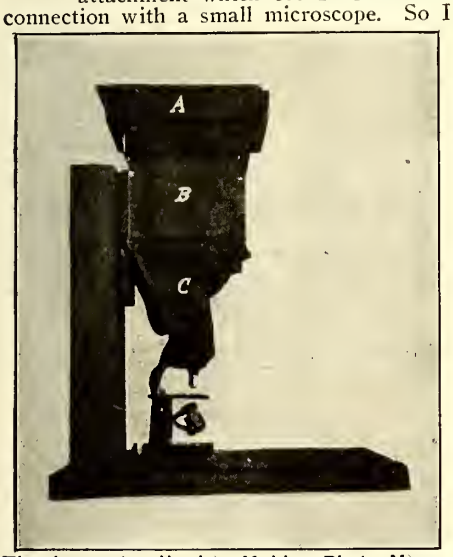
www.americanradiohistory.com

THE CONSTRUCTOR

How to Make Photo-Micrographs

By G. D. LAUDERMILK

BIOLOGY being one of the subjects in which I became interested, and having fitted up a small laboratory, I found that I required a photographic attachment which could be used in connection with a small microscope. So I finally evolved one made in the following manner:



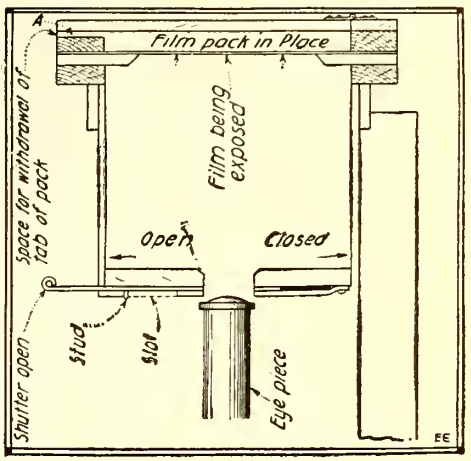
The Apparatus Used in Making Photo-Micrographs, Comprising a Home-made Camera for Holding Plate Holder or Film Pack in Proximity to Microscope Eye-piece

The camera was made in two parts; "A," the plate holder, is a shallow box 6" long, 4" wide and 1" deep. The top of the box is hinged and the interior of the plate holder has a depression of a size to take a No. 320 Premo film-pack. It is modeled after the plate holder of a Premo camera. The camera box is 5" deep, 3" wide and 4⅜" from front to back. The camera has a strip ½" wide around it, ¼" from the top, forming a shoulder upon which the plate holder rests when in place; both the edges of the plate holder opening and the rim above the shoulder are covered with black velvet, forming a light-proof joint.

In the center of the opposite end is an opening ¾" in diameter closed by a simple sliding shutter made of sheet metal. Both the plate holder and the camera box are covered with imitation leather and are constructed of light wood. The hood "C" is of black cloth and serves merely to confine the draw-tube and prevent leakage of light between the eye-piece and the opening in "B." At the base of the upright is a wooden form exactly of the same shape as the foot of the microscope. This form is so placed that it acts as a guide to keep the microscope in position with the eye-piece.

When photographing, the slide is placed on the stage in the usual way and focust so that all details are brought out sharp. The microscope is then placed in position, the hood drawn around the eye-piece and fastened with a hook and eye. The shutter is now opened and the exposure made. The length of exposure will vary with the degree of transparency of the object and the depth of staining. Thin clear objects or objects stained with methyl-violet or blue

(Continued on page 356)



Drawing Showing Sectional View Thru Camera and the Arrangement for Holding the Film Pack or Plate Holder, in Position Over the Microscope Eye-piece

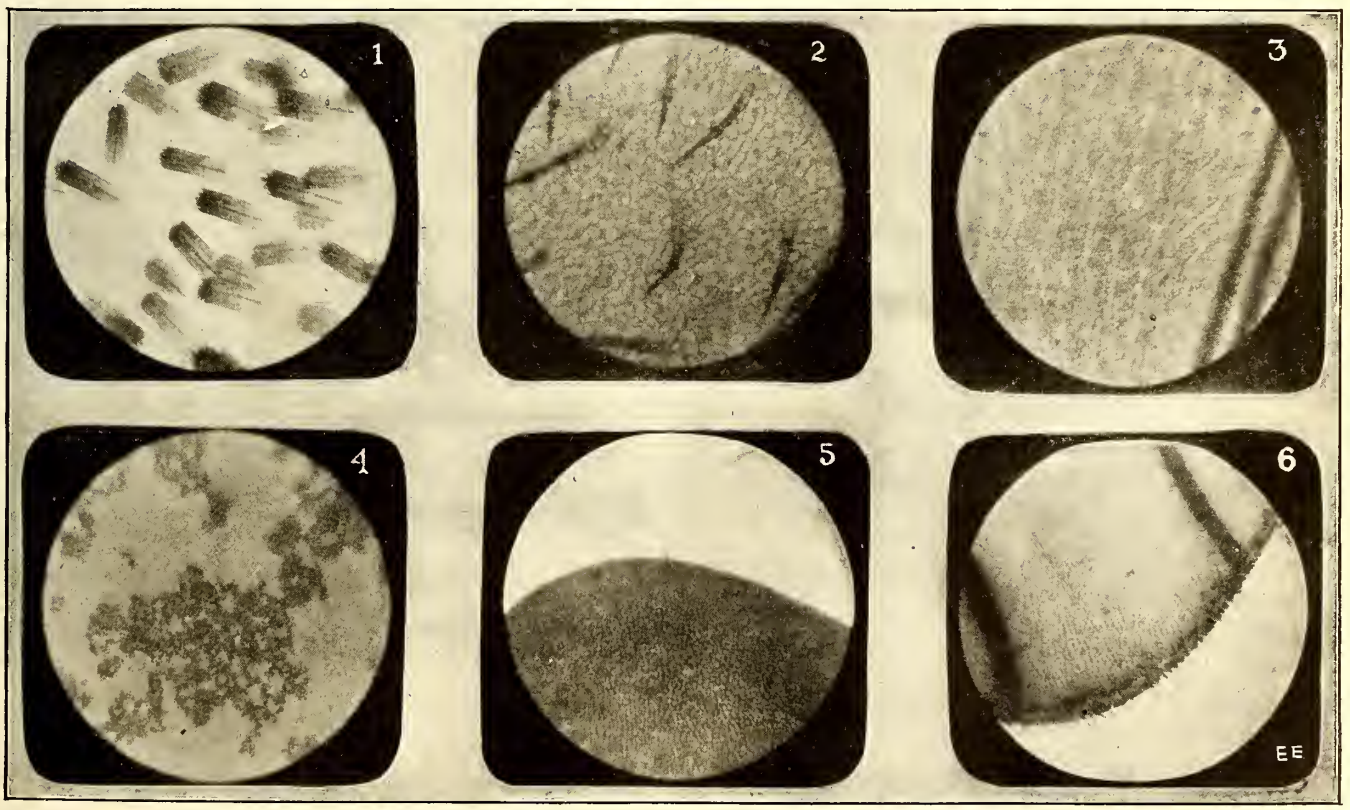


Fig. 1, Microphotograph Showing the Wonderful Wing Structure of the Moth from the Grape-vine Cut-Worm. 2—Parenchyma of Sun Flower Leaf. This Specimen Was Obtained by Stripping a Small Piece of the Epidermis from the Upper Part of the Leaf. The Large Pointed Objects Are Hairs. 3—The Magnified Surface of the Underwing of the Squash Bug; the Dark Line Is Part of the Vein. 4—Nitrogen Fixing Organisms from a Nodule on the Root of a Pea, Which Possesses the Property of Fixing Nitrogen from the Air. 5—Tip of Antenna of a May Beetle. The Short Sharp Bristles Are the Sensory Organs of Smell. 6—Micrograph of a Wing Tip from a Crane Fly, Showing Covering of the Wings.

www.americanradiohistory.com

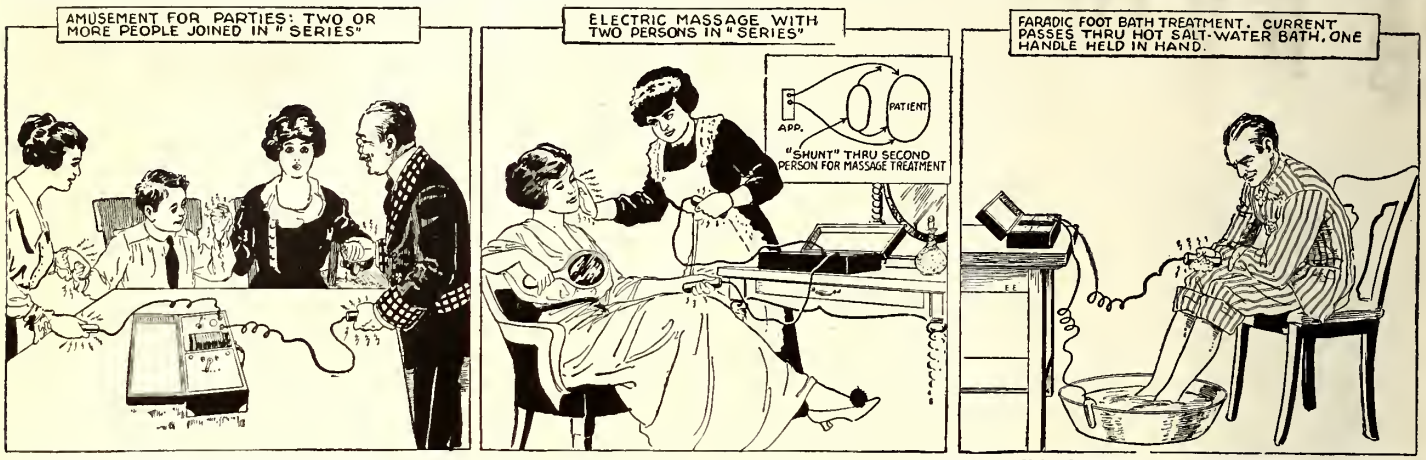
Faradic Currents--How to Apply Them

Sequel to "Building a Medical Coil Set."

AN extensive article accompanied by working drawings and photographs appeared in the June issue of this journal, covering the construction of a high grade electro-medical or faradic coil. Methods were there explained for testing out the polarity of the coil, and thus it becomes easy for even the novice to properly apply the *positive* and *negative* electrodes as required in the following directions for the treatment of various ordinary ills, such as, headache, nervousness, rheumatism, etc.

The accompanying illustrations show how several people may join hands so as to form a *series* connection to the medical or shocking coil, and as many as eight or ten people—or more, may thus join hands in a circle, evolving a great deal of amusement at parties and social gatherings. One of the illustrations shows how a second person may apply the faradic current for facial or other massage with the hand. There are two ways of giving this massage, and one of the accompanying diagrams shows the second method, whereby the person applying the currents forms a *shunt* circuit to the patient. Where a mild current is desired, the shunt method is preferable, while the *series* connection gives a harsher or stronger current. For the purpose of giving massage treatments, there is available on the market special wrist electrodes, which have a binding-post terminal on them, to which one of the secondary wires from the apparatus may be connected. Many other forms of electrodes, including foot-plates, sponge electrodes, hair brushes, massage rollers, et cetera, are shown in one of the accompanying illustrations. The faradic secondary current produced by medical induction coils is, as explained in textbooks, in the form of an unsymmetrical alternating current.*

Where much of this work is being done, it is always best to invest in a sensitive milli-ampere meter which can be connected in series with one of the handle cords, so that the current strength in milli-amperes being administered, can be regulated. The proper current strengths for different ailments is given in any of the works on Electro-therapeutics, which may be consulted at almost every library.



Illustrating Several Interesting Applications of the Faradic Current. The Apparatus for Producing This Current Was Described In Complete Detail in the June Issue of This Journal.

General Considerations.

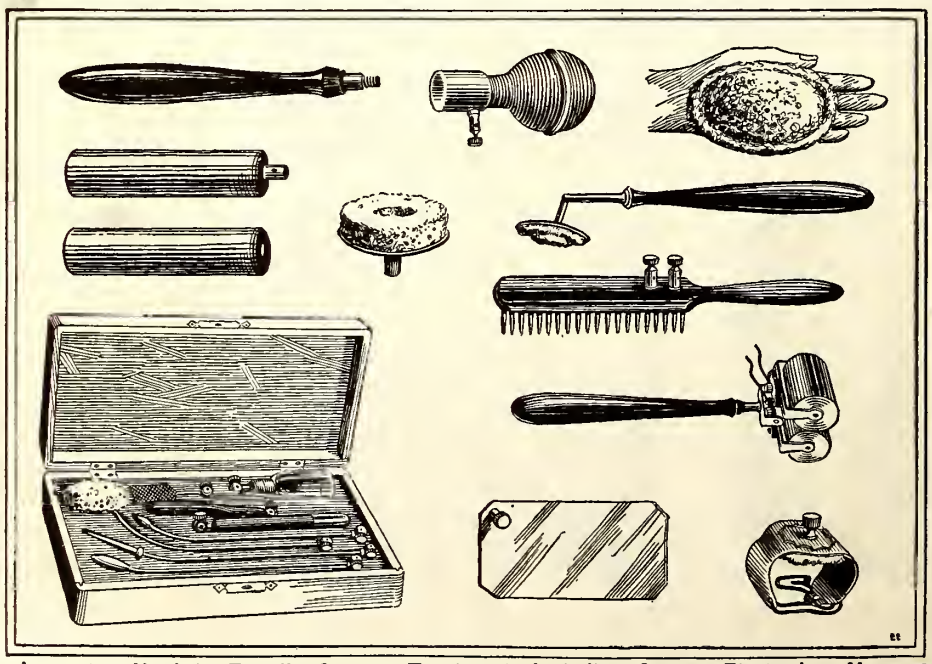
In treating diseases of an inflammatory nature and fevers the *positive* pole is generally utilized. This includes such ailments as swellings, bruises, sprains, extraneous growths and enlarged glands. In this treatment arrange the poles, if possible, *the positive above the negative:* while in debility, numbness, inaction, tendency to decomposition, treatment is given with the *negative* pole. The rule of the positive above the negative cannot always be followed in this treatment.

The primary current starts at the dry cell, passes thru one coil of wire (primary coil) thence thru the circuit-breaker thru the patient. The secondary is the *induced current* in the finer wire of the coil and is of much greater tension (voltage) than the primary, but not of so much volume (amperage). The *primary* current is used particularly in the treatment of scrofula ulcers, cancers, extraneous growths, enlarged tonsils, enlarged joints, granulated eyelids, enlarged glands, strictures, etc.*

The *secondary* current is applied in the cure of nervous and inflammatory diseases and acts as a tonic upon the system. There are two methods of applying electrical currents to the body viz: 1. General Electrization; 2. Localized Electrization.

By the first method the current is past thru the entire body or part of it. By the second method, the object is to influence special nerves, muscles or organs, limiting the action of currents to these parts, or, instead of trying to influence a muscle, we may stimulate the nerve supplying it, thus reaching the same indirectly. When the refreshing effects of the current are desired to relieve fatigue or ward off approaching paralysis some suitable exercise of the muscles should be combined with the galvanic current. Short sittings are better than long ones. In ordinary cases from two to

* For further details on the action of induction coils, including the wave form of the secondary or induced current, as well as the primary current, reference may be made to several works on induction coils including the following: "How To Make Induction Coils and Transformers," by H. W. Secor, and a later revised edition by J. S. Curtis, "Induction Coils in Theory and Practise," by Prof. F. E. Austin, "Induction Coils," by H. S. Norrie, "Induction Coils," by Armagnat, also several other works including those by A. Frederick Collins, Allsop, and Trevert.



Apparatus Used In Faradic Current Treatment, Including Sponge Electrodes, Massage Roller, Wrist Electrode, Foot Plate, Hair-brush, Bust Cupper, Et Cetera.

*See Electro-Therapeutics Handbook, by Trevert. Also Handbook of Electrotherapeutics by Dr. Strong.

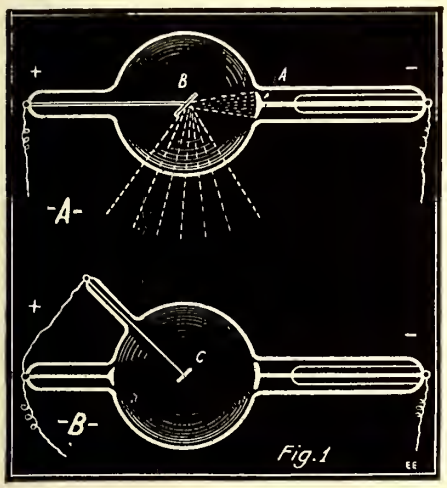
(*Cont. on page* 366)

www.americanradiohistory.com

X-Ray Experiments

By Ivan Crawford

THE average electrical reader is not ignorant as to the general nature of X-rays, or more properly Röntgen rays, but he usually knows comparatively little about them. Considering the ever broadening field of usefulness of these remarkable rays, it behooves the experimenter who wishes to keep abreast of the times to make himself better acquainted with them and their properties. It is the author's intention in the following article to briefly outline the latest advances in this branch of science and to give some experiments, using apparatus within the reach of every experimenter.



Simple Form of Vacuum Bulb for the Production of X-Rays. When the Cathode Particles Strike the Target, B, They Set Up Etheric Vibrations—X-Rays—Radiating in the Direction Shown by the Dotted Lines.

Röntgen, while experimenting with a vacuum tube, noticed that the sides of the tube exposed to the discharge were brightly phosphorescent, and that if a screen of some phosphorescent substance such as potassium platinocyanid was brought into its vicinity it would become luminous. He also noticed that if a thick piece of metal were interposed a shadow was cast, while a piece of wood or a thin sheet of aluminum cast only a partial shadow, showing that the rays producing the phosphorescence could penetrate more or less easily objects opaque to ordinary light, but that the amount of penetration varied *inversely* as the density. This may be further illustrated by interposing the hand between the tube and the screen. The flesh being less dense than the bones cast only a light shadow while the latter are distinctly outlined. The rays were also found to possess the property of affecting a photographic plate.



Fig. 5. Sklagraph Taken by the Author, Showing Bones of the Hand and Finger-Ring. X-Ray Tube Excited on Two-inch Spark Coil.

Of course, an ordinary vacuum tube such as the one with which Röntgen first remarked the phenomena, does not produce X-rays in any great quantity. Many different forms of bulbs have been evolved but they may be divided into two general classes, namely, those operated on spark coils and those operated on high frequency currents such as those from a Tesla coil. As the spark coil exciter is more within the reach of the average experimenter, it has been selected for description in this article. Those who are interested, however, in the operation of high frequency X-ray tubes are referred to a most complete article on the subject by Dr. Frederick F. Strong, in the September, 1917, issue of this magazine.

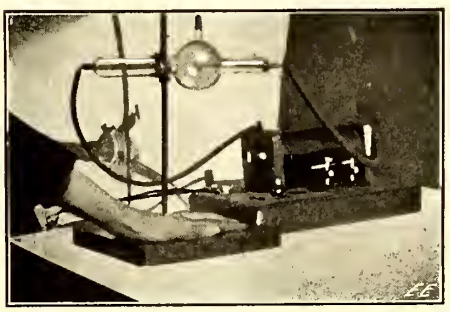
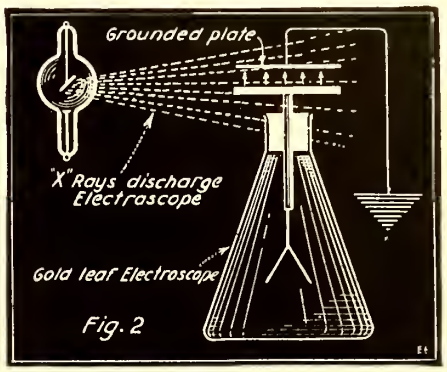


Fig. 4. How the X-Ray Tube, Hand to Be Radiographed, and Covered Photographic Plate Are Arranged.

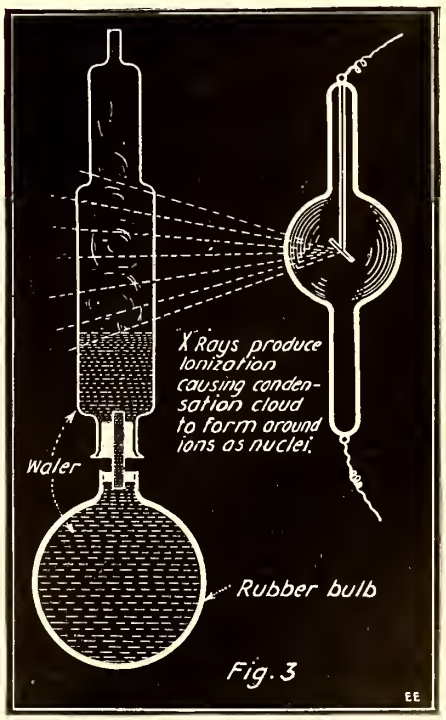
A simple tube for the production of Röntgen rays is shown in Fig. 1A. The cathode A is generally of aluminum and made in the form of a reflector. The anode B is faced with platinum or tungsten and inclined at an angle of 45 deg. to the cathode. Sometimes a third electrode (C, Fig. 1B) is added. This, however, is not necessary in small tubes. The pressure in the bulb must be extremely low. After extended use this tends to become even lower. This, altho producing more penetrating rays, decreases the supply of electrons, making it difficult for the discharge to pass. To remedy this some bulbs are equipt with a small platinum tube fused into the glass. When this is heated it allows the hydrogen to pass. If the bulb is not provided with any means of increasing the pressure it may be done by gently heating it in an oven. When the vacuum is high the bulb is said to be "hard"; as the pressure increases it is said to become "soft." For general work the bulb should be rather "hard."

The nature and properties of the rays will now be discust. When the cathode particles strike the target they set up etheric vibrations which radiate in the direction of the dotted lines in Fig. 1A. The nature of these vibrations has been the field of considerable discussion but has now been practically settled. It is the general belief that they consist of *extremely short ether waves*, similar in many ways to light. The chief points of difference lie in the facts that the objects which reflect or at least refract ordinary light are transparent to X-rays, neither are they subject to polarization. This evidence is, however, not so conclusive as it might seem at first sight. It has been known for some time that X-rays consist of vibrations about 10^{-9} cm. in length. It is impossible to conceive of a defraction grating of suitable spacing to intercept these waves. On the other hand, they have many similar characteristics. They move in straight lines, cast definite shadows, affect a photographic plate, and Brandes and Dorn have shown that they even produce a slight but sensible effect on the retina. Prof. Marx, by a series of complicated experiments showed that they traveled at the speed of light. His results, however, have not been generally accepted and his methods severely criticized. I have stated above that Röntgen rays are not subject to polari-

(*Continued on page 375*)



Experiment Demonstrating the Ionizing Property of X-Rays. A Charged Electroscope Is Quickly Discharged When X-Rays are Past Across the Gap Between the Electroscope and a Grounded Metal Plate.



An Intensely Interesting X-Ray Experiment, Showing How Rain (Aqueous Vapor) is Formed by Condensation Set Up on Nuclei Created by X-Ray Ionization.

www.americanradiohistory.com

Heat Engines

By JOHN J. FURIA, M. A.

Dept. of Physics, New York University.

THE question often arises, "why is the *hot air* engine not used?" Air certainly is cheaper than gasoline. It takes less fuel to heat air than to convert water into steam. However, it does not follow that the hot air engine

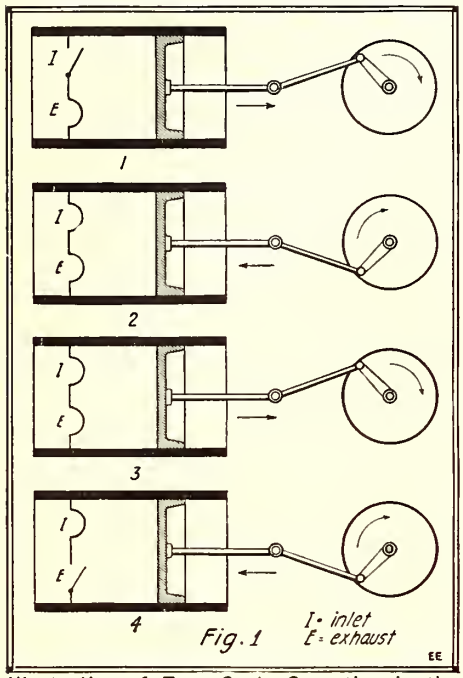


Illustration of Four Cycle Operation in the Gasoline Engine. First the Gas Mixture Is Drawn In. Second, Compression Takes Place. Third Comes the Explosion; and Fourth, the Expulsion of the Burnt Gases Takes Place.

is the cheapest to run and at the same time obtain the necessary power. A little review of the gasoline and steam engines together with the principles of operation of the hot air engine will answer our question, why this type of engine is not used.

The Gasoline Engine.

The gasoline engine (internal combustion) has attained great popularity by its use in the automobile industry. It is flexible, capable of delivering a large amount of power, it develops high speed and power almost instantaneously. It also has an efficiency of about 25 per cent. The engine and the fuel used are light in weight compared with other kinds of engines of similar power. The four cycle engine is typical. Figure 1 is a sketch showing the conditions at each of the four cycles. The first cycle is started by turning over the flywheel (cranking the engine). This causes a *suction* in the cylinder. The inlet valve is either opened automatically or by the suction. The properly mixed fuel (gasoline and air) enters thru the inlet. (During this cycle the exhaust valve remains closed.) After passing dead center, the inertia of

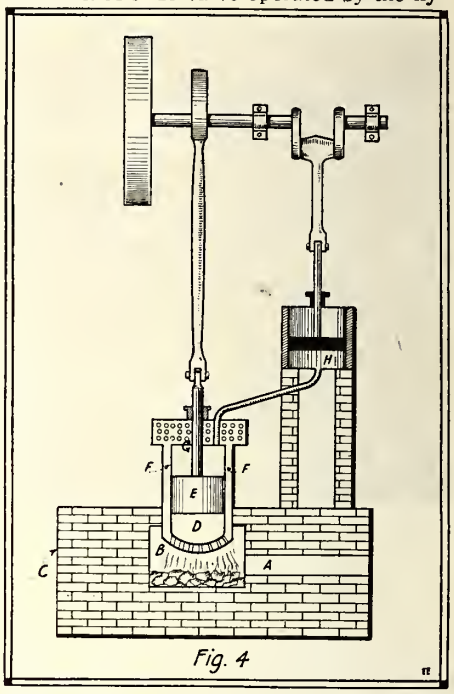
Gasoline—Steam—Hot Air

the moving fly-wheel causes the piston to move inward (cycle 2). The inlet and exhaust valves are both closed during this cycle, and the explosive mixture is comprest, rendering it capable of delivering greater power when it is exploded. As dead center is again reached, and the mixture is comprest to a maximum, the mixture is *ignited* by means of an electric spark properly timed. The mixture disintegrates as a result of combustion and forms a gas of tremendous pressure, this pressure causing the piston to move outward. This is the third cycle or power cycle. (Both valves are closed.) On again reaching dead center, the inertia of the fly-wheel causes the piston to move inward; the exhaust valve is automatically opened and the spent gases are expelled. (The inlet valve is, of course, closed during this cycle.) The four cycles are then repeated over and over again.

It is to be noted that during the whole four cycles, only one power stroke is secured; and that this power stroke is secured as a result of chemical action due to the combustion of the fuel mixture. The *four cycles* occur during *two revolutions* of the fly-wheel. It is therefore necessary to have a fly-wheel with a large moment of inertia in order to cause a steady running of the engine. Smoothness is obtained by using several cylinders instead of one, thus securing *more power strokes per revolution of the fly-wheel.* The high price of gasoline together with the complications arising in the devices for securing the proper mixture and the right kind of spark at the right time are points against the gasoline engine. Because of the high temperatures developed as a result of the chemical action, the cylinders must be cooled by some means, usually water circulation (another complication).

Steam Engines.

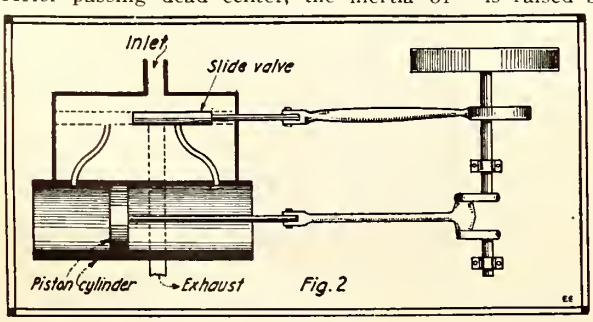
The steam engine is still very much used in spite of its low efficiency (usually ranging from 10 to 12 per cent). It possesses the disadvantage of not being capable of immediate starting; perhaps this is the chief reason for its not being used in automobile propulsion except in one or two special instances. Its bulk is, of necessity, very large comparatively as is the bulk of the fuel used. (A one horsepower engine requires about 2½ lbs. of coal per hour.) On the other hand it is simple in operation and control. Once steam is "gotten up," the movement of one throttle is all that is necessary to cause a change in speed and power. No fuel mixing device is used nor any electrical system. Figure 2 shows the main parts of a typical steam engine. Steam is raised by heating water contained in a boiler (any kind of fuel can be used). The steam is led into the cylinder thru the inlet valve. In the type illustrated below there are two inlets to the cylinder, one on each side. A slide valve operated by the fly-



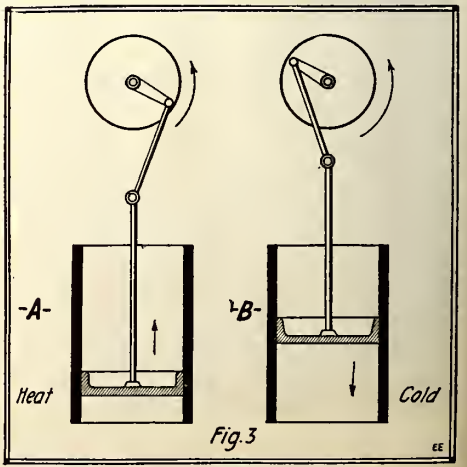
The Stirling "Hot Air" Engine. It Only Consumes 2 lb. Coal per H.P. Hour, Being Therefore More Efficient Than the Steam Engine. These Engines Have Been Built to Develop Several Horsepower.

wheel moves in opposition to the piston, alternately admitting steam to the left and to the right of the piston, thus causing it to move back and forth. It is therefore apparent that there are *two power strokes for each revolution* of the fly-wheel or *four times as many as in the four cycle gasoline engine.* The spent steam is usually exhausted into the atmosphere. In the more modern steam engine the spent steam is condensed and brought back to the boiler, thereby requiring water to be added to the boiler much less frequently besides saving fuel. Because of the high price of gasoline, several automobile concerns have expended a great deal of time and money in research and development on automobile steam engines, and their "selling points" are extremely good ones. Getting up steam is reduced to a matter of only a few min-

(*Continued on page* 373)



Left:—Principle of Simple Steam Engine, Showing Slide Valve Actuated by Cam Shaft from Flywheel Shaft. The Steam Is Successively Admitted and Exhausted from Alternate Sides of the Piston, Causing Rotation of the Flywheel.



Right:—Ideal "Hot Air" Engine, Comprising a Cylinder, Piston, Connecting Rod and Flywheel. Heat Is Applied to Bottom of Cylinder, Driving Piston Upward.

www.americanradiohistory.com

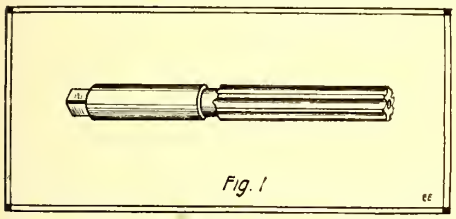
Experimental Mechanics

By SAMUEL D. COHEN

LESSON XIII

REGARDING REAMERS.

IN the last lesson we completed the discussion on the subject of "Twist Drills." The reader is undoubtedly aware by this time that it is quite impossible to drill any size hole he desires with rigid accuracy thru the use of drills in commercial



Standard Form of Hand Reamer. The Reamer Is Used to Accurately Clean Out Drilled or Cast Holes, Especially Journal Boxes and Shaft Bearings of All Types.

practise. For example, it is desired to place a pin into a drilled hole to have a *driving* or a *sliding fit.* The reader will find that nine times out of ten he will be unable to obtain the proper size drill to do the work. In this instance another form of tool is at hand, namely, the *reamer.* This tool is used whenever a hole is to be enlarged just a few thousandths more than the original. Sometimes the reamer is used when a smooth hole is required, in which case the hole being first drilled is made *smaller,* in order to obtain the finally required size after reaming.

As in the case of twist drills, there are a large variety of reamers, varying in size, and each is suited for a definite purpose. Properly speaking, the reamer may be defined as a tool for perfecting holes previously drilled or bored. Fig. 1 shows a standard *hand reamer.* The reamer should never be used to remove any considerable quantity of stock, but merely to eliminate minute imperfections left by other tools. In some cases the hole may be made to within .001 inch before the reamer is applied, but generally the allowance of .002 inch to .010, according to the diameter of the hole, may be left for the standard reamer to cut. If given too much material to remove, the cutting edges of the reamer will wear too fast, and its reliability as a *sizer* will be quickly destroyed.

Reamers may be divided into two general classes: the *side-cutting* or *fluted* and the *end-cutting* or *bits.* Each of these classes are subdivided into *solid* and *adjustable* reamers.

The first well-known reamer is called the *solid fluted* reamer, and is made with slight modifications to suit two different cases, namely, hand and machine use. Fig. 2 illustrates a hand reamer which belongs to the *short set.* Reamers of the same general design are also made longer in regular sets. The cutting edges of fluted reamers taper in diameter for about one-fourth their length, from E to D being about .01 inch smaller at E than at D.

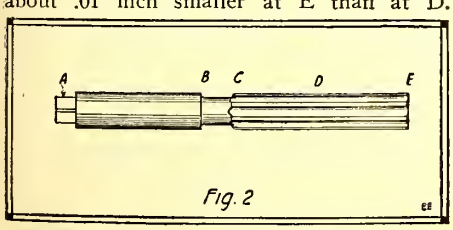


Illustration Showing a Hand Reamer of the Solid Fluted Type for Hand Use. The Letters Refer to Different Tapered Sections Described in the Text.

From D to C the taper is reversed, the diameter decreasing about .0002 inch per inch of length towards C. The part between A and B is usually made about .001 inch smaller than the largest diameter at D. When the cutting edges are worn to such an extent that the blank part, when free from bruises, will not pass thru the reamed hole, the reamer is too small for standard use.

As will be seen, the hand reamer has a square end, upon which a wrench is used to turn it. This is the main distinguishing feature between the above mentioned and the machine reamer of the fluted type. The latter is made with taper and parallel shanks the same as a drill. It may also have a shank of any special shape to fit a certain holder. The machine reamer is generally, tho not always, made straight or parallel, from E to D, Fig. 2.

A reamer having a flute parallel with its axis has a slight tendency to draw in. To overcome this, some mechanics prefer the flutes of both hand and machine reamers, made in the form of a left-hand spiral. The angle of the spiral or helix may be from 4 to 8 degrees.

Another form is the so-called *rose* reamer. Its name is derived from the fact that its cutting end resembles a rose. It is essentially an end-cutting tool and is rarely used for other than machine work. The rose reamer has chip and oil grooves on the sides and is made with any shank required in machine work. This reamer has the larger diameter at its cutting end, and tapers back at about the same rate as the hand-fluted reamer, viz.: .0002 inch per inch of length.

The object of the taper on the fluted reamer is to counteract the tendency of all such reamers to produce a hole larger at the outer end. The rose reamer as well as the twist drill have the taper for the same reason, viz: for clearance.

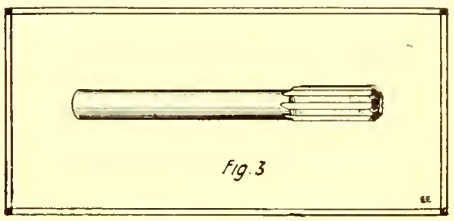
As compared with the fluted reamer, the rose reamer has one advantage, in that when new it will make holes more uniform in size and shape, but has the disadvantage that when the cutting lips are worn, it will bind on the sides and roughen the hole. If the fluted reamer becomes slightly worn at the end, it will still cut on the sides, but because of its cutting on the sides, it is more likely to be deflected by imperfections of the hole, or to cut larger than its fixt size.

As above stated, the standard fluted reamer should be used for *finishing cuts* only. However, the rose reamer can be utilized for roughing or finishing cuts. When the same reamer is used for both purposes, it becomes unreliable as a standard finishing tool. A good illustration of the rose reamer is shown in Fig. 3.

Another type is the *shell* reamer, which is identical in construction to the fluted and rose reamers, with regard to cutting edges, but differs in that the reamer proper is placed upon an arbor, thus saving in cost of material. It will be seen, however, that when the reamer becomes worn to such an extent that its accuracy is destroyed, it should be replaced by a new one, which occupies the same position on the arbor. Fig. 4 illustrates a typical shell reamer. The arbor drives the shell thru the engagement of its key with a rectangular slot cut across the rectangular shell. These reamers are made with either straight or spiral flutes.

The *shells* as ordinarily made are rather short for hand reaming. They are designed mainly for machine work. The taper begins at the cutting end, and the diameter decreases toward the opposite end in about the same ratio as the reamers previously described.

When these reamers wear .0003 inch to .001 inch below standard size, it is necessary to reset or regrind them to a smaller

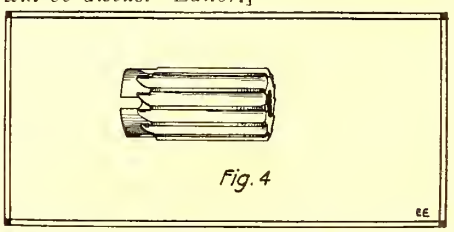


Typical Rose Reamer. This Is Used Considerably for Roughing and Finishing Work, but One Reamer Should Not Be Utilized for Both Purposes, as Inaccuracy Is Bound to Result.

size. Resetting consists in enlarging the diameter of the reamer by hammer blows in connection with a form of *set* or calking tool. The latter, which may be made by grinding a common chisel flat on the end, is held against the front of the cutting edges for this purpose. It is necessary to anneal the reamer for resetting, and each cutting edge must be treated until the diameter is about 1/64 inch larger than the standard. Having completed this work, the reamer is now retempered and brought to final size by *grinding.* This is usually accomplisht by placing the reamer in a Universal precision grinding machine.

Before grinding the reamer, its center should be carefully cleaned of any dirt or other foreign matter that may have adhered to it. A point scraper made from a three-cornered file answers well for this purpose. After scraping the centers it is usually necessary to lap them. For this process we *chuck* a short brass rod in the lathe and turn the end to the shape of the lathe centers. Having smeared this conical end with fine emery and oil, the reamer is placed on the center of the lathe and started at the greatest speed attainable. The reamer center is lapt by alternately forcing it against and releasing it from the revolving brass. This is done by light pressure with the tail spindle, and for each time that the reamer is prest against the brass it should be revolved slightly. By thus revolving it, we distribute the emery and counteract the tendency of the lap to scratch rings in the center. It is sometimes necessary to return the lap before finishing one reamer; but a skillful workman can do this in ten minutes or less. Instead of having to chuck the lap each time it is used, it would be better to make one to fit the hole in the lathe spindle directly.

[*In the next installment the subject of adjustable reamers and grinding of reamers will be discust—Editor.*]



A Shell Reamer. An Arbor or Shaft Supports the Reamer When in Use. They Are Held by a Key on the Shaft and Are Made With Straight or Spiral Flutes.

www.americanradiohistory.com

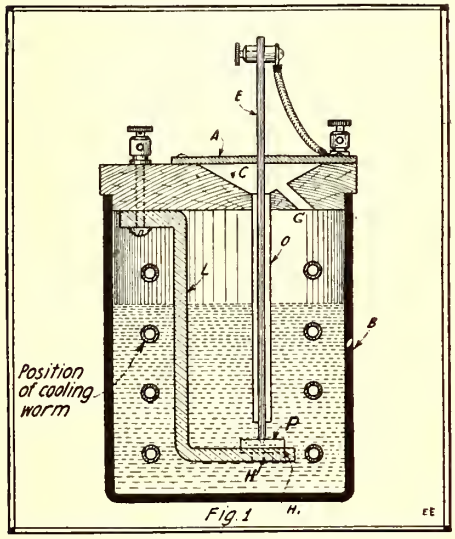
HOW-TO-MAKE-IT

This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 is awarded; for the second best idea a $2.00 prize, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

Automatic Electrolytic Interrupter

FIRST PRIZE, $3.00

After having experienced considerable trouble in devising a satisfactory electrolytic

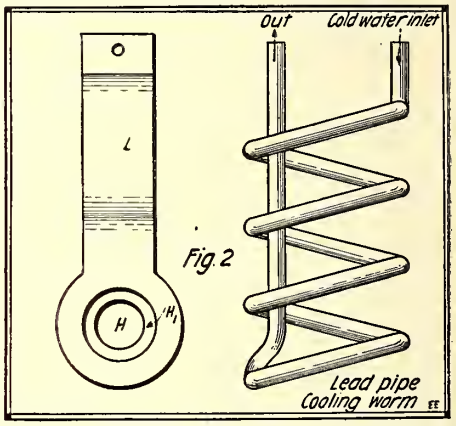


A Really Good Design of Home-made Electrolytic Interrupter.

interrupter, I succeeded in constructing the one described herewith in which most of the faults of its predecessors are eliminated. The greatest of these faults was the dropping of the rod electrode, thus short-circuiting the device. The materials required outside of the battery jar and wooden top, which must be boiled in paraffin to render it impervious to moisture, are: One-half pound of lead, about five inches of glass tubing, having an internal diameter of one-sixteenth inch, three binding posts, a small strip of brass and a small porcelain cup (used for mixing water colors).

The lead electrode is cast in the shape shown in Fig. 2. A hole somewhat smaller than the cup is bored in the large end. A rabbet, H^1, is cut around the edge of this hole so that the cup will fit into it. The lead electrode is now completed and fastened to the top with a machine screw and binding post. The top has a cup-shaped cavity reamed out as shown at C, Fig. 1, which is as deep as one-half the thickness of the top. A hole is bored in the center to receive the end of the glass tube, which should fit tight. The bottom of the tube is about three-sixteenths of an inch above the porcelain cup. The cavity also has a small hole G, Fig. 1, in one side to furnish an outlet for the solution which rises in the tube. A brass strip about one-quarter of an inch wide is fastened across the top of the cavity with a wood screw, binding post and a small screw. This strip has a small hole in the center for the rod electrode to pass thru. The rod is best made of phosphor bronze, and should fit the tube loosely. It has a binding post on top to serve as a weight and for connections. The interrupter is now complete, and should be filled to within an inch and a half of the top with a 10 per cent. solution of sulfuric acid.

The action of this interrupter is as follows: As the rod is worn away by the action of the solution, it is impelled downward by the weight on top, the porcelain cup preventing it from going too far. In case it



Detail of Lead Electrode and Lead Cooling Worm for Home-made Electrolytic Interrupter.

is desired to operate this interrupter continually for any length of time, it may be cooled by immersing in a large jar of water, or else by inserting a cold water cooling worm in the solution, after the design here pictured.

Contributed by SCOTT E. VANCE.

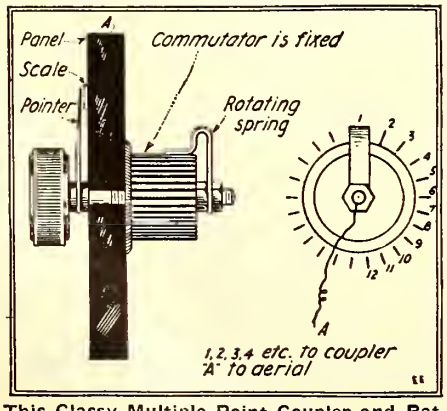
Clever Multiple Switch

SECOND PRIZE, $2.00

I submit herewith an idea for using a motor commutator as a rotary multiple point switch. This sort of switch is useful where it is desirable to economize on space, as on the secondary of a loose coupler.

This switch is, moreover, thoroly dust proof, as it is always on the inside of the cabinet.

Contributed by R. C. SMOLLEN.



This Classy Multiple Point Coupler and Battery Switch Is Constructed From a Small Commutator.

Send us some of your good ideas. We pay for all articles publisht. Address the Editor How-To-Make-It Dept.

THE PHONOGRAPH AS A TEACHER.

Many amateurs object to the use of a phonograph for learning wireless telegraphy because of the fact that the sound coming from the phonograph is in no way similar to the actual wireless message.

Close the doors of the machine and place a telephone transmitter on the inside. Or, better still, place the transmitter directly on the end of the tone arm. This latter method can be used with any make of phonograph. Then connect a telephone receiver (or a number of telephone receivers in parallel) in series with the transmitter and a few batteries.

This method overcomes all objections to the phonograph method and is much better than the omnigraph method since the phonograph records can be made to represent two stations of a different pitch sending at the same time, interference, etc. When you tire of listening to radio signals put on an ordinary record and have a "wireless" concert. What?

Contributed by PAUL G. EDWARDS

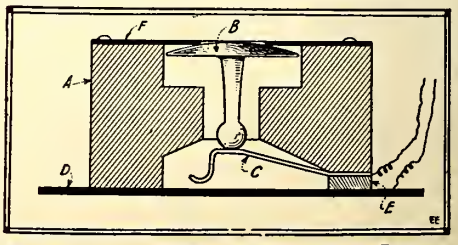
"Collar Button" Push Button

THIRD PRIZE, $1.00

Here is a push button designed to use up all your waste material and make you buy more collar buttons. Bore the holes as shown in a two by one-half inch block of wood, screw on the metal plate D, with the brass spring C insulated from it by the wood or fiber E, slip in your collar button B, glue on the thin piece of wood F, and Eureka! there you have it!

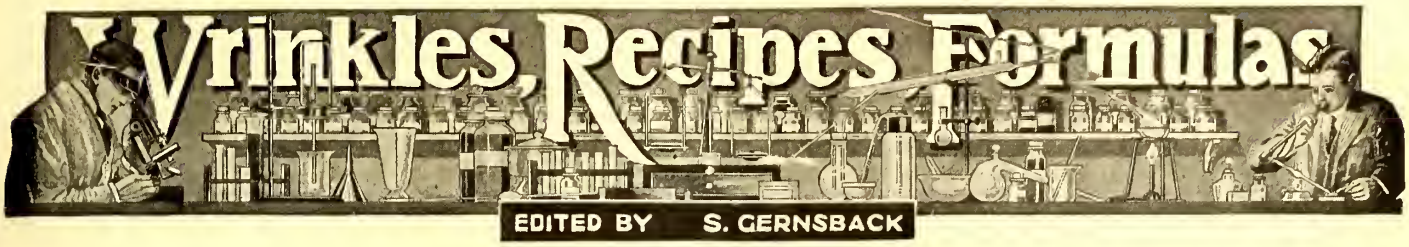
I know my friends will surely bless me for this valuable contribution to Science in the Home. Pa can rest his mind hereafter —when the shirt button drops, he will know it's gone to help the cause of true Science.

Contributed by RAY BILLINGTON.



At Last! The "Collar Button" Push Button. Papa Will Never Find His Collar Buttons Now, When They Roll Away Under the Bed. Little "Willie" Will See to That!

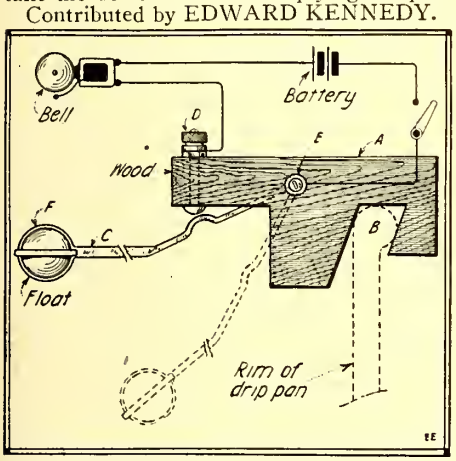
www.americanradiohistory.com



TELL-TALE FOR REFRIGERATOR DRIP PAN.

This tell-tale for an ice box drip-pan consists of a piece of hard wood or fiber cut into the form (A). A piece of No. 14 copper wire is bent into the form (C). This form is allowed to turn on pivot (E), which is a current carrying part of the circuit. When the pan is full of water, the form (C) floats up by means of a piece of wood (cork is good) attached to the end. The copper wire makes contact with (D), and the bell rings, indicating that the pan is full. The notch (B) makes it possible to take the device off when emptying the pan.

Contributed by EDWARD KENNEDY.



Simplicity Is Stamped All Over This Home-made Refrigerator Drip-pan Alarm. It Costs But a Few Cents to Make and Will Save Your Carpets and Hard-wood Floors.

HINTS ON LABORATORY APPARATUS.

By Eugene McGowan

To most experimenters chemistry undoubtedly proves a most interesting study. However the chief fault lies in the fact that things mess up so easily. The following is intended to overcome this difficulty.

First of all the laboratory should be arranged so that the one who uses the room may be able to find everything he wants.

A gross of empty wooden boxes, 12 inches x 8 inches x 4 inches, will be found convenient for keeping dry reagents in.

Labels should be used freely, and all unlabelled bottles washed out. Paper labels on bottles may be protected by a coating of paraffin wax varnish or shellac. But most bottles should have some label in the substance of the glass. These are made in two forms. Enamel labels are melted on the glass. They last well, but white enamel is not always distinct when white crystals are in the bottle. Sand-blast labels are made by roughening the surface of the glass with a jet of sand driven by a blast of air. They are apt to be indistinct when wet, if not made with a really rough surface. They can be made more distinct by rubbing over with crayon or chalk. Sand blast labels cost only about half as much as enamel labels.

Retort stands should be firm and substantial. The sliding collars for the rings should be slotted at the sides, so as to move easily; and a good clamp should be chosen with well-made screw threads.

Deflagrating spoons can be cleaned by holding the cup in the Bunsen flame for a few seconds.

Bunsen burners occasionally get blocked by some molten substance falling into the inner tube. They may be cleaned by washing with water. After washing blow thru the burner to remove any drop of water which may clog the exit. The revolving tube or ring should be frequently turned, so as to keep it in order; otherwise they get jammed and it is impossible to change quickly from a yellow to a blue flame.

Balances should turn with much less than a centigram. Balances with steel knife-edges, if protected from the air of the laboratory, will remain serviceable for years. Those with agate edges set in steel are more durable, but are more expensive. Weights less than a centigram are needless, and cause trouble to beginners. More exact weighing can always be done by watching the pointer, if the weights are accurate.

Management of mercury. Mercury is difficult to manage, on account of its weight and the ease with which it picks up impurities. Stone-ware mortars are better for holding mercury than glass beakers, which easily crack when set down. All operations with mercury should be conducted over a tray or on a table with a groove around the edge.

Dust on the surface of mercury may be removed by allowing the mercury to run thru a dry filter paper in which a few pin holes have been made. Or the mercury may be washed in a current of water, and then past thru a separating funnel. The little moisture on the surface may be removed with a blotting paper. Many metals easily dissolve in mercury; and a very little tin or zinc will spoil its fluidity. They are best removed by shaking the mercury in a bottle with a little nitric acid; the tin or zinc will then dissolve, leaving the mercury pure.

A few words of caution concerning the care of reagent bottles are in place here. A good reagent bottle must have its stopper ground to fit it, and this stopper will not fit any other bottle you may have. Consequently the stoppers should never be interchanged. Again, the stoppers of all reagent bottles, excepting sulfuric acid, should be paraffined, otherwise they are apt to stick.

Do not lay down the cork of a reagent bottle while pouring out a solution, as the stoppers may become changed. Again, no solution but the one corresponding to the name on the bottle should ever be placed in the bottle.

Another important item is that each bottle shall have its own particular place on the shelf, and always be put in its place; thus the amateur chemist will know exactly where to find the proper reagent, just as a printer knows where to find the letters in his case, by prearrangement.

USE FOR AN ATOMIZER.

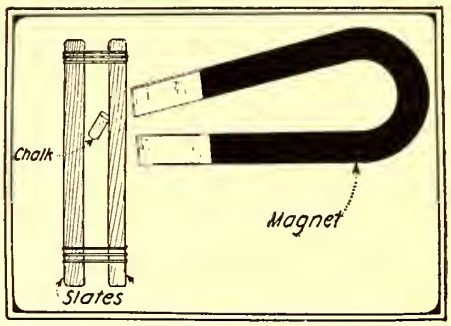
An atomizer is a handy appliance to furnish a draft of air when drying precipitates or evaporating solvents like ether or chloroform. The drying of precipitates and crystals can best be carried out when same is placed on a blotter to help absorb the liquid.

"SPIRIT" SLATE-WRITING.

Two thin slates are brought forth and offered for examination by the audience. The operator then places in between the two plates a small piece of chalk and hands the two slates to some-one (it does not matter whom) to tie with a string or seal all around with scaling-wax. After a few minutes or so, the slates are taken apart and Presto! there is found a message from the "spirit world" written with the chalk, which was placed in there by the "Medium."

The way it's done is this:

The chalk is of special formation; it is made of chalk dust mixed with iron-filings and a little glue. A strong (need not be very big) magnet is used to make the chalk move and write the message. The "Medium" located the chalk by tipping the slates to one corner and placing the magnet under it.



"Spirit" Slate Writing May Be Performed With This Simple Apparatus. The Chalk Container Could Very Well Be a Small Perforated Ball Filled With Powdered Chalk. The Slates Should Be Held Horizontally.

This works better in the dark for the simple reason that the people will not notice the magnet and its use. The darker the better.

Contributed by GEORGE PASTO.

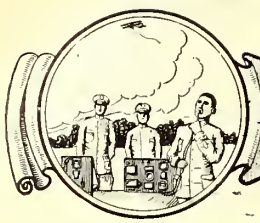
MAKING THE MOST OF A LITTLE SPACE.

It is most discouraging to have to spend half-an-hour finding tools and impedimenta before starting an hour's work in the evening. The remedy is to have a place for everything, and keep everything in its place. Also, keep them as compactly as possible. A good deal of extra room can be got out of an ordinary cupboard by the exercise of a little ingenuity. Things not often required should be kept on the top shelf. Perhaps there is still some space to spare. Then tack a piece of cloth or a large handkerchief inside the top of the cupboard, and screw in a couple of brass screw hooks a few inches from the ends. Sew a brass ring to each of the free corners of the cloth and you have a sort of cradle in which many odd things may be suspended by slipping the rings over the hooks.

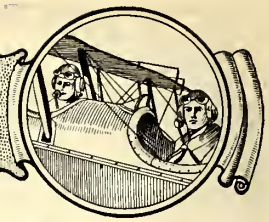
A dozen wooden soap or sugar boxes, stood one above another in a corner of the room, preferably in a recess, will do duty for a cupboard. Capital shelves can be made inside the boxes, using wood from the lids, while the whole structure can be effectually disguised during the daytime by covering it with a piece of dark colored material. Extra room can be made by fixing hooks to the outside edges of the boxes for things that can be hung up, while other odds and ends can be dropt into cocoa tins and the like tacked to the sides of the boxes.

Contributed by H. J. GRAY.

www.americanradiohistory.com



RADIO DEPARTMENT



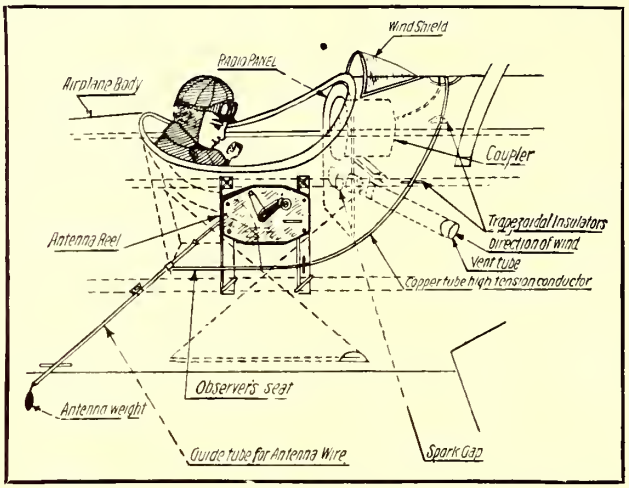
Airplane Antenna Reels

By LESTER F. RYAN

ONE of the most important parts of the antenna system in connection with airplane radio work is the *antenna reel*. Electrically, the antenna system of a radio transmitter consists of a single trailing wire and a counterpoise. The antenna wire is lowered from the airplane during flight by a hand reel and trails out to a distance of about 300 feet, at an angle of 20 degrees to the fuselage.

The antenna reel, as illustrated in Fig. 1, is so designed in order to stand all mechanical and electrical stresses under difficult service conditions.

It is constructed entirely of the highest grade insulating material and will therefore stand the high antenna voltages which are developed by the high power of the transmitter without leakage and danger to the operator.



Arrangement of Airplane Antenna Reel On Outside of Cockpit. The Reel Is Self-locking and Also Indicates At a Glance How Many Feet of Aërial Cable the Aviator Has Let Out. The Cable Runs Thru a Guide Tube As Shown. Thousands of Sets Like Those Shown Were Used During the War.

The drum of the reel will hold 600 feet of stranded phosfor bronze or other antenna cable, i.e., if one antenna of 300 feet of wire is lost, an additional antenna of 300 feet is still available. It is provided with a revolution counter as shown in figure which indicates the number of turns or feet of antenna wire in use.

It is also fitted with a *brake* or locking device, which is used to lock the drum when the reel is not in use. This brake may also be used to control the speed of the unwinding. The antenna wire is of tinned copper, and has a breaking strength of 400 pounds.

To prevent chafing and breakage of the antenna wire near the weight when the antenna is reeled in, due to the swinging of the weight, a stiff phosfor bronze wire is connected between the antenna wire and the swivel hook. A swivel hook is placed at the end of the tail wire to prevent spinning of the weight during flight. The weight is of lead, and weighs 1¾ pounds. It is of stream-line form to reduce wind resistance to a minimum.

The insulators used are of trapezoidal shape and serve the purpose of insulating the guide tube from the airplane. The flattened end of the trapezoid is made fast to the copper tube; the opposite base is made fast to the airplane fuselage.

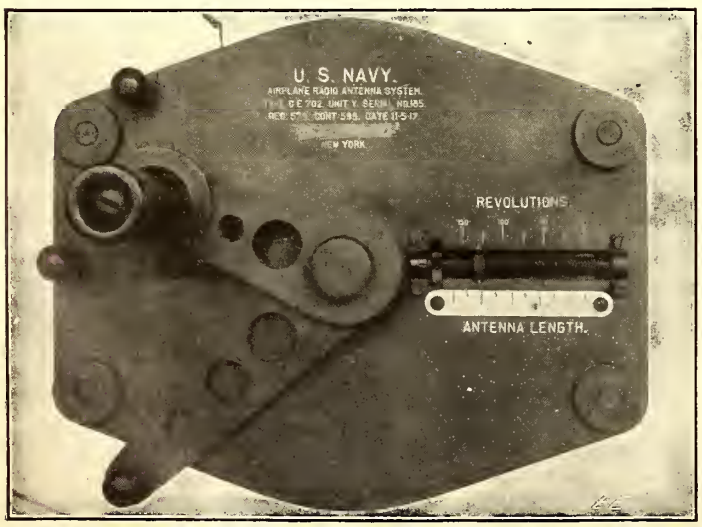
To prevent *sparking* or *grounding* of the antenna to the cowl a *cowl insulator* is used. It is made of bakelized canvas, six inches in diameter, with holes near its perifery for lashing to the cowl.

When installing the antenna system on a 'plane, great care must be taken to provide sufficient insulation against the high voltages developed by the transmitter. As a rule, the antenna reel is mounted outside of the fuselage on the right-hand side of the plane, as here shown. It is attached to two vertical pieces of wood which are lashed to the upper main and seat *longerons*. These pieces contain holes corresponding to the four attachment legs of the reels, and thru which these legs extend to the inside of the fuselage. The circular bakelite nuts, as shown in figure, secure the reel posts to these uprights. The copper guide tube thru which the antenna cable slides after leaving the reel is supported beneath and rearward from the antenna reel at an angle of about 20 degrees to the fuselage. It extends 6 inches beneath the fuselage, and is separated by insulators.

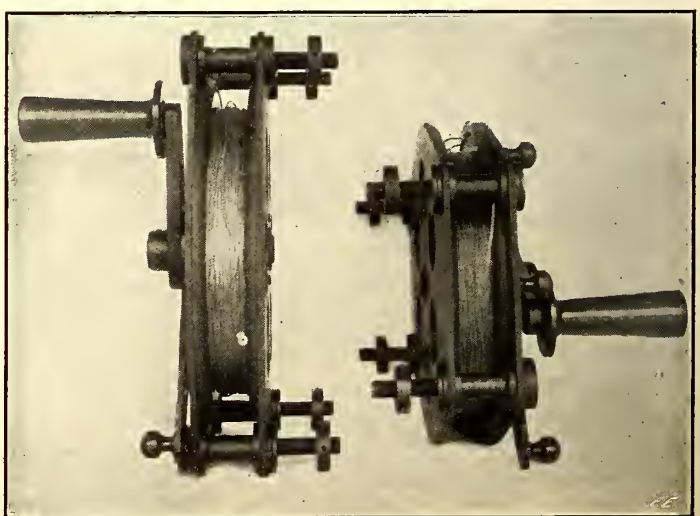
The connection between the antenna helix on the set and the antenna guide tube is as follows: The antenna helix is connected to the lower end of the cowl insulator as shown in figure by rubber-covered cable. The cowl insulator is connected with the antenna guide tube by means of a six-foot length of 0.180-inch copper tubing. The antenna wire is connected to the antenna reel by means of a hole thru the bakelite shaft on which the handle is fastened.

When properly installed, the antenna system should cause no trouble. The antenna reel may safely be operated while sending and is without doubt one of the most ingenious and novel features developed in airplane radio transmitters. This type of antenna reel is used in conjunction with the airplane transmitter described in the July issue of the *Radio Amateur News*.

The modern practise in airplane radiotelegraphy and telephony calls for the use of two antenna cables, let out from either side of the airplane. These cables have weights as usual.



View of Indicator Panel of Antenna Reel Device Fitted On Airplanes. The Length of Aërial Let Out Is Read Off Directly.



Two Sizes of Airplane Antenna Reels Are Here Illustrated. Note the Heavy Insulating Support Studs by Which the Device Is Supported.

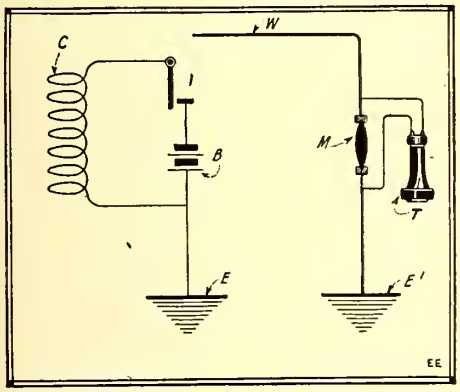
www.americanradiohistory.com

How I Invented the Crystal Detector

By GREENLEAF WHITTIER PICKARD

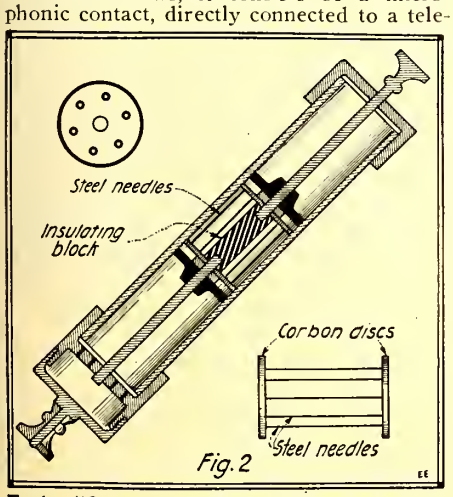
SPECIALLY WRITTEN FOR THE "ELECTRICAL EXPERIMENTER"

IN 1874 Prof. Ferdinand Braun discovered *unilateral conductivity* in a number of the natural metallic sulfids, such as pyrite, galena and chalcopyrite His observations were limited to the application of battery current to metallic contacts on the minerals, and he noted that a materially larger current would flow in one direction than in the other. Five years later, in 1879, Prof. D. E. Hughes, while experimenting with a carbon microphone, discovered that it was affected by a distant spark discharge, altho there was no wire connection between the circuits. Altho Prof. Hughes did not publish an account of his experiments until 1899, he exhibited his apparatus in operation, over distances as great as 1,500 feet, to many of the prominent English physicists, including Preece, Crookes, Stokes and Dewar. A glance at the circuit employed by Prof. Hughes in 1879 will show that he had the principal elements of the



Hughes 1879 Detector System. B Is the Transmitting Battery, C an Inductance Coil, 1 a Mechanically Operated Interrupter and E a Ground Connection. W is the Receiving Aerial, M a Carbon Microphone, T a Telephone Receiver and E¹ a Ground Connection. Hughes Discovered that the Carbon Microphone Was Affected by a Distant Spark Discharge. Fig. 1.

system re-discovered by Marconi in 1895. Undoubtedly, if Prof. Hughes had had proper encouragement at the time, he would not only have anticipated Hertz in the discovery of electric waves, but also Marconi, in their wonderful application to Radio-telegraphy, and so have altered considerably the course of scientific history. Our immediate interest in Prof. Hughes' work is, however, his detector. As my illustration shows, it consists of a microphonic contact, directly connected to a telephone receiver, and without local battery. It is the germ of the crystal detector.



Early "Carbon-Steel" Microphone Detector Used by the Author in 1902 at the Cape May, N. J., Wireless Station.



Dr. Greenleaf Whittier Pickard, Inventor of the Crystal Rectifying Detector. He is Well-known as an Electrical, Telephone, and Radio Engineer and Has Taken Out Numerous Wireless and Other Patents. He Has Tested 31,250 Crystal Detector Combinations.

The Coherer

In 1898, when my work in Radio-communication began, there was but one detector—the coherer. To the early workers in this field, the coherer was the *bête noir* of radio-telegraphy; the principal obstacle to assured and speedy communication without wires. Despite its unpleasant idiosyncrasies, the coherer had our deep respect, first because it was the only thing then known which worked, and second because of its *supposed* extreme sensitiveness to electrical oscillations. In the absence of any quantitative measurements, it was generally assumed that the received energy in radio-communication was so infinitesimal as to absolutely preclude its measurement or even detection by ordinary means, such as galvanometers or telephones, even if by some means it could be converted into a form suitable for these instruments. Altho in some of the early laboratory work with electrical waves various forms of thermo-couples and bolometers were used, the practical workers never considered these as possibilities in actual radio-telegraphy, because of the supposed extremely minute character of the received currents, to which such a device as the coherer could alone respond. In common with the other workers at that time, I held the same view of radio reception, and spent much time in attempts to improve the coherer as to regularity of action.

FEW inventions in radio have been made which proved of such tremendous importance to the young art than the Crystal Detector, invented by Dr. Greenleaf Whittier Pickard. In the olden days of the coherer, when we were still groping in the dark, only comparatively small distances could be bridged. The invention of the Crystal Detector may be said to have opened up an entirely new era in radio, for with the coming of this detector great distances were easily bridged and almost perfect communication was possible at all times. "Wireless" had arrived.

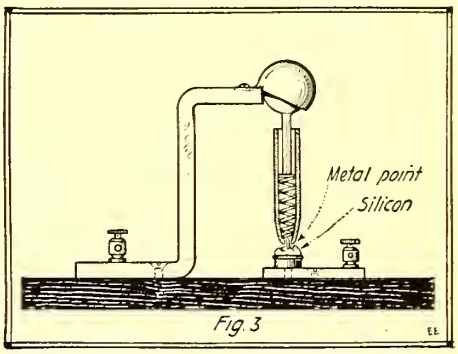
But you will want to read the story of how Dr. Pickard invented the Crystal Detector yourself. It is a historical classic. We promise you twenty minutes of most unusual as well as instructive reading.—EDITOR.

The Microphone Detector.

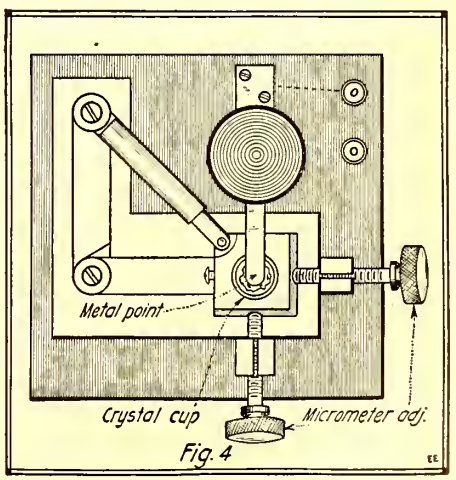
Much of the trouble in coherer working arose from the adjustments of the coherer adjuncts, the relay-tapper-recorder trio. Realizing this, in the latter part of 1899 I began experiments with a *single contact coherer,* in series with a battery and telephone receiver. I soon found, as several others did at about the same time, that a simple carbon steel microphone consisting of a sewing needle resting lightly against a carbon block, in series with a cell or two of dry battery and a telephone receiver, formed a most effective detector, exceeding the coherer in sensitiveness, speed of working and reliability. And, best of all, I found that this combination permitted a considerable degree of discrimination between Morse signals and static, which was not possest at all by the coherer-relay-tapper-recorder combination. All was fish that came to the coherer net, and the recorder wrote down dot and dash combinations quite impartially for legitimate signals, static disturbances, a slipping trolley several blocks away and even the turning on and off of electric lights in the building. Translation of the tape frequently required a brilliant "imagination!"

Altho the *microphone detector* was a

(*Continued on page* 360)



The "Silicon" Detector—A Good Old Standby of All Radio Operators. Invented by Dr. Pickard at an Early Date. It Involved a Sharp Metal Point in Spring Contact With a Piece of Fused Silicon.

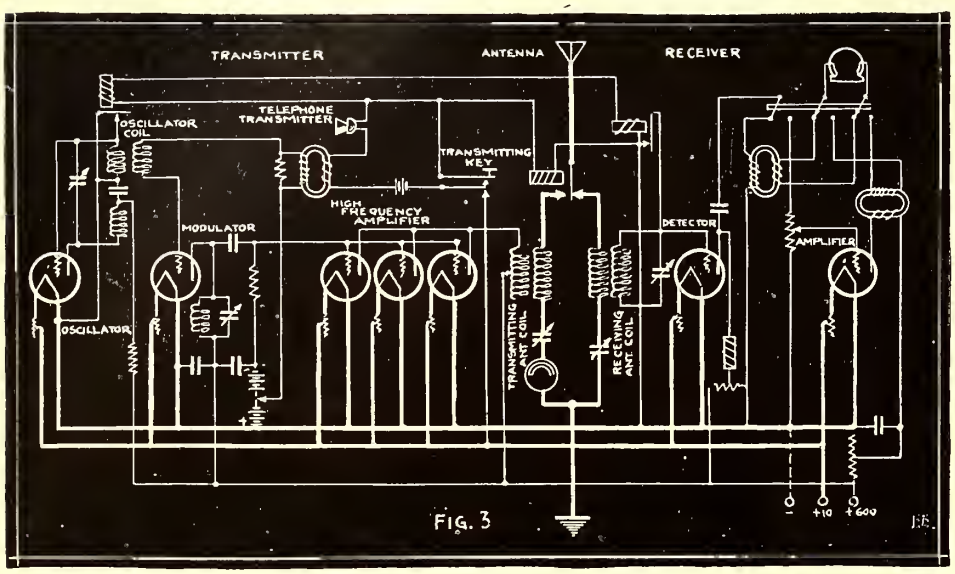


Dr. Pickard's "Micrometer Adjustment" Detector. Can be Used With Any Crystal and the Cup Adjusted With Precision in Any Direction While in Use.

www.americanradiohistory.com

A Review of Radio-Telephony

RADIO-TELEPHONY has been before the public so frequently of late that an article describing the modern scientific apparatus that has made it possible would not go amiss, it is believed. No one man can claim the credit for *discovering* "radio-telephony," but electromagnetic waves of so-called "radio" frequency were first intentionally produced and studied by Hertz who was guided by the electromagnetic equations deducced by Maxwell, constructed some twenty years earlier. The first radio telegraphic outfit was produced by Hertz, and improved by the discovery of the coherer by Brown, and of the invention of the present form of antennae first by Tesla, followed by Marconi, which allows the radiation of large power by long waves.



Battleship Radio-telephone Set—Schematic Circuit Diagram. Showing Microphone Modulator Circuit, Talking Key, etc. Note How the Vacuum Bulbs are Connected on Parallel.

At an early date it was realized that a crystal detector in combination with a telephone would produce in the telephone, currents whose amplitudes varied approximately as the amplitudes of the received high frequency wave, and consequently if the amplitude of this wave could be varied at the transmitting station in accordance with speech, radio telephony would be possible.

The receiving apparatus was therefore in existence and all that was necessary was a means of *varying the amplitude* of the transmitting wave. In regular wire telephony, the amplitude is so varied by *microphones*, and of course this device was at once applied to radio-telephony. The great trouble lay, however, in the fact that microphones, even when especially designed, cannot easily be made to carry large currents and still function properly. Because of this handicap, numerous voice-operated resistance-varying devices appeared. Using methods of this kind, considerable success was obtained, and in 1912 Vanni succeeded in telephoning 1,000 kilometers.

During the years of 1912 to 1914, a great deal of research work was carried on in connection with the use of the audion in radio-telephony, and in 1914 it was decided that the apparatus was sufficiently developed to warrant an attempt at long range wireless telephony. These tests were so successful, that the Navy Department erected an experimental station at Arlington, Va. The type of power bulb used is shown in Fig. 1. The current, by which the filaments were heated, was supplied by a local power company and brought by underground cable to the station.

Alternating current was used for heating the filament and any possibility of the superposition of a 60 or 120 cycle note, due to the frequency of this current, was eliminated by the use of a special scheme of connections. Between the plate and the filament of the power tube a constant voltage of about 500 volts was imprest. It was obtained from one of the motor generators used by the Navy in operating the large Poulsen arc, with which they were then transmitting to Darien and other remote points.

The immense racks containing the power tubes are shown in Fig. 2. At the left in this figure is the remote control for operating the motor generator set in the main Navy radio station at Arlington, and also for metering the currents used for lighting the plant and other such auxiliary purposes.

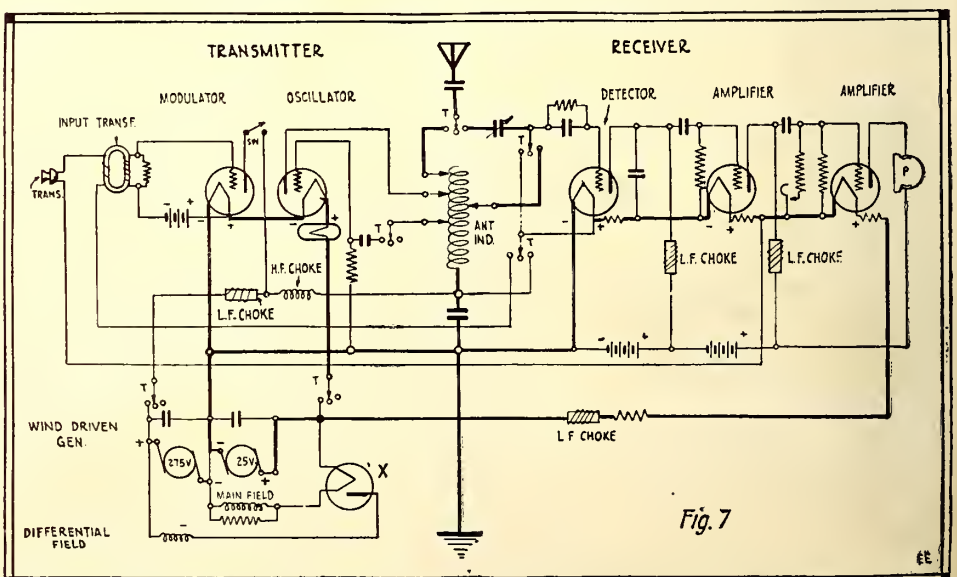
The first opportunity to demonstrate the use of wireless telephony in war was presented early in 1916. After several trials and experiments, the first radio telephone set installed on a battleship was placed on the U. S. S. *New Hampshire*. This set differed from the one in Arlington only in size. The set was installed on the lower bridge deck, and the telephone transmitter and receiver were mounted on the bridge itself. This allowed the captain, while on the bridge, to converse without leaving his post.

After many successful trials, it was decided to install two experimental sets on other battleships and give the operating staff an opportunity to investigate and criticize them. These sets were installed on the battleships *Arkansas* and *Florida* at Guantanamo, Cuba, the first part of February, 1916. It was found entirely practicable to hold a two-way conversation between vessels over 30 miles apart. There is no reason to think that this was the limit of communication as some of these conversations were overheard in Jamaica, a distance of 175 miles. No attempt was made for range as that was not the object in building these sets.

Each set consisted of a transmitting and receiving set complete with motor-generators. An extension circuit was provided so as to allow placing a hand set in the captain's cabin. The normal position of the antennae was connected to the receiving set in order to hear incoming signals. When it was desired to talk, a push button operated a solenoid switch which connected the antennae to the transmitting set and started the motor-generator. This operation consumed only a fraction of a second. The wave length range of this set was from 600 to 1,200 meters. The complete circuit is shown in Fig. 3.

The greatest success with radio-telephony has been accomplisht in connection with military work in the air. On May 22, 1917, Major General Squier, Chief Signal Officer of the Army, called a conference at Washington to consider the feasibility of intercommunication between airplanes while in flight by means of radio-telephony. There were present at this conference, besides General Squier, Colonel Rees, of the Royal Flying Crops of Great Britain, Captain, now Colonel, C. C. Culver, of the Signal Corps, and Major, later Lieut. Colonel, F. B. Jewett, and Captain, later Major, E. B. Craft, who had been assigned

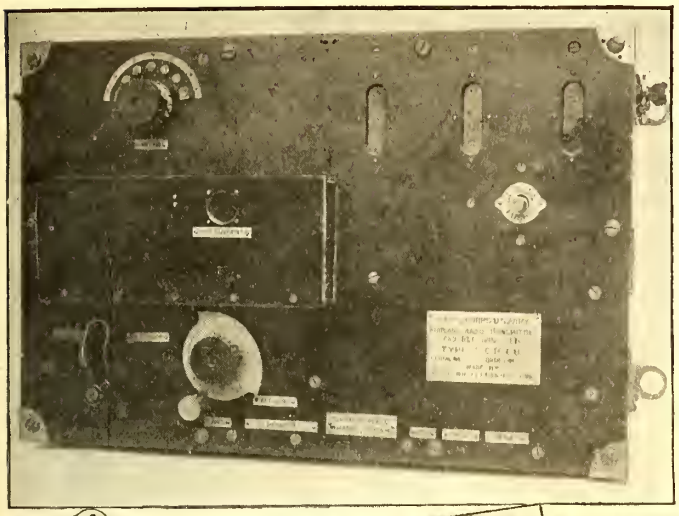
(*Continued on page* 369)

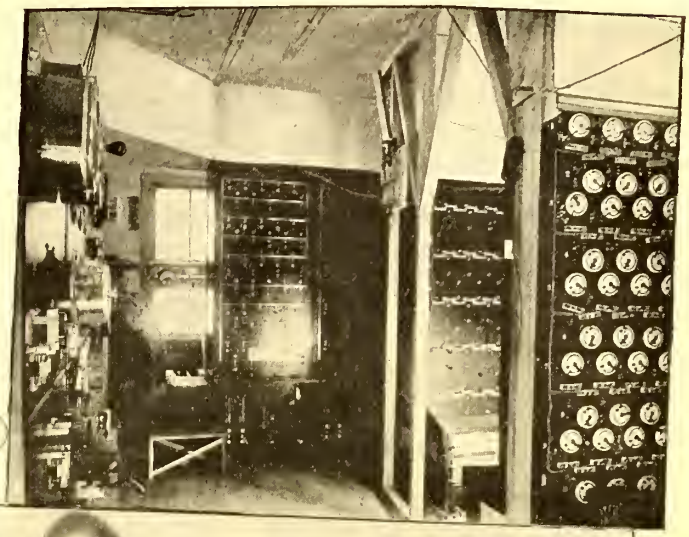


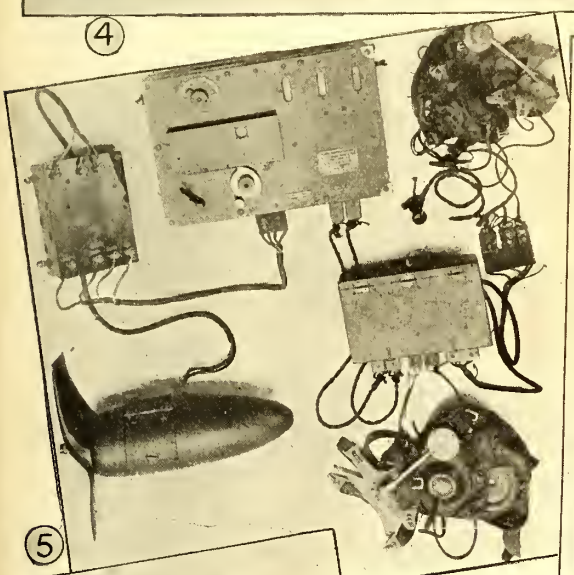
Schematic Circuit—Airplane Wireless Telephone Set, U. S. Signal Corps—Type SCR-68. Transmitting and Receiving Circuits Are Shown. "X" Indicates the Clever Vacuum Bulb Regulator for Maintaining the Dynamo Voltage Constant.

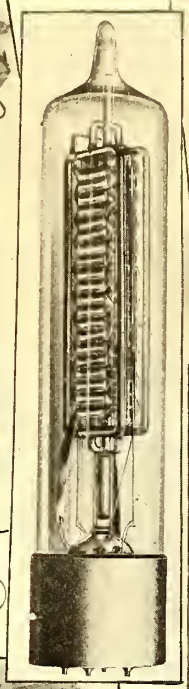
www.americanradiohistory.com

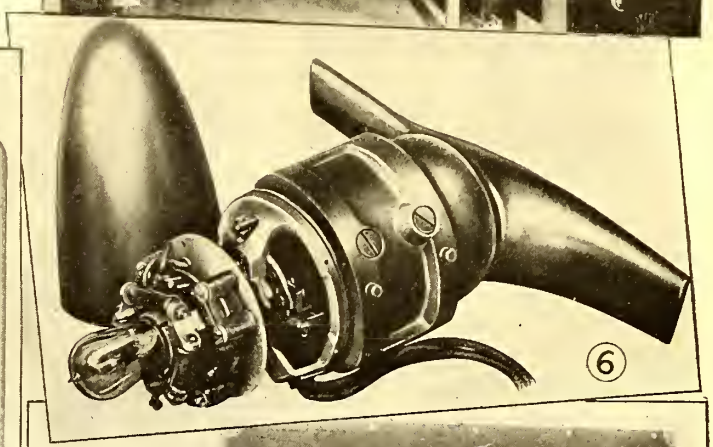
American Radio-Telephone Apparatus

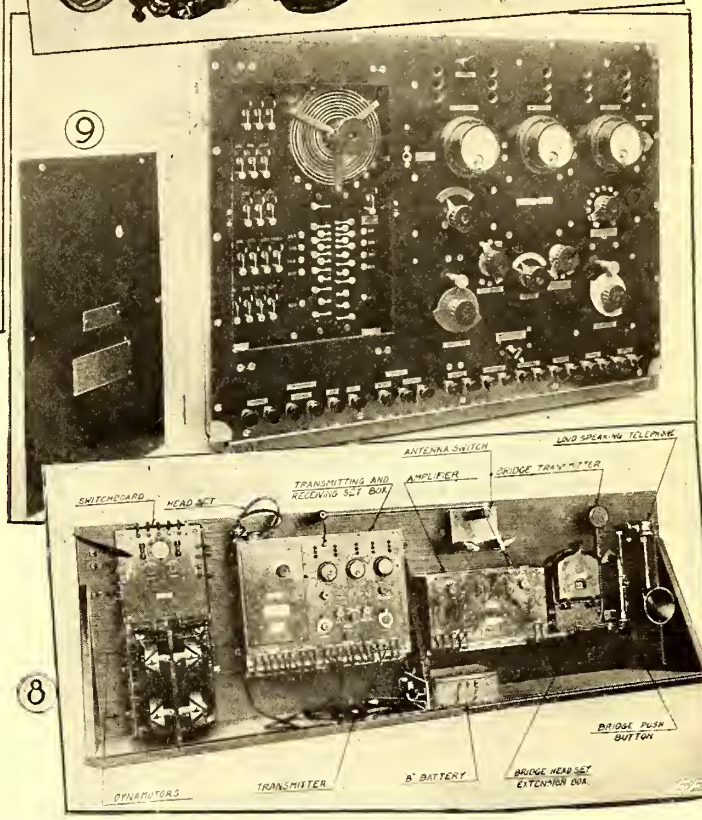


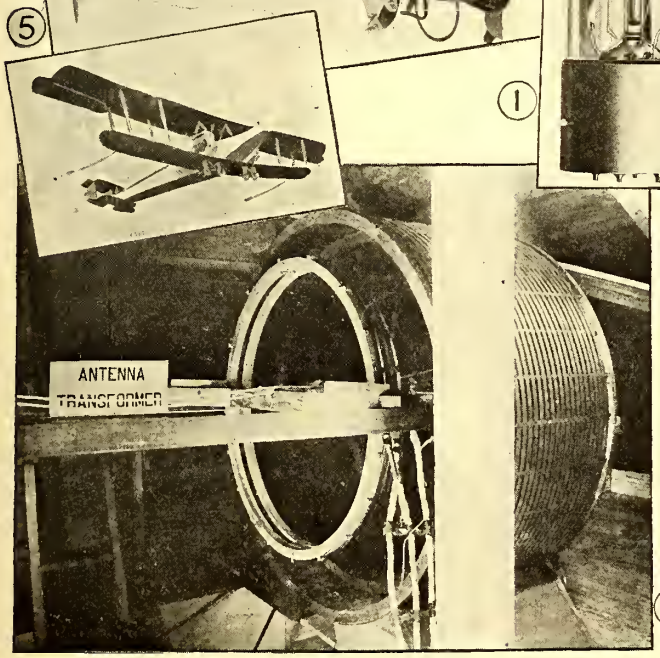












AMERICAN WIRELESS TELEPHONE APPARATUS DEVELOPED AND USED DURING THE WAR.

Fig. 1—Type of Vacuum Tube Oscillator Used in Long Distance Radio Telephone Work. Fig 2—Remarkable View Showing the Vacuum Tube Rack in the Radio Experimental Station at Arlington, Va. Note the Large Number of Rheostat Regulators for Controlling the Filament Currents of the Various Tubes. Several Hundred Tubes Were Available in This Laboratory, Any One or All of Which Could Be Used at One Time. Fig. 4—Front View of Transmitting and Receiving Set Used for Wireless Telephony by the U. S. Signal Corps. The Vacuum Tubes Are Safely Enclosed Within the Cabinet, and Their Degree of Luminosity Is Visible Thru the Oval Glass Windows in the Upper Right Hand Corner in the Panel. Fig. 5—This Shows the Complete Radio Telephone Equipment for Two-Place Airplane Service. Note the Two Helmets Fitted With Wireless Receivers and the Breast-Plate Transmitters, Specially Designed to Shut Out Noises From the Engine. The Wind-Driven Generator Is Shown at the Left. Fig. 6—View of Wind-Driven Radio-Telephone Generator with Stream-line Cover Removed, Showing Vacuum Tube Which Regulates the Voltage and Keeps It Constant at All Speeds,—an Extremely Clever Invention Due to an American Engineer. Fig. 8—An Assembled View of Various Apparata That Go to Make Up a Standard "Submarine Chaser" Radiophone Equipment. A Loud-Speaking Receiver Is Connected to a Three-Stage Vacuum Tube Amplifier. Fig. 9—This View Shows the "Submarine Chaser" Type of Transmitting and Receiving Set for Radiophony. Fig. 10—Shows One of the Gigantic Antenna Tuning Transformers at the Radio Experimental Station, Arlington, Va. The Secondary of the Tuning Transformer Is Moved In and Out of the Primary, by Means of Cables Which Run to Control Wheels in the Apparata Room. Some of the Most Important Radio-Telephone and Telegraph Researches Carried Out During the War Were Performed at This High Power Government Wireless Station.

www.americanradiohistory.com

Concentrated or Loop Aërials

By Prof. Lloyd M. Knoll, A. M.

SEVERAL freaks and dreams of radio experimenters before the war have been realized in a device developed by the writer, in connection with the 4th Naval District. Not only does the device eliminate a large amount of interference from other stations of the same wave length, but like the Rogers underground system, eliminates

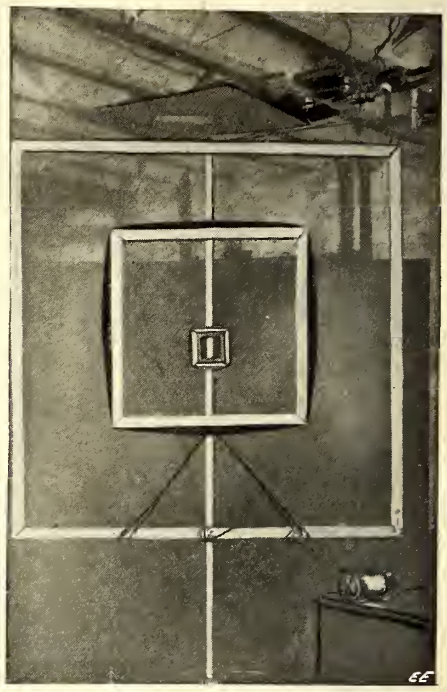


The Author and One of His Loop Aërial Radio Receiving Sets.

static as well, and being in a highly concentrated form it brings the outfit within the reach of the Radio Amateur. It is specially useful for the city wireless "Bug" who has limited space or a fussy landlord to contend with. It is no longer necessary to put poles on some high building, string aërials over large areas of ground nor even to tap an old 'phone line. The dream of the experimenter that some day he might put a nail in a flower pot for a ground and run a wire to a nail on the wall of his room is eclipsed and now the camper or tourist can pack a grip and be sure of always being in radio touch with the world.

Many operators will recall how it was easier to get certain stations when the aërial was disconnected from the set. This freak (?) set the writer and his friend, Mr. T. Appleby, to work to solve the problem of receiving regularly without an aërial and their results were put at the disposal of the government with the declaration of hostilities, and is only now being made public. Mr. (now Lieut.) Appleby discovered that the device had a strong *directional effect*. Later the writer concentrated the apparatus and discovered the way to eliminate static as well.

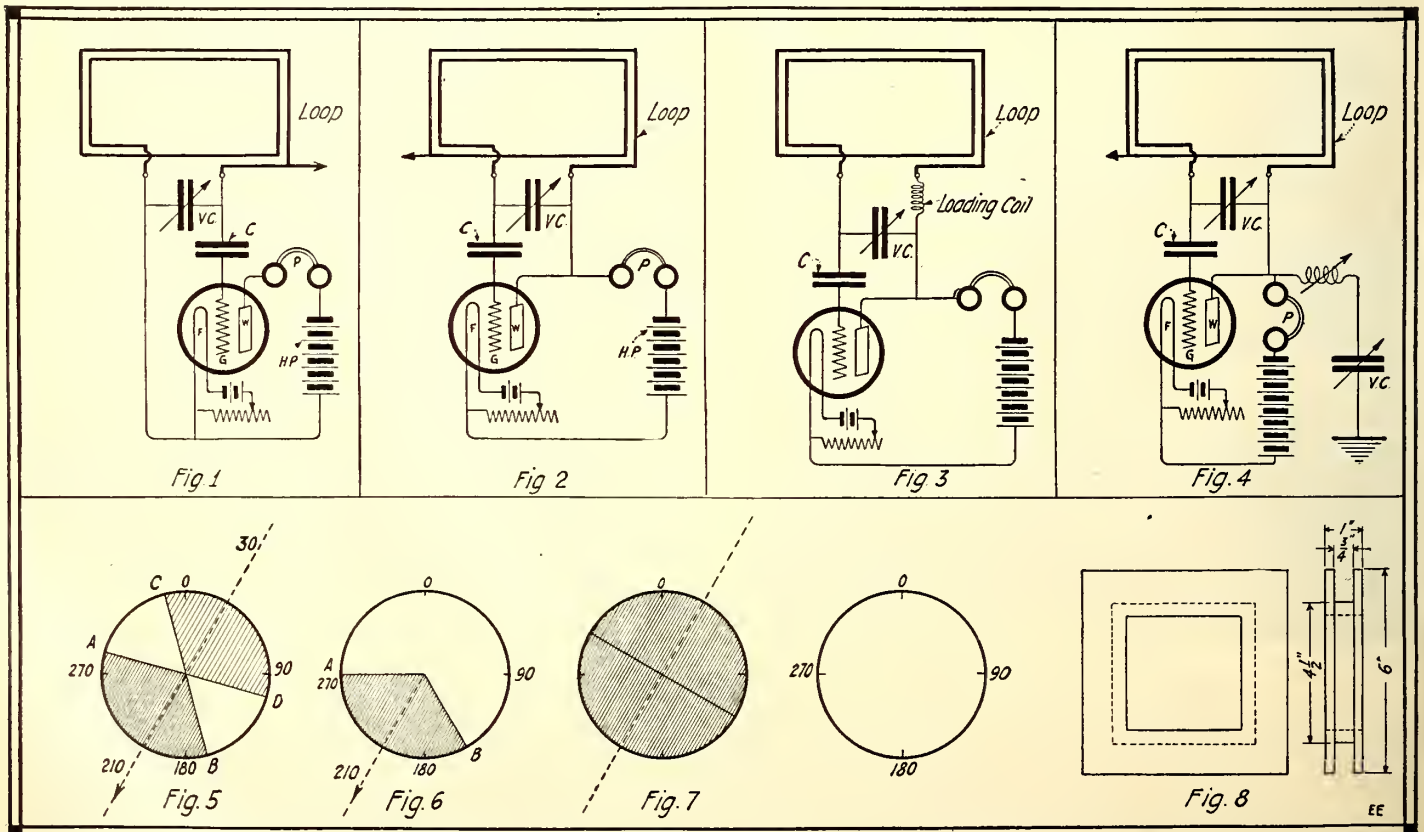
The extreme simplicity of the outfit is one of its most striking features. In fact the amateur has all the parts needed and early systems employed very much the same features but on a large scale. A loop of wire of proper proportions, a detector (a vacuum tube is most sensitive but not necessary), a pair of 'phones, the proper connections, and there you are. In the photograph may be seen a set in operation receiving on 2,500 meters wave length. Fig. 2 shows the receiving hook-up employed. As stated before there is a decided *directional effect* and if the loop is mounted in a vertical plane and rotated around a vertical axis, a remarkable fact is noticed. For example, suppose Fig. 5 to be taken as the circle described by the loop. Now if the signal is coming from a point along a line 210° from North, then if the end of the loop connected to the



Some of the Author's Loop Antennae. A Small Aërial of This Type Has Picked Up Messages From Stations 200 Miles Away.

grid of the audion or v. t. moves from A to B, there will be an increase and then a decrease in the intensity of the signal;

(*Continued on page* 362)



Various Hook-ups of Prof. Knoll's Radio Receiving Apparatus Involving Loop Antennae. The Lower Circle Diagrams Show the Relative Activities of the Loop Antennae.

www.americanradiohistory.com

To War on an American Destroyer

A Radio Operator's Experience Chasing the U-Boats

By A. H. WHEDON

TO begin with, let it be known that the author spent sixteen long, weary months with the United States Destroyer flotilla based in Queenstown, Ireland, and therefore feels competent to write the following few remarks.

The American destroyers arrived in Queenstown, Ireland, on the fourth day of May, 1917, after a ten-day trip across the Atlantic, during which time our radio transmitting apparatus was not used more than three or four times. You see, when we left the States we had no idea of what we were going into. Our idea of the German submarine question had been entirely derived from reading the newspapers. Consequently, we imagined that we would see a *dozen or so a day,* and that when a merchantship used her radio, several submarines got her position by a direction-finder, and sallied forth to attack her. Naturally, we were very quiet with our own radio instruments, and were terribly disappointed when we reached port without seeing a single "sub."



A "Lime-juicer" (English Sailor) Radio Operator Trying to Decipher What the Blankty-Blank the Yank's Code Message Means.



Don't Look at this Scene too Long or You'll Get Seasick. It Represents What the Radio Room on a "Destroyer" Looks Like In a Heavy Sea.



The Radio Room on the "Destroyer" Had a Leaky Ventilator in the Roof. What Didn't Happen in Those Two Awful Days Off Brest, France,—COULDN'T.

When we reached Queenstown, the British Admiralty Authorities came aboard to look us over and to hold a conference with our officers. One of the results of the conference was the determination to use the British method of radio-communication. They called it W/T (Wireless Telegraph). Of course, the code was the same, but there the resemblance between the two systems ended. And perhaps you think it was easy to forget, after years of thoro training, the things that came as second nature to us and to substitute absolutely new stuff—it was not very simple.

And when it came to working with the "Limy" (British) ships and stations—my, my! They sent at the terrific speed of sixteen to twenty words per minute. Twenty words was their high speed limit. The American operators who first went over there were all picked men, and their speed varied from twenty-seven to thirty-four, and to come down to sweet sixteen, once again meant hard work!

But gradually, as we operated with them, their receiving speed increased, and likewise did their transmitting speed, and again our troubles were increased. Very few of you, probably, have ever heard a "Limy" spark in action, but most of you are fairly familiar with the sound of a low frequency buzz-saw, and believe one who knows, there is not enough difference between them to be happy about. And then, when they started to speed up on a spark like that—can you imagine it?

Another trifling (?) detail (?) that bothered us was the fact that everybody and everything dashed off on the one wave length—600 meters. And altho there was an order out to the effect that radio work was to be reduced to a minimum, very few people ever took any notice of it. Consequently, in the Irish Sea there was an awful mixup, for on the English coast there are Liverpool, Fishguard and Land's End. Opposite them, a few miles away on the Irish coast, there are Belfast, Dublin and Queenstown, and when all of these stations are trying to work on the same wave length, to say nothing of all the ships in the Irish Sea, there is, to say the least, a *little* interference. But as the English boats are not equipt with an efficient wave changer, as are all our boats, nothing was ever done about it. Gradually the problem resolved itself into the equation: "The guy with the most power wins," for nobody would ever keep quiet long enough to let the other fellow work. There was a time when I, personally, had a message to send to Liverpool. It took 5 K. W. for 100 miles.

The English are not renowned for their quick perception. We found that fact out to our sorrow. Altho "playing flats" (unauthorized conversation) is not permitted in either Navy, there are times when it is necessary to talk to the other fellow about a message, or on similar subjects. Of course, such conversation must necessarily be as short as possible. In the U. S. Navy every word is abbreviated in this unofficial conversation. For instance, one operator wants to ask another "What is the check on message number one?" It would be transmitted: "Wht ck msg one." After the answer would come "Tks" for "Thanks."

There was an occasion when my ship, the U. S. S. *Conyngham* was in company with the H. M. S. *Snowdrop,* a boat of the "sloop" type, developed during the war. My sending set wasn't working any too well, but as I had a long message to send him, I decided to make a try at it. So I opened up and started. Very shortly I began to miss sparks, so I signalled over "ST BI 5 TRANS BRKN DWN," meaning "Stand by for five minutes. My transmitter is broken down." There was complete silence for a few seconds, while he tried to puzzle it out. Then he came back with a great big question mark. I thought it possible that I had been a trifle speedy for him, so I made a hasty connection and sent it again, more slowly. More silence. Then more question marks. By that time I had fixt my set up, and was just about to start in on friend "lime-juicer" with the message, when he came across with the conventional signal for "Your Morse is unreadable. Put a competent W/T operator on watch." That was all the thanks I got for trying to tell him to wait a minute.

There may be some of you who think that radio in the Navy is a soft job. Well, it is—on a decent sized ship that knows enough not to roll and pitch *all* the time.

(*Continued on page* 367)

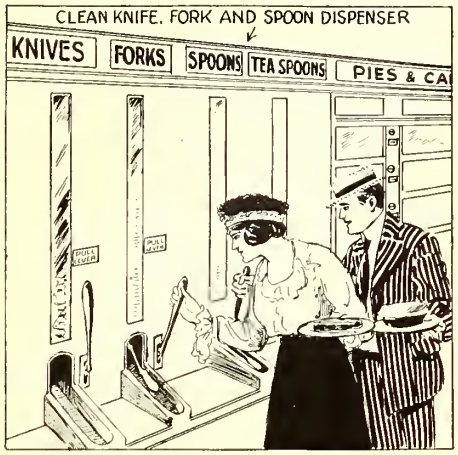
www.americanradiohistory.com

How to Develop Your Inventive Ability

By JAY G. HOBSON

(Author of "How to Finance and Manufacture a Patent")

AFTER many years of careful research into the mysteries of the human mind psychologists have concluded that every normal person is an inventor by nature, having inventive faculties to a certain degree.



The Automatic Restaurant Is a Clean Place To Eat, Isn't It? But Why Must We Allow People With Dirty Hands To Fumble Around In the Spoon, Knife and Fork Receptacle? Why Not Invent a "Dispenser" for the "Eating Tools?"

Many have developed these talents further than others, but the fact that we are all inventors naturally is of great importance to every one aspiring to create something of value to mankind and themselves. While we are assured that each individual is capable of creating, improving and originating new and useful things, yet most of us find considerable difficulty in deciding upon the best and surest course to pursue in order to develop our inventive qualities to a point of efficiency necessary to cash our ideas for their full worth.

Inventive ability is simply the power of close observation, scrutiny, imagination and analyzation of material things as they exist with the way they might be made to exist, if constructed in a different form. All things have at some time or other been the result of some dreamer's or some thinker's imagination and—observation crystallized into a mental picture, then developed until it has merged into actual form, a complete, improved article of practical worth.

The practise of observation, imagination,



Why Can't We Go to the Theatre and Find a Clothes Compartment in the Back of the Seat That Disappears Into the Basement When You Sit Down? Nobody Ever Thought of It!

constructive investigation and analyzation will develop this inventive ability and in time make it both perfect and prolific. But there are certain proven ways that help this development more than others. Idle curiosity over things will not promote the inventive training and is not constructive observation or investigation. Investigation, observation and analyzation must be done systematically and with a sincere aim in view. There must be a serious desire for betterment and improvement in mind to find that improvement or invention worth while.

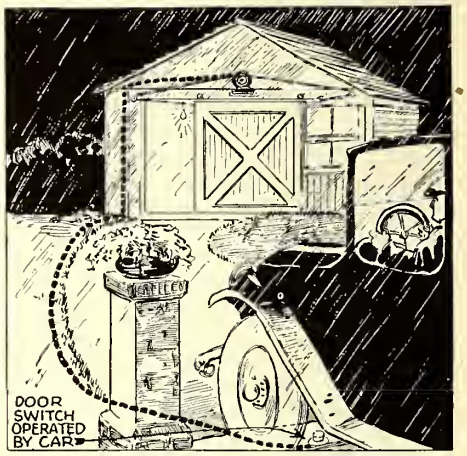
The great revolutionary inventions are few and far between, but when they do appear it is evident that some sincere mind has striven to create a working device of his mental picture which was undoubtedly conceived by a fervent desire to produce an improvement over unsatisfactory conditions as they were in the time of the conception. Or probably it was the aspiration to give the world a device that would save unnecessary labor, prolong life, or improve commercial intercourse for big business. However, it is establisht that to originate or create improvements of value, one must train his mind and imagination to picture things as they should be and then stick to his mental idea until it successfully matures into a practical device of certain operation.

There are numerous examples of inventive development but for illustration we will consider only a few. Elias Howe first observed the pressing need for a machine to do the tedious labor of sewing that in his day was entirely done by hand. After observation came investigation of his idea, then a mental picture or imagination of a machine capable of producing the desired result, then came analyzation of mechanical movements necessary to replace the human hand, and finally after years of discouraging effort he succeeded in designing and perfecting a model that not only did what the human hand would do but did it in one-fifth the time. It took Howe years to perfect his first machine mainly because in those days the art of mechanics was only in its infancy, which necessitated his working out of every mechanical detail. Today it is far easier for the inventor. He can conceive the idea, sketch plain plans and drawings and secure assistance to perfect the mechanical details. There are more and greater opportunities to become inventors today than ever. There is more money to be made and quicker. Elias Howe did not labor in vain as his invention made nearly two million dollars in royalties.

The incident of the hair pin and how its inventor observed his wife bending a straight hair pin to prevent it from coming out of the hair is a much hackneyed experience. But only recently an alert young man in Chicago conceived the idea of placing a hump in the neck of the old-fashioned hair pin to prevent it from coming out of the hair. A patent was obtained upon this extremely simple idea, they were offered to the feminine public in attractive packages and now sell by the millions. To date the inventor has made hundreds of thousands out of his simple little improvement, which only goes to prove that nothing is too small or too simple for our consideration and observation, if we would become successful inventors.

The simple ideas are, as a rule, more prolific and prevent infringement to a greater degree. After an idea is received the inventor should strive to picture it in the simplest possible form. *Simplicity in invention is the secret of patent success.*

There are five distinct ways in which the mind receives inventive ideas, namely thru the five human or physical senses; sight, taste, smell, feeling and hearing. A



Why Not Invent a Simple and Reliable Garage Door Opener? Thousands of Autoists Everywhere Will Not Only Bless You for It, But Will Buy Them by the Hundred. But It Must Be Cheap in First Cost and Maintenance.

person may see an improvement and patent it, or taste a flavor and create a better one, or smell an odor and design a device to eradicate it, or hear a situation and replace it with a different one.

All inventions have entered the inventor's mind thru one or more of these five ideas-carrying channels before materializing into completed form. The mind is the oven or incubator for hatching these inventive germs and forming them into practical articles for earthly use. Therefore to develop one's inventive faculties it is necessary to develop both the five human senses and also the mind that controls them.

For the purpose of suggesting an effective method of development I will now ask the reader to join me on a little inventive expedition up among the clouds of creation.

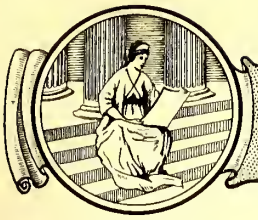
Our first imaginative stop will be in the office of a modern business man who is branch manager for a large eastern corporation. It is noon time and our friend decides to go out to lunch. We follow him down the avenue to a cafeteria. He en-

(Continued on page 338)

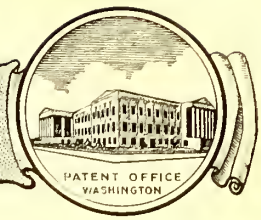


Can You Identify Yourself In a Strange City? You Could Do So With the Simple Pocket Case Here Shown, Containing Your Photo, Signature and a Cancelled Check Endorsed By You.

www.americanradiohistory.com



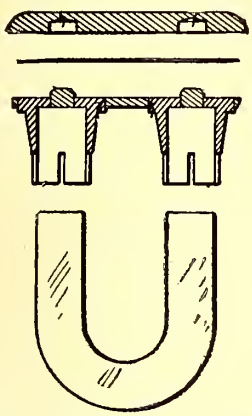
LATEST PATENTS



Magnetic Razor.

(No. 1,299,096, issued to Butler Ames.)

A very ingenious idea is this magnetic razor, which makes the cleaning of safety razors a very simple

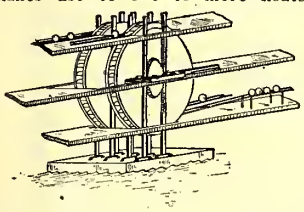


process, as the retaining cap over the razor blade may be instantly removed by pulling it off the magnet cores. The cap and blade members of the razor are adapted to be held in position by a guard member, by magnetic flux passing from one pole of the bi-polar magnet to the other pole, thru the blade and cap, which members are made of steel or other magnetic material.

Tidal-Power Motor.

No. 1,304,238, issued to Judson E. Wright.)

In this tide-motor the inventor makes use of one or more floats,

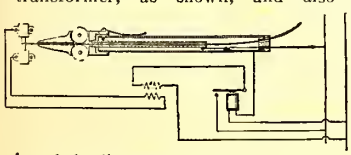


which rise and fall with the tide. The alternate up-and-down movements are made use of thru a pair of gear racks, acting alternately on a pinion or gear wheel as shown. One of the racks acts on the "upward" motion and the other on the "downward" motion, thus preserving a continuous rotary motion in the power wheel. When the action of the tide is low or nil, the power is maintained by a series of spherical weights acting on a bucket wheel connected with an auxiliary power member. These weights are carried to a higher level by the regular tidal motor thru a bucket conveyor.

Electric Soldering Device.

(No. 1,304,545, issued to Frederick A. Costello.)

This soldering device comprises a tubular holder resembling a pencil or pen holder, thru which the wire or strip solder is applied to the work to be united. This holder also carries a circuit-closing switch for the primary of a step-down transformer, as shown, and also

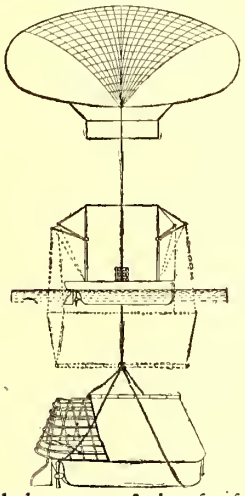


knurled "solder feeding" wheels. The electricity is used only in actually heating the solder when the same is placed in contact with the work to be united by this clever arrangement. A relay serves to open and close the primary circuit of the transformer in the manner evident.

Raising Submarine Vessels.

(No. 1,303,912, issued to Hideo Katayama.)

A clever idea for raising sunken

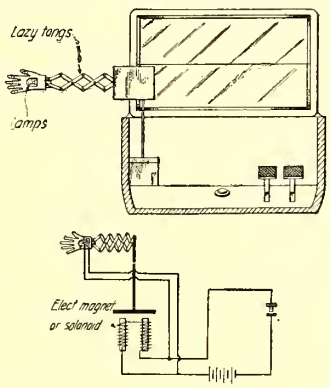


vessels by means of aircraft of the balloon or other type. In the first place, the surface of the upper deck portion of the sunken vessel is covered with a wedge of special pyramidal structure, so that when the balloon or other aircraft is connected with the wreck, as by means of slings, the buoyancy of the balloon may be utilized to greatest advantage. The slanting roof structure reduces the resistance of the body as it is lifted up thru the water.

Electric Semaphore for Autos.

(No. 1,299,361, issued to Hyman Lieberman.)

An electromagnetically operated semaphore for automobile signaling, two of which may be used on the car, one on the right and left, respectively. The device works by

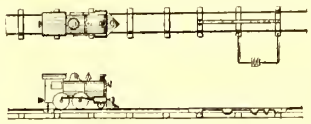


means of a lazy-tongs arrangement connected up to an electromagnet or solenoid. The driver has simply to close the electromagnet circuit with a foot-controlled push-button, when the electromagnet, becoming excited, causes the lazy-tongs to act, thus projecting the hand about two feet. At night the hand may be illuminated by an electric lamp in the palm, which can be seen from either front or rear, and also the fingers can be illuminated by a small electric light placed on each finger.

Electric Whistle for Toy Railroads.

(No. 1,303,117, issued to William C. Roe.)

This invention covers a design for a small electric whistle simulator,

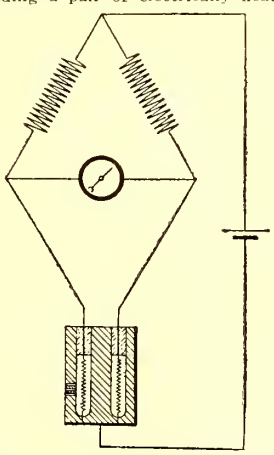


for electric toy railroads. A special circuit controller in the form of an auxiliary track member is provided, in the design here illustrated and described, so that as the locomotive and train pass over this auxiliary contact placed between the rails the whistle simulator circuit will be closed and the device actuated. The instrument is constructed in the form of a buzzer so as to give a high, shrill note, similar to a whistle.

Electric Gas Detector.

(No. 1,304,208, issued to Gilbert A. Shakespear.)

The definite rate of loss of heat from a body exposed to the gaseous mixture is employed as the detecting and measuring agency. A Wheatstone bridge circuit is utilized, including a pair of electrically heated

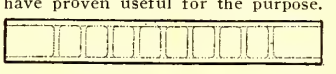


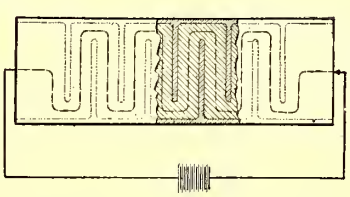
wires, one of which is surrounded by the gas to be tested, while the other is surrounded either by air or by any other gas, which can serve as a "standard" for comparison. A galvanometer is used to adjust the Wheatstone circuits to a state of balance.

Zigzag Carbon Resister.

(No. 1,298,421, issued to John Thomson.)

The present resister device renders the carbon element of the resister immune to oxidization, thus restoring the slotted member so as to maintain its original resistance at all times. To do this the slots of the resister are filled with a material having coefficient of expansion and contraction nearly identical to that of the carbon forming the resister. Fuzed aluminum oxid and silicon carbid in its crystalline form have proven useful for the purpose.

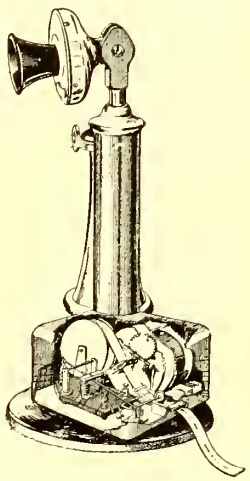




Telephone Call Recorder.

(No. 1,299,154, issued to Arthur Engelberg.)

This invention relates to an electromechanical device comprising a spring motor which will unreel a paper tape, and at the same time, by means of an electromagnet, cause to be recorded on the tape any telephone numbers of parties which may have called while the owner was absent. This device would seem to

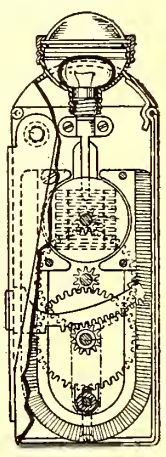


have considerable promise, and if taken up by the telephone companies should prove of great value as a time saver. The spring motor and electromagnetic recording device is controlled from the telephone exchange by "Central." Many times people call a party, only to find "that the line is busy" or else that "they do not answer," all of which wastes a good deal of time in the busy man's day. If the number calling was recorded in the office of the absent party, then upon their return they could call back the number in question.

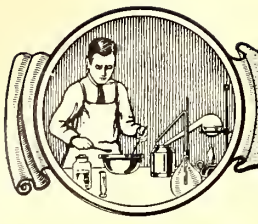
Magneto Pocket Lamp.

(No. 1,301,595, issued to Marc A. Pattay and Eugène Jaquemont.)

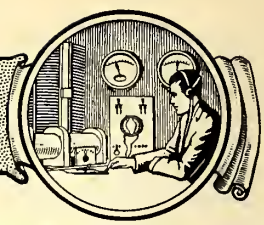
This is a clever idea in magneto electric pocket lamps, and represents several improvements over those heretofore proposed. Not only is it provided with a mechanism for spinning the armature of a small magneto generator, which develops the necessary current for lighting the lamp, by means of a reciprocating rocker arm, but it is also provided with a continuous circular movement crank operated independently and whenever desired by means of a change-over attachment. The device is ingeniously worked out, so that for ordinary lighting purposes it is but necessary to squeeze on the flexible casing of the pocket lamp, which causes the armature of the dynamo to be spun rapidly. No batteries are necessary, and by the arrangement of the mechanism in this lamp it would appear that the light should be practically continuous.



www.americanradiohistory.com



WITH the AMATEURS



Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light-toned ones. We pay $3.00 each month for the best photos. Address the Editor, "With the Amateurs" Dept.

"Amateur Electrical Laboratory" Contest

THIS MONTH'S $3.00 PRIZE WINNER—H. C. SMITH

I PRESENT herewith two photos of my laboratory and one of myself. My chemical laboratory has over 150 solid chemicals and about 100 different solutions. The glassware consists of beakers, Erhlenmeyer flasks, funnels, condensers, burettes, hydrometers, evaporating dishes, crucibles, graduates and retorts. It also includes a "French" microscope, a balance, and many other apparata too numerous to mention here. My "Electrical Laboratory" consists of various motors, generators, condensers, wireless transmitting and receiving apparata now in construction, also a switchboard under construction, ½ K.W. transformer coil and a two-inch spark coil. Unfortunately all of my "Electrical Laboratory" did not get into the picture.—H. C. Smith, 3816 S. Honore St., Chicago, Ill.

HONORABLE MENTION (One Year's Subscription to the ELECTRICAL EXPERIMENTER)—ROBERT NIESSNER and ROBERT BOHATY

HEREWITH are several flash-light photographs of the electrical laboratory and experimental machine shop of Robert Niessner and myself. In this laboratory we do all kinds of experimental and research work in chemistry, electricity, high frequency and wireless. This laboratory was started in 1917, and it is still growing very rapidly.

One of the photos (left) shows Robert Niessner, and the other (right) shows myself. Another shows a corner of our "office," where we do all the figuring and correspondence. One of the views illustrates our electrical testing bench and switchboard, and part of our chemical bench. We possess a large screw-cutting lathe on which we do all kinds of machine work. We have had this lathe only a short time and it has turned out quite a few dollars worth of work for us.

These photographs show only a small part of our equipment. We have all kinds of electrical motors, dynamos, generators, gasoline engines, steam engines, electrical testing apparata and a complete set of wood and metal working tools.

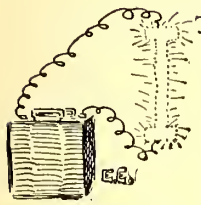
Among the magazines that we have in our "office" there is the ELECTRICAL EXPERIMENTER, which is of great value to us in our work. We also have many books pertaining to chemistry, electricity, steam and gasoline engines, et cetera.—Robert Bohaty, 434 East 77th St., New York City, N. Y.



www.americanradiohistory.com

Science in Slang

By EMERSON EASTERLING



IT was an Italian car, the chauffeur was an Italian, and he was delivering long accented discourses in galloping Italian. To be concise, the ignition system had gone on the "fritz" and the wop was "cussin" over the layout. Jazz Stokes and party, we, sat in the tonneau while the driver fingered and swore and smoked Turkish cigarettes.

"The name 'storage battery' is a misnomer," commented Jazz. "The juice is not stored as commonly conceded, but is generated or caused to circulate by the chemical action set up in the plates of the cell."

"How did the storage battery or secondary



Camille Alphonse Faure, Who Pasted Us a Hot One When He Handed Us the First and Original Pasted Gridplate.

cell come about?" asked "Rat" Morehouse, the bow-legged boy from Berkeley, California.

"Volta and Galvani started the ball in that direction when they got to monkeying around in the dynamic field, but the original storage cell was developed by a bird by the name of Planté. Gautherot got to shooting juice thru platinum wires in water and other electrolytes and observed that the little contraption was capable of kicking back a light current when the juice was cut off. The fact of the case was that he stumbled onto the accumulator idea when he was only trying to jerk the H_2O into O and a couple of packages of H. Electrolysis, that was his game. You remember, a lot of the scientists thought that ions was as far down as matter could be boiled—electrolysis did that. Like a lot of other things, the secondary cell was a secondary discovery—the inventor was not fishing for the cell.

"Two years after Gautherot's stunt, in 1803, Ritter constructed a secondary pile much like Volta's. By charging for a few moments with a strong galvanic current the pile would give quite a kick. The plates were copper disks separated by cloths moistened in sal ammoniac.

"Count Volta, Bequerel and a stack of other researchers became aware of the fact that gold, silver and platinum and some other nice metals would give secondary currents when subjected to electrolytic action in certain solutions.

"In 1842 Grove slipt us his celebrated gas (no, not mustard) battery. The big idea was the difference in polarity in the two gases, oxygen and hydrogen.

"Mike Faraday had the idea in his hand but did not close up on it when he found that peroxide of lead at the negative pole had a relative high conductivity. The old boy makes note of the fact in his *Researches.*

What Makes the Storage Battery Store?

"Until 1860, when Gaston (without the assistance of dear Alfonso) Planté threw a bunch of coiled lead plates together into a jar of solution, the old-timers never had the pleasure of seeing a *real* secondary cell. Gaston, with his plates of lead, lead peroxide and spongy lead, and finally lead sulphate in the sulphuric acid electrolyte, was able to run his battery down to where she took the count and then give her a shot of electric hop and watch her hump again. Metzger, Brush and some of the other highbrows boosted the Planté idea along until they had a fairly decent battery out of it."

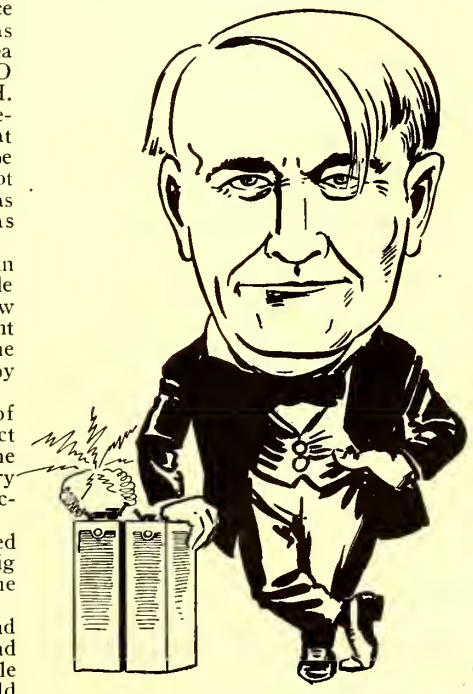
"What do you mean by lead, lead peroxide and spongy lead, and finally lead sulphate?" inquired Fred Cochran.

"To begin with, the plates are lead, unless the makers build up the plates from lead oxide and sulphates. The charging current turns the positive plate to peroxide of lead. The negative plate of lead sulphate is converted to spongy lead. The electrolyte is about 23 per cent. sulphuric acid in water. When I said that 'finally lead sulphate,' I was referring to the state that means curtains for the cell. A sulphated cell is like a car without gas or a ship on the rocks. Get the idea?"

"What chemical action goes on in the cell during charge and discharge?" asked Velt.

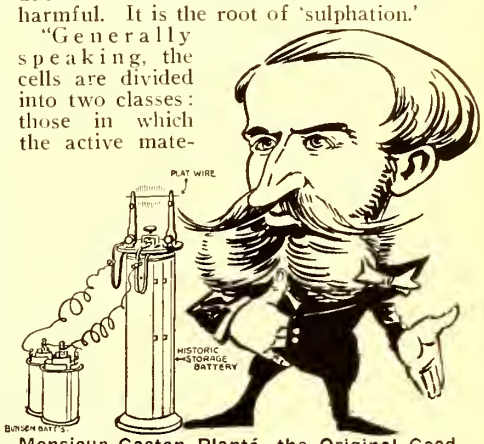
"It is like this," returned Stokes. "When the juice is sent through the cell, entering at the positive plate, the water is changed to its components, hydrogen and oxygen. The oxygen combines with the positive plate, forming lead oxide or peroxide. The hydrogen forms at the negative plate.

"On disconnecting the source and again closing the circuit, the water is again decomposed. The oxygen uniting with the hydrogen collected at the negative plate and with the plate itself, and the hydrogen uniting with the oxygen of the oxide of lead at the positive plate, causes a current to flow in the circuit that is closed. That is the simple explanation of the operation. There are minor and subsequent actions and reactions that take place, but the only one that makes any difference is the white insoluble sulphate formed by the red or yellow sulphates with the litharge. This formation is a non-conductor and otherwise bothersome and harmful. It is the root of 'sulphation.'



Tommy Edison Stept Off the Lead and Sulphuric Trail and Handed Us the Nickel-Iron Storage Battery.

"Generally speaking, the cells are divided into two classes: those in which the active material is formed by chemical or electro-chemical action, and those in which some easily reducible salt of lead is applied mechanically. Planté types are examples of the former and Faure types of the latter. The Gould batteries are made from the slow former process. The Willard batteries are also of the Planté type, while the Exide cells are of the Faure. The Faure type has a little better output for the weight, but the other has it over on them in sturdiness.



Monsieur Gaston Planté, the Original Goodness-to-Honest Storage Battery Kid.

"Tommy Edison stept off the lead and sulphuric solution train of thought and handed us a new one with nickel and steel and iron plates and a twenty per cent. solution of caustic potash (omiting Perlmutter) for the electrolyte. The electromotive force is not as great as the lead type, but the ampere hours per pound is about half—the bulk being the same, practically, as the old line of cells. Upon discharging, the Edison cell shoves as high as three volts and higher onto the line, but decreases after the load sits on her. You are aware of the fact that the old lead accumulator gives out about two and four-tenths volts at the beginning of the discharge—if you did not know of it before, you do now. The old heavy type has it over on the Edison for constancy of current, but the selling point for the Edison is the lightness and mechanical robustness.

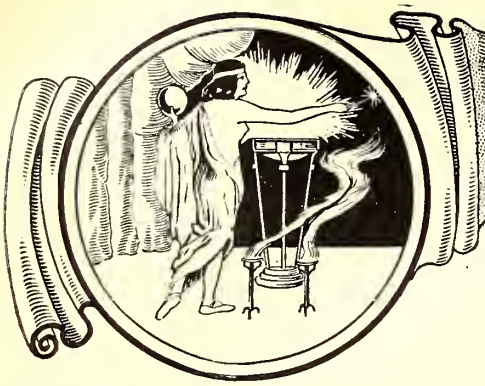
"There are other secondary cells that employ plates of bimetallical composition. The most satisfactory are the *zinc-lead, copper-lead,* and the *copper-zinc,* besides the Edison *nickel-iron* cell.

"Sacramento! Puerco! Blankety Blanko!" And a string of other stuff ending up with the statement that the *"automobile no bono"* and *"a infierno con todos!"* The wop broke in on our discussion—of Jazz's.

"I guess I will see what is the matter with the motor," said Stokes as he walked around the hood. "I've got a date with a blind man for a game of craps to-night."

In less than five minutes the Italian was saying *"gracias, signor"* and we were leaving a cloud of dust behind us.

www.americanradiohistory.com



THE ORACLE

The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be publisht. Rules under which questions will be answered:

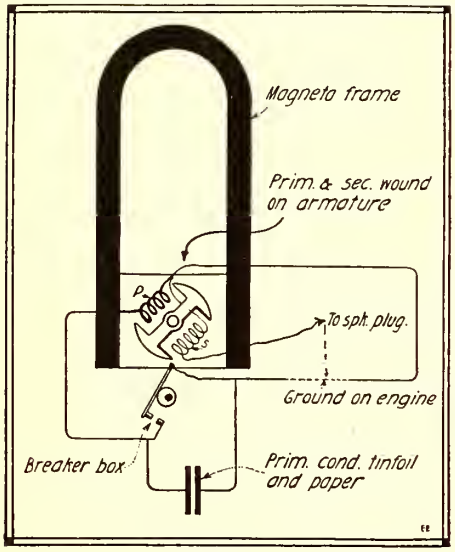
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addrest to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

MAKING HIGH TENSION MAGNETO FROM LOW TENSION TYPE.

(1016) J. G. Whitfield, Goldsboro, N. C., inquires:

Q. 1. How can I change a low tension magneto into a high tension type?

A. 1. It is rather difficult to change a low tension magneto of the ordinary type into a high tension magneto unless you are quite familiar with the make-up and appa-



How a "Low Tension" Magneto May Be Converted into a "High Tension" Type.

ratus of the latest type machine. We are pleased to give you herewith diagram showing how most of these high tension magnetos operate.

In one of the modern high tension magnetos there are no revolving coils or commutators of any kind, but simply a rotating mass of iron, which is so formed as to cut the magnetic flux in the field many times per second. In this machine the primary and secondary windings are stationary, and undoubtedly you can obtain some information on this machine, as well as other high tension types, which may be of interest to you, by communicating with the various high tension magneto manufacturers.

RADIO ANTENNA QUERY.

(1017) Rolf Carbo, Minneapolis, Minn., asks:

Q. 1. For data on a radio antenna for amateur requirements.

A. 1. Regarding the type of receiving aerial which would be best, should be about 125 feet long, 75 feet high, and at least 4 to 6 wires spaced about three feet apart, which will prove very satisfactory for average long-distance reception and commercial wave lengths.

If you intend receiving amateur wave lengths it will be necessary for you to interpose a variable condenser in your ground circuit.

About the best thing for an all-around set, we advise a small coupler and audion, adapted to a great many ranges of wave lengths. Unless you intend to build a set to receive only undamped wave stations, we would suggest a very large loose coupler.

We refer to our September, 1915, issue of the ELECTRICAL EXPERIMENTER for excellent data on loose couplers.

To Our "Oracle" Friends

Do you realize that not one day passes when we do not receive from 150 to 250 letters addrest to "The Oracle"? If we were to publish all the questions and their answers we would require a monthly magazine five or six times the size of the ELECTRICAL EXPERIMENTER, with no other matter but questions and answers. Of late the influx of letters has become so heavy that several of our associates have been forced to discontinue important editorial work, in order to answer the mail. This we are certain you do not wish. You do not want your magazine to lower its present high standard. You want the best, the very best, and you know we never have failed you yet.

Moreover the multitude of letters are wholly unnecessary. Most of the questions Readers ask every day have been answered before in "The Oracle." Therefore, ere you sit down to write us, look over your back numbers, and nine times out of ten you will find the answer.

We strive hard to publish only such matter as has not appeared before in our columns, and for that reason, only a small fraction of the queries received by us are actually publisht.

Your magazine is steadily coming to the fore as the greatest publication in the scientific world. To keep up its present high standard and to make it a better and bigger magazine requires a tremendous amount of untiring effort on the part of the Editors. Therefore, in the future, we CANNOT in your own interest, answer questions by mail, free of charge.

For questions requiring an immediate answer our fee is 25 cents for the first three ordinary questions, and 25 cents for each additional question. We will gladly advise fee for special questions entailing considerable research work or calculations.

Stamped and addrest envelope should be enclosed with the queries, and moreover, any sketches accompanying them should be drawn in ink on separate sheets. Write plain and, PLEASE, PLEASE BE BRIEF.

Editor of "The Oracle."

STORAGE BATTERY QUERY.

(1018) B. W. Dresser, Homedale, Idaho, asks:—

Q. 1. Several queries on storage batteries, etc.

A. 1. Answering your first question, would advise that water for storage batteries should be distilled and kept in glass containers, as no matter what form of metal you might use, it is only natural that minute particles of the container will mix with the water. It is absolutely necessary for storage batteries, to secure perfect satisfaction from the same, to use pure distilled water absolutely free from any elements which might contain iron or any other metals.

The difference between the current and voltage for static machines and high-tension transformers does not vary very greatly, the designs of the machines and transformers having much to do with their outputs, tho the currents are about practically the same.

It is unnecessary to insulate the conductors of a rotor in a squirrel cage induction rotor. In the usual cases bare solid conductors are merely wedged in the slots of the rotor.

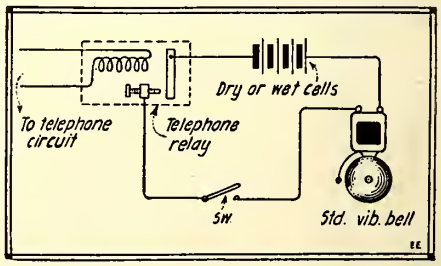
RINGING ALARM BELL FROM TELEPHONE CIRCUIT.

(1019) Theodore Mucha, Terlingua, Tex., writes:

Q. 1. How can I hook up an alarm bell to a regular telephone circuit?

A. 1. With reference to an alarm device for waking up a sleeping person, and to be connected to a telephone circuit, would say that several years ago the Editor installed a very successful form of alarm which will wake the dead.

In order to work this alarm, as the accompanying diagram shows, you will require a telephone relay. This can be pro-



Scheme for Ringing Extension Call Bell from Telephone Station by Means of a Telephone Relay. The Latter Instrument Can Be Obtained from Your Local Telephone Exchange or Supply House.

cured from any supply house at a cost of about $1.00.

The telephone relay is connected directly across the telephone line so that when the current is sent over the circuit, the relay will close the secondary circuit, in which you can connect batteries, electric horn or alarm bell, etc. You can also obtain, if you so desire, a large 6- to 8-inch telephone extension bell, which may be connected across the telephone line.

www.americanradiohistory.com



Copyright 1919 by R. J. Reynolds Tobacco Co.

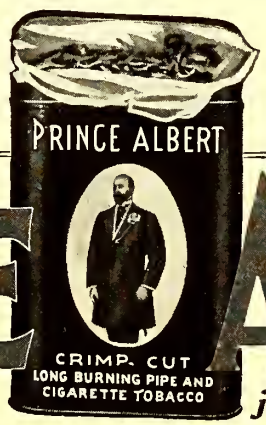
SAY, what a trick you'll turn for your tongue and taste and temper when you finally get down to bed-rock smokes and let some of that topjoy Prince Albert float into your system! Just will put the quiz into your thinktank as to how much pipe or cigarette-rolling fun you've gone shy on—and, you'll work in a lot of double headers for quite a spell to get all-square!

What's the idea kidding yourself when you know what P. A. will do for your smokespot; when you know what it is doing for men all over the civilized world! You can't hit a happier job than to stock a supply of Prince Albert, jam that joy'us jimmy pipe chuck-full and blaze away! Why, it's like falling into feathers when you've been batting-it-out-on-a-board!

Prince Albert just can't help doing you a clever turn because it won't bite your tongue at any stage! Bite and parch are cut out by our patented process. Want you to know right here, and now, that Prince Albert will be as gentle with your tongue as a toy purr-kitty is with a stuffed mouse! You can rip champeen-smokespeed-records right up the back with P. A. for packing!

You don't need a percentage table to figure out what Prince Albert's quality and flavor and fragrance will do for your happiness every time the clock ticks! You'll get the answer quick! And, now it's your draw! Prince Albert is sold in toppy red bags, tidy red tins, handsome pound and half pound tin humidors, and, in that classy, practical pound crystal glass humidor with sponge-moistener top that keeps the tobacco in such perfect condition!

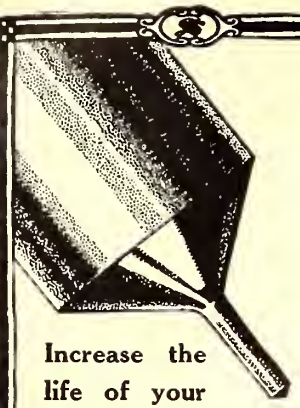
R. J. REYNOLDS TOBACCO CO.
Winston-Salem, N. C.



PRINCE ALBERT

the national joy smoke

www.americanradiohistory.com



Increase the life of your phonograph records!

Having parallel sides (not tapered) these new Sonora Needles always fit the record groove perfectly. They play 50 to 100 times and are for use on ALL MAKES of steel needle records.

Sonora
CLEAR AS A BELL

Semi-Permanent Silvered

NEEDLES

are more convenient and economical and save constant needle changing. They mellow the tone, add to the life of your records and give a maximum of service and satisfaction.

30c Per Card of Five
40c in Canada

FREE! To demonstrate the extraordinary advantages of the Sonora Needle we are glad to mail you a sample free.

Sonora Phonograph Sales Company Inc.,
GEORGE E. BRIGHTSON, PRESIDENT
279 Broadway, *Dept. G*, N. Y.
Toronto: Ryrie Building
CAUTION! Beware of similarly constructed needles of inferior quality

Send Only 12c
(Stamps or Coin)

And I will send you a copy of my valuable booklet.

"Hints to Music Loving Owners of Talking Machines"

Tells you how to take care of your machine and records, preserve the life of both, and gives many pointers to improve the tone of your instrument and increase your enjoyment of it. Instructs on the care of the motor, cleaning, speed adjusment, care of the needles—in fact every thing you should know. Send 12c today and the booklet will come by return mail.

J. H. ELLIS, Box 882, Milwaukee, Wis.
Patentee & Manufacturer, Ellis Harmonious Reproducer

FREE $20
Violin, Hawaiian Guitar
Ukulele, Guitar, Mandolin, Cornet or Banjo

Wonderful new system of teaching note music by mail. To first pupils in each locality, we'll give a $20 superb Violin, Mandolin, Ukulele, Guitar, Hawaiian Guitar, Cornet or Banjo absolutely free. Very small charge for lessons only expense. We guarantee success or no charge. Complete outfit free. Write at once—no obligation.
SLINGERLAND SCHOOL OF MUSIC, Dept. 422, CHICAGO, ILL.

BE A C.P.A. **ACCOUNTANCY**
The Highest Paid Profession taught thoroughly in a few months of home study by new system
FREE BOOK International Accountants Society
Dept. 39H, 2626 S. Mich. Ave. Chicago

Solving the Transportation Problem

(*Continued from page* 303)

two main tracks, while a revolving pinion engaged with this rail rack. The train derived its energy from an electric third rail and shoe which operated the electric motor; this in turn worked the pinion.

In Fig. 3 is shown a later type of hydraulic shoe also operated under the water pressure and water suction plan. With this shoe very little water is lost.

100 Miles Per Hour—Safely.

From what has appeared, it will be seen that being that there is no friction, enormous speeds can be obtained with such railways. As a matter of fact one hundred miles an hour is a conservative figure. Nor is it dangerous to run such wheelless gliding trains at such speeds for two reasons. One is that there is no friction. There is no wear and tear of material, and if the flat rail with its guard rails (see Fig. 2) is constructed right, it will be impossible for the shoes to jump the track. And now we come to the most important point as far as the speed is concerned.

These trains it was found could be stopt almost instantly, and *very simply by cutting off the water pressure.* This maneuver brings the hydraulic shoe in direct contact with the rail and an enormous friction sets in. No brakes are needed to stop such a train. *The train is its own brake.* Nor is that all. Such trains can be stopt where *the rails dip at an incline of* 40%, a thing unheard of on regular railways with wheels. You see in a train of this kind there is nothing to roll and the minute the water pressure is taken off, the train must stop at once even at the worst incline. Inversely if the right tractive method is used to propel the train, it will run up almost impossible inclines at angles no regular railroad would ever think of attaining. Furthermore, in view of what has appeared, it will be realized that the cars do not have to be of such ponderous weight as are the present day ones. They can be constructed of aluminum alloy and could weigh one-quarter of the weight of the ordinary car and still be safe.

Former Disadvantages.

There was only one real disadvantage on a railway of this sort. During the winter the formation of ice and snow on the rails tended to put the entire road out of business because no means could be found to do away with the forming ice and its consequent unevenness or roughness of the track. This, however, would not worry our present day engineers for the simple reason that our trains would probably carry some electric heater in front of it, each train thus melting the ice as fast as it formed.

New Ideas by Mr. Gernsback.

We have today a means for propelling the gliding railroad, which is as simple as it is efficient. Our cover illustration as well as Fig. 5 show the means proposed. Fig. 6 also depicts the various methods used. The writer proposes the use of a single track, each car having two hydraulic shoes of the kind shown in Fig. 3. The car is held upright by means of the gyroscope shown. This gyroscope is to be driven by an electric motor and the energy is to be taken from a third rail running alongside the track. This also furnishes the power for the electric lighting system of the train and for the motors which drive the compressors as well as supply the power for the suction pipes. The propulsion of the train is accomplisht as follows:

Electro-Magnets Pull Trains.

The entire track must be supplied with *power (tractive) electro-magnets* sunk or led into the rail which latter should be of some non-magnetic material such as brass or bronze. The power electro-magnets are placed about six inches or so apart and run thru the entire length of the track. Normally these electro-magnets are not energized as will be seen by referring to Fig. 6. When it is desired to start the train, the conductor moves his *magnet-control lever* inside of the car. This lever at the lower end has a contact shoe, which when sliding over the contacts as shown, energizes its particular electro-magnet. In Fig. 6 it will be seen that two of these contact shoes are used. This is done so as not to have any dead points, as otherwise the train could not start. In this figure it will be seen that the rear magnet contact shoe has just closed its contacts, and the rear hydraulic shoe comes now under the influence of the energized magnet. This will tend to pull the rear shoe over the energized magnet. But the instant the pull starts, the train moves along as well and the contact is broken.

The momentum of the train, however, is sufficient to carry it along, and by this time the forward contact shoe will have energized the electro-magnet at the extreme right, shown at Fig. 6. The forward hydraulic shoe now comes under the influence of the energized electro-magnet and the train is pulled forward again. This play is repeated constantly and of course very quickly; within a few seconds the train has obtained a terrific speed. This speed increase can be regulated simply by an arrangement which lifts the electric contact shoe away from the contact rail, and by this means the speed of the train can be

(*Continued on page* 338)

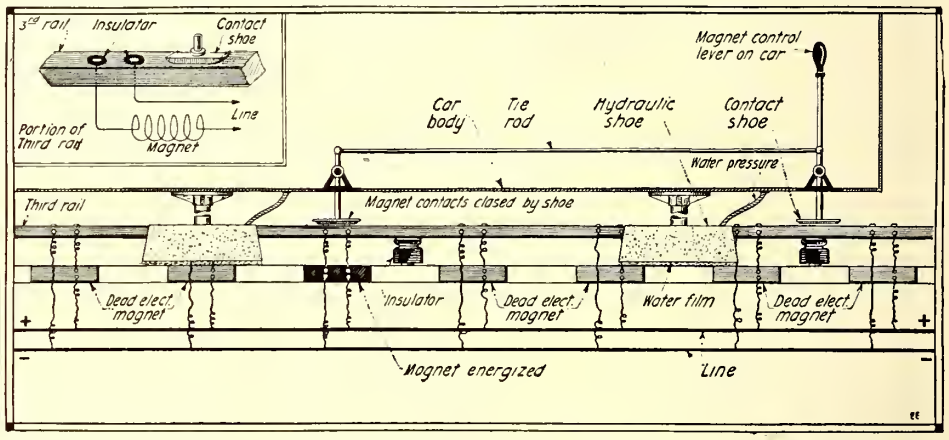


Fig. 6. Showing Mr. Gernsback's Arrangement for Propelling the Train by Means of Electro-Magnets. As the Train Moves One Electro-Magnet Is Energized at a Time, Which Exerts Its Traction on One of the Shoes, Thus Pulling the Train Along. Insert Shows Method of Making Contact with Power-Magnets.

www.americanradiohistory.com



Pres. Alonzo S. Thomas, Santa Fe Watch Co.

LISTEN MEN!

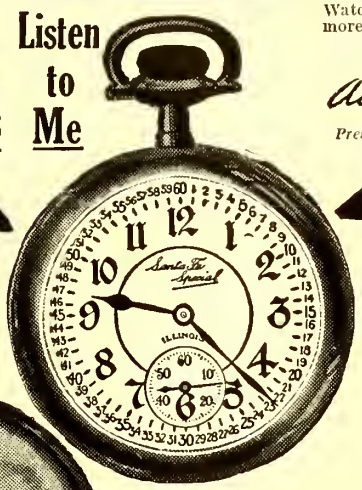
I HAVE determined to make 1919 the banner year in the Watch Sales of my Company. To do this I must distribute 5,000 "Santa Fe Specials" to 5,000 men in different communities this year. I must do this REGARDLESS OF PRICE OR PROFIT. Therefore, I have Cut the Price of these 5,000 Watches to ABSOLUTELY ROCK BOTTOM. This means that if you act at once you can get one of these Guaranteed Watches on this CUT-PROFIT PLAN, and pay for it in small monthly installments. MY OBJECT:—I know that every Watch sold on this Cut-Profit Plan will sell at least one more at the regular price, so I make this STARTLING, UNHEARD OF OFFER to men who will tell their friends of this remarkable Watch Value, if they find the Watches all and more than I claim for them.

Signed,

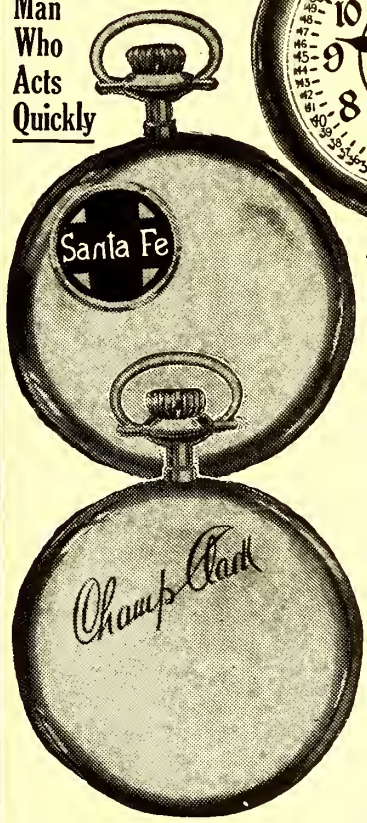
Alonzo S. Thomas

Pres. Santa Fe Watch Co.

Listen to Me



For the Man Who Acts Quickly



I SAY

Unless you already own a Watch that you are sure is just as good as they make them, this is a money-saving opportunity you positively cannot afford to miss. It is a Bargain such as you do not meet every day. For that reason you will have to act promptly or this allotment of 5,000 Watches may all be gone before you get yours. To make sure you get one, suppose you write me personally, care Santa Fe Watch Co., right NOW before you forget it. I want you to join my **"5,000 Watch Club"** and carry one of these beautiful Standard "Santa Fe Special" watches.

21 Perfect Jewels
Adjusted to Positions
Adjusted to Temperature
Adjusted to Isochronism
Adjusted to the Second
Thin Model
All Sizes

The ILLINOIS Famous Santa Fe Special 21 JEWEL RAILROAD WATCH $2.50 A MONTH

"Santa Fe Specials" are Standard Railroad Watches, **Guaranteed to Last a Lifetime and Give Satisfactory Service.** Are found in the pockets of men in service on the important railroads of this country. Senators, Congressmen and Governors keep their official appointments by "Santa Fe Special" time. Army Officers and Privates carried them all through the Greatest War in history—thousands of these splendid Watches are in use all over the World. If you want one on my liberal CUT-PROFIT PLAN you had better write for my Free Watch Book today and make your selection without delay. I will send the Watch for you to see WITHOUT ONE PENNY DOWN—I will even allow you to wear the Watch 30 days FREE—then sell it to you on a binding money-back guarantee.

THINK OF IT!

A Standard Watch at a Saving of ⅓ to ½ of Your Money. That is exactly what this wonderful offer means, and it is exactly what you get, **if you are so fortunate as to get your order in in time to get one of these 5,000 "Santa Fe Specials" on my Special Distribution Cut-Profit Plan.** The coupon, a letter or your name and address on a postal will bring my Free Watch Book right back to you. Don't delay—write today.

NEW CASE DESIGNS

I want you to see the newest designs in Cases used on these "Santa Fe Special" Watches, so that you will fully realize their beauty and up-to-dateness, as well as the value of the Bargain I am offering you. I want you to see the 3-color inlay work—nothing more refined. Then think how distinctive and personal **your Watch** would be with your own name, monogram or some appropriate emblem engraved in the Case, just to suit your own ideas. You will also want to see the new French Art designs in engraved Cases—all shown in **My New Watch Book,** printed in beautiful colors. Write for it today, it will be sent FREE.

SANTA FE WATCH CO.

880 Thomas Building **Topeka, Kansas**

(The Home of the Great Santa Fe Railway)

A letter, post card or this coupon will bring you my Free Watch Book

SANTA FE WATCH CO., 880 Thomas Building, Topeka, Kan.

Please send me your New Watch Book with the understanding that this request does not obligate me in any way.

Name .....

Address .....State .....

Tropical Climates Make No Difference with the "Santa Fe Special"—Four Seconds in Five Months.

I feel it my duty to let you know how my "Santa Fe Special" is standing the tropics. It is the best watch I have ever carried, with no exception. It has not lost over four seconds since I received it, about six months ago, comparing it with Naval time. I wouldn't sell it for $50.00 and take chances of buying another make half as good.

B. H. GABBARD, Tutuila, Samoa.

I received the watch and think it is one of the finest pieces of work I have ever had. I am pleased very much with it.

A. RATHOFF,
U. S. S. Jupiter, Atlantic Squadron.

Likes It Better Than a Watch that Costs $85.00.

I find my watch to be the best timepiece I ever owned. I owned an $85 watch before, which was stolen from me, and to tell you the truth, I can see no difference, so far as keeping good time is concerned, between it and my "Santa Fe Special." The "Santa Fe Special" comes up to the mark of efficiency in every respect. I put her through some severe tests this winter, and she hasn't lost or gained a second yet, as far as I know. If anyone knows the value of a good timekeeper, it is we people here in the Coast Artillery Service. The watch is worth more than you ask for it in my estimation.

FRANOIR L. WALLOW,
Cpl. First Company, C. A. C.,
Fort McKinley, Maine.

A Watch to be Proud of.

Received the "Santa Fe Special" watch today, and am more than pleased with it. I must say that the engraving is the best workmanship I ever saw, and I know I have a watch now that I can be proud of.

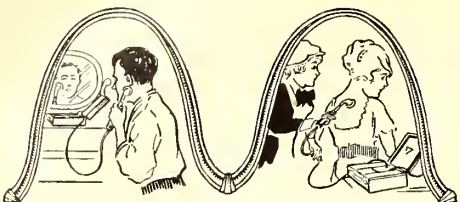
J. C. FAHNING, U. S. S. Washington.

Says It's Worth Sixty Dollars.

I want to say that the watch which you sent me is far above what I expected for the money. A friend of mine with a $50.00 Hamilton, almost new, offered me his watch and $10.00 for my "Santa Fe Special." A local jeweler tells me that my watch ought to have cost me $60.00.

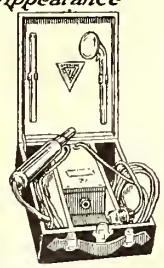
T. E. DAVIS, Hurlburt, N. Mex.

www.americanradiohistory.com



For Perfect Health, Strength, Unlimited Vitality & Improved Personal Appearance

The STERLING HIGH FREQUENCY VIOLET RAY



The Sterling Violet Ray is invaluable in the treatment of diseases of the skin, mouth, throat and lungs, derangements of the liver, kidneys, stomach and intestines—soreness in muscles and joints—tired or "sick" brains or lack of "nerve tone." It strengthens heart action—cleanses the blood—brings the flush of youth to the skin—enlivens the hair—puts a "spring in your step" and creates a clear eye and brain.

Specially designed for home use—fitted to work from the ordinary lamp socket—easy to manipulate—under control at all times.

VALUABLE BOOK FREE

Read how you can treat innumerable diseases and ailments, improve your personal charm, add strength and vitality and help yourself in hundreds of ways. Just mail the coupon or drop a postal. Do it now, this minute, before you forget it.

The Sterling Electrical Corporation

1278 West 3rd St. Cleveland, Ohio

MAIL THIS COUPON FOR FREE BOOK.

THE STERLING ELECTRICAL CORPORATION 1278 West 3rd Street Cleveland, Ohio

Gentlemen:—As per your offer in Electrical Experimenter, please mail me at once, free and postpaid, your book and full information about the Sterling Violet Ray Generators.

NAME .....

ADDRESS .....

CITY .....STATE .....



Skinderviken Transmitter Buttons

Nothing like it on the market. Will make an old transmitter better than new. Adjusted in a jiffy. Supersensitive. Talks at all angles.

Price $1.00 each. Discount in quantities

Send us One Dollar, for which we will mail one button prepaid under our money-back guarantee.

Booklet No. 3 free for the asking

SPECIAL NOTICE

To clear up any misunderstandings that might arise in connection with our offer of last month to pay for suggestions as to uses to which the Skinderviken Button may be put (see our July ad), we wish to announce the following rules:

1. **The offer extends only until August 30 and will close on that date.**
2. **The first prize of $10 will remain as announced. But instead of paying for all accepted suggestions in proportion to their value, we will pay $1 for every suggestion we accept.**
3. **By the words "best idea" we mean the most practical and the one having the most commercial value.**
4. **Anyone can compete whether you have purchased a button or not. Borrow your friend's—try it out—and send in your suggestion.**

Skinderviken Telephone Equipment Co.

For your convenience in writing us, address STECO, 2134 N. Clark Street, CHICAGO, ILL. 335 Broadway, NEW YORK CITY

You can be quickly cured, if you

STAMMER

Send 10 cents coin or stamps for 70-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering for 20 years.

Benjamin N. Bogue, 757 Bogue Building, Indianapolis

Solving the Transportation Problem

By H. Gernsback

(*Continued from page* 336)

regulated to a nicety. In order to overcome the difficulty of starting the train with a bad jerk, it is in the power of the conductor to move the contact shoe forward or back, for a few inches. Thus the hydraulic shoes can be brought under the gradual pull of the electro-magnets by being a greater distance away from the energized magnets as shown in Fig. 6. For, the further the hydraulic shoe is away from the electro-magnet, the less the tractive effect will be.

In the writer's system, the train is stopt the same as by the French method, simply by withdrawing the water pressure. The hydraulic shoe then comes into contact with the track and the train stops almost immediately.

System Not Expensive

It will be argued that this magnet arrangement is a very expensive method, but this is not the case. These railroads are not intended for great distances, but will be mostly used in cities where first cost is of no consequence. Witness for instance the truly enormous cost of subway construction where the cost per mile frequently runs into millions of dollars. In the electro-magnet tractive scheme, like in all other railroads, it is only the first cost that counts, and it is very much doubted if the idea advanced here will make this railroad cost even one-quarter as much per mile as an ordinary elevated railway.

Another important plan which the writer advances, and which is shown impressively on our cover illustration, is that this railway is not intended to run thru the streets, *but rather over the house tops.* This is quite practical with such a railroad for the following reasons: Firstly, the single track will take away practically no light where it crosses over the streets. The track can be very light because the cars themselves are light. Also, there is but a single track, and consequently the structure that carries it can be exceedingly light. Secondly, there is no noise whatsoever. You cannot hear the coming or going of the gliding wheelless trains. They make absolutely no noise and *there is moreover no vibration.* The pillars supporting the track can be placed on two adjoining house walls as shown in our cover illustration; therefore no foundations are required. Stations can be located on the roof tops if desired, where they will not be as unsightly as at present. Elevators will take the passengers up and down.

Being that these railroads can be run safely at a speed double or triple the present day ones, it should be possible to provide a seat for everyone, no matter what the increase of the population will be. We cannot transport in the future many more people than our present day transportation facilities provide. Airplanes are out of the question for obvious reasons and so are airships for the reason that they cannot be operated quickly enough, and also they cannot carry enough passengers no matter what their size. Take for instance a New York Subway car when packed full will accommodate often as many as two hundred passengers, while a ten car train carries two thousand souls. From this it can be seen that neither the airplanes nor the airship can ever hope to compete with the wheelless trains as outlined above.

How to Develop Your Inventive Ability

By Jay G. Hobson

(*Continued from page* 330)

ters, steps in line, picks up his tray and proceeds to obtain his knife, fork, spoon and paper napkin. Directly ahead of him is a man with dirty face and hands who also fumbles around among the silverware probably touching our friend's knife and fork as well as his own. Our friend notices this and frowns, but sees nothing of importance about it other than the unsanitary annoyance for the time being.

At five-thirty P. M. we return to our friend's office and find him all prepared to drive home in his eight cylinder flyer; so feeling the need of fresh air we invite ourselves to go along. We haven't gone far until it begins to rain in torrents, but we don't bother as the top is up. Arriving home our friend turns into the driveway and as he nears the garage observes both doors tightly closed which means that he must get out into the wet to open them and that's no joke. He simply jumps out, gets wet and mutters things we can't record here.

Our friend's wife meets him at the door with the usual welcome and he feels greatly relieved amid the comforts of his cozy little home. Supper is served with our friend enjoying a good meal. During dessert his wife expresses her great desire to see a certain good play at the opera. Husband frowns inwardly for it is his preference to keep within the shelter of his home this wet evening. But observing his wife's earnest desire for additional amusement he strives to show some enthusiasm over the suggestion. They leave for the show about seven-thirty.

Arriving at the theater thirty minutes later they enter, taking their wraps with them to their seats. Past experience with the check room service has convinced them of this wisdom. The theater is crowded, every seat is occupied. There is no empty seat near them to lay their hot wraps on. Our friend must hold the collection upon his lap which doesn't add to his comfort. Along about the third act when the exciting part of the play makes everyone sit rigid with expectation, our friend is simply sweltering under the many woolen garments over his knees but he just sits there and suffers without one idea concerning the uncomfortable situation.

Returning home after the show our friend finds a telegram waiting for him. It is from headquarters instructing him to make a special business trip up-state to a city that he has never visited before. He prepares for the trip and leaves the following morning. But before leaving he acknowledges the company's wire and at the same time requests them to send him an expense check.

While en route to his destination he takes the hotel directory from the Pullman Library and selects what appears to be the best hotel in the city. He proceeds to this hotel and registers as usual. The following day the company's check arrives

(*Continued on page* 340)

www.americanradiohistory.com



Cigarettes made to meet your taste!

18c a package

CAMELS are offered you as a cigarette entirely out of the ordinary—a flavor and smoothness never before attained. To best realize their quality *compare Camels with any cigarette in the world at any price!*

Camels flavor is so refreshing, so enticing, it will win you at once—it is so new and unusual. That's what Camels expert blend of choice Turkish and choice Domestic tobacco gives you! You'll prefer this blend to either kind of tobacco smoked straight!

As you smoke Camels, you'll note absence of any unpleasant cigaretty aftertaste or any unpleasant cigaretty odor. And, you'll be delighted to discover that you can smoke Camels liberally *without tiring your taste!*

Take Camels at any angle—they surely supply cigarette contentment beyond anything you ever experienced. *They're a cigarette revelation!* You do not miss coupons, premiums or gifts. *You'll prefer Camels quality!*

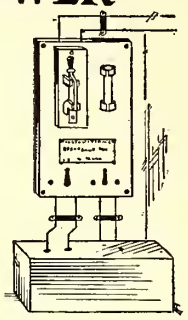
Camels are sold everywhere in scientifically sealed packages of 20 cigarettes or ten packages (200 cigarettes) in a glassine-paper-covered carton. We strongly recommend this carton for the home or office supply or when you travel.

R. J. REYNOLDS TOBACCO CO., Winston-Salem, N. C.

Camel CIGARETTES

www.americanradiohistory.com

$1.00 INEXPENSIVE ELECTRIC POWER $1.00



The wonder of the twentieth century inexpensive electric power, this is possible with our new electric power system, a new idea in electricity. With the aid of our instruction and chemicals you can make and install a power battery as shown in the illustration, absolutely safe and simple. **Stop wasting money** on buying batteries, install the new electric power battery. It is not an acid or dry battery, it is a new combination of wet and dry elements which produce electricity. These batteries are **powerful and cheap** to operate, they produce a direct current of more than 10 volts, cheaper than any other form of battery. They are wonderful for operating all kinds of experimental work, for lighting purposes and for many other uses where electric current is needed. Any user of batteries knows the value of an inexpensive high voltage electric current. These batteries should be in every home, office, shop and factory, no matter how small a current is needed; to reduce or raise the current of the battery, simply move the volt regulator on the switch board. The beauty of these power batteries is, that they do not evaporate or lose current when not in use, therefore, with every day use recharging the battery is necessary about every month or so, it can be recharged at home in a few minutes, **no electricity or machinery is required** for this operation, recharging material can usually be obtained around your home or can be bought for a few cents. These batteries when charged weigh about 34 pounds and if properly installed **will last for years.** Each battery making outfit consists of a completely wired switch board, battery connectors, wire, instructions and plan for making, installing and recharging the battery and complete chemicals. **Special introductory price, $1.00, prepaid.** Outside the U. S., $1.25.

NEW MODEL TELEPHONES $2.00



The most useful and inexpensive wall telephones yet developed. Good use can be found for a set of these telephones in many homes, and in office, store or shop, indoors and outdoors; they save many steps and much time. You can easily install these new model telephones and have your own private line with no operators to bother or listen to your conversation. They are thoroughly practical and serviceable all around telephones. Their construction is simple and neat, nothing to break or to get out of order, a child can operate them with ease, they will give satisfactory service at any distance up to 1500 feet, and even at that distance the voice will be perfectly plain and understandable as with the **regular commercial telephone.** These new model telephones are electrically operated, two batteries will operate a set of phones for a long time, the cabinets are made of polished oak and finished with a durable varnish and fitted with excellent receivers and transmitters, fine workmanship and construction throughout, **guaranteed to operate** under all conditions. We are offering the New Model Telephones at an **exceptionally low price.** Each telephone set consists of two New Model Telephones, calling system, wire, instructions and diagram for installing. **Special price to introduce $2.00, prepaid.** Outside the U. S. $2.25. **FREE**—We want every reader to own a New Model Telephone set, so we are going to give away a **2-cell battery FREE** to every purchaser of a New Model Telephone Set.



ELECTRIC LIGHT IN YOUR HOME $1.00

The latest electric light, no batteries to buy or electric bills to pay. Anyone can install and maintain this midget electric light. Safe, simple and inexpensive. No more smoke and smell, no wicks or oil, no chimneys to clean or break, just as safe in the barn, garage and clothes closet as in any open room, always ready for use, day or night. A touch on the switch and you instantly have a **bright electric light.** No matter where you live this light can be installed. It is not affected by heat or cold. Many homes have installed this electric light in their halls, closets, pantries, barns, sheds, cellars, garages, etc., with good results. It is an extremely useful light which no household should be without. The reason for this bright electric light is that the lighting bulb is fitted with a drawn Tungsten filament wire which is much more efficient and durable, besides giving a **300% increase in light** as compared with the ordinary carbon lamp. The power system furnished with this lighting outfit is somewhat similar to the electric power battery described above. Each electric light outfit includes the following: Complete directions and plans, copper wire, insulated wire holders, knife switch, drop light fixture with socket, friction tape, battery protector, maroon shade, national mazda globe. Our dry battery compound, which assists in renewing and supplying the current and our current renewing system with which you can **renew the current at home without expense.** With every day use one recharge usually lasts two to three weeks. This electric lighting outfit is undoubtedly the most practical and durable electric light of low cost and long service ever devised. **Special price to introduce these electric lighting outfits $1.00, prepaid.** Outside the U. S. $1.25.



Our Guarantee—It is our intention that every article described above will reach you exactly as described, that it will satisfy you perfectly, that it represents full value for the money you paid or we will refund your money.

Just to introduce our new line of goods we are offering them at these greatly reduced prices. We only have a limited number of the above described goods at these prices. **Order now,** direct from this ad. We guarantee safe delivery anywhere for additional 10 cents on each item.

A. B. C. PRODUCTS CO. JOHNSON & 13th STS. RETAIL DEPT. **CHICAGO**

YOU HAVE A BEAUTIFUL FACE

BUT YOUR NOSE?

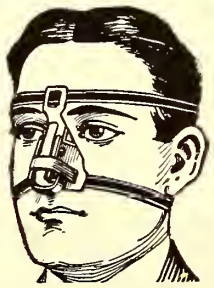




BEFORE



AFTER



IN THIS DAY AND AGE attention to your appearance is an absolute necessity if you expect to make the most out of life. Not only should you wish to appear as attractive as possible, for your own self-satisfaction, which is alone well worth your efforts, but you will find the world in general judging you greatly, if not wholly, by your *"looks,"* therefore it pays to "look your best" at all times.

Permit no one to see you looking otherwise; it will injure your welfare! Upon the impression you constantly make rests the failure or success of your life. Which is to be your ultimate destiny? My new *Nose-Shaper,* "TRADOS" (Model 24) corrects now ill-shaped noses without operation, quickly, safely and permanently. Is pleasant and does not interfere with one's daily occupation, being worn at night.

Write today for free booklet, which tells you how to correct ill-shaped noses without cost if not satisfactory

M. TRILETY, Face Specialist **1162 Ackerman Bldg., Binghamton, N. Y.**

Be an Artist

Comics, Cartoons, Commercial, Newspaper and Magazine illustrating. Pastel, Crayon portraits, Poster and Fashions. **Earn Big Money.** *Taught by Mail or* Local Classes. Write for illustrated booklet, terms and list of successful pupils

ASSOCIATED ART STUDIOS, 13A Flatiron Bldg., N. Y.

HEADACHES FLU **AK** NEURALGIA WOMEN'S ACHES

ASK FOR A-K TABLETS

How to Develop Your Inventive Ability

By Jay G. Hobson

(*Continued from page* 338)

as requested. Being a total stranger in the city he asks the hotel manager to kindly cash said check, explaining who he is and the integrity of his superiors.

The manager very diplomatically explains that he has often heard of his fine company and would be pleased to accommodate him if he will just have some one identify him so that he can be sure our friend is the proper person. For it is possible, from the manager's point of view, that our friend could have found the check—that had happened before! Of course, the hotel does not mean to doubt our friend's honesty for one moment!

Turning around he rams the check deep into his pocket with a vow, to himself, that he will get that check cashed by the first bank he comes to.

Walking slowly down the main business street he runs into a friendly looking bank and he decides to try his luck in there. Approaching the cashier's window deliberately he shoves the check for a hundred toward the cashier with the remark that he would appreciate the favor. The cashier excuses himself for a minute and retires to one of the financial reference books for information about the company.

Promptly returning to his money cage the cashier politely informs our friend that he would be pleased to favor him if he will obtain additional identifications. Our friend is almost desperate by this time and requests the cashier to take him to the president of the bank. The president is courteous but assumes the same stand about further identification as the others. Our friend's spirits dropt very low from this last retort. But glancing down on the expensive mahogany desk of the president he accidentally observed the national emblem of an organization to which both he and the president belong and quickly makes this known. The president's face softened and after a few hand shakes the cashier is summoned with instructions to honor our friend's check which was accomplished among expressions of appreciation.

Now shifting our minds into reverse we will return to our friend's first experience in the cafeteria and see what, if any, improvement was suggested by things that transpired. This simple little test of observation will help to show how far your inventive abilities have been developed. The more observing mind would have received an idea of value after seeing that man with dirty hands mussing over the silverware. A mental picture of a sanitary dispensing machine for knives, forks and spoons would have appeared. A machine with levers to operate the dispensing of the silverware so that only one pair of hands would touch the silverware to be used by them. This would be an improvement of worth.

The incident at the garage should have suggested a device to automatically open the doors as soon as the automobile came near enough to put it into motion. Possibly a small electric motor attached to the doors with a bumper switch to come into contact with the front tires of the auto. After the small motor had propelled the doors sufficiently to allow the auto to enter, there would be a cut-off switch on the end of the door that would stop the motor.

Then at the theater our friend's discomfort should have suggested an improvement in seats. One with a clothes compartment in the back that would open when the seat was bent forward and close and disappear thru the floor when the seat was pushed backward.

www.americanradiohistory.com

Being check-bound away from home in a strange city without anyone to identify you is no joke, for I speak from experience.

The trained observer's mind would have pictured a device in the form of a small pocket case with his picture in one side and across the picture would be signed his official signature. In the other side would be secured a cancelled company's check bearing his signature, the stamps of the different banks and clearing houses it has past thru on its way back to the company; and on its face it is marked PAID. This old check would be compared to the new one. The signature on the picture and on the old check and on the hotel register would be compared together, which would be all the identity necessary to obtain the money needed.

A few months ago I was visiting friends in the evening. They owned a popular phonograph that they played for hours each evening and fully enjoyed every moment of it. This particular evening that I called they refrained from playing even as much as one short record, and I could not quite understand the unusual situation. Being by nature somewhat nosey about unusual conditions I inquired of the cause for their abstinence. The husband frankly confest that he had neglected to stop by the music store for a very important accessory necessary for proper playing of their instrument. This explained, I exprest my regret but immediately an idea flashed thru my mind that there was a great need for a small device to make this important accessory.

For weeks I kept turning that spark of an idea over in my mind trying to picture a machine that would be satisfactory for the purpose desired. Finally I pictured it in detail and soon constructed a working model that proved efficient. Then I applied for broad patents both in the U. S. A. and foreign countries. It is about ready for the market now, but in justice to the manufacturers it isn't possible to explain definitely all about the construction and origination until ready for public announcement. However in a later article I shall show several drawings and give a complete explanation of the invention.

Copyrighted 1919 by Jay G. Hobson

Bomb Expert Eagan

(*Continued from page 296*)

use among the Italians. These bombs were made by Italians who had been employed in fireworks factories in Italy and in America. The cause for the placing of the bombs was feuds among the Italians. A section of the city became known as the "bomb centre."

While walking in a section of the east-side on a fair May day, in the neighborhood of East 11th and 12th Streets, I was stopped by a policeman from the East 5th Street Police Station House. "I was just up to the station house and sent a call for you," he said. "Why?" I queried. He answered, "We have located a big package down in 11th Street, which looks like a bomb, and the people in the house have left their apartments, fearing it will explode."

Upon arriving, I ordered all the children away from the place, and then started to operate upon the bundle. To my great surprise I came upon *two fulminate of mercury caps attached to two fuses, and twelve sticks of 40 per cent. dynamite put up in two separate packages!* To each six sticks of dynamite, a fulminate cap was attached. The bundle was surrounded on all sides with heavy pieces of iron, bolts and small pieces of slugs. It was then covered with burlap, which in turn was covered with newspaper and bound with

Why Not Earn $35.00 to $100 A Week

As A Mechanical Draftsman?

"Get into the profession of big pay and Rapid Advancement with the help of the school that has started hundreds on the Road to Success. I am ready to help you." Roy C. Claflin, President, Columbia School of Drafting.



Learn At Home In Spare Time

You don't have to stop work or leave home in order to become a trained Draftsman. Through our practical home study Training we will teach you Right in Your Own Home so that you will soon be able to qualify for a good position at Big Pay. We will continue to instruct and help you until we know you have the knowledge necessary to succeed.

No Previous Training Necessary

Right now—TODAY—there are openings for thousands of Draftsmen in the Government Departments, industrial concerns, and the big engineering offices. One department alone recently called for 1,800 draftsmen. With this tremendous demand has come a big increase in salaries.

Draftsmen Are Getting $35 to $100 a Week

with big chances for even better pay as the demand grows. By enrolling NOW for our practical Home Study Course in Drafting you can quickly qualify for a position as Draftsman and by properly applying the principles we teach.

You Have a Chance to Become a Chief Draftsman

and get to the very top in this fascinating profession. Our course will give you just the knowledge you need to make good as chief draftsman when your chance comes.

Peace Calls For More Draftsmen

With the problems of reconstruction facing the nation the demand for draftsmen is even Greater Than During the War. All big engineering, construction and manufacturing projects must first go through the drafting room before the workmen can commence. You can help in the work of reconstruction and secure a Big Salary with excellent opportunities for advancement. Prepare now and be ready when the demand reaches its height.

We Will Help You Secure a Position

as soon as you complete our course. We have already placed hundreds of our graduates in good paying positions and are constantly in touch with vacancies for which Draftsmen are Urgently Needed. Government Departments and Private Concerns are continually calling upon us for our graduates because they know that our instruction produces draftsmen of the caliber they need.

Thousands of Men Wanted Right Now

Drawing Outfit FREE

As soon as you enroll you will be sent our special drawing outfit FREE so that you will be sure to have it to work with while taking the course. This set will be yours to keep. You are not asked to return it after completing the course.

Illustrated Book of Particulars Sent Free

Fill in the coupon below—send it to us and we will send you FREE a copy of our illustrated book telling all about our practical Home Study Course and how you may secure our instruction at once on Easy Terms so as to quickly qualify for one of the Big Positions Now Open.

Mail This Coupon To-day

Columbia School of Drafting
Dept. 1050, 14th and T Sts., N. W.
Washington, D. C.

Without obligation to me, please send me your illustrated book telling how I can secure your complete Home Study Course, the FREE DRAWING OUTFIT, and your help in securing a position as Draftsman.

Name .....

Address .....

City .....State .....

www.americanradiohistory.com

AVON INN

AVON-BY-THE-SEA, N. J.

LOCATED directly on the beach, 50 miles from New York and 2 miles from Asbury Park.

Surrounded by spacious piazzas and extensive grounds, its accessibility to the beach makes it particularly desirable for families with children.

DANCING BATHING BOATING
TENNIS GOLF FISHING

Write for Booklet and Information

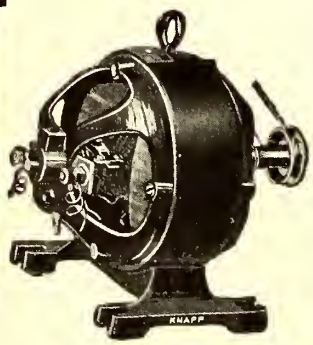
AVON INN HOTEL COMPANY

PROPRIETORS

S. THOMAS PENNA, Manager

DEPENDABLE KNAPP ELECTRIC SPECIALTIES

Motors and Electrical Specialties Are Best



Knapp Goods have stood the test for 29 years. No detail in construction has been spared to make them the best that money can buy. The complete Knapp line includes Toy and Power Motors, Generators and Dynamos. Specialties and Novelties that amuse and instruct. Fans, Rheostats, Compasses, etc. And Knapp prices are always lowest. Always insist on Knapp Goods.

KNAPP "LEARNELECTRICS"

A complete Electrical Laboratory, including a very valuable instruction book by H. P. Gorman, A.I.E.E. Covers all subjects clearly and concisely.



KNAPP DYNAMO MOTOR

Will electroplate, charge storage batteries, run lamps, motors, train of cars, induction coils,—in fact, the number of experiments it can be used for is unlimited. Runs on 4 to 6 Volts or can be connected to run on 110 Volts through a transformer.

Price, Complete, $7.00

Price, Complete, $3.50

Order to-day. Or your dealer can secure them for you. DESCRIPTIVE CIRCULAR and CATALOG of celebrated **KNAPP MOTORS** *and Electrical Specialties from 10c up mailed FREE on request.*

KNAPP ELECTRIC & NOVELTY CO., 523 West 51st Street, New York City

STAMPS

50 diff. Belgium (large bi-color), China, Jamaica, Portugal, Venezuela, etc., 10c; 100 diff., nice packet, 20c; 1,000 well mixed, 40c; 100 var. U. S., 50c; 1,000 hinges, 10c; Agts. wanted, 50%. List free. I buy stamps. L. B. Dover, Overland, Mo.



TYPEWRITERS

$10 AND UP. ALL MAKES. SAVE $25 TO $50 on rebuilt at the factory by the well-known "YoungProcess." Sold for low cash—instsllment or rented. Rental applies on purchase price. Write for full details and guarantee. Free trial. YOUNG TYPEWRITER CO., Dept. 821, Chicago

a heavy wire. In all, the bomb weighed about thirty pounds.

With the development and common knowledge of explosives of the nitro-cellulose group, chlorat and nitrat mixtures disappeared and the number of composite nitro-cellulose and nitro-glycerin bombs has increased and many ingenious combinations of the above mentioned methods of ignition have been devised, showing that much keener minds and men well trained in chemistry and the use of explosives have made these later type bombs.

Speaking of Large Bombs.

The first bomb of this type, the "Cunard Bomb," discovered in 1902, was the largest bomb I ever handled. This type was very rare then, but it is now "the usual garden variety." The Cunard bomb was of the nitro-glycerin class mechanically detonated. The bomb consisted of 100 lbs. of 60 per cent, dynamite, placed in two boxes, each containing 50 pounds. These boxes were set inside a larger box within which was set a *timing device* which would set off the fulminating caps and detonate the explosives. The timing device was set to explode when the ship had proceeded two hundred miles from the coast. The man who made the bomb was discovered in a tenement and was found to be insane.

The O. K. Bottling Works Bomb was of the nitro-cellulose type, mechanically and electrically operated, as was evident from the circumstances, weight and size of container, the express charge and the debris. On the morning of December 12th, 1913, a small pasteboard box was delivered by the Adams Express Company and was received by the stenographer, Miss Anna Amusewitz, who laid it aside until she had opened the mail. The bookkeeper who was in the office when the bomb exploded and who survived his injuries, stated that Miss Amusewitz cut the string, thereupon an explosion occurred. The office was wrecked, Miss Amusewitz was hurled into the corner and died within ten minutes. The perpetrator was never discovered.

The Herrara Bomb was of the nitro-glycerin group, chemically ignited. The circumstances were similar to those of the O. K. Bottling Works Bomb, which killed Miss Amusewitz. Mrs. Herrara was killed outright and her husband was totally blinded.

The Taylor Bomb, the second manufactured by Klotz, was of the same type and made by the same person. This bomb killed Mrs. Taylor under the same attendant circumstances as noted above.

My own fingers were blown off by a bomb of the same description and manufactured by the same man who sent it to a prominent man in New York City, (Judge Rosalsky), related Inspector Eagan.

Shortly after the third bomb, Herman Klotz, a draftsman and former employee of the City of New York, was mortally injured by a bomb he was making. Klotz confest to these outrages before his death in the Fordham Hospital.

Since the beginning of the European War, bombs have been of an improved type and are modelled along the lines of munitions used by the European Belligerents.

The Fay Bomb manufactured by Lieutenant Commander Fay, of the German Imperial Navy, was of the alkaline metallic nitrat and chlorat type, mechanically detonated. The bomb case was of steel plates welded together by 100 rivets, and a riveted cover with a water-tight gasket. The interior was filled with a chlorat, nitrat, sulfur and antimony mixture. There were two detonating devices, one within the steel case and the other one the exterior. The exterior mechanism was attached to the propeller shaft of the steamship and the rotation of the shaft tightened the spring on the interior me-

www.americanradiohistory.com

chanism so that when the spring automatically released, it tript the firing pin which exploded the percussion cap, thus detonating the chemical mixture.

The Recent "Gimbel Bros." Bomb.

The late nation-wide Post-Office Bombs were composite bombs of the nitro-glycerin, alkalin, metallic, chlorat type, manually, mechanically and chemically ignited, and were the work of a trained, experienced expert, who knew chemistry, explosives and the psychology of his victims. These nineteen bombs were similar in composition, but not in operation, to the bomb which killed Governor Steunenberg of Idaho. See photo of bomb.

The latest bomb outrages known as the "Anarchist Fighter's Bombs" were of the *high explosive* type. The details cannot be divulged at this time, but the destruction surrounding the residences where the bombs were set off tells the tale all too well.

There are many foolish bomb scares—from diamond studded wrist watches, sent without notice, to one of the Four Hundred's latest debutantes, to a piece of copper ore sent to a mining engineer or a new kind of cheese sent to a prominent patron of the Waldorf-Astoria, who is a connoisseur of famous cheeses, or it may

***INSPECTOR OWEN EAGAN** holds perhaps one of the most unique positions in the world. Mr. Eagan is the official bomb opener in New York City, where during the last decade more bomb outrages have been perpetrated than in any other community in the world. Mr. Eagan has consented to publish some of his experiences in the columns of the ELECTRICAL EXPERIMENTER, and we feel certain that every reader will be intensely interested in Mr. Eagan's experiences. Inspector Eagan has opened thousands of bombs in his past career, only once being injured, when he lost a finger of his left hand due to the premature explosion of a bomb.*

be a box of coals containing a ticking alarm clock which has been sent to the Italian barber in the corner barber shop. These jokes cause much worry and excitement and should never be perpetrated. In one case I found a woman in a serious condition, due to the receipt by messenger of a package the inner wrapper of which was decorated by skull and bones and a warning of death. Arriving there and removing this cover, I extracted a bottle of plain "Pluto Water"!

The latest bombs were not the only ones sent to prominent persons.

Carnegie Mansion at Ninety-first Street and 5th Avenue was the scene of a bomb discovery. Another bomb was discovered outside the offices of the Italian Consul at 212 Lafayette Street. These were of the nitro-glycerin class, manually ignited by the application of a match to the fuse.

The late Honorable Mayor Gaynor was the recipient of a similar bomb which was discovered outside his office window with three burnt matches, and a piece of Chinese lighting punk which showed evidence of having been ignited.

The wealthy and prominent persons of our city are not the only victims to have these unreliable and unexpected packages sent to them. Two bombs were placed in churches in this city. Two bombs were placed in moving picture houses on the East Side. One bomb tore away the stairway and gallery. Even tenements suffer as much as mansions and private residences.

Bomb-Making An Unhealthy Vocation.

The "bomb maker" is not particular where he manufactures his infernal ma-

Try This Interesting Experiment

It is something *everybody* can do.

It is something you *must* do, if you would ever be more than a drudge.

It will bring you freedom from worry.

It will make you happy, and independent.

It is wonderful insurance.

It puts you where you can grasp opportunity when it comes along.

It gives you a vacation when you need it.

It means more advantages for your children.

It denotes character and stability.

It puts you out of debt.

It is the beginning of Success.

Try it.

It is—*SAVING!*

It is now made easy by a new system, and interesting.

Almost as fascinating as a game.

It is the Budget System of Saving and Making Money.

You have read about it in the magazine and newspapers.

All authorities endorse it.

It stops you from slipshod spending.

It saves the money that now slips through your fingers—puts it where it will do you some good when you need it.

Thousands of happy, successful families use it today.

It is fast becoming universal among worth-while people.

A business principle applied to the home—that's what the Budget System is.

It shows you in advance the minimum amount you can save.

A Chicago family beat their Budget by $65.00 last January.

That's getting ahead.

You can do the same.

You have always *intended* to save more.

You have worried about the high cost of living.

You have wondered where all your money went to.

Take that last $50.00 you spent.

What have you got to show for it?

How much of it can you account for?

Can't you account for *all* of it?

No?

Then you are a reckless spender.

Just such methods keep millions poor.

They cause hand-to-mouth living—and destitute old age.

The Budget System corrects this evil.

But learn the Budget System correctly at the start.

It's so simple.

An accountant named Palmer devised a wonderful Budget Book—

based on seven years' actual experience in the home.

It tells you all about starting a Budget—and how to keep it up.

Then there are pages to last you two years.

By Palmer's System it only takes you a few moments each day.

A grammar school child can do it.

It is all in one handy volume—well bound,

convenient,

handsome.

You'll be proud to show it to your friends.

But prouder still to enjoy the advantages it brings to you and those dear to you.

You won't be without this wealth-creating book if you see it.

We want to send it to you *at our expense.*

You don't even need to send postage.

Merely mail the coupon.

We send the book—all charges prepaid.

You keep it five days.

Quickly you will see that it will pay for itself several hundred times.

You will see why users are so enthusiastic about it.

You will want to keep it.

No matter whether your income is steady or variable.

No matter what season of the year.

You will never be without Palmer's Household Money Maker if you see it.

That's why we make such a liberal offer.

Keep it five days.

Then send us the purchase price—

only three dollars.

Think what a trifling sum this is.

It is less than half a cent a day, as the book lasts two years.

Read the letters in this ad.

They are pouring into our office every day.

You, yourself, are likely to write us a letter that will appear on this very page.

But the first step is to send the coupon.

DO IT TODAY!

The quicker you get Palmer's book the quicker it begins to save you money.

ACT NOW!

KRIEBEL & CO., 643 Home Insurance Bldg., Chicago.

Users Are Enthusiastic

I am wild about this book, the one I should have had long ago.
T. B., Watertown, Fla

I kept tab on house expense for 6 years, when I told my folks it averaged $40.00 a week they just laughed at me. We are 10 in the family. Taking the book home I told one of my daughters to put everything down from January 1st to date, when we closed the month of January it amounted to $174.79. It surprised them all. I am sure I can save what I paid for the book in a week; don't need to wait two years as it is an eye-opener to the folks at home. Be sure and send me another book in December, 1920.
R. K., Odebolt, Ia.

I am very much pleased with same. Enclosed please find money order to pay for two copies of this great book, kindly send me another copy by parcel post as I desire to turn same over to a close friend
D. O. R., Frankfort, Ky.

Will you please accept this check and forward one copy of this book? I have seen a copy of this book and it is just the article I've been looking for for the past year or so.
W. L. F., Alexandria, La.

I gave the book to a friend of mine for a wedding present and if I am not mistaken it will prove the most valuable present I could have given him. Kindly send me another of these books for my own use.
W. G. V., Kansas City, Mo.

Attached herewith you will find check in payment of your account against me, and for the balance request that you mail your Household Money Saver to the following four parties.
A. E. K., Cleveland, O.

KRIEBEL & CO., 643 Home Insurance Bldg., Chicago.

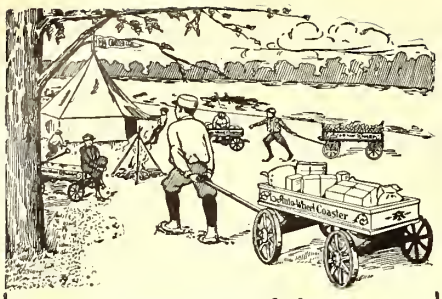
You may send me Mr. Palmer's book, prepaid. Within five days after receiving it I will send you $3, or mail the book back to you.

NAME .....

ADDRESS .....

For the convenience of those who wish to remit cash with order, we allow a cash discount of 25 cents, making the price of the book $2.75. If you remit cash with order you may keep the book five days, then return it if you do not want it, and we will refund your money.

www.americanradiohistory.com



Adventures of the
Auto-Wheel Coaster *Club*

HOW THE AUTO-WHEEL HELPS AT CAMP.

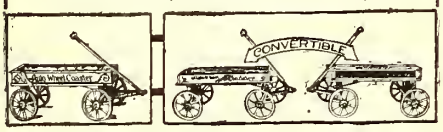
——First the long hike, with the Auto-Wheels carrying the heavy loads—tents, and chow, and fishing tackle, and all the rest

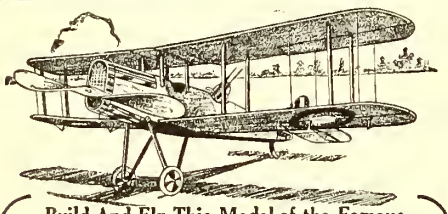
——And when we pitched camp the Auto-Wheels did a man-sized job hauling away rubbish from the camp area, and bringing up firewood. Jim, the Club Captain, bossed the job, and camp was ready in forty minutes.

——We all wore our Club caps—the kind all Auto-Wheel Club members get free by writing to the Buffalo Sled Company for details.

BOYS: If you want to share the fun of the Auto-Wheel Coaster Club, write for booklet showing Auto-Wheel Coaster and Auto-Wheel Convertible Roadster. *A Free Felt Pennant* goes with this handsome booklet.

THE BUFFALO SLED CO., 163 Schenck Street, In Canada: Preston, Ont. N. Tonawanda, N. Y.





Build And Fly This Model of the Famous

DE HAVILLAND DeH-4
BATTLE PLANE

Here's a new IDEAL Model Aeroplane—a faithful duplicate of the war-famous Battle Plane that downed the enemy over the battlefields of France. This new IDEAL Model is in every detail a practical, 3-ft. copy of the original. Has oval aluminum radiator, veneer cockpit and fuselage, aluminum top and bottom engine cowling, hand carved propeller, ball-bearing propeller shaft and rubber-tired disc wheels. Guaranteed to fly from the ground. Miniature gun mount and guns can be made and mounted on the rear cockpit. Build one; it's easy! IDEAL Accurate Scale Drawings, including building and flying instructions, show any bright boy how to do it.

PLANS AND INSTRUCTIONS
for any of these 'planes sent postpaid

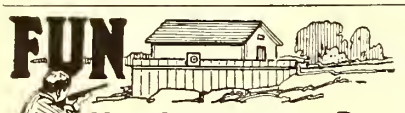
DE HAVILLAND BATTLE PLANE	**.35c**
Curtiss Military Tractor	25c
Bleriot Monoplane	25c
Nieuport Monoplane	25c
Taube Monoplane	25c
Cecil Peoli Racer	25c
NC-4 (ready August 15th)	50c

Advance Orders now booked for NC-4 Plans

IDEAL Model Aeroplane Construction Outfits containing all parts and materials needed to build these Model Aeroplanes are sold by Leading Toy, Sporting Goods and Department Stores. Ask for them at your store.

IDEAL Model Aeroplane Catalog, 48 pages, 5c Postpaid
IDEAL AIRPLANE & SUPPLY COMPANY
159-161 Wooster St., cor. W. Houston St., N. Y. City

FUN $5.00



Noiseless Target Practice

Fit your .22 with a Maxim Silencer and get no end of fun this summer practicing in your back yard and on your vacation.

MAXIM SILENCER
MAKES YOU A BETTER MARKSMAN

It eliminates recoil and all noise of the report, and steadies your aim. Direct from Dealer or Factory $5.00. Write for Free Book of Stories.

FREE BOOK



MAXIM SILENCER CO.
89 Homestead Ave., Hartford, Conn.



HERE BOYS

ALL THE PARTS & PLANS
50 CENTS PREPAID.
Don't Send Stamps
Put together in a JIFFY; flies 100 feet. Next contest Model Aero-Fleet, next Sept.
NIFTY NOVELTY & TOY CO., Newark, N. J.

chine. A cellar in an East Side tenement, the laboratory of a prominent hospital, an abandoned shack in the marshy sections of the suburbs, the servant's room of the mansion, a suite in the most modern apartment house, perhaps in the next apartment wherever you may be living. *Bombs, strange as it may seem, have been made by many types of men, in all degrees of education, wealth and state of life.*

In the bomb factory in the rear of a quiet and prosperous barber shop, the proprietor was killed by an explosion and upon the examination of his body, a little carelessness in placing a too highly reactive chemical in his pocket was found to have caused the end of his career. This rear room contained enough chemicals to stock a small drug store, sufficient dynamite to clear Long Island of tree stumps and enough modern fire arms and ammunition to make envious a "would-be" Jesse James.

The making or setting of bombs is not a safe and lucrative occupation or hobby, as many of these men meet destruction by their own bombs. The greatest death toll paid by bomb makers occurred in the top floor of a six-story apartment house on Lexington Avenue, between 102nd and 103rd Street. Three anarchists, Hansen, Carron and Berg were killed. A brother of Louis Berger, who used a fictitious name "Murphy," escaped death with severe injuries. The force of the explosion destroyed the three upper stories of this building.

During the war I was kept busy with the routine work of the Fire Department cooperating with the Police, Federal authorities, Defense authorities and in the instruction of agents who were assigned to the investigation of various enemy activities. The signing of the armistice brought its train of trouble with shells, rifle and hand grenades, fuses and every imaginable war relic which contained explosives. Many fingers were torn off by grenades exploding in the hands of children."

Mr. Eagan Only "Official Bomb Opener."

At this point we ventured the question: "How many men are engaged in this kind of work, Mr. Eagan?"

Mr. Eagan's answer is illuminating: "The only official bomb opener other than my own unique position, was the Imperial Chief Inspector of the late Czar of Russia, who held an exalted place in court circles and received a fabulous salary. I am one of the hard working, loyal American citizens in the Civil Service of this City, accepting an humble salary and have secured my position by long and trying experience, constant study and research."

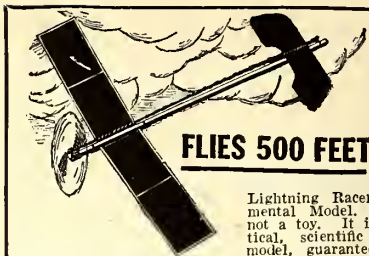
To the question: "How did you engage in this mysterious and dangerous work?" Eagan's answer is to be found in the indomitable spirit of his race.

"As a boy, my Mother would relate to me the mysteries of Cleena, the Fairy Queen of County Cork, Ireland, whose invisible palace was on my great grandfather's estate near Fermoy. The spirit of delving into the occult and mysterious was early developed and not lacking the necessary nerve and grit, I went to it."

The telephone bell rang. "Another bomb," laconically said the inspector.

"Here's my card. Ring, if you get a package," were his last words as he dived into the express elevator. I looked at his card. This is what it says:

OWEN EAGAN.
BOMB EXPERT.
Fire Headquarters. Worth 4100.



FLIES 500 FEET

Lightning Racer Experimental Model. This is not a toy. It is a practical, scientific flying model, guaranteed to fly hundreds of feet; designed and built from the finest selected materials, by Model Experts. This machine and our famous "Montauk Flyer" are the only Complete Model Aeroplanes guaranteed to fly 500 ft. selling for less than $5.00. This model, shipped with monoplanes detached, ready and guaranteed to fly, $3.75 prepaid. Send stamps for circular describing this wonderful model.

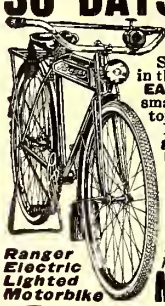
Blueprints of the following models 1-2 actual size 50 cents postpaid in U. S.

Bleriot Racer, flies 600 ft. Manhattan Racer, flies 2000 ft. Montauk Flyer, flies 500 ft. 3 ft. Curtiss or De Havilland Biplane, 75 cents each, postpaid.

HEC Flying Boat guaranteed to rise from the water and fly 500 ft. Two sheets blueprint $1.00 postpaid U. S.

HEC AEROPLANE CO., 300 E. 49th St., N. Y. C.

30 DAYS FREE TRIAL



and *freight prepaid* on any **"RANGER"** bicycle. **Write at once** for our *big catalog* and *special offers*. Select from 44 styles, colors and sizes in the **"RANGER"** line.

EASY PAYMENTS if desired, at a small advance over our Regular Factory-to-Rider cash prices.

You cannot afford to buy without getting our *latest propositions* and **Factory-to-Rider** prices.

Boys, be a "Rider Agent" and make big money taking orders for bicycles and supplies. Get our *liberal terms* on a sample to introduce the new **"RANGER".**

Tires, equipment, sundries and everything in the bicycle line at *half usual prices. Write today.*

Ranger Electric Lighted Motorbike

MEAD CYCLE COMPANY Dept. F.107, Chicago

Chemical Tricks for Boys



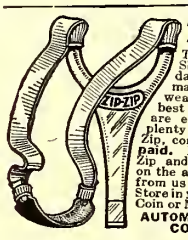
Puzzle your friends with mysterious, harmless Chemical tricks. Four red, white and blue from a glass of water, write secret letters with invisible ink, write with water and have it turn blue, make your own blue ink or ink powder. You can have lots of real fun doing these tricks with "CHEMCRAFT" Junior, complete outfit shown at left. Send for yours right away and get a Free copy of "The Chemcraft Chemist," an interesting magazine for boys.

Amateur Chemist's Catalogue and Hand Book

Containing valuable Chemical information for Boy Chemists and listing many useful chemicals and apparatus, sent postpaid for the None Free. Regular "CHEMCRAFT" Chemical Outfits, at $1.50, $2.00 and $5.00.

The Porter Chemical Co.
Arcade Bldg., Hagerstown, Md.

CHEMCRAFT JUNIOR 25¢ POSTPAID



ZIP-ZIP Patented Sept. 3rd. 1918

The Greatest 50 Ct. Article on the Market. Shipped right from the factory the same day we get your order. The Prong is made of beautiful metal; never break or wear out; scientifically made and best workmanship. The rubbers are elastic and lasting, with plenty of pep and force. Zip-Zip, complete, only **50c prepaid.** Be sure the name Zip-Zip and our address appear on the article you buy. Order from us or any Sporting Goods Store in your city. Send Stamps, Coin or Money Order.

AUTOMATIC RUBBER CO. COLUMBIA, S. C.

35 Miles per hour Is Record of this Car



Boys, Build This Car. This nifty little car driven by gasoline motor, can be built by any boy. Parts are furnished by us and are very cheap. Send 26c for building plans and price list of parts showing how to build this lad's car.

SYPHER MFG. CO.
156 Warren Street
TOLEDO, OHIO.

UMAKEM

Airplane Workchest, containing aircraft work table with mitre cutting board and length gauge, steel drill, steel hammer, Model Maker's steel square, screwdriver, sandpaper block, 10" scroll saw, together with finest quality reed and bass wood, aluminum, silk, para rubber, full set of blueprints, directions, and all fittings for building one 36" Bleriot Model flying Monoplane. Price $10.00. Other UmakeM Outfits 50c to $50.

W. R. PRICE, Inc.
No. 2 UmakeM Building, 127 Fifth Avenue, New York

STAMMERER



Send 10 cents for my remarkable book, "How To Stop Stammering." Kill the fear of stammering. Re education the key.

The Hatfield Institute, 109 N. Dearborn St., Chicago, Ill.

www.americanradiohistory.com

U. S. S. TENNESSEE ELECTRIC DRIVEN.

The U. S. super-dreadnaught Tennessee is a sister ship of the California, now being built at the navy yard, Mare Island, Cal., and which is to be launched in the fall. The Tennessee is 624 feet long, 97 feet 5¾ inches in width, and has a draft of 30 feet 6 inches. She displaces 32,600 tons and has a speed of 21 knots. She has eight water tube boilers and a fuel capacity of 1,900 tons. Her armament will consist of twelve 14-inch guns, fourteen 5-inch guns, four 6-pounders, four anti-aircraft guns, and two torpedo tubes. She will be manned by a crew of 58 officers and 1,024 men. She will burn oil exclusively and will be equipt with electric drive.

Man's Greatest Curse--Infected Teeth

(*Continued from page* 301)

"Tooth infection is undoubtedly transmitted from person to person in the same family, from parents to children, by means of kissing, the use of common drinking and eating utensils, and many other ways. So, if one has infected teeth, he is not only dangerous to himself, *but may transmit this infection to other members of his family, especially his children,* and produce serious conditions which are difficult to explain. One is appalled at the condition of the first teeth of children, many of whom have to have their first teeth filled. Often the second teeth become infected from the first set and the child carries thru life the result of the neglect of the teeth, on the one hand, and the transmission of the parent's infection, in addition.

"Consequently, we feel justified in advocating radical measures in eliminating the infection from children as well as adults, and that means extracting all infected teeth, whether in children or adults, as soon as there is evidence of infection.

Conditions Resulting from Infected Teeth.

"As we give further attention to the subject of chronic infection of the teeth, we are finding more and more conditions resulting therefrom. At first, *the relation of infected teeth to rheumatism* was demonstrated by Hastings in 1914. This was a very important discovery, for this disease had baffled physicians who could find no definite cause for it and many fanciful theories were put forward to explain the cause. *Not only can rheumatism be prevented by intelligent care of the teeth,* as outlined above, *but in many cases it can be cured by the simple method of extracting infected teeth.* Possibly the most common ailment of people in general today is summed up in the general term 'stomach trouble,' and often this condition resists all attempts at eradication by the ordinary methods and may persist for years, causing the patient to drag out a miserable existence. In the majority of cases, infected teeth are at the root of the trouble, and if the condition has not progrest too far, extraction of those teeth, so fondly cherished for years, may clear up the chronic stomach trouble.

"We have proven conclusively that the infection of the teeth, after years, may spread to other organs of the body and cause disease in these remote regions, which disease has apparently no relation to the teeth, but, nevertheless, the infected teeth are directly responsible for the condition. The bacteria which grow and propagate

(*Continued on page* 347)

Make a Bigger Income Learn Draftsmanship



Great demand for draftsmen now. Still greater demand in prospect. War over, building is to be resumed and manufacturing to expand to meet home and foreign needs—which means plenty of good positions for draftsmen. Take up this paying profession. The Chicago "Tech" method is the quickest, easiest way to become a draftsman in spare time while you hold your present position. That proved before you pay a penny. (See free lesson offer below.) Send coupon. Learn how to earn

$25 to $100 a Week or More

at interesting work with opportunities to rise to superintendent, manager, or other executive positions. Let the Chicago "Tech" engineers train you At least get the free lesson and information.

Drawing Outfit



(No Extra Charge)

Every student of the Chicago "Tech" Home Study Course in Draftsmanship receives this drawing outfit—set of instruments in case, drawing board, T square, triangles, scale, curve, drawing paper, pencils, etc., or a cash credit in case he already has an outfit. You use them while learning.—then take them right into your practical work.

NOTE: Enrolled with Chicago "Tech" you have the personal direction of practical engineers, builders and architects who teach you the methods they use in their own work. No useless theories, no time wasted. You are prepared to stand beside old, experienced men. Big advantage to learn from a staff like this—every man a specialist.

Come To the College or TRAIN at HOME

Wherever you are you can have this Chicago "Tech" training. Complete instruction by mail. Exercises, lessons, personal direction of our experts right in your own home if you cannot come to the college for a resident course. Send the coupon and get the facts.

Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Splendid opportunities open now.

Learn All This in Spare Time

All about the Principles of the Automobile.
All about Gasoline Engines.
All about Power Plants and Transmissions.
All about Carburetors and Fuel Supply Systems.
All about Lubrication and Cooling.
All about Batteries.
All about Magneto Ignition.
All about Starting and Lighting Systems.

Know How To Fix Troubles

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men.

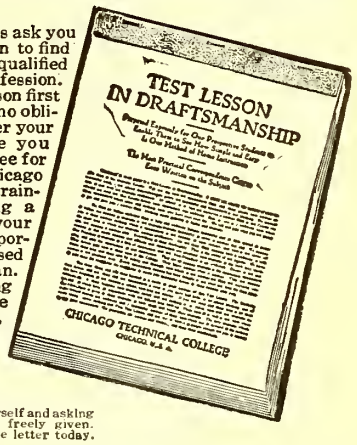
Write Send the coupon and get catalog and all information now.

Easy Payments

The fees for Chicago "Tech" courses are very moderate—and you can pay on easy terms. And also—you can obtain in a few months what it would take several years to acquire by ordinary methods. You can get an early start. You are soon ready to take a paying position and to quickly get back the cost of your course.

FREE TEST LESSON

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything. And see for yourself just what Chicago "Tech" offers you in training which will bring a ready market for your services and open opportunities which are closed to the untrained man. The coupon will bring all the facts about the course, the small fee, and the easy terms.



Mark with X the branch you are interested in--or if in doubt about which course to take, write a letter stating facts about yourself and asking our advice which will be freely given. Mail either the coupon or the letter today.

CHICAGO TECHNICAL COLLEGE,
845 Chicago "Tech" Building, Chicago

Without obligation upon me, send your Catalog on subject indicated below. Also FREE Lesson if inquiry is on Drafting or Plan Reading. Mark X opposite work in which you are especially interested.

- ☐ Architectural Drafting
- ☐ Machine Drafting
- ☐ Electrical Drafting
- ☐ Structural Drafting
- ☐ Sheet Metal Drafting
- ☐ Builders' Course
- ☐ Plan-Reading—Buildings
- ☐ Plan-Reading—Shop Men
- ☐ Estimating
- ☐ Surveying
- ☐ Map Drafting
- ☐ Autos and Gas Engines

Name.....

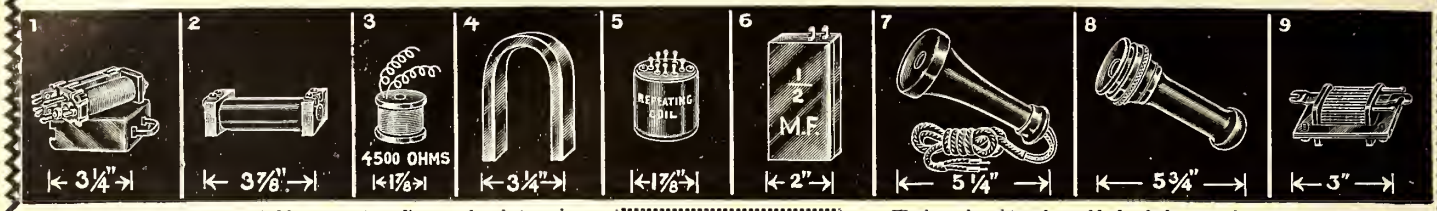
Address.....

City..... State.....

College or Home Study? State which.....

www.americanradiohistory.com

FOR EXPERIMENTERS ONLY!!



WE have in the past held many extraordinary sales, but we believe that the present one eclipses all by the wonderful values we are offering. The goods which we offer on this page are all standard telephone apparatus. Every piece we are offering is equipment that for one reason or another was discontinued by the telephone companies. If you wanted to buy any of the pieces which we offer herewith, from the manufacturers, the price would at least be ten times what we are asking for it. You can readily ascertain this for yourself by looking over our wonderful prices.

RUSH

Cut out and attach to your order. It will leave us within 24 Hours.

We have bought a large block of these goods and have a large quantity of every item on hand. Immediate shipment can be made on all of the goods in practically any quantity within reason. *Shipment within twenty-four hours* will be made if you use the adjoining coupon. This coupon saves you several days and your order will then be considered a rush order. We guarantee every piece to be as represented, and we will refund the money if goods are not exactly as claimed by us.

No. 1 TELEPHONE RELAY, 1500 ohms—has two silver-contact springs and is very sensitive. Can be used wherever a sensitive relay is needed. It is adjustable and can be used for a variety of purposes.
No. 1 Relay—shipping weight, 2 lbs. Price..... **$1.50**

NO. 2 STANDARD TELEPHONE Induction Coil, primary 1 ohm, secondary 55 ohms. Used wherever you need a good induction coil. Has primary and secondary and iron wire core; fibre heads.
No. 2 Induction Coil as described—shipping weight, 2 lbs. Price..... **$0.50**

NO. 3 STANDARD RESISTANCE wound with German silver wire—4,500 ohms, can be used as a choke or plain resistance, and has many other uses that readily suggest themselves to the experimenter.
No. 3 Standard Resistance as described—shipping weight, 4 oz. Price..... **$0.40**

NO. 4 HORSESHOE MAGNET, size 3¼ inches wide x 5 inches high. Will lift about 1 lb. Quality euch as used on magnetos, which means the best.
No. 4 Horseshoe Magnet — shipping weight, 2 lbs. Price..... **$0.30**

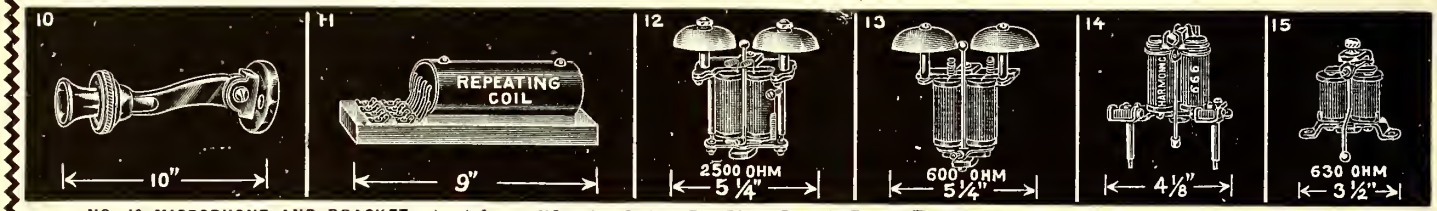
NO. 5 REPEATING COIL (Transformer). This is a standard small repeating coil and is used by all telephone companies. It has 4 different windings and eight contacts. Entirely enclosed in iron. The resistance being respectively 72 and 120 ohms, and 90 and 100 ohms. Diagram is furnished. Can be used for wireless, for boosting signals, etc.
No. 5 Repeating Coil—shipping weight, 2 lbs. Price..... **$0.50**

NO. 6 ½ M.F. CONDENSER. This is a standard telephone condenser and has ½ microfarads. Condenser comes in neat metal casing. This condenser is used in connection with spark coils to absorb the vibrator spark. Invaluable for test buzzers to absorb spark and make the sound of buzzer more steady. Is also used by every experimenter in connection with wireless where a fixed capacity is needed. Several of these condensers should be in every experimenter's laboratory.
No. 6 Condenser, ½ M.F.—shipping weight, 1 lb. Price..... **$0.50**

NO. 7 DOUBLE POLE BELL TELEPHONE RECEIVER—hard rubber casing with 4 ft. cord and tips. Standard 75 ohms—very powerful magnets. This receiver can be used in connection with any ordinary telephone work, and you will even find it sensitive enough for short distance wireless work.
No. 7 Bell Telephone Receiver—shipping weight, 3 lbs. Price..... **$0.80**

NO. 8 STANDARD TELEPHONE RECEIVER with Metal Head. This receiver is made by Stromberg Carlson Co., with genuine hard rubber handle and ear cap. A very good fool-proof as well as sensitive receiver that cannot be put out of order if you try. Used for the same purpose as No. 7 Telephone Receiver.
No. 8 Standard Telephone Receiver—shipping weight, 3 lbs. Price..... **$0.75**

No. 9 IMPEDANCE COIL (Close Core Transformer). This is a very fine little transformer and is used extensively in connection with telephone work. It is in reality an A.C. transformer for which you would pay $5.00 if you had it made to order. The primary has 0.15 ohms, secondary 2000 ohms. It can be used for a variety of purposes that will suggest themselves to every experimenter. Can be used successfully to boost wireless signals. Also in connection with audions, etc. An A-1 instrument. Size 3 x 3 inches.
No. 9 Impedance Coil—shipping weight, 2 lbs. Price..... **$0.65**



NO. 10 MICROPHONE AND BRACKET. An A-1 sensitive microphone of the carbon grain type. Has hard rubber mouthpiece and enamel steel bracket, the instrument being 10 inches long. This microphone, in connection with our No. 7 or 8 Receiver, will constitute a complete telephone outfit, good to speak 50 miles or more, at a remarkably low price.
No. 10 Microphone and Bracket—shipping weight, 5 lbs. Price..... **$1.00**

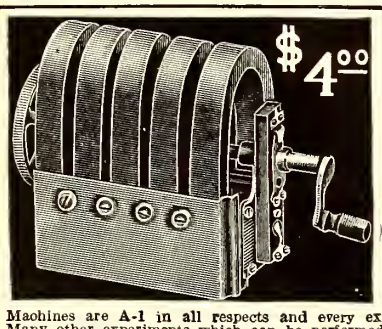
NO. 11 REPEATING COIL (Transformer). A standard repeating coil used for telephonic work. The coil windings are encased in an iron tube 2¼ inches in diameter. There are eight terminals for the four windings to connect to and the instrument is invaluable in connection with radio work to boost up eignals, audion work, etc. Many interesting uses will be found for this coil. Resistances are: 100, 120, 145, 175 ohms.
No. 11 Repeating Coil—shipping weight, 8 lbs. Price..... **$2.00**

NO. 12 POLARIZED RINGER with Bells. The resistance of the two coils is 1250 ohms each. The armature is perfectly adjustable. Bell will work on any magneto. We also furnish blue print with ringer showing how *a first class polarized relay* can be made by anyone using only a few pieces of metal and screws.
No. 12 Polarized Ringer with Bells—shipping weight, 2 lbs. Price..... **$1.50**

NO. 13 POLARIZED RINGER with Bells. This is the eame kind of ringer as the No. 12, except that it is not adjustable and that the resistance is less. First class in all respects. Blue print furnished with this to *make polarized relay* same as with No. 12. Solenoids on this ringer are worth more than the price we ask for the entire ringer, and do not forget a powerful magnet that goes with it.
No. 13 Polarized Ringer with Bells—shipping weight, 2 lbs. Price..... **$1.00**

NO. 14 HARMONIC RINGER. This ringer is also polarized and has a powerful magnet. It works on 66.6 cycles and any magneto will operate it if run at a certain speed. A very finely built instrument. Resistance of each coil being 200 ohme. Can be converted into a polarized relay by substituting a very fine leaf spring instead of the heavy one furnished. A most interesting instrument with which to experiment.
No. 14 Harmonic Ringer — shipping weight, 4 lbs. Price..... **$1.60**

NO. 15 RINGER without Bells—630 ohms. This also is a polarized ringer and has an adjustable armature. The adjustment is done by means of the top screw. A beautiful little instrument. With this instrument, too, we furnish a blue print showing how a *polarized relay can be built.* You should have several of these beautiful little instruments. They are worth their weight in gold; the powerful magnet alone being worth more than the price we ask for the entire instrument.
No. 15 Ringer—shipping weight, 2 lbs. Price..... **$0.80**



No. 55 5-bar magneto, 110 Volt A. C. Generator

This is one of the most powerful magnetos ever built, when manufacturers could afford to put good stuff into them; equipt with transmission, make and break, etc. Transmission wheels are all brass, crank handle furnished. This magncto, as well as the other ones listed below, will light a 110-volt lamp merely by turning the crank handle slowly. While this magneto gives alternating current only, it can be rewound so it will light up a number of four, six and 10-volt lamps, all depending upon the thickness of the wire you wind on the armature. As we furnish these magnetos, they will give a powerful alternating current and you will not be able to stand the current when grasping hold of the terminals. This makes an ideal shocking machine. All our generators can be transformed into a direct current machine by equipping it with a home-made commutator. Machines are **A-1** in all respects and every experimenter should have one of them in his shop. Many other experiments which can be performed with this machine will readily suggest themselves to any experimenter. The magnets furnished with these generators are very powerful, each one being able to lift one pound easily.

NO. 55 5-BAR MAGNETO GENERATOR as described—shipping weight, 25 lbs. Price..... **$4.00**

NO. 33 3-BAR GENERATOR, same as described above except that it has only 3 bars, and is somewhat emaller.
No. 33 3-bar Generator—shipping weight, 10 lbs. Price..... **$2.00**

NO. 44 4-BAR GENERATOR, same as No. 55 except that it has 4 bars, and is somewhat smaller.
No. 44 4-bar Generator—shipping weight, 15 lbs. Price..... **$3.00**

NO. 66 6-BAR GENERATOR, same as No. 55 except that it has one more magnet and the armature is somewhat larger and more powerful. This is the biggest type made and is extremely powerful.
No. 66 6-bar Generator—shipping weight, 30 lbs. Price..... **$4.50**



Complete Wall Set

This is a complete commercial telephone station. The cabinet is of polished oak, piano finish, within which is contained the powerful magneto, the 300 Ohm polarized ringer, and induction coil. The magneto is exceptionally efficient, being of the two bar type with brass gear transmission. The extra sensitive microphone, mouthpiece and two gongs are mounted on the front of the cabinet, giving the entire instrument that desirable appearance of compactness and efficiency. Guaranteed to work over 20 miles. The telephone receiver is a double poled one, and has a hard rubber case. Seven binding posts are provided for connections. The instrument is one which we can offer with pride to our patrons at a ridiculously low price. It is unobtainable anywhere else at less than $15.00 and is an instrument unequaled in value for the price we ask. Size over all 11" x 10" x 8". Shipping weight, 15 lbs.
No. 26 Long Distance Telephone Set..... **$8.00**

CARBON GRAIN TRANSMITTER



A special design of transmitter for long distance work. Is used on wireless telephone sets where a steady current of ¾ to 1 ampere is constantly required. Sizes over all 3¼ x 2½ inches. Shipping weight, 3 lbs. **No. 6080 Carbon Grain Transmitter as described..... $1.00**

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 176 Big Pages, 400 illustrations, 300 instruments and apparatus, etc. Big **"Treatise on Wireless Telegraphy."** 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 20 measure 7x5¼". Weight ½ lb. Beautiful stiff covers.

ELECTRO IMPORTING CO., 231 Fulton Street NEW YORK

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

I enclose herewith 6 cents in stamps or coin, to cover postage, for which please send me your latest Cyclopedia Catalog No. 20 as described.

NAME .....

ADDRESS .....

STATE..... E. E. 8-19

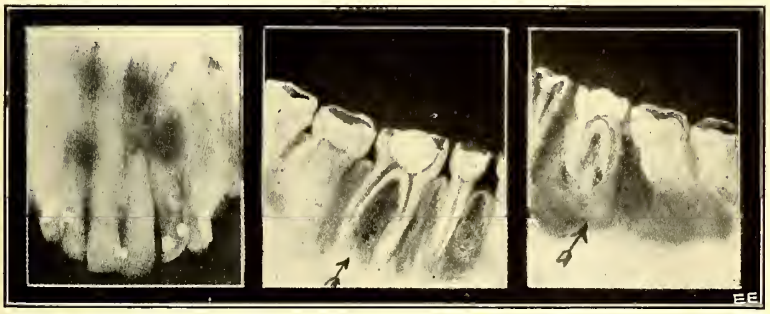
www.americanradiohistory.com

Man's Greatest Curse--Infected Teeth

(*Continued from page* 345)

at the roots of infected teeth must have an outlet, especially if the tooth has been crowned and all means of drainage from the upper part of the tooth is thereby cut off. *Then the bacteria filter thru the bone in which the teeth are embedded, which bone is microscopically porous, and from the organisms or bacteria gain access to the lymphatic system and migrate to other organs and set up a secondary focus of infection.* When this condition occurs, it is easy to understand that the mere extraction of the offending tooth will not clear up the condition but the infection must then be eradicated from this new focus.

"We have various methods of locating these secondary *foci* of infection. If the tonsils are infected as a result of infected teeth, *the teeth should first be extracted and then the tonsils removed.* If the stomach is infected, an examination of the contents will show the presence of this infection and it can be treated by means of vaccines, but always *after* the infected teeth are extracted. In the more serious conditions the *intestinal tract* may be the seat of the *secondary infection* and, by means of the X-ray certain things relating to the function of the intestines may be found and intelligent surgical aid may have to be invoked.



Three X-Ray Views of Infected Teeth. The Two Right-hand Radiographs Show Abscesses Indicated by Arrows: The Dark Patches In the Left-hand Radiograph Indicate Abscesses. This Photo Was Taken Down Thru the Top of the Mouth, the Patient Holding the Plate in the Mouth Between the Teeth.

"There can be no doubt that many unexplained diseases have their origin in infected teeth. Thus Barker, at the Johns Hopkins Hospital, has shown that many cases of *pernicious anemia* have recovered when the infected teeth are extracted. It has also been shown that *serious heart conditions, diseases of the kidneys*—commonly known as 'Bright's Disease'—*diseases of the gall bladder* and many other diseases may be the result, directly or indirectly, *of a focus of infection originating in the teeth.*

Nervous and Mental Diseases Due to Infection

"Finally, the most serious result of infected teeth is to be found in the relation of this infection to *nervous and mental conditions.* We have been for years groping in the dark, trying to find a cause for these unexplainable conditions. We have considered mental diseases as something apart from general diseases where such things as worry, grief, fear, overwork, and many other elements are usually given as the cause of disease of the mind. Since we have found at the State Hospital at Trenton *that many of the patients suffering from mental disease had also very serious chronic infections of the teeth, tonsils, and gastro-intestinal tract,* and that by **eliminating these infections our patients recovered,** we are justified in concluding *that these chronic infections play a very important role in the causation of the mental condition.* Of course, other factors, such as we have mentioned, have a profound effect in lowering the vitality and allowing a latent infection to become active.

"By recognizing the fact that mental diseases may be the result of infection and the toxemia or poisoning due to this infection, we have been able to restore many patients, who with our former methods of treatment, became chronic patients and remained in the hospital until the time of their death. *Thus we have been able to discharge 87 per cent. of the patients admitted to the hospital in the last nine months, whereas for a period of ten years, the proportion of discharges to admissions was only 43 per cent.* In other words, we have *doubled* the number of patients who leave the hospital as a direct result of our researches.

"As a prevention of mental diseases, then, it would seem that the proper care of the teeth is of the utmost importance, and we would emphasize the fact that the proper care is entirely different from what the usual dental examination reveals, *and that only by refusing to have devitalized teeth* (teeth in which the nerve has been destroyed), *crowned, or otherwise preserved, and insisting upon having these teeth extracted, can we hope for better teeth and prevent infection, which later will have serious consequences.* This is a matter which can be controlled by the individual and it is the public in general who can bring about a better state of affairs by insisting upon good dentistry, in the sense we have explained, and by not allowing the kind of dental work which preserves the teeth to the detriment of the patient's health. Such results as we are trying to obtain can only be brought about by educating the public in these matters, as well as the medical and dental profession. For this reason we believe that the widest publicity should be given to these facts and their importance emphasized both from the standpoint of prevention and cure.

CONCLUSIONS.

"We feel justified in summing up the results of modern scientific medical and dental investigations as follows:

1. That bad or infected teeth are extremely prevalent and because they cause no symptoms to the patient are often unrecognized.

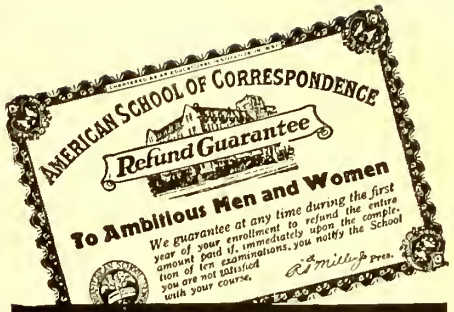
2. That these same infected teeth may be the source of many serious and often fatal diseases, including nervous and mental diseases.

3. That the only known prevention of the effects of this infection is to have all devitalized teeth removed as well as the teeth known to be infected.

4. That one should not allow devitalized teeth to be capt or crowned nor pivot teeth to be placed on old roots but insist that these teeth be extracted.

5. That all persons should keep in mind the danger of transmitting this infection to other members of their families, especially children, and thus prevent serious trouble in after years.

6. That while the infection may originate in the teeth, in the course of years this infection will travel thru the lymphatic system and invade other organs, and eventually set up secondary foci of infection, which become more dangerous than the original focus in the teeth."



Find Out What TRAINING Means to YOU

What it Has Done Intensive training has qualified men like YOU for the positions they wanted—given them steady employment—made them sought after by employers—multiplied their earning power—made them leaders in their chosen lines. For thousands, it has changed the drudgery of "getting by" into the joy of GETTING ON. Do you realize that the *same* intensive training can do the same for you?

Why it Does it Doing things better than the other fellow—thinking and acting for yourself—having a grip on your task—the expert touch—the trick of KNOWING HOW—that is why you succeed after intensive training. *That is what it does for you.* Training clears away the cobwebs, throws the spotlight on the things you don't know about your work, and makes you the master of any emergency.

Don't Fool Yourself

Don't be fooled into thinking that "luck" or "pull" will make you a winner. The man without training just scrambles through life—never a money-maker—never sure of his job—never holding a responsible position. As long as you refuse to train you must pass up opportunities and make way for the man who does. Face the facts and then let the American School help you into a better position—the one you want—as it has helped its thousands of students.

You Take No Risk

The American School's guarantee above means that you can test what training will do for you without risking one cent of your money. We've got to make good with you, so check and mail the Coupon—NOW—for Free Bulletin.

AMERICAN SCHOOL of Correspondence
Dept. CG26
CHICAGO

TRAINING THE KEY TO SUCCESS

Please send me booklet and tell me how I can fit myself for position marked X

ASC

....Western Union Course	.....Accountant and Auditor
....Telephone Engineer	.....Steam Engineer
....Draftsman and Designer	.....Lawyer
....Automobile Engineer	.....Business Manager
.....Automobile Repairman	.....Certified Pub. Accountant
....Airplane Mechanic	. ...Bookkeeper
....High School Course	.....Stenographer
....Fire Insur. Adjuster	.....General Education Course
....Sanitary Engineer	....Com. School Branches
....Heating and Ventilating Engineer	.....Electrical Engineer
....Master Plumber	.....Electric Light and Power Superintendent
.....Civil Engineer	.....Hydroelectric Engineer
....Structural Engineer	.....Wireless Operator
.....Mechanical Engineer	.....Architect
.....Shop Superintendent	....Building Contractor

Name .....

Address .....

www.americanradiohistory.com



Save TIRES LIKE THESE

I Earned $2200 In Four Months

This is Richard A. Oldham

Mr. Oldham was tel graph operator for the Illinois Central Railroad for twenty years. He is fifty-eight years old. One day he read one of my advertisements and the possibilities of making money in Auto Tire Surgery business. In a few weeks he had purchased and installed a Haywood outfit. A short time afterward he wrote us that his income in four months was as much as it had been in Two and One-Half Years as Telegraph Operator.

Be a TIRE SURGEON

Make $2,500 to $4,000 Per Year Giving New Life to Old Tires

A Haywood Tire Surgeon can do more with old tires than was even dreamed before the war. By the **Haywood Method a Haywood Tire Surgeon** can give 4,000 to 5,000 more miles of new life to a tire that two years ago would have been thrown on the junk pile. And it's easy to learn.

HAYWOOD'S TIRE SURGERY

Stations are Needed Everywhere

20,000,000 tires wearing down every day. By Tire Surgery you can quickly repair, rebuild and give new life to tires seemingly all worn out. Cuts, gashes, tears, bruises, broken fabric, every kind of an accident that can happen to any tire, inside or out, you can repair and save for long service. **The chance to make money is simply wonderful.**

$2,500 to $4,000 a Year is Possible

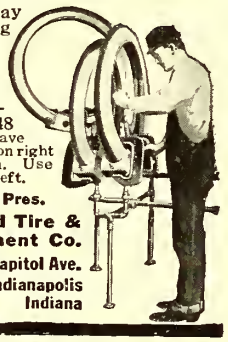
If we told you all the truth you wouldn't believe it. You would say, "it is too good to be true." But you can see what a great field there is for **Haywood Tire Surgery Stations**—for this better way.

WITH THIS HAYWOOD OUTFIT

Send Today for My Free Book

WRITE TODAY

I have ready to mail you the day I get your request, a fascinating book—all about tires—how to repair them by the Haywood Method—how to start in business—how to build up trade—what to charge. In 48 to 72 hours you can have the whole proposition right in front of you. Use coupon at the left.



M. HAYWOOD, President
HAYWOOD TIRE & EQUIPMENT CO.
1210 Capitol Ave. Indianapolis, Ind.

DEAR SIR: Please send me by return mail your free book on the new Haywood Tire Surgery Method and the details of your free school of tire repairing.

Name _____

Address _____

M. Haywood, Pres.
Haywood Tire & Equipment Co.
1210 Capitol Ave.
Indianapolis
Indiana

HOME BATTERY CHARGING

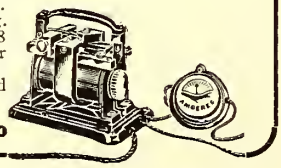
means vitality and long life to your battery and anyone can do it with the

NEW F-F BANTAM BATTERY BOOSTER

which will fully charge any 6 volt storage battery eF-Ficiently from 100 to 130 volt 60 cycle alternating current lamp socket.

This is a new size of F-F Rectifier and similar to our standard F-F Magnetic Rectifier which has been on the market for over 3 years. Thousands in use giving satisfactory service. Simple, safe, sure acting. Copper and carbon electrodes rectify the current. Capacity 6 volts 8 amperes. Shipping weight 10 pounds. Price complete with Ammeter and Battery Clips $15.

Send check for prompt shipment via express or if via parcel post add sufficient for postage and insurance. Bulletin 12 on request.



THE FRANCE MANUFACTURING CO., Cleveland, Ohio



Says the Master Mechanic. The Greb Automatic Grip Puller is a One-Man Puller—Quick-acting, strong and simple in the extreme. May be locked in any desired position. A combination of two or three arms. Heavy Duty Size capacity 1" to 18"—Junior size capacity 1" to 7". Two sets of jaws furnished with each size.

Ten Days' Trial If your dealer or jobber does not have them we will send you one. Try it ten days. If not satisfactory, return to us and we will refund your money. We also make the GREB RIM TNOL.

THE GREB CO., 230 State Street, BOSTON

MARKO

STORAGE BATTERIES
ARE GOOD—TRY ONE

Paul M. Marko & Co., Inc.
1402-1412 Atlantic Ave.
Brooklyn, N. Y.

The "Torpedoplane" and "Sub" Spotter

By George Holmes

(*Continued from page* 306)

called because of its weakness for laying eggs in other people's nests—is one further testimony to British engineering ability and the resourcefulness of our navy.

Rear Admiral Bradley A. Fiske, U. S. N., conceived the idea of a torpedo-carrying airplane in the winter of 1910-1911 as a means of defending the Philippine Islands, and discust the idea with the General Board of the Navy. In April, 1912, he applied for patent on the torpedoplane, which was granted in July, 1912, by the U. S. Patent Office.

The Italians were the first to make experiments in dropping weights from an airplane, with a view to evolving a method of launching torpedoes. Captain Alessandro Guidoni, Royal Italian Navy, using a 1910 Farman biplane equipt with floats, made a number of experiments at an Italian naval base in 1912-1915.

Captain M. F. Sueter, who was then director of the air department of the British Admiralty, appreciated the value of the idea and in conformity with the practise of the British Navy, which provides that the name of the commanding officer shall appear on a patent application with the name of the author of the invention, a patent application was made in the joint names of Captain Sueter and Lieutenant Hyde Thomson, in March, 1914.

The sinking of a Turkish troopship while at anchor in the Sea of Marmora, in 1915, by a British torpedoplane, created a little more interest in the experiment, but no greater support was given to the work and the experiments were superficial in nature and dragged on slowly, due to lack of official interest.

In May, 1917, those who believed in the potentiality of the torpedoplane and hoped that the Allies would put this device into effect against the German Navy before Germany could build torpedoplanes, were made heartsick by the report that the British steamship *Gena* had been torpedoed by a *German torpedoplane*.

In connection with the above, it is stated by the Admiralty that this method of attack was first practised successfully in August, 1915, by R. N. A. S. pilots, who sank several ships in the Dardanelles by torpedoes from seaplanes.

How the Torpedoes Are Carried.

A sketch of one of the German seaplanes that participated in the attack against the *Gena*, showing the pontoon arrangement for holding the torpedo in the German seaplane, is exactly like the arrangement on Admiral Fiske's torpedoplane. The torpedo is held between the two pontoons of the seaplane with a bracing to keep the torpedo from moving while the seaplane is flying.

Some years ago I had occasion to discuss, first with Admiral Fiske and then with Allied officers, the advisability of using *automatic brakes* to check the velocity or fall of the torpedo. This discussion led to considering a number of methods, such as lowering the torpedo by means of a cable. But it was realized that while it would be feasible to lower the torpedo several hundred feet by means of a cable, and its direction could be maintained by means of vanes, and the possible swerving of the torpedo might also be checked by means of vanes, which would hold the torpedo steady excepting in case of sudden turns, the advantages to be gained were not readily apparent. The giant naval seaplane NC-4, which crost the Atlantic, could easily carry two full-size torpedoes.

www.americanradiohistory.com

One Hundred Miles an Hour Torpedo Boat!

Some of the transatlantic planes being designed at present are capable of covering 3,000 miles without stopping. These machines can be converted into torpedoplanes by merely attaching the torpedoes under their planes or at some other convenient place. And then they become flying torpedo boats, capable of cruising at a speed of 100 to 125 miles an hour or more. A crew of half a dozen men will be sufficient to operate such a torpedoplane. Imagine this marvellous combination of speed, potentiality and mobility! What better weapon can we find for the defense of our coasts and island possessions? An enemy fleet bent on attack or carrying an invading force would have to contend with large torpedoplanes before it could come within 1,000 miles of our shores and with smaller torpedoplanes launched from aerodrome ships, such as are recommended by Admiral Rodman.

Admiral Fiske's "Sub" Spotter.

A patent was recently issued to Admiral Fiske on a clever submarine localizer.

As the illustration shows the aircraft, plane or dirigible tows a super-sensitive sub-sea microphone thru the water by means of a float or else an armed boat, which may serve to give battle to the enemy, should he arise to the surface. Suspended from the boat is a sound-detecting microphone connected by circuit wires carried by a cable to a battery and telephone receiver in the car of the airship.

The operation is as follows: When a submarine is under water, power is supplied from her storage battery to an electric motor, whereby the submarine is driven. The continuous whirring sound made by the motor while in operation transmitted thru the water affects the microphone so that this sound is heard and recognized in the telephone receiver by an observer in the airship car, listening thereat.

Being thus apprised of the location of the submarine, the observer may transmit that information to a station ashore, or to a vessel afloat, by any known means—as, for example, by visible signals or by radiotelegraphy.

In order to enable the observer to convey information as to the speed and direction of the submarine, the sea area to be protected may be mapt in divisions of predetermined area, as 1, 2, 3, etc., of the detail drawing reproduced herewith. The observer knowing, for example, that he is over division 7 and hearing the submarine noise in his telephone, signals that fact to an observer at some central station. Afterward, being over division 5, *if he still hears the sound,* he communicates that further fact. The central station observer thus becomes informed that the position of the submarine is first in division 7, for example, and that its course is to a second position as in division 5, and, therefore, northeasterly, while the time elapsing between the signals will show approximately the speed of the submarine in going from the first to the second position.

The boat may be simply a float in boat shape, or it may be an armed motor-boat with crew on board. In the latter case, as soon as the observer in the airship signals the crew of the detection of a submarine sound, the cable may be detached from the boat, leaving the microphone suspended from the cable, and the boat free to watch for and attack the submarine, or to give warning to other vessels in the vicinity. Any suitable means of release may be provided.

By noting where the sounds in the telephone become louder or fainter, and by steering in such a direction that the sounds become louder or remain in the same intensity, the observer in the airship can move in a direction and at a speed approximately that of the submarine.

The Worst Crime of Civilization



LIONEL STRONGFORT
"Dr. Sargent, of Harvard, declared that Strongfort is unquestionably the finest specimen of physical development ever seen."

AMONG all our laws for the protection of women and children there is not one to prevent a weak, sickly, anemic man—a creature who is a man in name only—from marrying some pure, wholesome girl and making her the mother of children destined before their birth to be a source of grief and anguish to her as long as she lives.

Men of America, what are you going to do about it? How are you going to protect your sisters and your daughters? How are YOU, who read this, going to protect your future wife and *do your part* to breed a race of strong, sturdy children that will be a credit to America, instead of poor, sickly, watery-blooded little creatures who have no chance in life, and who, when they grow up, will inevitably help to fill our insane asylums and our jails?

Men of America, Wake Up!

It's up to YOU, to every individual one of you, to make YOURSELF fit, first of all. It's a living condition that confronts you, not an academic theory. It's a condition based on the immutable laws of heredity, which have operated ever since the world began. It's a condition recognized by every breeder of live stock, and taken advantage of to improve the qualities of the cattle, horses or dogs he raises. It's the great inexorable Law of Nature that Like Breeds Like; that the progeny will inherit the qualities of the sire in an *intensified degree.*

Read those last two words again, and think—think *hard.* What will YOUR children be? If YOU are weak and sickly; poisoned by constipation, green with biliousness, tortured by indigeston, wrecked by nervous headaches, with vitality barely sufficient to carry you through your daily work—*what kind of children can you beget?*

Fit Yourself to Be a Father

You don't want to deceive the girl who loves and trusts you and wreck her life by making her the mother of children who will cause her to curse the day she married you. You want her to bear happy, healthy, laughing children, who will grow up into strong, virile men and women, a source of joy and comfort to you both in your old age.

FIT YOURSELF to beget such little ones, and at the same time to take the place among men in the world to which you are rightfully entitled. YOU CAN DO IT—there isn't any question about it—IF YOU MAKE UP YOUR MIND TO DO IT. You can get rid of the hampering ailments that are preventing you from being quick, efficient in your work and keeping you from getting a better job or higher position at bigger pay; you can break off any evil habits that are giving you a hang-dog feeling and making you ashamed to look your fellow men and women in the face; you can build up your flabby muscles, strengthen all your vital organs, make your blood rich and red and fill yourself with the punch and power of a REAL MAN, if you will stop "putting it off until tomorrow," *take hold of yourself and go about it the right way.*

Strongfortism Will Enable You to Do It

Strongfortism has lifted thousands of weak, ailing, impotent, discouraged men out of the bog of hopelessness and despair and placed them on the broad, straight road to health, happiness and prosperity. Strongfortism has restored the manhood they had destroyed and thought they had lost forever and given them renewed vitality, ambition and the power to DO THINGS in the world. Strongfortism has enabled them to beget children who will make Americans of whom both they and their country will be proud.

Strongfortism will do for YOU what it has done for them. It is simply Nature's way of living life; the way that has no drugs or medicines about it; the way that makes for health and power and potency; the way that gets the most enjoyment out of life. I KNOW whereof I speak. My lifetime has been spent in studying the human organism; in learning Nature's way of building up and strengthening the tissues of the muscles, the vital organs and the brain. I GUARANTEE results; I guarantee to improve you 100 per cent, physically and mentally, if you will follow my directions, and it makes no difference where you live, what your present condition is or whether your youthful follies brought you to it. You can follow out my course without interfering in any way with your present occupation, in the privacy of your own bedchamber if you like.

DON'T DELAY—tomorrow never comes to those who put things off. **Take the first step NOW.** Send for my FREE BOOK, **"Promotion and Conservation of Health, Strength and Mental Energy."** It will show you how to make a MAN of yourself. There's no charge for it; I ask you only to enclose 3-2c stamps to pay for packing and postage. Fill out the coupon and send it in TODAY. You'll hear from me by return mail with something you wouldn't miss for any money.

LIONEL STRONGFORT
Physical and Health Specialist
1011 Strongfort Institute Newark, N. J.

FREE CONSULTATION COUPON

Mr. Lionel Strongfort, Newark, N. J.—Please send me your book, **"PROMOTION AND CONSERVATION OF HEALTH, STRENGTH AND MENTAL ENERGY,"** for postage of which I enclose three 2-cent stamps. I have marked (X) before the subject in which I am interested. (1011)

..Colds	..Insomnia	..Vital Losses
..Catarrh	..Short Wind	..Impotency
..Asthma	..Flat Feet	..Gastritis
..Obesity	..Stomach Disorders	..Heartweakness
..Headache	..Constipation	..Poor Circulation
..Thinness	..Biliousness	..Skin Disorders
..Rupture	..Torpid Liver	..Despondency
..Lumbago	..Indigestion	..Round Shoulders
..Neuritis	..Nervousness	..Lung Troubles
..Neuralgia	..Rheumatism	..Increased Height
..Flat Chest	..Youthful Errors	..Stoop Shoulders
..Deformity (describe)		..Muscular Development

Name.....
Age.....Occupation.....
Street.....
City.....State.....
Write Plainly

www.americanradiohistory.com



Be An
ELECTROTECHNICIAN

Study to enter the field of electricity as a high-salaried Industrial Specialist.

Qualify as a Power Plant Superintendent, City Technician, Salesman of Electrical Equipment, Supervisor of Electrical Equipment Maintenance.

WITH OR WITHOUT A HIGH SCHOOL EDUCATION you can take up this study **at this school ONLY.** Better your previous education sooner you finish. That's all. Combination of work-shop, laboratory, drafting room and recitation room instruction quickly and thoroughly prepares you as an Electrotechnician.

"Earn While You Learn" if you like.

There is no time for delay if you wish a place reserved for you. Next term opens September 2. Clip and mail the coupon **today.** It may mean a life-time of success for you. DO IT.

School of Engineering of Milwaukee
104-373 Broadway Milwaukee, Wis.

CLIP HERE

School of Engineering of Milwaukee
104-373 Broadway, Milwaukee, Wis.

Gentlemen:—Without obligation, send me catalog, Photo-Story and full particulars regarding the Electrotechnician Course.

Name .....

Address .....

City .....State .....

Age .....Education .....

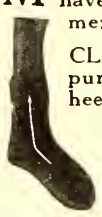
School of Engineering of Milwaukee
Institute of Electrotechnics
104-373 Broadway Milwaukee, Wis.

Be a
Mining Engineer

A great profession, not overcrowded, offers the diligent and ambitious student assured and exceptional rewards. *Located in the heart of one of the greatest copper mining districts in the world,* the College offers a unique combination of theoretical instruction with practical experience in all phases of mine development and operation. Four year course can be completed in three. Vast mines, mills, smelters, electrolytic and power plants of the most modern type, are practically a part of the College equipment and constitute a factor of enormous value in the courses of instruction. Every opportunity for specialization. A state supported college not conducted for profit. Established 1886. "M. C. M. Men Make Good." For descriptive book address Administrative Officer, Houghton, Michigan.

Michigan College of Mines

MEN will be surprised at what we have ready for our special Summer Hosiery Showing.



CLOCKED Seamless socks of pure thread silk with reinforced heel and toe.

Exceptional value at 89c per pair. Postpaid.

Black — Navy — Grey — Cordovan with white clocks.

Write today for Catalog No. 100X and get acquainted with our other special numbers.

The Bertex Distributing Co.
124 W. 18th St., N. Y. City

NATIONAL TRADE DENTAL SCHOOL

506 S. Wabash Ave., Chicago, Ill.
LEARN MECHANICAL DENTISTRY—DEMAND UNLIMITED

A paying professional trade: You will be a trained dental mechanic and receive our diploma when competent. Students given advantage of thoroughly up to date laboratory, and services of graduate Dental Surgeons on practical cases. No effort spared to place graduates advantageously. No age limit. Day or Evening. Individual instruction. No educational requirements. No book or home study. Easy terms. Highest references. Especially attractive proposition to those who write at once for catalog H.

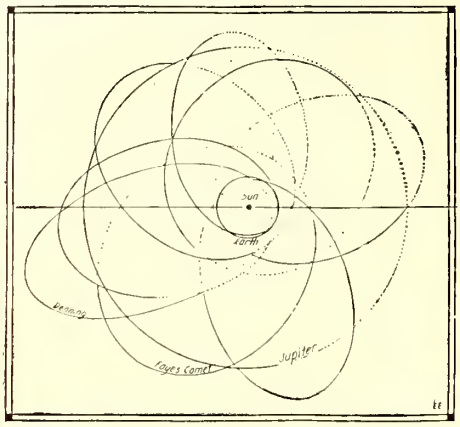
Popular Astronomy

THE NATURE OF COMETS

By Isabel M. Lewis

(Continued from page 313)

istic tail and peculiar cometary features are fully developed. As the comet again recedes from the sun after perihelion passage its speed slackens once more. It soon parts with all its spectacular features and fades rapidly away into oblivion.



This Diagram Shows How the Planet Jupiter Captures the Large Majority of the Comets. It Will Be Noted That Most of the Comets Are Grouped Around Jupiter's Orbit.

THE DISTINCTION BETWEEN STARS AND PLANETS.

THE chance enquirer into the mysteries of space usually is puzzled by the distinction that is to be drawn between stars and planets. All celestial objects except the sun, moon and a few chance comets he is apt to group together vaguely under the head of "stars" even to the "shooting stars."

The planets shine only by the *reflected light from the sun* around which they revolve, as does also the earth, which is one of the smaller planets. This light from the sun may be reflected from a rocky surface, as in the case of the moon, which is not a planet, to be sure, but a satellite *of* a planet, —the earth,—or it may be reflected by a cloudy atmosphere as in the case of Venus or from surface snow and clouds as in the case of Mars. The outer and larger planets Jupiter, Saturn, Uranus and Neptune, being chiefly in a gaseous condition, reflect sunlight from the gaseous vapors that envelope their central molten or gaseous cores.

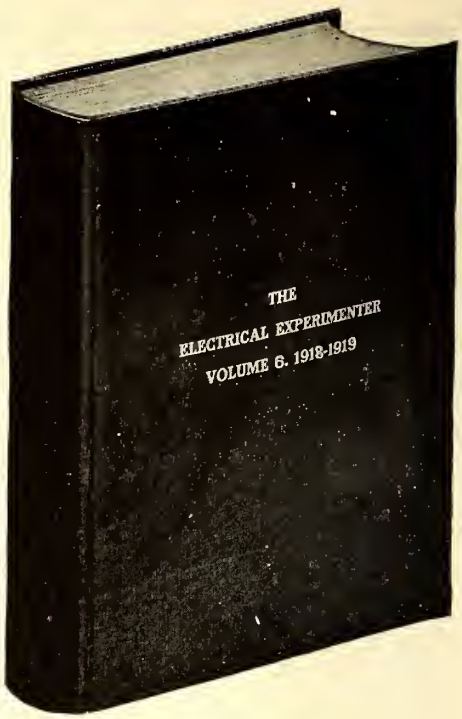
Stars, on the contrary, are *suns* composed of intensely hot incandescent vapors of many chemical elements *emitting light and heat of their own.* The heat of the stars is inappreciable to us simply because they are so far away.

In size, the planets are conspicuously inferior to the sun and to the average star tho it is now known that there are some dwarf stars in existence that are as small as planets. The sharp distinction remains, however, that planets revolve around a central body that supplies them with the light and heat that they do not possess themselves, while the stars, however small they chance to be, shine by their own light and move thru space as independent bodies.

Not only is the distinction between stars and planets one of physical condition and, generally speaking, size. It is also one of relative distances.

The planets are all comparatively close to the earth. All are companion satellites of the same sun. The nearest Venus comes at times within twenty-six million miles of us and the farthest Neptune within twenty-seven hundred million, but the very nearest

(Continued on page 357)



This Book Cost $34,000

1200 Authors Contributed

Our Bound Volume No. 6 contains a goldmine of electrical and scientific information. No such value has ever been offered before for so low a price. A marvelous cyclopedia of electricity. A reference book of authentic information not found in any other book in print.

Volume contains twelve numbers of the "Electrical Experimenter" magazine — May, 1918 to April, 1919, inclusive. There are 984 pages, 2,110 complete articles, 1,908 illustrations, 369 questions and answers. Sizes, 12" high; 9" wide; 2" thick.

A world of electrical information; the entire electrical Progress for one year; the greatest reference book on current "Wireless"—all at a price within reach of everybody. Mind you, the book is durably bound in attractive green linen with heavy covers. Letters stamped in gold. You will be proud to have it in your library. We have only 600 copies, therefore be sure and order to-day. Shipping weight 8 lbs. Add a sufficient amount for postage, otherwise we must ship by express.

$3.00 add postage for 8 lbs.

Positively the Greatest Electrical book bargain in the World. We ship AT ONCE. Order today to avoid delay.

EXPERIMENTER PUBLISHING COMPANY, Inc.
Book Department
233 Fulton Street - New York, N. Y.

Fill in--Tear out--and Mail

8-19

Gentlemen:

Please send at once your Volume No. 6 as advertised, for which I enclose herewith $.....

I also enclose $.....extra for postage.

.....

.....

Name .....

Address .....

.....

www.americanradiohistory.com



DO Your Own PLUMBING AND HEATING at low cost

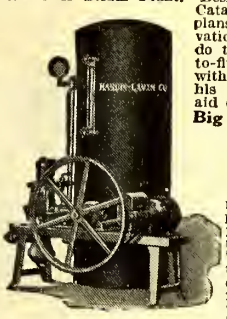


Send for our big instructive 256 page well-bound Handy-Man Book Catalog. Every Home Owner, Contractor, Electrician, Farmer, Factory Manager, etc., needs it. Shows over 10,000 Fixtures and Supplies in plumbing and heating at wholesale. Shows how to save skilled labor, hard work and unnecessary material by

OUR NEW

Cut-to-fit-Method

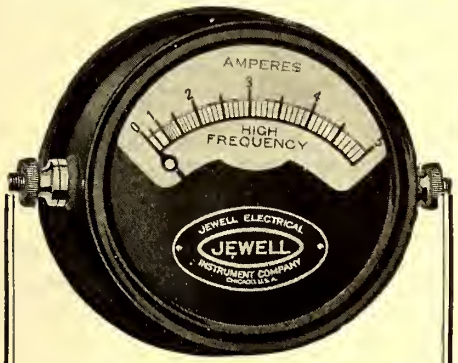
This wonderful book helps you select and install the proper Plumbing, Water Supply System, Hot Air, Water or Steam Plant. Besides being our Wholesale Catalog it has many practical plans, diagrams, sketches, elevations, etc., showing how to do the work this newer, cut-to-fit way. Any handy man with a few tools can easily do his own installing with the aid of this



Big Handy-Man Book

We have spared no effort and have gone to a great expense to compile this valuable book. With economy still a national necessity, it would be unpatriotic to send this expensive book broadcast to non-interested parties. Therefore, we request a temporary deposit for each copy of 25c which we refund on first order, or we send our Bargain Bulletin Free. Address Today

HARDIN-LAVIN COMPANY
40 Years At
4510-20 Cottage Grove Ave., Chicago
$500,000 plants behind our guarantee



RADIO FREQUENCY AMMETER

4 inch Face

0 to 3, 0 to 5 or 0 to 10 Amperes. Specify Reading Required.

$11.00 Net

The Jewell Electrical Instrument Co. is prepared to fill the instrument needs of the amateur experimenter in radio and general electrical work, as well as those who desire more precise and accurate measurements of electrical quantities.

We show above our high frequency ammeter, of the thermo couple type, especially desirable for medium sized installations.

For receiving panels, we are supplying small D. C. instruments for plate voltage and filament current, at a very reasonable price.

Write for our special radio instrument bulletin.

JEWELL ELECTRICAL INSTRUMENT CO.
1640 Walnut St. Chicago

READ THE CLASSIFIED ADS. ON PAGES 380—382

CARUSO CONCERTS TO AMATEURS BY WIRELESS 'PHONE.

Cleveland, Ohio, or that portion equipt with wireless receiving instruments, heard its first wireless telephone concert on the night of April 17th. And it is to become a permanent institution.

Every Thursday night between 8 and 10 o'clock the radio amateur or professional who "tunes" his instrument to receive wave lengths of 375 meters will be able to listen to strains from Caruso and Sousa's band interspersed with baseball scores and the latest news bulletins.

The concert will come from the plant of the Martin Company, air plant manufacturers and will be audible to wireless operators within 200 miles. It is estimated that 400 radio amateurs "listened in" on the first concert.

The wireless transmission of music is accomplished by use of the wireless telephones as developt by F. S. McCullough, wireless expert for the Martin Company. The same apparatus as is used in airplanes is employed and the music produced by a phonograph. The transmitting apparatus of the telephone replaces the phonograph horn. The baseball news and bulletins were announced by voice, so that no knowledge of "codes" were required to receive them.

Changing Nature's Face

(Continued from page 300)

copper wires extend from the blasting machine to one or more of the detonators. The ends of the two insulated wires inside the cap of the detonator are bridged by a very fine wire, which is soldered to the ends of the feed wires, and it is the heating of this fine bridge wire in the midst of the explosive charge, due to the passage thru it of the electric current transmitted from the dynamo, which ignites the cap explosive and in turn the main dynamite blasting charge. Electric blasting caps are made practically air-tight and water-tight, and are therefore safer to handle than the ordinary open-end blasting cap. It requires about 1½ to 2 amperes to melt the fine platinum bridge wire in the cap.

Connecting Wires

Owing to the small amount of current required, about 2 amperes, to melt the fuses in the electric detonators, and as these are invariably connected in series, a fairly small wire can be used to carry the current from its source to the location of the blast, as well as between the various charges, as shown in the accompanying diagram. No. 20 insulated copper wire is usually employed for connection between the dynamite charges in the holes. For the feed wires between the charges and the dynamo, a larger wire, such as No. 14 rubber covered copper conductor, is used. Several ways of connecting the charges in a group, as for instance in blasting a "ditch" or "brook," are illustrated in the accompanying diagrams, *A, B, C, D.* As will be seen, the various charges are connected in series. However, under some conditions the charges are connected in parallel. The series connection here shown is invariably used when a hand-operated *blasting machine* is employed to explode the charges. Parallel or series-parallel arrangements are used with dry or storage cells, or else an electric generator driven by a gasoline engine is used as the source of electricity for firing the blast. The standard blasting machines, fitted with magneto generators are designed in different sizes to fire from 1 to 200 charges, depending upon the type and size. The amount of current produced is about 3 amperes with this machine, while

Mechanical Engineering



Learn at Home!

Employers everywhere are looking for men with mechanical ability. Splendid salaries and rapid advancement are offered.

There is an easy, delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving men and women just the training they need for success in mechanical engineering and more than 200 other subjects. Hundreds of thousands have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6197, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

ELECTRICAL ENGINEER	CHEMICAL ENGINEER
Electrician	SALESMANSHIP
Electric Wiring	ADVERTISING MAN
Electric Lighting	Window Trimmer
Electric Car Running	Show Card Writer
Heavy Electric Traction	Outdoor Sign Painter
Electrical Draftsman	RAILROADER
Electric Machine Designer	ILLUSTRATOR
Telegraph Expert	DESIGNER
Practical Telephony	BOOKKEEPER
MECHANICAL ENGINEER	Stenographer and Typist
Mechanical Draftsman	Cert. Pub. Accountant
Ship Draftsman	Traffic Management
Machine Shop Practice	Commercial Law
Toolmaker	GOOD ENGLISH
Gas Engineer	STATIONARY ENGINEER
CIVIL ENGINEER	CIVIL SERVICE
Surveying and Mapping	Railway Mail Clerk
MINE FOREM'N OR ENG'R	Textile Overseer or Supt.
ARCHITECT	AGRICULTURE
Architectural Draftsman	Navigator
PLUMBING AND HEATING	Poultry Raising
Sheet Metal Worker	Automobiles

Spanish
French
Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____

ELECTRICAL ENGINEERING training again open to civilians. Over 3000 men trained for electrical industries in experience of more than a quarter of a century. For men of ambition and limited time. Condensed course in Electrical Engineering enables graduates to secure good positions and promotions. Theoretical and Practical Electricity, Mathematics, Steam and Gas Engines, Mechanical Drawing. Students construct dynamos, install wiring and test electrical machinery. Course with diploma, complete.

IN ONE YEAR



Thoroughly equipped fireproof dormitories, dining hall, laboratories, shops. Write for catalog. 27th year opens October 1, 1919.

BLISS ELECTRICAL SCHOOL
260 TAKOMA AVENUE, WASHINGTON, D. C.

WOULD YOU KNOW WHAT TO DO?
TO HAVE YOUR WISHES COME TRUE?
TO BE HAPPY AND SUCCESSFUL?
TO FEEL THE THRILL OF NEW POWERS?
TO HAVE A WINNING PERSONALITY?

Our system of Personal Development has shown thousands. It can show YOU. First lesson in SUCCESS, and your Personality Sketch for 10c and birthdate.

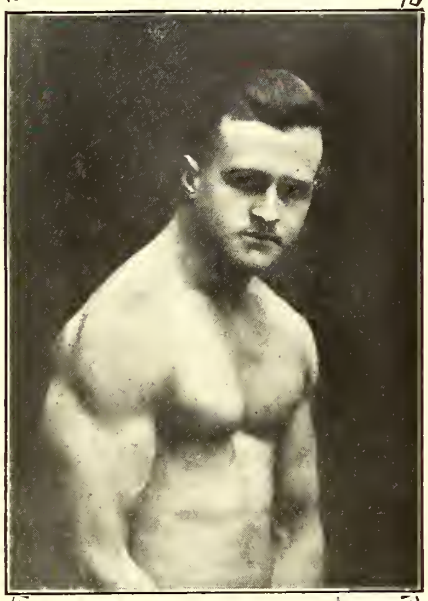
THOMSON-HEYWOOD CO.
Dept. 350. Chronicle Bldg., San Francisco, Cal.

www.americanradiohistory.com

I Can Make You STRONG

I can show you how to develop every bit of strength that a real man should have. I can give you an abundance of vitality and a highly developed body and mind.

The Man who wishes to succeed in business must be endowed with an unusual amount of strength, endurance and vitality. I have found the way to develop these qualities in the shortest possible time. I have done it myself, with my own body, and I have done it for many other of the world's strongest men.



EARLE LIEDERMAN

The Acme of Physical Perfection

Let me take you in hand and make a real man of you. You will always bless the day that first you sent for my book. I can put pep into your actions, vigor into your step, and make your mind so clear and alert that you simply must go ahead in business and social life. There is no reason why you should go on through life all fagged out, more dead than alive. Let me change all this—let me make life worth living. Give me a chance to show you what I can do for you.

Send To-day for

MY NEW BOOK

"Muscular Development"

It tells how I can help you. I will send this valuable book to you by return mail on receipt of only 10c to cover cost of mailing and wrapping. Use the coupon below. The book contains full particulars of my splendid offer, and is profusely illustrated with pictures of many of the world's strongest men whom I have trained. **Don't pass this by. Sit right down and fill in the coupon. Do it now, this minute, while it is on your mind.**

EARLE E. LIEDERMAN

Dept. 211, 203 Broadway, New York

Earle E. Liederman

Dept. 211, 203 B'way, N. Y. C.

Enclosed find 10c for which you are to send me at once your new, illustrated book, "Muscular Development."

Name.....

Address.....

City.....

the larger machines develop several hundred volts.

In some cases electric light or power circuits are tapt in order to furnish the necessary current for firing the charges. For example: if a circuit is supplying 250 volts and 10 amperes to a light or motor load beyond the point where the line is tapt, then this can be safely short-circuited and relied upon to fire 125 detonators in one series or five series of 625 detonators each. Such use of this current will not interfere with the operation of the motor or the lights, as connection is made for too short a time. Dry cells can be used for exploding electric blasting caps, but their rapid deterioration makes them unreliable. A storage battery will prove much more trustworthy.

How to Prepare the Blasting Charge.

The preparation of the load is accomplisht in several different ways and depends upon natural conditions where the blasting is to take place. Where ordinary wet ground such as in meadows or near a brook is to be blasted, in order to form another ditch or stream, it frequently happens that the necessary blasting holes may be drilled with a crow-bar. After the dynamite cartridge has been placed in the bottom of this hole with the electric detonating wires attached, the hole will in most cases fill with water, and this provides a satisfactory substitute for *tamping,* and will give very high efficiency when the blast takes place. It is interesting to mention in this particular instance, that in actual coal mining operations the drill hole is commonly filled with water instead of being tamped with coal dust, etc. Water being practically incompressible and possessing considerable inertia under the sudden bursting pressure of the charge, results in very high efficiency of the blast. Where a hole has been drilled in rock, or wherever it has been tamped or filled up with loam, the following proceeding is to be noted: To guard against danger of a prematurely detonating charge, the first five to eight inches of tamping over the dynamite cartridge should be *gently packed* by means of a tamping stick. When this amount of lightly tamped material has been placed, the rest of the tamping should be made as hard as possible, using a *wooden* tamping stick for the purpose. Moist clay free from gravel and clods makes good tamping material. Free running sand or moist loam is also effective. As pointed out in instruction books on the handling of explosives, it is not necessary to use any loam to tamp the drill holes, where the blasting is done in *watery ground,* or wherever the water will fill the hole to a depth of a foot or more. It is good practise, especially where heavy charges are used, to place two inches of paper or dried leaves immediately over the priming charge, so that they can be used as a safety marker, if the tamping has to be removed for any cause.

Purposes of Blasting.

The accompanying illustration shows three distinct purposes for the blasting operations carried on by agriculturists, and those desirous of cleaning up stump-strewn and rock-covered property. The method of using one, two or three lines of holes for blasting various widths of ditches is shown in the left-hand illustration. It is indeed surprising to learn that these ditches, in actual tests carried on before Government experts, have been blasted out with dynamite in the manner here shown. The bottom level of the ditch, when finished, was so nearly perfect *that not a shovel had to be touched to it.* In some cases, where specially deep ditches are desired, it sometimes becomes necessary to place another row of holes along the bottom of the first ditch blasted out, and then to blast this out.

The experts in charge of the blasting

NORMA TALMADGE says:

"It is one of my favorite magazines. I enjoy reading it every month."



"JUST to get acquainted" send a dollar and receive the next four numbers of

***The* PHOTO-PLAY WORLD**

Contributions by leading authors
Beautifully illustrated, handsomely printed
By the year $3.50—35 cents a copy

Trial Offer: 4 numbers for $1

(Foreign postage 50 cents extra)

THE DOWNS PUB. CO., Bulletin Bldg., Phila., Pa.



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle massage. Can be used with or without electric current.

All users of the Lek-Tro-Shav speak well of it

A barber says—"Have shaved for years and have never used any shaving device near its equal."

A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."

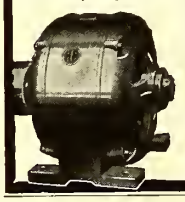
No. 1 Made for use from Light Socket.
No. 2 Made for use from Dry Battery.

Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.

VIBRATING ELECTRIC RAZOR CO.
Dept. 122. Omaha, Nebr.

USE HB BALL BEARING ELECTRIC MOTORS

Big Saving in Power Bills Every Month—HB Ball-Bearing Motors furnish ideal power at lowest cost for factory, machine shop or garage. All power waste eliminated. Amply designed, absolutely trouble proof, economical and reliable. Highest efficiency in daily service. Bearings need refilling only once in three months, require almost no attention.



$20 Brings You Any HB Motor. Balance on Easy Terms. Sizes 1 to 15 h.p.--Choose to Suit Your Needs. If in doubt about requirements, write our service department. Get their expert advice—FREE. Simply state what machinery to be run and type of current available. We plan your power system for best results at least cost. Pin this ad to your letterhead and mail TODAY for full information. Ask also about HB Battery Chargers, Generators, etc.

HOBART BROTHERS COMPANY
Box 82E Troy, Ohio
Successful Manufacturers Since 1893

Telegraph Pictures
BY ELECTRICITY



Complete sets of two machines of this marvelous equipment at ridiculously low prices. Instructive, mystifying and useful. This picture of President Wilson was telegraphed by these machines. Will transmit pictures, maps, drawings and hand writing. Picture telegraphing is the coming science. Write today.

J. LEISHMAN CO., Dept. T Ogden, Utah

How to Get Rid of Moles



A simple, safe home treatment—15 years' success in my practice. Moles (also BIG growths) Dry Up.

Ask for Free Booklet of Full Particulars

WM. DAVIS, M.D.
4140 State Street Perth Amboy, N.J.

www.americanradiohistory.com

usually drill a few holes and try several trial shots to ascertain the best depth and spacing for the holes. For ditches of three or three and one-half feet width, the depth of the holes will usually be 24 to 30 inches, and the spacing between the holes from 18 to 24 inches, altho it may be necessary to increase the depth and decrease the spacing in some cases. The test is usually begun with holes two feet deep and 18 inches apart. These are placed in lines and about 10 of them loaded with one dynamite cartridge each.

This loading, say the experts, should lift the soil at least 200 feet into the air and scatter it over the adjoining swamp for a distance of 150 feet, *leaving a clean ditch.* If such is not the case, then a different loading layout should be tried.

Blasting Stumps.

One of the principal uses of dynamite as utilized by agriculturists and by engineers in clearing up large areas containing obstructions is that of blasting out stumps. The lower illustration in the accompanying view shows how a large lateral stump is drilled, and how the electric blasting caps and dynamite cartridges are placed. The terminals of the blasting caps are connected in series, and the two wires run to the blasting machine which should be situated 250 to 300 feet away from the stump at least.

A new innovation in drilling the holes for stump blasting is the use of a portable electric drill or auger. One or more of these electric drills, as may be required, can be operated from a portable gasoline engine and dynamo outfit, or else from electric feed wires supplied by the local light and power company. Comprest air drills have also been used to some extent for this work and have proved very satisfactory. In all stump blasting it should be noted that the depth of the holes should reach to the sub-soil, not close up to or in contact with the wood. The best tools for making the holes are the crow-bar and the sub-soil punch.

Breaking Boulders.

There are three general forms of blasting applied to rocks, particularly those of the *boulder* class. *Blockholing* requires the smallest amount of explosives, altho more labor is involved with the drilling of a hole or series of holes directly into the boulder, as shown at the top of the right-hand illustration herewith.

Mudcapping, as depicted at the bottom of the right-hand illustration, requires the smallest amount of labor, but a considerably larger amount of explosives, while *snakeholing* is intermediate with respect to both labor and amount of explosives required. Each method has its own particular and special use.

Blockholing consists of drilling a hole into the boulder and charging it with a small amount of dynamite. It is the best and simplest method for breaking very hard or very large boulders, especially those of the "niggerhead" type, which are very difficult to break by other methods.

Snakeholing consists of punching a hole underneath but immediately against the bottom of the boulder, and placing a charge of explosives in as compact shape as the size of the boulder will permit. A boulder which has been snakeholed out of its resting place is shown in the accompanying right-hand illustration. As will be seen, the explosive, being confined on the under side of the boulder by the earth, can exert a powerful blow on the boulder and will force it out of its position or roll it out. If a sufficient charge is used, the boulder will be broken into fragments. The boulders should always be either pried out or snakeholed out of their resting places to the top of the ground, before attempting to break them by blockholing or a shattering blast of the type described above.

Learn Electricity



In the Great Shops of COYNE IN 3½ MONTHS

Thousands of Electrical experts are needed now. Come to the great shops of Coyne and let us train you quickly by our sure practical way backed by 20 years of success.

Earn $125 to $300 a Month

Come to Coyne where experts train you on the actual apparatus. You work on everything from the simple bell to the mighty Generators, Electrical Locomotives and Power Plants. Everything to make you a Master Electrician. Look at the picture taken from life in our shops.

Become an Expert in 3½ Months

No need of taking 1 to 4 years to become an expert. We have proved this in thousands of cases. We are the only school teaching by the original Coyne methods, which means no books, no classes—all practical training.

Earn Your Way. Our employment department will help every ambitious man to earn a part or all his expenses—without charge.

Bennett W. Cooke, Director
COYNE TRADE AND ENGINEERING SCHOOLS
Dept. 28, 39-51 E. Illinois Street
CHICAGO, ILL.

LEARN DRAFTING

The country needs hundreds of skilled Draftsmen in all lines at big salaries.

Coyne is the only school in the country that gives you the advantages of big shops full of construction and machinery. This makes our drafting courses practical, just like the job you'll have when you graduate. You can't get this in any other school.

WE TEACH ELECTRICITY, DRAFTING, MOTION PICTURE OPERATING AND PLUMBING

We teach all these professions in such a thorough, practical way that when you finish you can step right into a position of responsibility and big pay.

Fill out the coupon *now* and send it for our big free book of information. It tells what others are doing and have done, what you can do.

Be sure and check the trade that interests you. Do it now.

COYNE SCHOOLS
Dept. 28, 39-51 E. Illinois St.
CHICAGO, ILL.

Please send me that big free book. I'm interested in:

[] Electricity [] Drafting [] Plumbing
[] Motion Picture Operating.

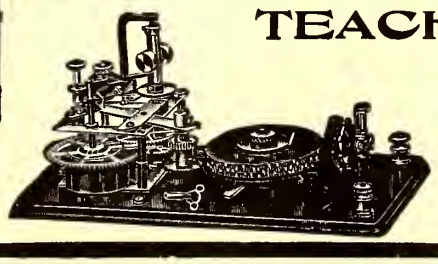
Name .....

Address .....

"THERE'S MONEY IN IT"

AT HOME **LEARN TELEGRAPHY** AT HOME
MORSE AND WIRELESS

TEACH YOURSELF



In half the usual time, at trifling cost, with the wonderful Automatic Transmitter, **THE OMNIGRAPH.** Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would.

Adopted by U. S. Gov't. 4 styles. Catalogue free.

OMNIGRAPH MFG. CO.
39L Cortlandt St. New York

MODEL AIRPLANE SUPPLIES



Build and fly Model Airplanes ~

Send 5¢ for catalog of complete and knocked-down scale models of new machines, parts, fittings, and supplies.

Wading River Mfg. Co. 672 Broadway, Brooklyn, N.Y.

www.americanradiohistory.com

How to Sell Your Real Estate



Any Kind Anywhere

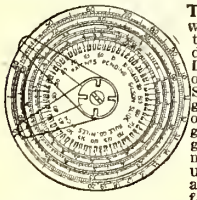
I got cash for my property in less than two weeks. Made sale myself so had *no commission to pay.* You can do the same with The Simplex Plans for Selling Real Estate. No matter where located, these practical, scientific plans will show you how to sell your property—*quickly and for cash*—without employing agents or paying commissions. Investigate at once. Learn how easily *you* can use The Simplex Plans, just as I did, to sell *your* real estate. Write today (a postal will do) to

THE SIMPLEX CO.
Dept. 62, 1123 B'way, New York

They will send you full particulars *without cost or obligation.*

Quick Results

"Sold for cash in 10 days. Recommend your methods."—*Wm. H. Cartland, Mass.* "Your method sold my farm for cash."—*Mrs. L. A. Childs, Minn.* "Sold my property. Your plan quickest I ever saw."—*Johnson String, N.J.* "Sold my hotel for $5,375."—*G. F. Stewart, Ill.*



THE MIDGET SLIDE RULE will solve any problem in addition, subtraction, multiplication, division and proportion. A Log-Log Scale gives any root or power of any quantity. Gives Logarithms, Sines, Tangents, Cosines, Cotangents and the decimal equivalents of fractions to six figures. It is grease and water proof and will give years of service. This rule is not to be compared with the paper utility rules which sell for $1.00 and are put together with paper fasteners. It is accurate, simple to operate and comparison shows that it is undoubtedly the fastest and most complete rule made. Our refund guarantee protects you from loss or disappointment. An instruction book 16 pages, 12 illustrations, is sent with each rule. Diameter of rule 4 in. Made in two models: Metal (white coated steel), **$1.00;** White Celluloid, **$1.25.** Leather Case **50c** extra. Send for catalogue of Slide Rules. Your money back if you are not satisfied.

Gilson Slide Rule Co., Niles, Mich.

Build Your Own PHONOGRAPH,

It's Easy With Our Help

SAVE OVER HALF

A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fine profit building phonographs for your friends.

Write Today for Our Free Blue Print Offer. Agents wanted for our ready built Choraleons.



Choraleon Phonograph Co.
708 Monger Bldg., Elkhart, Ind.



$7.77

Springfield-Remington

Single shot rifle altered and refinishsd. Shoots cal. 30, model 1966 army cartridge. Weight 7½ lbs., total length 39 inches, U. S. Barrel 23½ inches Remington breech action, blued finish U. S. graduated sight. Price $7.77 plus war tax 78 cents. Cartridges $3.50 per 100 war tax 35 cents, packing charge 45 cents.

FRANCIS BANNERMAN SONS 501 BROADWAY, N.Y.



Free Book! Write today for the book which tells about the greatest of all industries—

AVIATION

Big demand for trained men. Passenger and mail service soon to all cities. Write for this FREE book, which tells ambitious young men how to get a start and win. Don't delay. Write TODAY. Address

NATIONAL AERO INSTITUTE
Dept. 744Y, 916 So. Michigan Ave., Chicago, Ill.

LEARN WATCH REPAIRING



You can learn by our modern and original system of instruction every part of the **Watch Repairing Trade** at home as good or better than at a shop. You can earn money while learning and secure a well paying position or start in business after completing our course of instruction. Good watch repairers are always in demand and earn from $20 to $35 per week. For particulars apply to the

Milwaukee School of Watchmaking 166 Mason St., Milwaukee, Wis.

Red or Black "Vulcan" Ink Pencils



Two Sizes—4¼ and 5½ inches. Extra Size—8 inches (black only) **$1.50.** Your name in gold inlay—$.35. FREE—Liberal supply of ink with retail orders. *Agents wanted. Big profits.*

The ONLY perfect, non-leakable ink pencils at moderate prices. Order today. **$1.25**

J. R. ULLRICH & CO., 27 Thames St. New York

Mudcapping is known by a variety of fantastic and expressive names, such as "Bulldozing", "Blistering", "Poulticing" and "Adobe Shooting", and is made possible by the fast, shattering action of the higher grades of dynamite. In practise it consists of removing the dynamite from the shell and packing it in a compact conical heap on the boulder, and after inserting a cap and fuse covering it with several inches of thick, heavy mud.

The explosive should be placed on the boulder at the place where it would be struck with a hammer were it small enough to break in that way. This may be on the top or side. If the boulder is embedded in the ground, a snakehole shot to roll it out on the surface should first be made, *because the confining dirt makes it much harder to break with a mudcap shot.* The mudcovering should be as thick and heavy as it is convenient to make it, *not less than* 5 *or* 6 *inches,* and should be free from stones, *as the blast will throw them as tho they were bullets. Never lay a stone on top of the mud for the same reason.*

The explosives used are 40 per cent dynamite for easily broken rock and 50 per cent strength for hard "niggerhead" boulders.

Seam Blasting:—Frequently ledges and boulders have *seams* from which the mud or stone chips can be removed to a considerable depth. When such a seam is as much as one-half inch wide, successful blasts can be made by packing a reasonable amount of 40 per cent or stronger dynamite into the crack and tamping it securely with moist clay. This method will require about the same amount of dynamite as snakeholing, but is more satisfactory for badly-seamed boulders or ledges. The greatest care must be exercised in placing and tamping the charge *to prevent the expanding gases from escaping thru the cracks.*

Diameter of Boulder in Feet	No. of Cartridges Required: Mud-capping	Snake-holing	Block-holing
1½	2	1	¼
2	3	1	¼
3	4	1½	½
4	Don't attempt	4	¾
5	Don't attempt	6	1

This is based on the use of dynamite of 50 per cent strength. If 40 per cent dynamite is used, increase the amounts by half, and if Red Cross Farm Powder is used for snakeholing or blockholing, the amounts should be doubled.

Scrapping Old Machinery.

Breaking up old machinery, such as heavy castings or steam boilers, can be readily done with dynamite.

For scrapping a boiler use only 40 per cent or stronger explosives. Remove the dynamite from the shell and distribute in a continuous cord about half an inch in diameter all the way around the boiler, and secure it with a heavy mudcap. This can be placed along one of the seams more easily than on the smooth plates. When detonated such a charge will cut the plates almost as neatly as a shearing machine, and will reduce the cumbersome boiler to a size that can be handled.

For breaking heavy castings mudcapping is practised the same as on boulders. Sometimes a hole in the casting can be used for a block hole and loaded as described previously.

Large vessels and even boilers can be broken up *by first filling them with water, and, if possible, closing all openings.* The dynamite is primed and suspended in the water near the bottom or the thickest metal, *but must not be in actual contact with the metal.* The explosion of such a charge transmits a powerful blow to all sides and shatters them.

Brilliant Electric Lights and Big Profits in Battery Charging with this HB Lighting & Charging Set



With this sturdy, dependable HB outfit, you can make your own electric light at lowest cost, and charge auto batteries at the same time. You SAVE MONEY and make BIG PROFITS. Outfit runs from line shaft or engine. No wear out, trouble proof, economical.

Small Payment Puts This Money-Maker In Your Shop



Balance on easy terms. Profits pay for outfit. Absolute Money-Back Guarantee. Ask our Service Department about proper size for your needs. Pin this ad to your letterhead and mail **today** for information.

HOBART BROTHERS CO.
Box 83E, Troy, Ohio.
Successful Mfrs. since 1893.

110 V. A. C. GENERATORS

Only $5.00



Holtzer-Cabot hand generators, while they last, $5.00

Order from this ad.

House - Lighting Plants

$225.00 to $2,100.00. Battery chargers and Motor-Generator Sets, $25.00 to $120.00. Dynamos, Motors, all sizes.

WATSON ELECTRIC CO., Dept. 18 Gas Building, Chicago

AMATEURS — INVENTORS

ELECTRICAL APPARATUS MADE TO ORDER COSTS NO MORE THAN READY MADE

and allows you to

WORK UP YOUR OWN IDEAS

KAUFMAN MACHINE COMPANY
1357 Odell St. New York City
Engineers Expert Instrument-Makers Designers

EXPERIMENTS

In—Science, Electricity and Invention
256 Pp., by P. Edelman, $1.50 Ppd.

Here is the big illustrated

how to make and do it book you want. Full of stunts, home laboratory wonders, models, etc.

Edelman Publishers, 1802 Hague Ave., St. Paul, Minn.

Fun, Magic and Mystery!

56 Feats in Magic, 250 New Jokes, 21 Puzzles, 1 Fortune Telling Tablet, 52 Money-Making Secrets, 15 Card Tricks, 71 Toasts, 58 Verses in Comic Poetry, 10 Funny Readings, 41 Epitaphs, and 11 Parlor Pastimes. You get all the above-mentioned and our big illustrated Catalog of 125 Magic Tricks for only 10 cents. Write today.

MYSTIC MFG. CO.,
909 Springwells Ave., Detroit, Mich.



"POPULARITY FOLLOWS THE"

UKULELE



If you play quaint, dreamy Hawaiian music or latest songs on the Ukulele you will be wanted everywhere. We teach by mail 20 simple lessons; give you free a genuine Hawaiian Ukulele, music, everything—no extras. Ask us to send the story of Hawaiian music. You will love it. No obligation—absolutely free.

The Hawaiian Institute of Music
1400 Broadway, Suite 1108, New York

Learn to PAINT SIGNS and SHOW CARDS



I teach you personally, by mail, in a short time. Oldest and largest School. Big field, work interesting. You can

EARN $18 TO $45 A WEEK

Fritzner, Minn., wrote. "Did job after first lesson, got $10, profit $7.05." Crawford, B. C., says: "Earned $200.00 while taking course." Get literature, samples, guarantee; all FREE.

DETROIT SCHOOL OF LETTERING
Established 1899. 688 D. S. of L. Bldg., DETROIT, MICH.

PHOTO CRAFT

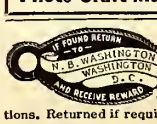
THE NEW PHOTOGRAPHIC JOURNAL

Devoted to the Art of Picture Taking and Nature Work with the Camera.

Four Competitions with Valuable Cash Prizes Leading to a Fifth.

Send 10c for three months' trial subscription.

Photo Craft Magazine, Ann Arbor, Mich.



EARN MONEY

Stamping Names on Key Tags. $50

Either sex. Spare time. Soma make ♦ Send 25c for Tag with your name on and instructions. Returned if required. **Exp. Key Tag Co., Cohoes, N.Y.**

www.americanradiohistory.com



In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries addrest to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are publisht here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

Automatic Cut-Out Switch.

(334) Ben Waigand, Nampa, Idaho, states: "I am enclosing a print of a patent my brother and I took out some time ago. I would very much like to hear from you as to its worth in the electrical field. Also what we shall do with the patent.

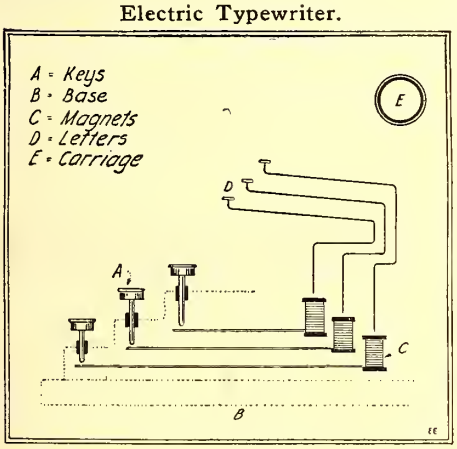
A. The invention relates to an automobile cut-out switch which is to produce a mechanically operated means, whereby, when a fuse in a three-phase circuit is blown, the switch connecting the circuits will be automatically thrown out of operation from the circuit. In three-phase circuits, one of the fuses may be blown, but this does not entirely break the circuit since it will continue to operate on a one-phase circuit, tending to overheat the motor or diminish the lights. By means of this invention, however, upon any of the fuses being blown, the switch is thrown open automatically. This seems to be a very good idea except for the fact that the fuse links which work this switch are exposed all around, which we believe is against the Fire Underwriter's ruling. Some device should be attachable whereby this objection is overcome. Otherwise, we think the patent is a good one. How successful it will be from a commercial standpoint we have no means of knowing. It all depends upon the owners of the patent who wish to exploit it.

Mechanical Converter.

(335) Herbert M. Hubs, Indianapolis, Ind., wishes to know if he could obtain a patent on a mechanical current converter which he designed. He claims that it will work with an efficiency of 80%.

A. It is impossible to say off-hand if a patent can be obtained on the idea as we do not know what it is about. We do not know the technical details; for that reason we cannot give any intelligent advice.

Electric Typewriter.



(336) Lucius M. Turner, Royston, Ga., writes as follows: "I have an idea which I think is entirely original concerning a typewriter that will work with electromagnets. My idea is as follows: Have each key used as a switch or, in other words, used like a telegraph key. As you are aware, each arm on which the letter is attached is shaped somewhat as shown in diagram. When the key is pressed the circuit of that particular magnet is closed. For instance, take the letter 'K.' Press the letter K and that closes the circuit of that certain magnet and the letter K is made. Magnets are located under each letter, as shown in illustration. IN THIS WAY ALL LETTERS WILL BE HIT WITH EQUAL FORCE. In reading letters and typewritten matter you often see some letters less plain or dimmer than others. This would be absolutely avoided. The magnets would be very small and therefore consume very little current. The current could be supplied with a few batteries located under the table or in the drawer, or in any other convenient place that is not needed. Please advise me as to whether it could be patented, and if it would be practicable. Also if it could be manufactured at a reasonable price (please give me some idea as to the price) and if I could find a ready market for same."

A. A very clever idea, and it seems it has the germ of a possible great future. Our present typewriters are operated on a very antiquated plan, and have not been improved since Remington built his first machine. What we refer to is the muscular energy it takes in operating a typewriter. It is rank foolishness in this age of invention and electricity to ask people to wear themselves out by pounding the keys. Electricity should be the mover. Mr. Turner in his invention has shown a very simple way of doing it. He uses the keys to establish the contact. Even the slightest touch will close the circuit. Then electricity, plus electromagnets, will do the rest. Each electromagnet will pull down its key. It thus should be possible to operate a typewriter with the very slightest touch, and each typewriter could be plugged into a light socket or otherwise, a battery or storage battery without any trouble whatever. Of course, the details will have to be worked out to make the device practical, but we certainly think that it is a coming thing. We believe also that such a typewriter could be marketed at a cost only slightly higher than the present-day machine.

We think a patent can be obtained on this invention without much trouble, and we would advise our correspondent to get in touch with a patent attorney at once.

Auto Tail Lamp.

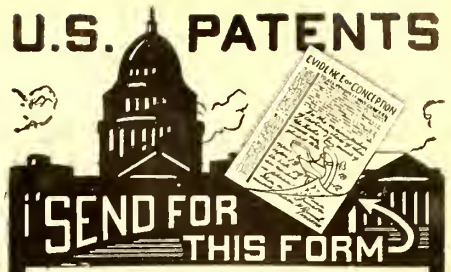
(337) G. R. Smathers, Charlotte, N. C., says: "I have invented a combination auto tail lamp. It is a combination affair of two lamps in one, one being red, the other white. Either red or white bulbs can be used, or instead use red or white lens. It is electrically operated and is provided with extra "push" for white light, which is to be used in backing out of garage or "turning around" at night, in order to avoid "backing" into obstacles such as fences, ditches, etc. The white light, which is larger and brighter than the red one, serves the same purpose as do the front headlights. This device is also provided with the well-known license-plate bracket. The red light throws a white light on plate from under side."

A. From the description and drawings which we have inspected, we do not see anything fundamentally new in the device, and we doubt very much that a patent can be obtained on the combination. There are many similar devices on the market now.

Adjustable Book-Mark.

(338) N. Alpert, Sedalia, Mo., submits description and model of a new article of manufacture. In part he says: "Please advise me whether I can obtain a patent on an adjustable book-mark. It is to

U.S. PATENTS



Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

LANCASTER & ALLWINE

255 OURAY BLDG.,
WASHINGTON, D. C.

PATENTS COPYRIGHTS TRADE MARKS DESIGNS

U.S. PATENTS

Our facilities for securing patents enable us to give prompt and reliable service at reasonable rates. Inventors are invited to write to us regarding questions appertaining to securing patent protection. All matters receive prompt attention. Send sketch for preliminary examination.

Books free on request

A. M. BUCK & CO.

Patent Attorneys

205 Second National Bank Bldg.,
Washington, D. C.

PROTECT YOUR RIGHTS TO INVENTION

Write today for "Record of Invention," which contains forms to establish evidence of conception. Prompt personal service. Preliminary advice without charge.

J. REANEY KELLY
732-P Woodward Bldg. Washington, D. C.

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE ON CONCEPTION." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention we will give our opinion as to its patentable nature.

Our illustrated Guide Book, "HOW TO OBTAIN A PATENT," sent Free on request.

Electrical Cases a Specialty Highest References Prompt Attention Reasonable Terms

FREE COUPON VICTOR J. EVANS & CO., Patent Attorneys

New York Offices: 1001 to 1007 Woolworth Bldg. Pittsburgh Offices: 514 Empire Bldg. Philadelphia Offices: 135 S. Broad St.
Main Offices: 779 Ninth Street, N. W., Washington, D. C.

Name ..... *Address* .....

www.americanradiohistory.com

PATENTS

TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
164 Owen Building, Washington, D. C.
2276-8 Woolworth Bldg., New York City

PATENTS

LACEY & LACEY

Attorneys-at-Law—Patent Practice Exclusively
Solicitors of
U. S. and Foreign Patents
Trade-Marks, Copyrights
659 F St., N. W., Washington, D. C.
Write Us for Our Free Inventors' Book
PATENT-SENSE
Established 1869

PATENTS

INVENTORS: Send us sketches or a model of your invention and a description of the device for advice in regard to the best way of obtaining patent protection. Our practical experience covers a period of twenty years. Our hand-book on patents is sent free on request. All communications strictly confidential. Write us today.

TALBERT & TALBERT
Patent Lawyers
4287 Talbert Bldg. Washington, D. C.

PATENTS

Hand Books on Patents, Trade Marks, etc., sent free. Our 70 years of experience, efficient service, and fair dealing, assure fullest value and protection to the applicant. The Scientific American should be read by all inventors.

MUNN & CO., 622 Woolworth Bldg., N. Y.
Washington Office, 622 F St., Washington, D. C.

Patents Promptly Procured

Send sketch or model for actual search of U. S. Patents. Highest references. Personal service. Moderate fees. Write for Free Patent Book.

GEORGE P. KIMMEL, Patent Lawyer
99-W Loan & Trust Bldg. Washington, D. C.

PATENTS

If you have an invention and desire to secure a patent, send for our Free Guide Book, HOW TO GET YOUR PATENT. Tells our Terms, Methods, etc. Send model or sketch and description for our opinion of its patentable nature.

RANDOLPH & CO.
Dept. 172 Washington, D. C.

be made of two strips of steel. The adjustable strip is so fastened that it is able to slide up and down or sideways. The stationary strip can move sideways in either direction. Near the end of this strip and on the underside, a clip is attached, by which the whole thing may be fastened to a page. I am sending a rough model with this letter. It will give you an idea of how the device will work.

A. This is a very clever idea, and we think there ought to be a market for it. It could possibly retail for five or ten cents, and for this reason five-and-ten-cent stores would probably be a good market to exploit the idea. We think a patent could be obtained.

Improved Fuse Plug.

(339) Thomas Sheehan, Duluth, Minn., wishes to have our opinion on an improved fuse-plug which works on the thermo-electric principle, similar to the *blinker contact* arrangements, that blink electric lights. This fuse is made similar to the regular fuse, except that in the interior it has a steel wire, which has a tendency to contract when a certain number of volts and amperes pass thru it. Naturally the wire must be of the gage that will not contract unless the voltage is over 110 volts. Our advice is asked on this invention.

A. While this is a very clever idea, and while no doubt it works and perhaps a patent can be obtained upon it, we doubt very much whether it would prove a success from a practical standpoint. We think the Fire Underwriters would not allow such a fuse plug to be put in use, for the reason that there probably would be bad arcing at times, and the heating effect therefrom would endanger fixtures, etc.

A gold palladium alloy which makes an acceptable substitute for the more expensive platinum iridium alloy used in chemists' utensils has been developed by metallurgists in California.

CREDIT CORRECTION NOTICE.

The story entitled "The Autograph of an Oyster," publisht in the July issue of the ELECTRICAL EXPERIMENTER, should have been credited to the courtesy of the *"New York Sunday American"* instead of the Star Company, who are the publishers.

How to Make Photo-Micrographs

(*Continued from page* 317)

will require a shorter exposure than dense objects or objects stained with carmine or picric acid. The experimenter should use his own judgment in regard to the length of exposure; some idea of the length of exposure may be obtained by examination of the photo-micrographs here shown.

No. 1. Scales from the wing of the moth of the grape-vine cut-worm, and are a good example of the scales which cover the wings of all moths and butterflies. This is the "dust" which comes off on the fingers when holding a butterfly or moth by the wings. Different shaped scales will be found on the same insect by taking scales from the various parts of it.

No. 2. Parenchyma of sunflower leaf; the specimen was obtained by stripping a small piece of the epidermis from the upper part of the leaf. The large pointed objects are hairs, the thin jagged lines mark the cell walls; the small objects shaped somewhat like coffee grains are the stomata by means of which the plant takes in CO_2, its principal food, from the air.

No. 3. Part of the surface of the under wing of the squash bug. The photo shows cells and the opening of glands which exude moisture, keeping the wing from becoming brittle. The dark line is part of a vein.

No. 4. Is a micro-photograph of the nitrogen fixing organisms from a nodule on the root of a pea. These micro-organisms have the property of fixing nitrogen from the air.

No. 5. Tip of antenna of May beetle; the short sharp bristles are the sensory organs, probably the sense of smell.

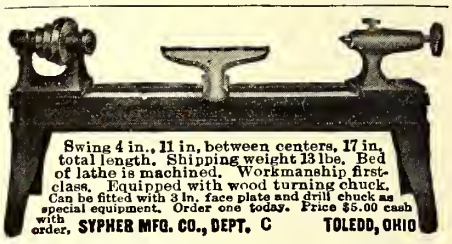
No. 6. Tip of the wing of the crane fly, showing covering of fine hairs.

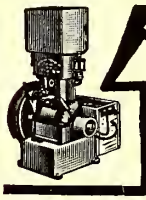
For the average experimenter a microscope having a magnification from 15 to 250 times is sufficient, and with it photographs of pollen, mould, mildew, et cetera, can readily be made.

Competent Patent Service
By a Former Examining Official of the U. S. Patent Office
NORMAN T. WHITAKER
Lawyer and Engineer
480 Whitaker Bldg. Washington, D. C.
Branch Office, 87 Nassau St., New York City,
INQUIRIES INVITED

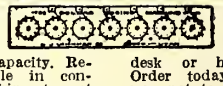
PATENTS
Inventors Invited to Write for Information and Particulars
Highest References. Best Results.
Promptness Assured.
WATSON E. COLEMAN
Patent Lawyer
624 F Street N. W. Washington, D. C.

PATENTS C. L. PARKER
Formerly Member Examining Corps. U. S. Patent Office.
PATENT LAWYER
McGill Bldg.
Washington, D. C.
Patents, Trade Marks, Copyrights, Patent Litigation
Handbook for Inventors, "Protecting, Exploiting and Selling Inventions," sent upon request.


Swing 4 in., 11 in. between centers, 17 in. total length. Shipping weight 13 lbs. Bed of lathe is machined. Workmanship first-class. Equipped with wood turning chuck. Can be fitted with 3 in. face plate and drill chuck as special equipment. Order one today. Price $5.00 cash with order. SYPHER MFG. CO., DEPT. C TOLEDO, OHIO


SMALL ENGINES
Perfected Gasoline Engines—½, 1 and 1½ h. p.—for Farm and Shop use. Price, $27.50 and up. Also,
WASHING MACHINES
We ship on trial. Send for Booklet and Special Offer.
SIEVERKROPP ENGINE CO.
1401—19th St., Racine, Wis.
STARTER for FORD CARS


BUILD A $100 PHONOGRAPH
Assemble your own Phonograph
Do it yourself easily. Have the finest machine. Astounding saving. We give you the phonograph secrets. Complete instructions 10 cents.
CATALOG FREE!
ELECTRO MECHANICAL PARTS CO.
160 N. Wells St. CHICAGO

DOLLAR ADDING MACHINE $1

Adds and multiplies with speed of expensive machines. Seven columns capacity. Remarkably simple in construction. Nothing to get out of order. Weight one ounce. Made of metal and celluloid. The ideal pocket, desk or home machine. Order today. The best way not to forget is to do it now.
L. J. LEISHMAN CO., Dept. 142, Ogden, Utah


$3 AND $4 a month WILL BUY
A Beautifully Reconstructed
TYPEWRITER
With Every Modern Writing Convenience
WRITE TODAY FOR ILLUSTRATED CIRCULAR
Explaining Try-Before-You-Buy Plan
HARRY A. SMITH, 738-218 North Wells St., Chicago, Ill.



"Talk as fast as you like. I am taking it down in K. I. Shorthand."
SHORTHAND Simplified
Learn Easily at Home
Practical *K. I. Shorthand;* quickly learned. You attain speed easily. Great saving in time and expense. Guarantee and *30 days' trial* given. Home study. Many endorsements. Used in Government service, in corporations, schools, professional and business offices, private use, etc. Brochure and specimen lesson *FREE.*
KING INSTITUTE, ED-300, Station F, New York, N. Y.

www.americanradiohistory.com

Popular Astronomy

By Isabel M. Lewis

(*Continued from page* 350)

of the stars is twenty-six trillion miles away. An inconceivable great abyss separates the sun and his planet family from the stars.

It is because they are so near that planets appear disk-like in the telescope, just as the sun and moon appear disk-like without the telescope. Even in the most powerful telescope in existence the stars appear as points of light simply because they are so distant.

Since the planets are so near, they appear to wander thru the sky from day to day and from year to year, the result of the earth's motion around the sun as well as their own motion. As a result of these two motions their apparent motion thru the sky is very complicated and the nearer the planet is to the earth the greater the rate at which it appears to move thru the sky from day to day. The stars, on the contrary, are apparently immovable for many hundreds of years, tho in reality they are in rapid motion thru space.

The continual change of position of the planets is confusing to the beginner who desires to learn to know the grouping of the stars into constellations. It is quite disconcerting to find an unknown bright star where none is indicated on the map. Perchance the observer may think he has discovered a brilliant *Nova*, but Novae, especially brilliant ones, are extremely rare. Gradually the fact is brought home that the unknown object is simply one of the five planets visible to the naked eye.

Uranus at the limit of visibility and Neptune far beyond it we need not consider.

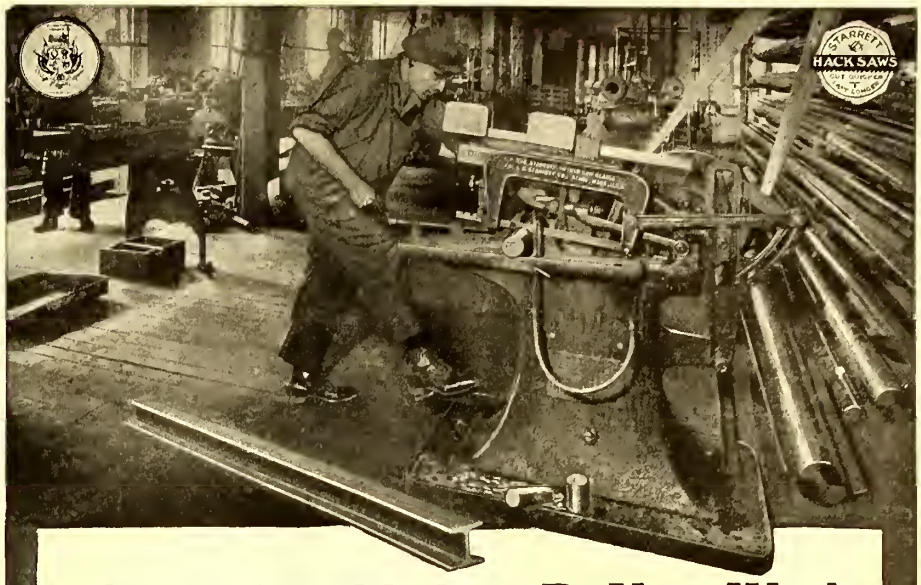
Venus and Jupiter one soon learns to recognize by their unusual brilliancy which far surpasses that of the brightest stars. They are distinguished from each other by their distinctive colors and relative brightness. Venus is always a clear sparkling white and considerably brighter than Jupiter who glows unflickeringly with a slightly yellowish tinge .

Mercury, "The Elusive One," as the ancients called him, is rarely seen as he is always so near the sun. When it is possible to catch a glimpse of him in spring or fall when the ecliptic rises most sharply from the horizon, one marvels at his beauty and brilliancy as he twinkles in the twilight with the splendor of a first magnitude star.

Mars, "The Ruddy One," always glows with a deep red tinge but changes very greatly in brightness. When far away from us Mars is very like Antares, the deep red star glowing in the heart of the Scorpion low in the southern, summer sky. When comparatively near to the earth, however, Mars is one of the most strikingly beautiful objects in the sky and surpasses all stars in brilliancy.

Saturn, never particularly interesting without the telescope, is dull leaden colored and, in brightness, resembles a number of first magnitude stars. It is, therefore, more easily mistaken for a star than any of the other planets. It is easy to keep track of this planet when it is once found, however, as it takes nearly thirty years to make one trip around the sun and therefore moves eastward among the stars about twelve degrees a year.

During July and August the splendor of Venus will attract the attention of even chance observers of the heavens. It will be "Evening Star" during these months, as it has been during the spring and early summer and will reach its greatest brilliancy on August seventh. After that date it will draw rapidly nearer the sun.



Choose Your Blade to Fit Your Work

If you've been cutting 3" round machine steel with a heavy gage, coarse blade and find your next job is on structural beams—7" I beams, for instance—it's cheaper to change to a blade designed for that class of work than to keep on with the coarse blade you used on round stock.

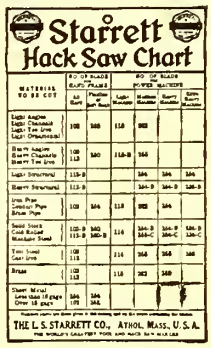
The smaller the cross-sectional area to be cut, means fewer teeth engaged at any single instant and a corresponding increase in wear on the blade at that point. Also, the fewer teeth used the sooner they will dull and the greater likelihood of stripping.

That's *one* reason why the Starrett Hack Saw Chart recommends different blades for different kinds and shapes of metal. In this case, our tests show that a blade with more teeth to the inch should be used on structural steel than on round stock.

Write for Starrett Hack Saw Chart No. LE.

THE L. S. STARRETT CO., Athol, Mass.

The World's Greatest Toolmakers.
Manufacturers of Hack Saws Unexcelled. 42-933



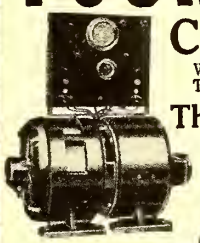
Starrett Hack Saws

YOUR OPPORTUNITY

Canceled Government Contracts

We have secured a large quantity of Small Motors, Generators and Charging Outfits. This material is new, still in original cases and carries the full factory guarantee.

This is Your Opportunity to buy new, guaranteed Electrical Apparatus of Standard Manufacture



Battery Charging Outfits

For use on 110 volt, A. C., 60 cycle, single phase current only.

80 watts, 8 volts, 10 amperes . $48.50
130 watts, 80 volts, 5 amperes . $68.50
150 watts, 15 volts, 10 amperes . $68.50
800 watts, 80 volts, 10 amperes . $94.50

All outfits complete with switchboard as cut shown.



1/2 H. P. INDUCTION MOTOR $32.50
110 or 220 volts, A. C. 60 cycle, single phase, 1750 R. P. M.

ALL MOTORS COMPLETE AS CUT



1/4 H. P. 110 volts A. C., 60 cycle, single phase 1750 R. P. M.

WASHING MACHINE MOTOR

Suitable for operating Small Compressors, Coffee Grinders, Bottle Washers, Lathes Drill Presses, etc. $18.50

Mail $5.00 cash or Money Order. We will send C. O. D. subject to full examination.

MONEY BACK GUARANTEE

WRITE FOR CATALOGUE. BARGAINS IN MOTORS AND GENERATORS. SPECIAL QUANTITY PRICES

220 volts **POLYPHASE MOTORS** 1750 RPM.
60 cycle, 2 or 3 phase. Complete, pulley and base
1 H. P. $59.50 3 H. P. $ 84.50
2 H. P. $72.50 5 H. P. $102.50

NEW MOTORS

110-220 volts **REPULSION MOTORS** 1600 RPM.
60 cycle, single phase. Complete with pulley.
1/2 Hp. $44.50 1 Hp. $67.50

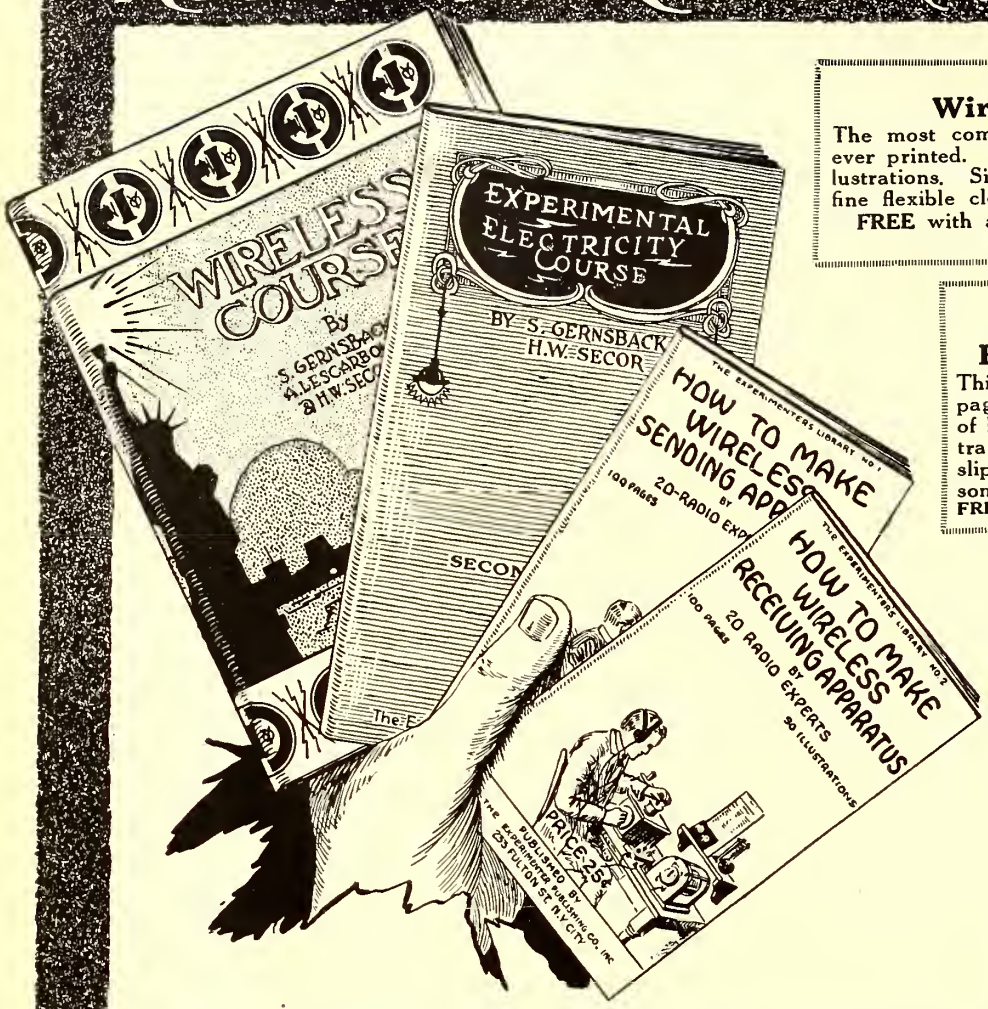
MANUFACTURERS' DISTRIBUTER

CHAS. H. JOHNSTON - West End - PITTSBURGH, PA.

www.americanradiohistory.com

FREE TO YOU!

Read this Remarkable Offer!



OFFER No. 1

Wireless Course

The most comprehensive Wireless Course ever printed. Contains 160 pages, 350 illustrations. Size of book 6¾"x10". Very fine flexible cloth cover.

FREE with a year's subscription.
Add 5c for postage

OFFER No. 2

Experimental Electricity Course

This masterpiece contains 160 pages, 400 illustrations. Size of book 5"x9". Printed on extra thin paper, so book can be slipped into pocket. Handsome flexible cloth cover.

FREE with a year's subscription. Add 5c postage

OFFER No. 3

How to Make Wireless Sending Apparatus
By 20 Radio Experts

How to Make Wireless Receiving Apparatus
By 20 Radio Constructors

These books are by far the most successful wireless books on the market. Size of each book 5"x7", well bound on good book paper. Covers in two colors. We really cannot praise these books too highly. Each book contains 100 pages and from 88 to 90 illustrations. **BOTH** books **FREE** with a year's subscription. Add 5c for postage

This is a very limited offer. It may be withdrawn at any time, due to the tremendous cost of paper, which IS JUST DOUBLE WHAT IT WAS ONE YEAR AGO. We have only a limited supply of these fine books on hand; after they are gone we cannot reprint the books until conditions become normal again. **Now is your chance.**

The publishers of this journal have earned an enviable reputation of giving more than 100 cents' worth for each dollar spent with them. Profit by this liberal opportunity NOW; it may never be made again.

HERE'S THE OFFER

Subscribe to the ELECTRICAL EXPERIMENTER for one year, at the **regular subscription** price of $2.00 per year (Canada, foreign and N. Y. C. $2.50) and we will send you either books shown in one of the above offers. If you subscribe for two years, two offers will be given, etc.

If you are a subscriber at present take advantage of this wonderful opportunity anyway. If you do, we will extend your present subscription.

This Offer Limited. ***Act Now.***

EXPERIMENTER PUB. CO.
233 FULTON STREET NEW YORK CITY

FILL IN — TEAR OUT — AND MAIL

8-19

Gentlemen: Please enter my subscription to the ELECTRICAL EXPERIMENTER for the term of .... year..for which I enclose herewith $..... You will also send me at once FREE your book..... as per offer No.....

.....

.....

Name.....

Address.....

www.americanradiohistory.com

Inside a U-Boat

(*Continued from page 309*)

captured enemy craft, the U-117, U-140, UB-148, UB-88 and the UC-97. The views here reproduced were taken on board the surrendered submarine U-105, and the machinery shown is typical of the other German craft of this type.

Under a U-boat's Deck.

The submarine UC-97 was a smaller craft than some of the others, but proved to be one of the most troublesome craft possest by the enemy during the war. This boat was designed to serve as a mine layer, as well as being fitted for carrying torpedoes, and provided with a 4.1 inch deck gun. She was propelled by oil-burning Diesel engines, each rated at 300 h.p. for travel on the surface. Propulsion when submerged was accomplisht by means of four compound-wound interpole generator-motors, mounted in pairs on the same shaft and coupled to the engine by means of a clutch. Each generator-motor unit developed 100 kilowatts capacity, or 130 h.p., when running as a motor at full load. These machines were artificially cooled. When these units are driven by the Diesel engines, while cruising on the surface, they operate as dynamos and charge the storage batteries. When submerged the engine clutches are thrown over, and the generators are now operated as motors by the electric current supplied from the storage batteries. A motor-driven air compressor supplied the necessary compresst air for discharging the torpedoes, emptying submerging tanks, et cetera. The electrical control and switchboard rooms on the UC-97 are situated forward of the engine room, from which all electrical apparatus is controlled. The hull is divided off into water-tight compartments which can be sealed off individually by close-fitting doors. The control room is directly below the conning tower. In this control room we find apparatus for steering the vessel, firing the torpedoes, planting the mines, also for filling or emptying the submerging tanks. Much of this part of the control equipment is installed in duplicate, so that if one set is disarranged the other set may be instantly put into service. The U-boat is steered by electric motors, provided in duplicate. One motor is placed aft and one forward, thus reducing the chances of becoming totally disabled to a minimum. It is possible to maintain the U-boat within two feet of any specified depth below the surface by discharging from or letting in water to the submerging tanks. There are provided elaborate and carefully calibrated depth gages on all submarines which indicate at any instant the exact depth at which the submarine is submerged. One of the accompanying photographs shows these depth gages.

Collapsible Motor-Operated Periscope.

The periscope is a collapsible affair which can be quickly elevated, thanks to the ubiquitous electric motor, for the purpose of taking a "sighting" and then quickly lowered. Two periscopes are invariably provided, in the event that one should become fouled or shot away. The periscope measures approximately four inches at the base and two inches at the top, thus reducing the visible portion and its accompanying "wake" to the smallest possible dimensions. This is highly important as the "wake", if very broad, can be easily seen by a sharp enemy look-out. Aiming at the head of this wake, the eagle-eyed gunner can make things highly unpleasant for the submersible.

In the forward part of the submersible are located the officers' quarters and the radio operating room, as well as the sub-sea telephone apparatus, by means of which the sounds of the propellers and engines of ships can be heard several miles away.

The Under-water "Ears" of the U-boat.

No wonder the surreptitious U-boats popt up in the least suspected places, for they could detect an enemy merchantman one to two hours' sail away. By carefully listening to the sounds picked up by the microphones mounted in the shell of the vessel, a steamer or warship could be trailed or maneuvered around for miles. U-boats have been known to dodge the Allied destroyers for periods of three and four hours; "blind-man's buff" you might call it, but he who laughs last laughs best, for the destroyers carried a better under-water sound detector than the "Heinies" and every move along his tortuous course was closely checked up. Periodically, depth charges were "let go" and many times, more than the Germans care to admit, the final crunching sound of a vanquished U-boat, as the depth bomb spelled its doom, came to the ears of the destroyers' officers via the sensitive hydrophone. The U-boats could be trailed just as accurately finally, as if they had been maneuvering on the surface of the sea.

Life on these craft was not to be craved for, especially when a U-boat got cornered and had to lay on the bed of some sound or harbor, for 10 to 15 hours. Electric cooking utensils were supplied, the same as on all of the Allied submarines.

The larger U-boats measured 300 feet and more in length, and had a capacity of 20 or more torpedoes and 45 mines. Craft of this type are propelled by two powerful Diesel engines, developing 1,200 h.p. each, for cruising awash, charging the storage batteries, etc., and when submerged propulsion is effected by a set of four 500 h.p. electric motors. The motors are operated as generators while awash, when it becomes necessary to charge the batteries. These large sub-sea craft often had a cruising range as great as 7,000 miles. The speed of this type of craft on the surface is about 19 knots and submerged about 10 knots. They carry two disappearing deck guns of 4 to 6 inch caliber. The torpedo tubes are four in number at the bow, while two are provided at the stern. At the bow of the U-boat the Germans mounted a cleverly contrived saw for cutting thru sub-aqueous nets. Even so, the nets placed in the waters about the English coasts enmeshed many of them, from which they endeavored to struggle loose in vain, as the official Admiralty reports prove. It may be said in closing that, contrary to the usual expectations, inspection showed the workmanship on the machinery of these U-boats to be very plain and ordinary.

Go to Church by Telephone

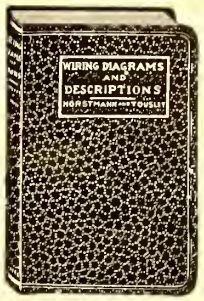
Holding church services by telephone was one result of the influenza epidemic. This was done by one church in Muncie, Ind., which arranged that at 10:30 o'clock, thru the coöperation of the local telephone company management, the telephones of all subscribers who wished should be connected with the telephone in the church, to which a special microphone was attached. The church organist also played a few numbers, which were thoroly enjoyed by the listeners.

Fit Yourself for the Big Job

Don't hesitate any longer. There is a greater demand for trained men now than ever before — greater opportunities — bigger pay — more rapid advancement. It's training that counts now—accurate knowledge—a complete grasp of your trade.

Drake's Practical Mechanical Books

For Home Study

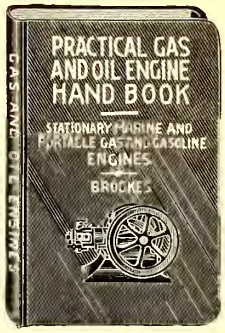


Pave the way to the fat pay envelope. Written in non-technical language that any man can grasp. Send the price of any book listed below. We will send the books postpaid — you keep them five days—if not entirely satisfied return the books and your money will be refunded in full. Order direct from this page. Use the Coupon.

Electrical Books

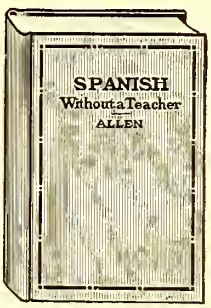
Electric Motor Control Systems and Methods. Leatherette.....$1.50
Electrical Tables and Engineering Data. Leatherette 1.50
Motion Picture Operation. Leatherette.. 1.50
Alternating Current. Leatherette..... 1.50
Wiring Diagrams and Descriptions. Leatherette 1.50
Armature and Magnet Winding. Leatherette 1.50
Modern Electric Illumination. Leatherette 1.50
Modern Electrical Construction. Leatherette 1.50
Electricians' Operating and Testing Manual. Leatherette..... 1.50
Drake's Electrical Dictionary. Leatherette 1.50
Electric Motors, D and A. Leatherette.. 1.50
Electrical Measurements and Meter Testing. Leatherette..... 1.50
Drake's Telephone Handbook. Leatherette 1.50

Automobile Books



Automobile Ignition. Leatherette, $2.00
Brookes' Automobile Handbook. Leatherette ..$2.00
Automobile Starting and Lighting. Leatherette ..$1.50
Ford Motor Car, Truck and Tractor Attachments. Cloth, $1.00
Ford Motor Car, Truck and Tractor Attachments. Leatherette ..$1.50
Automobile Catechism and Repair Manual. Leatherette.....$1.25
Gas and Oil Engine Handbook. Cloth... 1.00
Gas and Oil Engine Handbook. Leatherette 1.50

Modern Language Courses



French Without a Teacher, Spanish Without a Teacher, German Without a Teacher. By Professor Philip Schuyler Allen, University of Chicago. An entirely new home series of modern foreign languages. Simplest, easiest-to-master language method ever devised. French, Spanish or German. Pocket size. Each $1.25

Mail the Coupon NOW

Order on our five day money back plan.

FREDERICK J. DRAKE & CO.,
1009 Michigan Ave., Chicago, Ill.

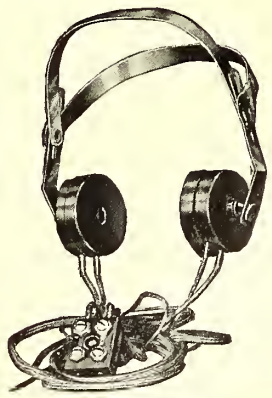
Enclosed find ($.....), for which please send me prepaid the books checked in this adv. (or list attached). It is agreed that I may return same in 5 days if not entirely satisfied, and money will be refunded in full.

Name .....

Address .....

www.americanradiohistory.com

MURDOCK No. 55



IT CAN BE PROVED

that our 'phones are good enough for ANY radio service. Order a set NOW. Use them. Test them. Compare them. DECIDE. If after a thorough trial you find that they do not PROVE as good as you want, send them back and get the money. WE WANT YOU TO PROVE OUR POINT—FOR EVERY SATISFIED USER "BOOSTS" MURDOCK 'PHONES.

3,000 Ohm Double Set **$4.00**

2,000 Ohm Double Set **$5.00**

INTERESTED IN GOOD RADIO APPARATUS? ASK FOR BULLETIN No. 19

WM. J. MURDOCK CO.

55 Carter St.

Chelsea, Mass.

Pacific Coast Representatives
KEELER WHITE CO.
221 Second St., San Francisco.

CORE WIRE

We have been fortunate in securing thru auction several tons of guaranteed pure, double annealed **Norway Iron Core Wire** and are selling this wire to "Experimenter" readers

At Pre-war Prices, 20cts. lb.

This wire is just the thing for spark coils, transformers, etc., and it is, of course, a very much more superior product than the usual iron wire.

We have only one size left:
24 INCHES LONG.
Thickness about No. 21 B and S

If this size should be too long we advise cutting the wire down yourself by means of shears.

As long as the supply lasts we offer this wire as described above to our customers at the very low price of 20c a pound. Add postage or we will ship express collect. Order at once.

Electro Importing Co., 231 Fulton St., N.Y.C.

How I Invented the Crystal Detector

By Dr. G. W. PICKARD

(*Continued from page* 325)

great improvement over the coherer, I soon found that it, also, had defects. Severe static or nearby sending would usually cause a partial or complete paralysis of the contact, curable only by the hit-or-miss process of repeatedly jarring the detector so that new contact points were formed, or the old ones unwelded. Even in the absence of severe electrical disturbances, the contacts gradually became, as it were, fatigued, and the signals weakened toward inaudibility, unless periodically restored by jars. Then, also, the microphone detector lived up to its name by acting as a microphone, picking up any slight sound or vibration in a most annoying way. Finally, even if the detector was screened from sounds and jars, it was prone to develop a hissing or frying sound, which overlaid faint signals to their obliteration.

The Contact Detector Is Invented.

In the first part of the year 1902, the American Wireless Telegraph and Telephone Company erected stations at Atlantic City and Cape May, N. J., about 40 miles apart, and also equipt the schooner *Pleiades* as a floating experimental station. On May 29, 1902, I was in the Cape May station, experimenting with a new system of tuning, and receiving signals from the *Pleiades*, then about two miles off Cape May. The detector I was using consisted of several fine sewing needles, laid lightly across a pair of carbon blocks, and in series with three cells of dry battery and a telephone receiver. Becoming annoyed at the microphonic "fry" of my detector, I attempted to check this by, as I thought, cutting out of circuit two of the three dry cells. The frying ceased, and the signals, tho much weakened, became materially clearer thru being freed of their former background of microphonic noise. Glancing over the circuit, I discovered to my great surprise that instead of cutting out two of the three cells, **I had cut out all three**, so, therefore, the telephone diafram was being operated **solely by the energy of the receiver signals.** A contact detector, operating without local battery, seemed to me so extraordinary, so contrary to all my previous experience, that altho I did not then know the reasons for its operation, I appreciated its possible great value to the art, and resolved at once to thoroly investigate the phenomenon at the earliest possible moment. This entirely accidental discovery was the foundation of my invention of the crystal detector.

Silicon and Other Detectors Invented.

During the summer of 1902, I was concerned with the development of a system of radio-telephony, conducting this work in the Boston laboratory of the American (Bell) Telephone and Telegraph Company. As one of the essential elements of this system was a detector which would respond quantitatively to telephonically modulated electrical waves, I at once began a series of tests, first with the form of the carbon-steel microphone I had used at Cape May, and then with other contact materials. Discovering that such detectors responded quantitatively to musical spark signals up to at least 2000 sparks per second, and were therefore capable of receiving speech, I devoted my energies for the time to the transmitting end of the system, finally discovering, in the fall of 1902, an effective means of telephonically modulating a stream of electrical waves. Returning to the detector development, I found that the Telephone Company had in their laboratory a large quantity of magnetite ($FeO.Fe_2O_3$) crystals, which had been procured as a possible material for loading coil cores. I broke one of these crystals apart, exposing a fresh fracture face, made a small area contact thereon with a brass point, and found that this crystal, like the carbon steel detector, operated well without local battery, but, unlike the carbon-steel contact, did not require a light or microphonic contact for best operation. In the period 1902 to 1906, I tested many different minerals and combinations, including magnetite, pyrite, galena, molybdenite, silicon and zincite. Much development was also required on holders for these minerals. Perhaps one of the greatest early stumbling blocks in such development was the old coherer idea that extremely light pressure contacts were necessary. With the carbon-steel microphone, this was still true, but I can remember my surprise when I found that many of the minerals worked best with quite high pressure contacts.

31,250 Crystal Detectors Invented.

A list of the several thousand materials I have tested would make dry reading. *Suffice it to say that I have found some two hundred and fifty minerals and furnace products which make operative detectors, either against metallic contacts, or in combination with other minerals. The possible combinations of these two hundred and fifty substances, amounting to some* 31,250 *pairs, have all been tested by me, or by my assistants, and many hundred useful pairs have been found.*

Oscillating Crystal Detectors.

The last word on crystal detectors and their uses has yet to be written. **For example, it may be of interest to know that they can be made to OSCILLATE, under proper circuit conditions, and I have found it possible to receive intelligible signals from UNDAMPED wave stations across the Atlantic, on a simple contact between a fragment of galena and a fine wire.**

MOTHER SHIPTON TOLD OF AVIATION IN 1488.

The following, which is known as "Mother Shipton's Prophecy," was first published in 1488, republished in 1641 and again in 1875. It will be noticed that all the events predicted in it except the last two lines have come to pass:

Carriages without horses shall go;
And accidents fill the world with woe.
Around the world thoughts shall fly,
In the twinkling of an eye;
Water shall yet more wonders do;
How strange, yet shall be true.
The world upside down shall be,
And gold be found at root of tree.
Through hills men shall ride,
And no horse or ass be at his side.
Under water men shall walk,
Shall ride, shall sleep, shall talk.
In the air men shall be seen,
In white, in black, in green.
Iron in water shall float
As easy as a wooden boat.
Gold shall be found, and shown
In a land that is not known.
Fire and water shall wonders do,
England shall at last admit a Jew.
The world to an end shall come
In eighteen hundred and eighty-one.

(It is curious to note that only the last two lines—WHICH DO NOT RHYME—have failed to come true. All the others that do rhyme did come about as prophesied!—Editor.)

www.americanradiohistory.com

THE ONLY VACUUM TUBE WHICH AMATEURS CAN USE



Fleming Pat. No. 803684
De Forest Pat. Nos. 841387-879532

Agreements recently effected have made vacuum tubes available for experimental use. The Marconi V. T. is the only vacuum tube, or audion, which may be sold to amateurs, laboratories, schools of instruction and experimenters.

MARCONI V. T.

$7.00 each

Standardized base $1.50 additional

A highly developed, all-around tube for use as a detector and amplifier in wireless communication. It has practically the same electrical constants as the tube used by the Allied armies and navies throughout the war in continuous wave transmission and reception. The terminals of the elements of the tube are brought out to a 4-prong standardized base, fitting into the standard four-contact bayonet sockets.

Filament current, 0.7 ampere. Filament potential, 4 to 6 volts.
Plate potential, 20 to 60 volts for reception.

For lighting filaments a *lead* storage battery is preferable because of its constancy of voltage. Ordinary dry cells or flashlight batteries may be used to provide the plate voltage.

The approximate operating life of the MARCONI V. T. is 1,500 hours.

Delivered postpaid in special container insured against breakage to any address upon receipt of purchase price.

COMMERCIAL DEPARTMENT

Marconi Wireless Telegraph Company of America

Sole distributors for De Forest Radio Telephone & Telegraph Co.

Woolworth Building, 235 Broadway, New York

www.americanradiohistory.com

HALCUN
BAKELITE AUDION PANEL

A die molded panel. 5" by 9" 3/8" thick. A beautiful permanent glossy black. Wires and all connections molded right into the panel, entirely concealed, impossible to corrode or become loosened. Switches all of the bearing type, large shafts to prevent wear.

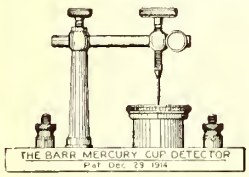
All metal parts nickeled. Connections arranged for damped spark, undamped arc, regenerative and ultra connections. There is nothing like this panel on the market. It is a quality article thruout. Other manufacturers ask more for wood and thin sheet panels.

The Halcun panel is 3/8" thick with a beveled edge provided with supporting brackets. Price, less bulb, prepaid **$12.50**

Our big full-line catalogue 6c.

HALCUN RADIO CO. 437 Market St. San Francisco, Cal.

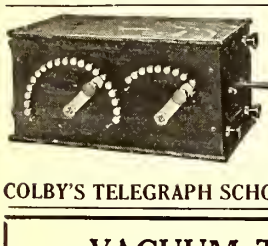
THE BARR
MERCURY-CUP WIRELESS DETECTOR



The most efficient Detector on the market. Tested by the United States Government and Marconi Wireless Telegraph Co.

Increases the efficiency of every wireless receiving set by making the signals clear, sharp and distinct.
Instantly adjustable at a constant pressure.
For full information and price—write
THE BARR MERCURY-CUP DETECTOR
169 Columbia Heights Brooklyn, N. Y.

Arnold **Loose Couplers**
Combination Loose Coupler Parts and accessories.
Send 3c stamp for literature which is sure to interest you.
J. F. ARNOLD **2082 Lexington Av. N.Y. Established 1910**



ONLY $10.50
"I am highly pleased with my Colby tuner. Richard F. Morse, 818 Julia St., Jacksonville, Fla." Send 3-cent stamp for bulletin.
COLBY'S TELEGRAPH SCHOOL, AUBURN, N. Y.

VACUUM TUBES
In Wireless Communication
The only book on the subject. Written by E. E. Bucher, author of "Practical Wireless Telegraphy". Price $1.75.
Wireless Press, Inc. 233 B'way, N. Y.


Actual Size

AMERICAN ELECTRO TECHNICAL APPL. CO.
235 Fulton St., N. Y. City Cort. 3153
Batteries,-special type for Audions
Switch Points—Binding Posts, Knobs —Levers—Rods—Sliders, Etc.
All parts for the Amateur to make his own Apparatus.

AMATEURS! DO NOT OPEN TRANSMITTING STATIONS
without first learning to send and receive radio MSGS.
WILGO WIRELESS PRACTICE SET



The first need of every amateur. Hightone buzzer and key for learning code. Also for test buzzer and four other purposes. With code, wiring diagrams and instructions.
$1.00 Postage Extra
Our new cat. "E" of electrical and wireless apparatus and code chart sent for 3c stamp.
THE WILCOX LABORATORIES LANSING MICHIGAN

E. F. W. Alexanderson Wins "I. R. E." Gold Medal

At the May meeting of the Institute of Radio Engineers held in New York City, May 7th, E. F. W. Alexanderson, consulting engineer of the General Electric Company, was awarded the gold medal of the institute in recognition of his original research and inventions in the radio field.

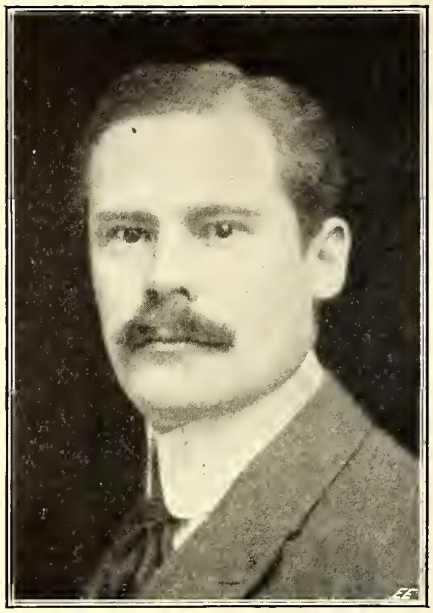
In accepting the gold medal, Mr. Alexanderson said:

Such great strides have been made in all fields of science and engineering during the emergency of our late war that I feel it a specially high honor to receive the Radio institute medal at this time.

"The radio art has drawn its talents from almost every profession. Broadly speaking, radio men may be classified as radio physicists, radio engineers and radio amateurs. In a sense we are all amateurs and we shall never know who was the first amateur. We do know, however, that the first radio physicist was Hertz who discovered and determined in his laboratory the laws of electromagnetic radiation. We also know that the first radio engineer was Marconi, who made the first use of electromagnetic waves for practical communication and developed the wonderful system which for the last 20 years has made the high seas safe for navigation.

"Fessenden conceived the possibility of bringing radio engineering within the realm of power engineering, and it was my privilege, due to connection with the General Electric Company, to develop the first radio frequency alternator. Indeed it was thru the work which this Company was requested to do for Fessenden that my interest in radio communication was first excited, and this has resulted in the contributions which I have had the opportunity to make to the radio communication of today.

"Radio telephony is a by-product of the development of sustained radio waves as a method of alternating current power transmission. With the previous system of spark telegraphy it was no more possible to transmit the modulation of the human voice than it would in land telegraphy to reproduce speech from the dots and dashes of the Morse code. But with the sustained energy of the continuous wave, it has become possible to put a dynamo electric machine behind the wave and vary the flow of power in correspondence with the modulations of the human voice, thus making long distance radio telephony possible.



E. F. W. Alexanderson, Well-known Radio and Electrical Engineer, Awarded the "I. R. E." Gold Medal.

"Mr. President and members of the institute, it has been a privilege to be connected with the great development in radio in the last years and I wish to express my deeply felt appreciation of the recognition represented by this beautiful medal. I thank you."

Concentrated or Loop Aërials

(*Continued from page* 328)

from B to D no sound, and then from D to C another rise and fall of intensity, the maximum in each case occurring when the plane of the loop is along 30-210° line but the signals in A B sector are about twice as loud as in C D sector; this gives the direction of signal in direction of arrow. If however the connections of Fig. 4, are used then the result will be as shown in Fig. 6. The signals will be much louder and will be heard only in the A B sector, thus making it strictly *undirectional.* If the loop be grounded on the grid side, then Fig. 7 shows the result, i. e., *loud signals but NO directional effect whatever.*

Fig. 3 shows the connections when it is desired to receive on other than the wave length of the loop. In practice it will be found to be simpler to have several loops of proper wave lengths rather than be bothered with a tuner.

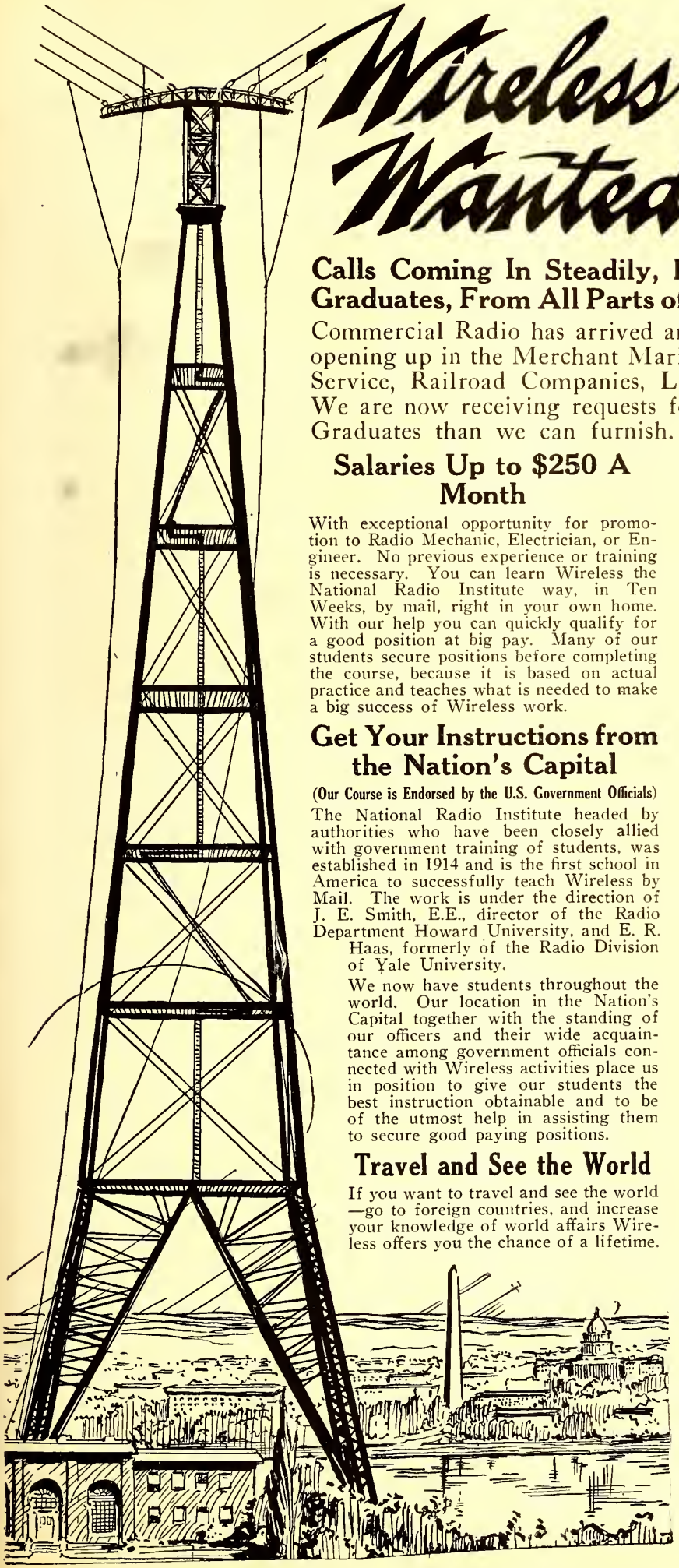
As many navy and army operators know, the loop eliminates a lot of interference and also static. However, if it is desired to eliminate static more effectively, then it is necessary to take the loop and outfit into the cellar or under ground. Signals will be found to come in just as loud as tho an elevated aërial were used, but the static will be absent, *even in the midst of a thunder-storm* when an ordinary aërial "spits fire."

The loop shown in the photo and diagram Fig. 8, consists of 240 turns of No. 22 S. C. C. and with a 43 plate variable condenser has a range of from 2,000 to over 3,000 meters. Larger loops can be made if it is remembered that the same length of wire is required. The inductance is determined by the area turns, and hence a small loop will act about as well as a large one. If several loops are operated simultaneously from known points, but separated some distance, the exact location of the sending station can quickly be determined. And further if the circuit of Fig. 4, is used a very large amount of interference on the same wave length can be eliminated, since only such stations as lie in the region from 150° to 270° will be heard at all, while receiving from 210° and as the outfit tunes sharp much of this is cut out. By carefully adjusting the apparatus as good receiving can be done on the loop as with the ordinary aërial, and all other features will be additional. *Stations 200 miles away can be located to a pin point on the map.* Thus the Radio Amateur has opened to him a wide field that will make possible better work with less bother.

RADIO TELEPHONE BETWEEN ROME AND TRIPOLI.

Wireless telephone communication is maintained between Rome and Tripoli, 600 miles apart, mainly over water.

www.americanradiohistory.com



Wireless Operators Wanted—At once

Calls Coming In Steadily, For National Radio Institute Graduates, From All Parts of the Country.

Commercial Radio has arrived and thousands of positions are now opening up in the Merchant Marine, Aerial Mail and Land Station Service, Railroad Companies, Lake and Ocean Steamship Lines. We are now receiving requests for more National Radio Institute Graduates than we can furnish.

Salaries Up to $250 A Month

With exceptional opportunity for promotion to Radio Mechanic, Electrician, or Engineer. No previous experience or training is necessary. You can learn Wireless the National Radio Institute way, in Ten Weeks, by mail, right in your own home. With our help you can quickly qualify for a good position at big pay. Many of our students secure positions before completing the course, because it is based on actual practice and teaches what is needed to make a big success of Wireless work.

Get Your Instructions from the Nation's Capital

(Our Course is Endorsed by the U.S. Government Officials)

The National Radio Institute headed by authorities who have been closely allied with government training of students, was established in 1914 and is the first school in America to successfully teach Wireless by Mail. The work is under the direction of J. E. Smith, E.E., director of the Radio Department Howard University, and E. R. Haas, formerly of the Radio Division of Yale University.

We now have students throughout the world. Our location in the Nation's Capital together with the standing of our officers and their wide acquaintance among government officials connected with Wireless activities place us in position to give our students the best instruction obtainable and to be of the utmost help in assisting them to secure good paying positions.

Travel and See the World

If you want to travel and see the world —go to foreign countries, and increase your knowledge of world affairs Wireless offers you the chance of a lifetime. However, you are not obliged to travel, but may secure a permanent position at one of the big Land Stations, Railroad, Telegraph, or Steamship Companies if preferred.

Pay As You Learn

Our plans of payment bring a wireless education within the reach of anyone who desires to learn. A small payment down on our convenient payment plan, and small following payments, often enables our students to earn the cost of their tuition while actually learning to be a wireless operator.

Free Instruments to Every Student

In addition to 5 text books—35 Special Lessons, and 18 Personal Examinations we send you, while taking our course a Standard Automatic Wireless Transmitting and Receiving Set for sending and receiving messages. These fine instruments are Free only to National Radio Institute Students.

Oldest Wireless School in America

In addition to being the oldest and largest Wireless School in America our location in the Nation's Capital enables our Students Employment Department to keep in close touch with the best openings for our graduates. A Post Graduate Course is given Free to every graduate. Special discounts are allowed to discharged soldiers, sailors, and marines with former wireless experience and to Radio amateurs.

FREE

Our booklet "Wireless the Opportunity of Today," gives you complete information in regard to our course, the quick and easy methods by which you can master wireless, and other important facts you should know. It is free. Just mail the coupon. No obligation whatever on your part.

Mail This Coupon Today

National Radio Institute
Department 90
Washington, D. C.

Send me free of charge, your booklet, "Wireless the Opportunity of Today," with full particulars regarding your famous 10 weeks Home Study Course, and your Special FREE INSTRUMENT OFFER.

Name .....

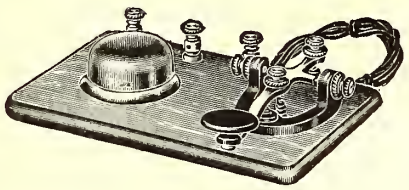
Address .....

Town..... State.....

www.americanradiohistory.com

Wireless Receiving Ban Raised

MESCO WIRELESS PRACTICE SET



The Practice Set comprises a regular telegraph key, without circuit breaker, a special high pitch buzzer, one cell Red Seal Dry Battery, and four feet of green silk covered flexible cord.

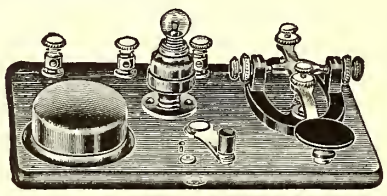
The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes.

List No.		Price
342	Telegraph Practice Set, with Battery and Cord	$3.24

Weighs 4 lbs. packed.
Price does not include postage.

MESCO Combination Practice Set for Learning the Morse and Continental Visual and Audible Codes

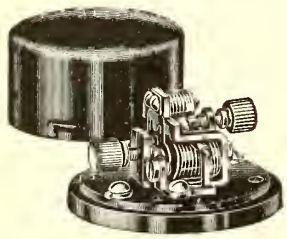
This outfit is the only reliable instrument which will enable students to become proficient operators in the U. S. Naval Service, because it is equipped with a buzzer and miniature lamp enabling the user to master both the visual and audible signals quickly.



List No. 52—Practice Set with Red Seal Battery and Cord $4.05

Weighs 4 lbs. packed. Price does not include postage.

MESCO RADIO BUZZER



This buzzer maintains a constant note and is recommended as an exciter for checking wavemeters where pure note and ample energy are required.

It consists of practically a closed circuit field of low reluctance, having a steel armature to which is riveted a strap supporting a movable contact. The armature tension is adjustable by means of a screw with a milled head large enough to be easily and permanently adjusted with the fingers. The stationary contact is adjusted by means of a similar screw. The magnet coils are connected in series with a total D. C. resistance of 3.9 ohms. Shunted across these coils is a resistance having a D. C. value of 3 ohms. This shunt eliminates all sparking such as occurs at the break on ordinary radio buzzers and the energy saved thereby is transferred into any oscillating circuit connected to it, the result being that this buzzer as constructed radiates five times more energy than any other existing type. All connecting wires liable to be broken are eliminated. Contacts are of genuine platinum, which is essential in order to maintain a constant note. The parts are mounted on a Condensate base to insure constancy in operation.

Diameter 2 in., height 1¼ in. The cap is attached to the base by a bayonet joint.

List No.		Price
55	Mesco Radio Buzzer	$2.05

We carry a Large and Complete Line of Standard Wireless Material Recognized by Experts as such with Competent Experienced Wireless Attendants in Charge

Send for the New Edition of Our Catalog W28

It is pocket size, contains 264 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Wireless Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

Manhattan Electrical Supply Co., Inc.

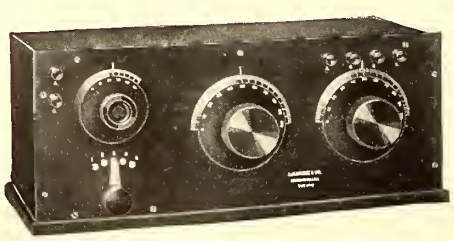
17 Park Place, New York, N. Y.

CHICAGO
114 S. Wells St.

ST. LOUIS
1106 Pine St.

SAN FRANCISCO OFFICE: 604 Mission St.

INSTALL A NEW GREBE REGENERATIVE RECEIVER In Your Radio Station



Short-Wave Regenerative Receiver Type CR-2

This Receiver is intended for long distance relay work on wave-lengths between 170 and 580 meters and embodies a highly developed circuit employing continuously variable inductances of the variometer type as well as a number of new mechanical features.

Various models designed to operate on wave length ranges from 170 *to* 20,000 *meters are described in our bulletin sent free upon request.*

A. H. GREBE & CO., Richmond Hill, New York

Radio-Planes Watch Forests and Ranches

(*Continued from page* 295)

stations erected about the ranch. The installation and maintenance cost of these stations is relatively small in any case. They have also been so greatly simplified during the war that practically anyone can be instructed in handling the talking and receiving apparatus in a short time. Some of these sets work as simply as the ordinary telephone.

Airplanes and Radio Serve to Protect Nation's Forests.

Recently the use of *airplanes* to patrol the forests and watch for incipient forest fires was extended by the Government and now the *wireless telephone* has been installed for an experimental trial. If found to be practicable the wireless will be extended to cover the great woods with an invisible net of communication.

The wireless is expected to be an improvement upon wires or cables for one very important reason. In the past great difficulty has been experienced in maintaining wire communication in the forests because of the interruption to the service caused by falling timber, especially in the stormy season. Snowslides have been another source of destruction to the wires. The use of wireless, of course, obviates all such difficulties.

For the purposes of the present experiment the Signal Corps of the Army has lent to the Forest Service four combination sets of transmitting and receiving apparatus. One set of the equipment is to be installed on Mount Hood at an elevation of about 13,000 feet, and another at the nearest forest ranger station, about twelve miles away. Two other sets are to be placed in the Clearwater Forest region of Idaho, which is a very heavy wilderness country.

All of the wireless stations will be establisht at *look-out points,* where watch is kept for forest fires, and will supplement the regular service, which not so long ago was augmented by the addition of airplanes for patrol. Now two additional airplane routes for that purpose have been mapt out, both operated from Mather Field, near Sacramento, Cal. The other two routes of the airplane service are operated from March Field, near Riverside, Cal.

The first route from Mather Field will cover the northern parts of the Eldorado and Tahoe forests on the valley side of the Sierras. The planes will start from Mather Field each morning and proceed to Oroville by way of Placerville, Colfax, Nevada City and Strawberry Valley. A landing will be made at Oroville, where a suitable field has been provided. The return trip will be made in the afternoon.

The second route from Mather Field will cover the southern parts of the Eldorado and Stanislaus forests. Starting from Mather Field, the route runs to Placerville, Grizzly Flat, Big Trees, and to a landing near Sonora or Tuolumne. In this case also the return trip will be made in the afternoon. Each of the Mather Field routes has a round-trip length of about 150 miles.

Forest Service reports tell of a successful trial patrol undertaken recently under test conditions. No difficulty was experienced in detecting fires in heavy timber at elevations of from 6,000 to 10,000 feet.

Peculiar interest attaches to the movement for conservation as affecting North Carolina, Tennessee and Kentucky because of the potentialities involved.

www.americanradiohistory.com

NEW SUBSTITUTE FOR PLATINUM.

The question of substitutes for platinum has received almost world-wide attention, many nations having been obliged to devise something. Most of the platinum came from Russia before the war. Germany was no exception. Some of the recent substitutes are enumerated in a German paper. The most important seems to be that suggested by Gotthold Fuchs, of Berlin, consisting of a wolfram-gold-nickel alloy which can be cast, forged and rolled, is of light color and polishes brightly, which platinum does not. Another substitute is an alloy of silver, wolfram and nickel. Both these alloys are stated to be acid resisting. A nickel-iron alloy, known as platinit, is said to be serviceable as a substitute for platinum in glow lamps, its coefficient of extension being similar to that of glass. For laboratory purposes an alloy of nickel and chromium affords a platinum substitute for wire and sheets, but cobalt alloys, such as cobalt-iron and cobalt-chromium are as serviceable, especially for acid-resisting purposes.

Peacetime Uses for War Inventions

By H. Winfield Secor

(*Continued from page* 298)

The illustration in Fig. 7 shows two applications out of many for the once busy *U-boats*. America and the other Allied countries can make use of all the superfluous U-boats without a doubt. For exploring the *flora* and *fauna* of the undersea regions they are ideal. They can be fitted with powerful electric projectors, observations lenses and windows, when not only can visual observations of the deep sea life be studied, but even motion pictures can be taken. And for pleasure trips at the seaside resorts—I would hate to have the job of figuring up how many five dollar bills one could rake in, in a single Saturday afternoon, with one of these pleasure submarines at Coney Island, not to mention the Beach at Coronado, Calif., and who would not like to explore the secrets of the Great Lakes? We have heard of the chap who endeavored to dash over Niagara Falls in a rowboat, and no doubt we shall soon hear of the enterprising fun-promoter, who will, for a consideration of $25.00 or so, invite you for a trip over Niagara in one of the former Kaiser's plush upholstered U-boats. Plush upholstered is right, and we would like to have it about nine feet thick.

In order to attract the sea and lake fishes for the edification of the passengers aboard, we can imagine that some genius will roll up his sleeves and get busy developing a "food gun" which can be attached to the torpedo tube. Presto! Push the button and out flies a perfect barrage of fishsome dainties for our piscatorial neighbors, when they will come bounding forward in great flocks, much to the delight of the submarine's guests, snapping their teeth gladly and otherwise showing how delighted they are.

The *Submarine Detector,* which is shown in Fig. 8, and which was wonderfully perfected during the World War, should find many peacetime applications, particularly on all ocean-going and inland lake vessels for the purpose of locating other vessels in a fog or at night, and also for accurately locating the presence of icebergs and reefs. The submarine detector, of which several different types were developt during the war, operates on one general principle, that of *sound wave transmission thru the water.* The sound produced by the propeller and driving motors or en-

(*Continued on page* 378)

BRANDES WIRELESS HEADSETS



Score 100% efficiency in actual use

"Superior" Set $6.

CLEAR IN TONE — LIGHT IN WEIGHT — DEPENDABLE IN SERVICE

Sharp, unblurred, readable signals assured by

"BRANDES MATCHED TONE"

We achieve this by perfectly matching the tone of both receivers in each set. This eliminates all confusion to the ear due to unmatched harmonics.

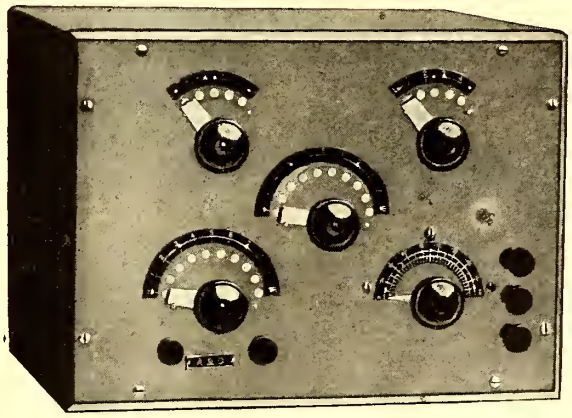
YOUR RECEIVER IS **RIGHT** IF IT'S A "BRANDES".
Used by many U. S. Gov't experts, and experts abroad, by colleges and technical schools, and by professionals and amateurs everywhere.

TRIAL OFFER—Brandes Wireless Headset sent to you on trial for 10 days. Test it; compare it with others, for sensitiveness, clearness, distance. Prove for yourself the fine quality, the "matched tone". The two diaphrams, toned exactly alike, strengthen the signals and prevent blurring. If, for any reason, you are dissatisfied, your money back without a question.

Send 4c for catalogue E

C. BRANDES, Inc.
Room 814
32 Union Square **New York City**

UNIVERSAL RADIO APPARATUS



Type UL-5 Receiver

It is the policy of this company never to consider a sale completed until the customer is thoroughly satisfied. Incidentally our instruments seldom fail to satisfy, because they are scientifically designed and built on honor. If you are interested in radio apparatus of the highest grade at fair prices, enclose a 2-cent stamp for our catalogue.

Type UL-5 Receiver.

This is a complete receiver for undamped waves up to 17,000 meters. No external coils, couplers or condensers are needed, since it is entirely self-contained. Sizes 8" x 12" x 7" approximately.

We control the patent rights for the Mignon System and can supply these instruments.

UNIVERSAL RADIO MANUFACTURING CORP.
Dept. W **Elmira, N. Y.**

www.americanradiohistory.com

ANY YOUNG MAN

earning less than $200 per month will find it to his interest to enter the wireless field as a vocation.

We prepare you in 20 weeks, through our correspondence course, for splendid positions and obtain same for you immediately on graduation.

We also pay back a considerable portion of the tuition fee after the student has completed the course.

Write for Booklet and Details

SERVICE RADIO SCHOOL

Largest Radio School in the World

Dept. E, 900-2 Pa. Ave. Washington, D. C

PROGRESSIVE RADIO APPARATUS



To what reasons can the popularity of De Forest Radio Apparatus be attributed?

Is it because of its consistent performance, excellent workmanship, materials, low prices?

These would account for it partly. The real reason must lie in the fact that we have always been in the van. Design and system employed have been so far in advance of others as to overshadow our rivals.

The De Forest Company is one of the recognized successes in the radio field. Our success has been progressive—more than merely financial, because we give better service—more for your dollars—most modern apparatus—than you can obtain elsewhere.

We do not aim to sell the most radio apparatus—only the best. Quantity is a secondary consideration.

We were the first to produce the audion amplifier and the oscillion undamped wave transmitter, and its popularity is attested by its wide use.

Our latest productions, the Honey Comb Coils, Unit Set, Coil Mountings, Two Step Amplifier and Audion Control Box have been greeted with enthusiastic demand far exceeding our expectations.

The Unit Receiver fills the demand for a really efficient receiver for any and all wave lengths of any preferred circuit and design without the usual costly cabinet and expensive assembly.

We have been literally swamped with orders, so do not feel surprised when your dealer tells you it will be necessary to wait a few weeks before you can get delivery.

By placing your order now you will avoid the greater congestion in our factory when the purchasers of this meritorious apparatus of novel design begin enthusiastically recommending it to their friends.

DE FOREST RADIO TEL. & TEL. CO., 1415 Sedgwick Ave., New York City

Faradic Currents—How To Apply Them

(*Continued from page* 318)

eight minutes or at the outside fifteen minutes is long enough for a treatment. The exceptions to this rule are in the treatment of some chronic diseases, as chronic articular rheumatism, etc., and in general electrizations, where a little longer time might be allowed.

No definite rule holds as to the frequency of sitting, as much depends upon the nature of the disease, the sex, age and habits of the patient. Some acute cases require daily sittings, seldom more than that. In chronic cases from two to four times a week may be enough.

Constipation

Connect the rectum electrode to the *negative* pole of the battery and place it in the anus. At the same time the *positive* over the stomach, liver and bowels. Use the *secondary* current. A small internal dose of cascara sagrada will sometimes prove beneficial. However, the use of cathartics, as a rule, is not advisable, and the above treatment is much better without them. Eat good plain digestible food. A dish of oatmeal and milk eaten in the morning will help to regulate the bowels.

Corns.

Place the foot upon the foot plate, it being attached to the *negative* pole of the battery and apply the *positive* pole directly to the corn, using a small piece of sponge fastened to the ear electrode. Treatment should last about ten minutes daily. Use the *primary* current.

Canker.

This is caused by indigestion. Let the patient live upon a light milk diet for a few days. Thoroly wash the mouth and throat frequently with borax or boracic acid diluted with water. Electrical treatment: Place the *positive* at the nape of the neck on the spine and apply the *negative* to the stomach. This treatment should last about ten minutes. Use *secondary* current. Another treatment is to place the tongue electrode in the mouth having previously attached it to the *positive* pole of the battery and apply the *negative* to the neck and throat. Use *primary* current. A general tonic treatment two or three times a week will be beneficial.

Diabetes.

Diabetes seems to be a nervous disease, and for that reason we recommend what is called *Central Faradization*. The object is to bring the whole central nervous system under the influence of the primary current. Place the *negative* pole at the pit of the stomach and pass the *positive* over the head and forehead, down the back of the neck and along the whole length of the spine. Use a very light current about the head and increase gradually. Do not apply the current to the head more than one or two minutes at a time. The spine will stand a much stronger current than the head. The back may be treated about five or six minutes. After this give tonic or general treatment for ten minutes, with the *secondary* current.

Death—Apparent.

People who have to all appearances been dead, have been restored to life by electricity. The test is as follows: Place the sponge electrode (*positive* pole) to the back of the neck, and apply the *negative* to the body over the lungs and heart. A mild *secondary* current is first used, gradually increasing it until the patient shows signs of life. Keep this treatment up for about five minutes, also apply the *negative* electrode to the arms, wrists and hands. Now sponge the whole body with the *nega-*

(*Continued on page* 371)

www.americanradiohistory.com

DESTROYER FLOTILLA NAVIGATED 1,100 MILES BY DIRECTIONAL WIRELESS.

Seven links in the chain of naval destroyers stretched across the Atlantic by the United States Navy for its transoceanic flight reached their Newfoundland base after traveling from New York enveloped in fog from Fire Island to Trepassey Bay, thus navigating 1,100 miles entirely by directional wireless, with which the Transatlantic seaplanes were equipt. The trip was said by Captain Arthur Crenshaw, base commander, to have been one of the severest tests this means of navigation ever had. The destroyer Philip became separated from the flotilla in the fog, but she entered the harbor soon after her companions.

To War On An American Destroyer

By A. H. Whedon

(Continued from page 329)

Of course, a certain amount of roll and pitch is to be expected—but a destroyer of a very nervous disposition just can't be still at all!

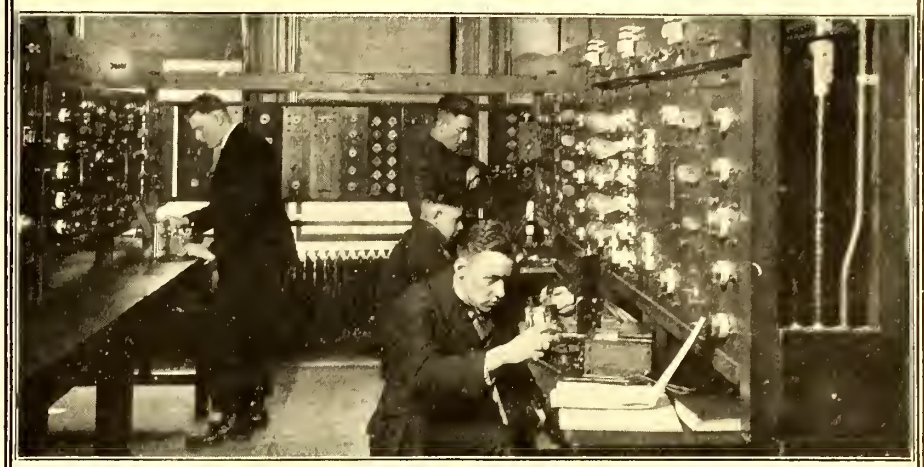
The largest roll that we made while I was on the *Conyngham* was seventy-two degrees to starboard and sixty-eight to port. That is in the ship's log, and signed by the Captain. And, friends and fellow citizens, I maintain that *that* was sure *some roll.* Try it once and see. A destroyer is always rolling at sea, and in a storm she is one great "dance artist."

The *radio shack* is mounted either way forward or way aft, in the place most calculated to get the benefit of the rolling and pitching. Of course, it is superfluous to mention the fact that everybody from the oldest salt down to the newest rookie gets sea-sick on the first trip to sea on a destroyer. The rookies come aboard expecting to be sick. But when a "gob" wise in the ways of ships (big ones) comes aboard, he proclaims for all to hear that he has been going to sea too long to get sea-sick. The day comes when we go to sea. The next day friend "gob" fails to rise for breakfast—not that he is sea-sick or anything like that, y' understand, but simply that last night's chow must have disagreed with him. By noon time he joins the rest of the gang at the lee rail, actively engaged in the sport technically known as "feeding the fishes." Yea, verily, 'tis a great life until you get used to it. And nine-tenths of the sailors get so that the more she rolls, the better they like it.

But now consider the case of the poor radio man, who is forced to sit for at least four hours before his set, never getting up from his chair and never taking his receivers off. Every time the ship takes a big roll he rolls with it, unless his chair is screwed to the deck—but they never are—and there is a wild scramble to hold on to pencils, pads, code books, and other loose articles that have a tendency to hide under power transformers, switchboards, or any other place where it is deuced hard to recover them.

At the first calm spot, the "op" nervously attempts to readjust his detector, and succeeds in making things worse. So he shifts over to the audion and thinks his troubles are over. So they are until he discovers that the filament battery is run down and needs recharging. Then follows a choice line of briny "cuss" words. About this time the boat decides to take another roll, and the show starts all over again.

In between times, the "op," if he is new on a destroyer, realizes that he really isn't feeling well. Then he begins to wonder why he ever joined the Navy anyway. Of course, he can't leave his post to join



ONE OF THE SEVEN LABORATORIES

AT THE SCHOOL OF ENGINEERING OF MILWAUKEE

Where ELECTRICITY Is Taught Quickly And Thoroughly

Become an Electrician in One Year

or learn an electrical trade in six months. Greatest of all professions open to you. "Forty billions will be invested in Electricity in next five years," says Edison. Salaries are high. Demand for TRAINED electricians ENORMOUS. Think of electric lighting, electric street cars, electric railway trains, electric telephone and telegraph, electric motors, electric automobiles, electric cooking and heating. Electricity in the air and under the sea. Is it not dazzling?

Field Limitless—New—Uncrowded

Our forty professors of the three departments teach the laws and principles of electricity. Actual training in laboratories; lectures and problems. No special schooling required to enter our practical electrical, electrotechnician and trade courses.

"Earn While You Learn" if you wish. We arrange half-time employment that will help you defray expenses. Athletics, Glee Club, Lakeside Advantages. Board and Room at Students' Fraternity House at cost.

Catalog explains in full. Send for it.

SCHOOL of ENGINEERING of MILWAUKEE

102-373 Broadway, Milwaukee, Wis.

Clip Here

MAIL THIS COUPON TODAY—RIGHT NOW

SCHOOL OF ENGINEERING OF MILWAUKEE
102-373 Broadway, Milwaukee, Wis.

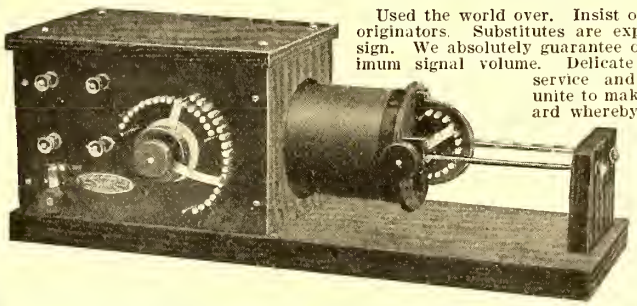
Without obligating me, please furnish details of course (or courses) marked below.

Electrician, 1 year — One Year Drafting Course
Electrotechnician, 1 to 3 years — Six Months Trade Courses
Electrical Engineer (3 years) B.S. Degree — Extension or Home Study Courses

Name .....
Address .....
City ..... State .....
Age ..... Education .....

TRACO QUALITY

RECEIVING TRANSFORMERS



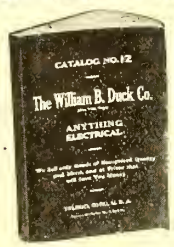
Used the world over. Insist on the genuine, built by its originators. Substitutes are expensive, irrespective of design. We absolutely guarantee our tuners to give the maximum signal volume. Delicate refinement, uninterrupted service and high class workmanship unite to make TRACO tuners the standard whereby all others are judged. If your Dealer does not handle them, order direct from us.

LIBERTY DETECTOR VALVES. RADIO AMPLIFYING PHONES, type used by the UNITED STATES, BRITISH and FRENCH GOVERNMENTS, now in stock, for sale.

Send stamps for bulletins.

The Famous 5A and 5C Models

THE RADIO APPARATUS CO., Pottstown, Penna., U. S. A.



DUCK'S BIG 300 PP. Wireless & Electrical

Catalog is now as it always has been, the largest and most complete and dependable Wireless Catalog published. Mailed for 12c in stamps or coin which may be deducted on first order of one dollar. Catalog not sent otherwise. This catalog costs us twice the price of other catalogs.

Everything in wireless *worth while* is listed in this catalog. The experienced amateur will tell you to see our catalog before buying. You are thereby insured against an unwise purchase. It is the *Beacon Light* to guide you right in the selection of your wireless apparatus. No bigger or better values are obtainable elsewhere. Send for revised price list. It is yours for the asking.

THE WILLIAM B. DUCK CO., 230-232 Superior St., Toledo, Ohio

www.americanradiohistory.com

AMPLIFY YOUR RADIO SIGNALS

With the new DETECTAGRAPH-TRANSMITTER, the amateur can amplify radio signals to such an intensity that he can hear the signals about his station without the need of the telephone head set.

By the addition of a loud talking telephone he is able to hear the messages many feet away from the instrument.

The super-sensitive DETECTAGRAPH-TRANSMITTER herewith shown is two and three-eighths inches in diameter, five-eighths of an inch thick and weighs less than three ounces. It is the most sensitive sound detecting device ever brought before the public.

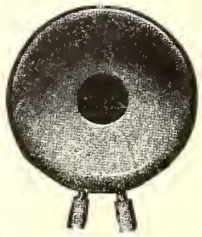
The manner in which the amplifying process is attained is by attaching with tape the DETECTAGRAPH-TRANSMITTER to the regular wireless receiver.

Not only is this instrument applicable for amplifying radio signals, but it can be used with equal satisfaction for magnifying other sounds. Phonograph music can be transmitted from one place to another by means of this instrument, and those who are afflicted with deafness will find enormous benefit by using this transmitter. It is the greatest device for building your own loud talking telephone, detectagraph and other devices. Can be used for any purpose where a sensitive detecting instrument is required.

SUPER-SENSITIVE Detectagraph MICROPHONE DEVICES



Our Super-Sensitive Detectagraph Transmitter. Price, $7.00 Complete



Our Special No. 25 Loud Talking Receiver. Price, $4.00 Complete



Detectagraph Rheostat, especially made for amplifying circuits. Price, $2.00 Complete



Super-Sensitive No. 40 Receivers to be used in connection with Detectagraph-Transmitters, $10.00



The Detectagraph Junior Deaf-Phone $15

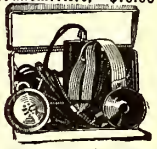
Equal to any $35 instrument made. Outfit consists of Super-Sensitive Transmitter with cord connector; Super-Sensitive Ear Piece with small black cord; Black Single Headband; Black Case and Two Batteries.



Model "B" Horn, with Loud Talking Receiver, Cord Plugs and Desk Stand Base. Price, $10.00 Complete



Model "C" Horn, with loud talking Receiver, Cord Plugs and Wall Base. Price, $10.00 Complete



Detectagraph $15

This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord, Receiver, Headband, Case and Battery.

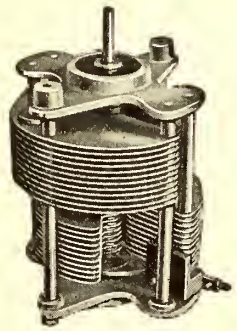
Order direct from ad.

Or write for free descriptive circular.

G. BOISSONNAULT COMPANY

26 CORTLANDT STREET NEW YORK CITY

Makers of Super-Sensitive Microphone Devices



Type 800

Balanced Variable Cond. Supplied in three sizes. Unmounted or mounted in nickeled brass case for use with oil or other liquid dielectrics

Radio Electrical Apparatus

Our new Bulletin Y offers a distinctive line of Radio and Laboratory apparatus including Transformers, Spark Gaps, Oscillation Transformers, Variometers, Variable Condensers, etc., in fact, the most complete line built by any single manufacturer in America.

Bulletin R describes the Cambridge alternating Current Rectifier for

STORAGE BATTERY CHARGING

Send 3c stamp for both bulletins

CLAPP-EASTHAM CO.

131 Main Street Cambridge, Mass.

You Need These Remarkable Books

No. 5. Wireless Construction and Installation for Beginners

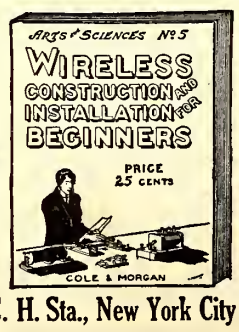
Describes in detail with *working drawings* how any handy boy can make his own apparatus at lowest possible cost. Describes simpler and cheaper apparatus than No. 6 Book. 73 pages—67 illustrations.

No. 6. Experimental Wireless Construction

Explains in detail with *working drawings* how to build wireless apparatus, how to erect the aerial, connect and operate. 86 pages—93 illustrations.

No. 3. Lessons in Wireless Telegraphy

Explains in detail the principles and apparatus for wireless from aerials to end losses and Audions.



Price, 25 cents each, Postpaid, Anywhere

COLE & MORGAN, Inc., *Publishers*, P. O. Box 473 C. H. Sta., New York City

his friends at the lee rail, but he must do something—quickly!! Ah—he grabs somebody's tin pail that is lying around, which is used to wash in. But friend "op" is not standing on ceremony, he wants action, and quick action—and he gets it!

The radio shack on the *Conyngham* was an inside room, and had no port-holes or other openings on deck. In order to provide for good ventilation, a small air vent was installed in the overhead of the radio room, leading out on deck. It was put in hastily, and was far from being watertight. When we hit a storm and the waves broke over the deck, lo! much "moisture" used to descend into the radio shack. In vain I pleaded with the ship's carpenter, and with tears in my eyes I begged him to fix that "gadget." But he was always doing something else. So I tried to see what I could do to it. When I got thru, it didn't leak, it poured! I had completely broken it. But I was triumphant. Now it would *have* to be fixt.

But we put to sea with the blame thing still busticated. It was the middle of December, 1917, and, for a change, the sea was unusually calm. Everything was all ski for two days, till we met the U. S. S. *George Washington* and the U. S. S. *Huron* to be convoyed into Brest. (This was before the *George Washington* became the Presidential ferryboat. Then, suddenly, all the furies of the sea and heavens turned loose. Everyone who was at sea in that part of the ocean will remember that storm to their dying day. For two days and nights we headed into it and gained but forty miles! Ordinarily the destroyers would have ridden it out with the storm instead of against it. But we had fifteen thousand U. S. soldiers to guard, and we stuck—! At last, even the troop-ships could stand it no longer, and we got a signal from the *George Washington* to "countermarch." That is, turn around and go with the storm. All that night we just drifted, taking things easy, and the next morning the storm had subsided enough for us to try to make port. There were times during those awful two days and nights when even the captain on the bridge remarked that we would never live thru it. And in the face of his belief, he refused to leave the troop-ships to the tender mercies of a stray submarine, for while no "sub" could work during the storm, there was bound to be a calm spell afterward when we would be needed. So we stuck—!

We finally reached port, but what a mess our division was! Of course, everything was absolutely swept clear of the decks. One destroyer even had a smoke-stack carried away, and another one had her main mast broken off. The *George Washington* had lost most of her life boats, and eight men had been washed overboard. The *Conyngham* escaped with very little damage. All our compartments were flooded, and of course there was nothing left on our deck in the way of sea chests, the carpenter's bench, etc. AND the radio shack! Just drift back a few lines to where I mentioned the broken ventilator and then on down further where I mentioned the storm. Two and two never made six—so you can imagine what our radio shack looked like. I had a young Atlantic Ocean in there—six inches of water rushing all over the deck and having a fine time playing with the power transformers and the Leyden jars, with *ye scribe* perched up on the desk, soaking wet and wondering who started this war.

And so it goes—as someone once remarked—"If we had some ham, we'd have some ham and eggs—if we had the eggs, ——etc." For those that like it the Navy is sure a fine playground, but personally I am better satisfied to sit here writing this short reminiscence in order to win a few extra pennies for a new pair of shoes for the baby!

www.americanradiohistory.com



COMMERCIAL WIRELESS

Splendid opportunities now in the MERCHANT MARINE for Wireless Operators. Salaries now being paid—Junior Operators, $85 per month; Chief Operators, $110; food and quarters included. Equivalent ashore from $35 to $40 per week. Interesting and fascinating work. Our graduates in all parts of the world as operators, instructors, inspectors, etc., etc. Students from all over the country. If you are interested in Commercial Radio let the EASTERN RADIO INSTITUTE train you. Endorsed by Marconi and Government officials.

SUMMER COURSES. Day or evening start any Monday. Send for prospectus.

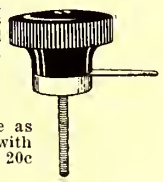
EASTERN RADIO INSTITUTE
899B Boylston St. Boston, Mass.





WIRELESS!

KNOB AND SWITCH LEVER—Mounted on brass bearing and shaft, threaded 6-32, two inches long. Lever securely fastened to knob. Each 40 cents, postage 4 cents.



KNOBS as illustrated above as used on Switch 1¼x¾ with hole for mounting, each 20c postpaid.

CONTACT POINTS 7/32x7/32 Brass with screw for mounting. Postpaid 25c per doz.

Bakelite-Dilecto panels, about

9½ x 19 x ¼	Black XX	$4.00
19 x 19 x ¼	Black XX	8.00
9½ x 19 x 3/16	Black XX	3.00
19 x 19 x 3/16	Black XX	6.00

A. H. CORWIN & CO.
924 Kinney Building Newark, N. J.

GET OUR PRICES

on the Wireless Apparatus you need. We handle New and Second-Hand instruments on which we can save you money.

All Second-Hand instruments guaranteed to be in perfect working order. What do U need?

Send us your list now

RADIO EQUIPMENT COMPANY
630 Wash'n St. Boston, Mass.

TELEGRAPHY

Both wire and wireless, and Station Agency taught thoroughly and quickly, BIG WAGES NOW PAID, some of our recent graduates procuring $138.00 per month to start. Great opportunities for advancement. Our school the oldest and largest—annual enrollment 600 students. Endorsed by railway, telegraph, wireless and government officials. Expenses low—chance to earn part. Catalog free. Write.

DODGE INSTITUTE, 22nd St., Valparaiso, Ind.

A Review of Radio-Telephony

(Continued from page 326)

from the Western Electric Company Engineering Organization to engage in this work. At this time plans were in the making for the tremendous aircraft program which was later undertaken by the Army, and it was clear to all that a successful means of communication between battle planes when flying in squadrons would be of inestimable value and would greatly increase the efficiency with which these squadrons could be maneuvered. The early work had shown such promise that there was justification for assuring the Signal Corps that this means of communication could be worked out successfully and applied to aircraft of various types. As a result of this conference, orders were issued by the Signal Corps for the Western Electric Company to undertake the development of a wireless telephone system for the purpose.

The problem now was to produce sets of minimum size and weight, physical structures which would withstand the extreme vibrations and jars encountered in flying, especially in landing, the most convenient disposition of control elements, suitable sources of power for both high and low voltage, and a form of antenna which would not interfere with the evolutions of a plane in squadron formation.

It was realized that the solution of the last mentioned problem would consume more time than was at our disposal, and while work was immediately started in the field on antenna measurements and study, the design of the sets proceeded on the basis of using a trailing wire antenna.

The working out of a practical helmet design proved to be more difficult than the success of the earlier experiments indicated. It was found that the degree of interference experienced changed very rapidly with slight imperfections in fit. The problem was also complicated by the necessity of providing means for using oxygen at high altitudes, and of providing for the comfort of the wearer over a period of several hours. It was found that a very slight amount of pressure on certain portions of the ear caused excessive pains and headaches after a very short period, and the final design was a compromise between comfort and efficiency as to sound insulation.

The problem of power supply was an interesting one. It was required that the weight should be reduced to a minimum, which precluded the possibility of employing storage batteries. There are obvious objections, also, to attaching any form of generating device to the propelling engine. Consideration of all the factors led to the adoption of a wind-driven generator for the purpose. This generator of about 100 watts direct current output was required to produce a potential of 300 volts for the plate circuits of the vacuum tubes, and a potential of 25 volts for the filament circuits. It is necessary, to insure most efficient operation, that the filament current be kept constant, and the fact that the specifications called for operation with airplane speeds varying from 40 to 160 miles per hour made the problem of voltage regulation loom large. Ordinary forms of electro-mechanical regulating devices did not prove to be successful, and while it was probable that something of this type would eventually have been developed, the problem was solved by a very ingenious arrangement proposed by Mr. H. M. Stoller, in which the vacuum tube is the essential element. The voltage of the generator is held approximately constant by means of a vacuum tube regulator, which controls the field flux. Two field windings are pro-

RADIO MATERIALS

Terminated War Contracts
Enable Us to Offer at Less Than Cost a Large Stock of Fabricated Parts and Raw Materials.

SHEET ALUMINUM, COPPER, BRASS and TRANSFORMER STEEL

FIBRE, BAKELITE, DILECTO MICANITE, CELLULAK IN SHEET, TUBES and ROD

WIRE and LITZ
IN ASSORTED SIZES

Also Completed
CONDENSERS
TRANSFORMERS
SPARK GAP UNITS
REACTANCES

Call At Our Stock Rooms
57 New Chambers St., N. Y.

EMIL J. SIMON
217 BROADWAY, NEW YORK

Q. S. T.

"All men having commercial licenses should report for jobs at once."

Big shortage of operators!

Every student completing the course secures a berth immediately paying $85—$130 per month and keep.

Short thoro course — excellent laboratories.

Dormitories — swimming pools.

Call or write for illustrated booklet.

Y. M. C. A.
RADIO SCHOOL
NEW YORK CITY

Manhattan Branch: 154 East 86th St. Tel. Lenox 6051
Brooklyn Branch: Marcy Ave. Near B'way Tel. W'msburg 3800

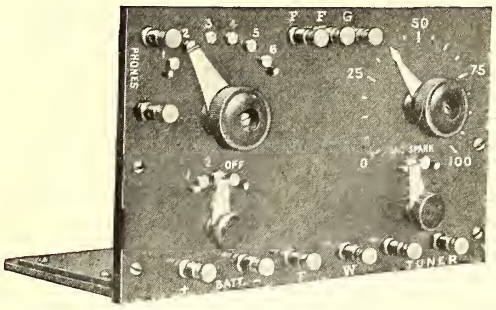
WIRELESS apparatus, Raw Materials, Magnet wires, motors, experimenters' needs, novelties listed in our Catalogue C-3. Assure yourself of prompt service and right prices by buying from this world famed, reliable, experimenters' Supply House.

The Newman-Stern Co., Cleveland, O.

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

AUDIOTRON
VACUUM TUBE PANELS
PARTS AND ACCESSORIES



Panel full XX Grade Continental Bakelite Dielecto Steel cut and whitened engraving. All metal parts heavily nickeled. Switches for double filament tubes and arc or spark reception. New type Back mounted smooth running rheostat. Panel also furnished in maple with imitation black bakelite finish.

No. 8B.	Full Bakelite panel assembled.....	$15.00
No. 8BP.	Complete set of parts.....	12.00
No. 8W.	Wood panel complete	12.50
No. 8WP.	Complete set of parts.....	10.00

Send for free bulletins on panels, couplers, detectors, parts, etc.

Send cash with order and save all delivery charges. Dealers: write for proposition.

AUDIOTRON SALES CO., 311 Lick Bldg., San Francisco

Consolidated Radio Call Book
The "Telephone Directory" of the Sea

This book contains a list of high power Radio Stations of the world with wave lengths they transmit on—a list of stations sending press—time—Q signals—tables for finding charges on radiograms—data on American, British, Canadian, and French Radio Compass Stations, in addition to the

Wireless Calls of Over 9000 Ships and Shore Stations

In fact this publication is so *complete and up to date* that large radio companies have contracted for copies for their ships. Since our advertisement in the last issue we have received and tabulated so many additional Radio calls that it has been necessary to raise the price of the book. Price, $1.00.

Orders postmarked prior to August 1st will be accepted at the old price of 75c.

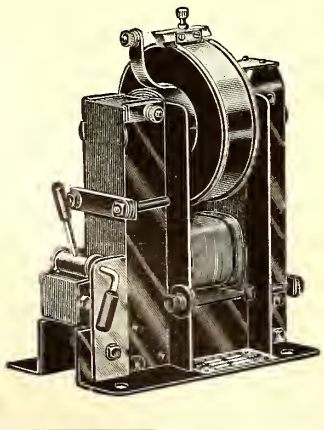
Published by the

CONSOLIDATED RADIO CALL BOOK COMPANY, INC.

41 Park Row, New York City

Send your order to the above address if you are unable to obtain it from your local dealer in Radio Supplies. Orders have already been received from the following dealers:

Haller-Cunningham Electric Co., San Francisco, Cal.
L. Bamberger & Co., Newark, New Jersey.
Smith Novotoy Electric, Inc., Charlotte, N. C.
Radio Equipment Co., Boston, Mass.
Electro Importing Co., New York City.



THORDARSON'S
25,000 Volt
WIRELESS
TRANSFORMERS

For further information write

Thordarson Electric Mfg. Co.
501 S. Jefferson St. Chicago, Ill.

vided, the main field, which is in series with the filament of the regulator tube, and a differential field which is in series with the plate circuit. At minimum speed the differential field is inactive and the generator behaves like an ordinary shunt machine, except that the main field has a small resistance in series due to the regulator tube filament. This filament is so designed that the main field current heats it to a temperature which gives a small electron current. This current flows thru the differential field and reduces the resultant flux. At minimum speed, the differential current is small, but as the speed increases, the main field current tends to rise (as in any shunt generator) and this increases the temperature of the regulator tube filament. The electron current is, therefore, considerably increased, which current, flowing thru the differential field, reduces the generator flux and thus restricts the rise in voltage. Due to the fact that the electron current of the regulator tube increases very rapidly with increase in filament current, the voltage is held practically constant between 4,000 and 12,000 revolutions per minute. The 1.5-ohm resistance units are provided so that the regulator may be set to give different voltages by cutting them in or out of the main field. The 100 ohms shunt resistance is used to prevent hunting.

Upon the completion of the next set of models, field tests were resumed and on August 20th the first two-way telephone conversation between two planes in the air was successfully accomplisht. After this first trial, Major Bartholf and Lieutenant Stevens, of the Signal Corps, held two-way conversation between planes with very satisfactory results.

Late in 1917, the type of airplane set shown in Figs. 4 and 5 was installed on our airplanes. The various parts are arranged so that they can be mounted in any available space in the machine. The switch box shown in the diagram is to provide for communication between pilot and observer by means of the same microphones and helmets used in radio-telegraphy. The transmitting and receiving set proper is shown in Fig. 4. This set is 17x10x7 inches and weighs but twenty-one pounds. The generator is of the wind-driven type, and is shown in Fig. 6 with the tail cover removed giving a view of the vacuum tube regulating device. The complete weight of the entire outfit is about fifty-eight pounds. Fig. 7 shows a simplified form of the circuits.

The last distinctive type of radio-telephone outfit is the short wave set installed on submarine chasers and destroyers during the war. These sets are shown in Figs. 9 and 10. The circuits of these sets are practically the same as for the airplane sets, except that the power for them is obtained from small dynamotors run on a 30-volt storage battery. The complete transmitter and receiver, together with the amplifier and extension set, are shown in Fig. 8 and the transmitter receiver itself is shown in Fig. 9.

The set is installed in the radio room with the amplifier for the loud-talker. An extension set consisting of a telephone transmitter and receiver, together with the loud speaker, is mounted in the pilot house. By means of a switch in the radio room, the operator can cut in the extension set while the conversation is being carried on by the captain. It is also possible to use either the head receivers or the loud-speaker for receiving.

This equipment has an effective range of from 5 to 10 miles and can be used in four wave lengths ranging from 250 to 600 meters.—*From a paper by E. B. Craft and E. H. Colpitts, entitled "Radio-Telephony," read before the American Institute of Electrical Engineers, Feb.* 21, 1919. *Photos courtesy Western Electric Co.*

www.americanradiohistory.com

Faradic Currents—How To Apply Them

(Continued from page 366)

tive while the *positive* electrode is at the base of the spine. The room should be well aired, and the patient's feet and hands should be kept warm with hot water and bags.

Headache.

The treatment of headaches depends upon the cause. If caused by disordered stomach or bowels, what is called a sick headache, place the *positive* electrode at the base of the brain and apply the *negative* over the stomach, liver and bowels, using a *mild secondary* current. General tonic treatment of the whole body with *secondary* current will cure or help some patients, while central faradization (as described in treatment of diabetes) will help others.

Indigestion.

Place the *positive* at the back of the neck and sponge the region of the stomach and bowels with the *negative*. Another method is to place the *positive* electrode on the tongue and the *negative* at the pit of the stomach. Use *secondary* current. If the patient is debilitated give general tonic treatment of the whole body.

Neuralgia.

If properly treated, neuralgia is one of the diseases that yield most readily to electrization. There is one difficulty in the treatment of neuralgia by electricity and that is the intensity of the pain. Often the first few treatments aggravate the pain, especially if the current is too strong or the treatment is continued too long. Not over one treatment a day should be given. Give a general tonic treatment of the whole body every other day. For local treatment, where there is no swelling, apply the *negative* to the painful parts, and the *positive* at the hands or feet. If there is swelling apply the *positive* to the disease, and the *negative* at the hands or feet, using a *secondary* current.

Rheumatism—Inflammatory and Acute.

Either of the above kinds of rheumatism may be treated with the *positive* electrode. If the trouble is about the head, neck, arms or shoulders, hold the *negative* in the hands and apply the *positive* to the painful parts. If the pain is below the arms, apply the *negative* electrode to the feet and the *positive* to the affected parts. Drink freely of lemonade. Avoid alcoholic liquors, meats and fatty food. A rigid diet for a few days is to be recommended.

Rheumatism—Chronic.

Chronic rheumatism is much more obstinate and resists a cure more than the acute kind. Very often the general tonic treatment will give relief. For local treatment, treat with the *negative* electrode instead of the *positive* as in the acute form. Also use the primary and secondary currents alternately. If the joints are enlarged treat with the *positive* electrode, using the primary current. Keep the body warm and the feet warm and dry. Do not allow the patient to expose himself to any dampness. The electric bath is to be recommended.

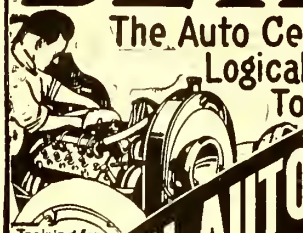
Sunstroke.

In most cases of sunstroke, electricity is a valuable agent in restoring persons who have been overcome with the heat. General tonic treatment should be given, also central galvanization as described in the treatment of diabetes. Local treatment to the head may be given and a *very light secondary* current should be used, *positive* electrode at the head and *negative* at the base of the spine. In all cases have the attention of a good physician.

DETROIT

The Auto Center is the Logical Place To

LEARN AUTO AND TRACTOR BUSINESS



Training for Head and Hand

Trained men are needed everywhere to test, repair and give expert advice on care and handling of automobiles, trucks and tractors. Big money for M. S. A. S.-Detroit trained men. Good jobs or independent businesses await our graduates. Opportunities unlimited.

Earn $100 to $400 Monthly

Our Course will teach you how in a few short weeks. Most complete, comprehensive and up-to-date Course known. Wholly practical. No job too hard for our graduates. Every phase of work covered. Actual experience given on dozens of different cars. Entire equipment best obtainable. Instruction includes complete Tractor Course. Brazing, Welding and Tire Repairing taught separately.

Learn in Detroit — Start Any Time — Our Graduates in Demand Here you get the benefit of finest co-operation of biggest factories. They know the thoroughness of our Course and gladly help our students in every way possible. Almost daily we have calls for graduates to fill responsible positions. School open all year. Enter classes any time. No need to waste or lose a moment.

Money-Back Guarantee We guarantee to qualify you for a position as chauffeur, repair man, tester, demonstrator, auto electrician, garage man, automobile dealer, or tractor mechanic and operator, paying from $100 to $400 monthly, or refund your money.

Big Factories Endorse Our School

They know what we do—how we teach, and the type of graduates we turn out and give our students unusual assistance. Every instructor an experienced man—one who knows and is able to teach others.

KING MOTOR CAR COMPANY

BUILDERS OF KING CARS — DETROIT, U.S.A.

ARTEMAS WARD JR.

Replying to a recent letter addressed to Mr. Artemas Ward making inquiry as to the reputation of the Michigan State Auto School, will say that as far as I know all Detroit Automobile manufacturers endorse the work they are doing.

It is managed very efficiently and they have been turning out some pretty good men for the automobile industry and cannot see any reason why you should hesitate about taking a course with this institution.

Yours very truly,
KING MOTOR CAR COMPANY

Get Free Catalog

Tells all about "The Old Reliable School" located in "the Heart of the Auto Industry." Or, better still, jump on the train and come to Detroit as hundreds do. Your fare refunded if everything not as represented.

MICHIGAN STATE AUTO SCHOOL

A. G. ZELLER, *Pres.*
668 Auto Bldg., Woodward Ave.
DETROIT, MICH., U. S. A.

DETROIT THE HEART OF THE AUTO INDUSTRY

MICHIGAN STATE AUTO SCHOOL

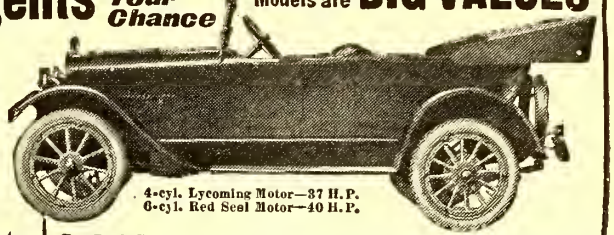
THE AUTOMOBILE CENTER OF THE WORLD

44 AUTOMOBILE FACTORIES — 140 ACCESSORY FACTORIES

County Agents *Here's Your Chance* The 1919 Models are **BIG VALUES**

THE **BUSH**

5-Pass. 4-cyl. Touring
5-Pass. 6-cyl. Touring



4-cyl. Lycoming Motor—37 H.P.
6-cyl. Red Seal Motor—40 H.P.

For nearly five years the Bush Car has been doing heavy duty all over this country.

It's sold through County Agents only—we do not have distributors.

County Agent's Proposition is liberal beyond your expectations.

Get all the information quick. Write at once to J. H. Bush, Pres., Dept. H-15

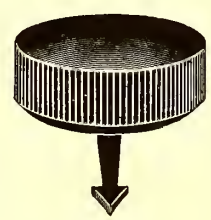
BUSH MOTOR CO.
Bush Temple, Chicago

The Bush Car for 1919, both in the Light Four and Light Six, are unequaled in value anywhere this year. Think of a car with all the modern refinements which includes in its equipment the Boyce Motor Meter at prices modest in the extreme. The Bush method of marketing the Bush Car not only gives the County Agent a better profit than he usually gets but the Bush method of sales gives the user the benefit of high quality at low price. We list below some of the big things—the high grade features—that go into the Bush Car for 1919. These are the things that make a real car.

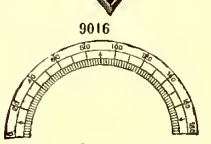
Full Floating Rear Axle	37 H. P. 4-cyl. Lycoming Motor
Two Universal Joint Drive	40 H. P. 6-cyl. Red Seal Continental
116-Inch Wheel Base	Refinement in Body Finish
Copper Radiator	Plate Glass Rear Windows in Top
Electric Lighting and Starting (2 unit)	Deep French Pleat Upholstering
Willard Batteries	Extra Leg Room in Body
Timken Bearings Throughout	Light Weight—2450 lbs.

The Bush Car is not a twelve months or less proposition. It's not ready for the scrap heap after a year's use. The best material obtainable—the very highest quality construction coupled with what every one knows to be good equipment, such as Willard Batteries and Timken Bearings, insures a long life to the Bush Car even under unusually hard service.

There is a Money Back Guarantee Goes with Every Bush Automobile to show you we mean just what we say about the quality of this car and to prove to you that your confidence in us will not be abused. Our Guarantee is in writing.



9016



9020

Whatever is worth doing,
Is worth doing well

. . . . . .

Use Bunnell Parts
Sold by all Dealers

. . . . . .

Catalog No. 40 E now ready

J. H. BUNNELL & CO.
32 Park Place New York City, N. Y.



9014



9021

What 15c will bring You from the Nation's Capital

Washington, the home of the Pathfinder, is the nerve center of civilization; history is being made at this world capital. The Pathfinder's illustrated weekly review gives you a clear, impartial and correct diagnosis of public affairs during these strenuous, epoch-making days.

The little matter of **15c** in stamps or coin will bring you the Pathfinder **13** weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth and only the truth; now in its **26th** year. This paper fills the bill without emptying the purse; it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you would appreciate a paper which puts everything clearly, fairly, briefly—here it is. Send **15c** to show that you might like such a paper, and we will send the Pathfinder on probation **13** weeks. The 15c does not repay us, but we are glad to invest in new friends. **The Pathfinder, Box 576, Washington, D. C.**

www.americanradiohistory.com

Not Toys But Real Apparatus

the same as used by all operating companies. You had better send us your order immediately to insure prompt delivery, as this equipment will not last long at these prices.

110 Volt Hand Generators....3 bars, each	$3.00
4 bars, each	4.00
5 or 6 bars, each	5.00
Telephone transmitters with arms, each..	.75
Good ringers complete with bells, each....	.50
Telephone receivers, each.....	.75
Condensers, ½ to 2 M.F., each.....	.50
Induction coils, each.....	.50
Relays, each	1.50
Repeating coils, each.....	2.00
Real complete C.B. wall type telephone...	4.50
Skinderviken Transmitter Button.....	1.00

Please send money-order or cash with your order

ELECTRICAL SPECIALTY COMPANY
Dept. E, 48-50 So. Front St., Columbus, Ohio
Dept. E, 128 So. 11th St., Philadelphia, Pa.

"The Livest Catalog in America"

WIRELESS

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 180 Big Pages, 500 illustrations, 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy," 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons, FREE Cyclopedia No. 20 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.

Send 6 cents in stamps or coin for which we will send our latest Cyclopedia Catalog No. 20 as described.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

110 V. TRANSFORMERS 6-12-18 Volts Output

Consumes so little current will not move ordinary meter. Ideal for experimental work—NO MOVING parts. Cannot get out of order; with cord and plug $2.00. Transformer No. 12—Heavier Output, 6, 12, 18 Volts—$2.50 with cord and plug. Order from this ad. $1.50 Postpaid

NATIONAL TRANSFORMER CO.
Dept. 17, 3124 North California Ave., Chicago, Ill.

WIRELESS CONTROL IN THE PEACE TREATY.

Wireless: During a period of three months after the peace German high power wireless stations at Nauen, Hanover, and Berlin will not be permitted to send any messages except for commercial purposes, and under supervision of the allied and associated Governments, nor may any more be constructed.

Cables: Germany renounces all title to specified cables, the value of such as were privately owned being credited to her against reparation indebtedness.

Germany will be allowed to repair German submarine cables which have been cut, but are not being utilized by the allied powers, and also portions of cables which, after having been cut, have been removed, or are at any rate not being utilized by anyone of the allied and associated powers. In such cases the cables, or portions of cables, removed or utilized remain the property of the allied and associated powers, and accordingly fourteen cables, or parts of cables, are specified which will not be restored to Germany.

Air: The armed forces of Germany must not include any military or naval air forces except for not over 100 unarmed seaplanes to be retained till Oct. 1 to search for sumbarine mines. No dirigible shall be kept. The entire air personnel is to be demobilized within two months, except for 1,000 officers and men retained till October. No aviation grounds or dirigible sheds are to be allowed within 150 kilometers of the Rhine, or the eastern or southern frontiers, existing installations within these limits to be destroyed. The manufacture of aircraft and parts of aircraft is forbidden for six months. All military and naval aeronautical material under a most exhaustive definition must be surrendered within three months, except for the 100 seaplanes already specified.

POCKET WIRELESS SOON, PREDICTS MARCONI OFFICIAL.

Godfrey Issacs says the English Marconi company, of which he is managing director, expects to have a commercial service of wireless telephones in operation in New York and London early next year.

The company hopes to make arrangements with New York and London telephone companies so that eventually the British and American wireless 'phone subscribers will be able to sit at their desks and "Hello, London" or "Hello, New York."

Isaacs foresees the day, not far distant, when pocket wireless telephones will be in wide use. A business man's secretary, walking along the street, Isaacs says, will hear a bell ring in his pocket, will put a receiver to his ear and hear "his master's voice" give him instructions, probably from an airplane hundreds of miles away.

The Daily Mail says that the British government probably will compel all commercial airplanes and airships to carry wireless telephone or telegraph equipment. Larger machines of both types may be compelled to carry both.

BULLARD ONCE AGAIN RADIO DIRECTOR.

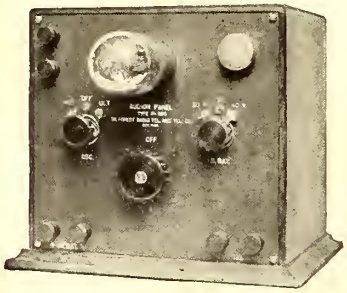
Navy orders were issued April 9th, reappointing Rear Admiral William H. G. Bullard as Director of Naval Communications, a position he held at the time the United States entered the world war, but from which he was detached for service overseas.

Rear Admiral Bullard is an honorary member in the Radio League of America, as our readers will remember.

AMAZING AUDION DETECTOR VALUES-$9.50 $11.75 $18.85 $22.00

Remarkably efficient and handsome audion control panels within the price limit of **EVERY AMATEUR, BUILT AND DESIGNED FOR THE AUDION, AS ONLY THE MAKERS OF THE AUDION CAN BUILD IT.** IN THE PAST, INSTRUMENTS OF THIS CALIBRE HAVE NEVER BEEN OFFERED AT TWICE THESE PRICES.

GENERAL SPECIFICATIONS, ALL MODELS: Beautifully engraved and grained genuine bakelite panels; 4 prong heavy nickeled tube receptacles; smooth running, positive acting, adjustable rheostats; impregnated efficient mica stopping condensers; adjustable or fixed grid leaks with polished nickel covers; bakelite covered binding posts with new slotted positive connecting feature; positive segmentally connected nickel plated switches; 40 volt B battery of two 20 volt type units cast en block with operating life of 6 to 12 months—a remarkable advance in B batteries; handsome quartered oak cabinets, round corners, standard de Forest "Early English" finish; perfect workmanship and expensive design throughout.



TYPE P500—$22.00

Type P-400 Audion Panel—Consists of tube receptacle, grid leak and condenser, rheostat and binding post for connection to tuner, A and B batteries on bakelite panel 7½" x 7½" without cabinet and B batteries.....$9.50

Type P-401 Audion Panel—Same as above with cabinet, $11.75

Type P-402 Audion Panel—Larger panel with 40 volt B battery in cabinet.....$18.85

Type P-500 Audion-Ultraudion Panel—Type P-402, Panel with two switches for audion-ultraudion connection and either 20 or 40 volt B battery in cabinet.....$22.00



TYPE P401—$11.75

NOTE: All de Forest audion apparatus is sold without the tubes. Audion detector oscillator or amplifier tubes, $7.00 each additional. Catalog sent on receipt of 10c in stamps to cover postage.

DE FOREST RADIO TEL. & TEL. CO., 1415 Sedgwick Avenue, New York City

www.americanradiohistory.com

Heat Engines

By John J. Furia

(*Continued from page* 320)

utes at the beginning of the day and the steam pressure is controlled automatically. Kerosene is used as the fuel which is considerably less expensive than gasoline. No shifting of gears is necessary. A turn of the throttle will give enough steam to climb any hill or to slow down to a crawl. No fussing with carburetor or ignition systems. The spent steam is condensed and led back to the boiler so that a much smaller water supply tank is used. No cooling system is necessary. A pilot light using up a negligible amount of fuel keeps enough steam pressure all day, so that one can make an immediate start. All gages operating on the fuel and steam are automatic, thus eliminating all danger. Why is it then that we do not see many of these steam cars. Two reasons—it takes a long time to educate the public—steam cars cannot be kept in the present public garages, since the open flame of the pilot light is liable to ignite the gasoline vapors present in all garages and cause fire. No doubt the steam car has a great future (provided the oil companies do not boost the price of kerosene).

The Hot Air Engine.

The *hot air* engine uses neither gasoline nor steam but plain ordinary air and that is pretty cheap. Let us examine the principles of its operation. Figure 3 shows an ideal engine consisting of a cylinder, piston, connecting rod, and fly-wheel. Heat is applied to the lower end of the cylinder as in A, the cylinder being composed of non-conducting material, except the bottom which is a good conductor. The heat will cause the air in the cylinder under the piston to develop great pressure and *eventually to expand,* forcing the piston *upward.* If the heat is suddenly removed and replaced by cold, when the piston reaches the top of its upward motion, then the air under the piston will *contract* and the piston will move *downward,* due to two causes: (1) the suction under the piston and (2) the pressure from above the piston, since the air above the piston was comprest when the piston moved up. This then would constitute the complete cycle and if repeated indefinitely our engine would continue to run. Let us look at Fig. 2 again. If the inlet were connected to a tank of air and the air heated, the air would expand, enter the cylinder and move the piston; if then new air were admitted and heated, this on expanding and entering the cylinder from the other side, because of the action of the slide valve, would cause the piston to move back again, giving us a motion similar to that of the steam engine.

The ideal hot air engine described above and this steam engine operated as a hot air engine, illustrate the two types of hot air engines in existence. The first typifies the *closed cycle* engine which operates continuously with the same mass of air (a fresh charge being occasionally admited to compensate for leakage). The second typifies the *open cycle* in which a new charge of air is admitted and exhausted at each stroke. The closed cycle engine is analogous to the new type of steam engine employing a condenser for the spent steam, while the open cycle is analogous to the old type non-condensing steam engine. Therefore it is readily seen that the closed cycle engine is more efficient than the open cycle, none of the fuel being wasted on the exhausted air. In all types of *hot air* engines, the power is secured by the pressure of the air produced by heat transferred by a separating metal wall. The air is admitted to the cylinder at a high temperature and pressure, it is allowed to do mechanical work on the piston as a result of which the pressure and temperature fall off.

There are two heating systems employed in hot air engines—the *regenerative* and the *non-regenerative.* A regenerative system is one which uses a device for absorbing the heat from the air as it passes in one direction and supplying it again on passing in the opposite direction. A non-regenerative system does not employ such a device. One of the best of the hot air engines is the Stirling engine which has been actually used commercially, tho without much success. It is of the closed cycle type working with a constant volume of air, and requires about 2 lbs. of coal per hour horsepower (i. e., more efficient than the steam engine). Its chief objection was that the heating plate, which takes the place of the boiler of the steam engine, burned out rapidly. Figure 4 is a sketch of the essential parts of the Stirling engine. C is the brick foundation of the engine, B the fire box, A the draft, H is the working cylinder, E the displacer acting in opposition to the working piston, D the air-box, F metal gauze, and G coils of pipe thru which cold water flows. The total volume of the air contained in the air-box, the working cylinder and the connecting pipe *remains constant.* The lower end of D is a plate pierced with holes, thru which the air flows when the displacer E moves downward. The upper part of D, thru which the coils G pass, is known as the *refrigerator.* The fire heats the air in the air box D. As the engine is started the displacer E moves downward, forcing the hot air thru the regenerator gauze F. Heat is absorbed by F and the air cooled. It is further cooled by the refrigerating pipes G. The pressure in H is therefore diminished and the piston moves downward. This forces the air back thru F into D, gaining heat from F and forcing the displacer upward. The heat gained from F, in addition to that gained from the fire, causes the air to *expand,* raising the piston in H. This completes the cycle. The inertia of the fly-wheel causes the fly-wheel to push down the displacer E and the cycle is repeated.

Steinmetz's Own Shorthand

(*Continued from page* 314)

"It is my opinion that every college student should learn some good accurate system of shorthand, so that he can follow the lectures and make notes without effort."

The system of shorthand that Dr. Steinmetz has evolved as the best adapted for writing on electrical subjects is based upon the "Arends" system of stenography as taught in Europe. Words are written as they are pronounced without regard to their spelling; that is, they are written phonetically. The word "height" is written h-i-t, but in this case the long "I" is used.

One of the most interesting features in connection with this system of shorthand is the fact that French and even Latin and Greek words and names can be perfectly written and read without the slightest hesitation.

With his own hand, Dr. Steinmetz has written down the rules, or it might be said, the "code" of his system, so as to assist those persons with whom he is working in a translation of his reports and various articles.

With a view of affording every reader of this article, especially those attending college, some knowledge of Dr. Steinmetz's system, a reproduction is given of the alphabet, written out by the famous electrical wizard himself.

Become An
Electrical Engineer



Bachelor of Science Degree in 3 Years

Study Here. Receive a good training. Our degree equals the University but is given for three years of intensive work twelve months of the year.

There is unlimited demand for well-trained ELECTRICAL ENGINEERS. A great industry is using them in vast numbers here and abroad.

Our forty professors are experts. Men of standing in the profession. They will guide you surely and carefully to certain SUCCESS.

Shop practice, laboratory, drafting room and recitation room prepare you fully to enter the Electrical Engineering profession.

Full provision for making up deficient high school credits.

"Earn While You Learn" if you wish.

Clip the coupon. Do it **TODAY.**

School of Engineering of Milwaukee
College of Electrical Engineering
103-373 Broadway Milwaukee, Wis.

CLIP HERE

School of Engineering of Milwaukee
Milwaukee, Wis.

Gentlemen:—Without obligation, send me catalog, Photo-Story book and particulars concerning your 3-Year Electrical Engineering Course with B.S. Degree.

Name .....

Address .....

City .....State .....

Age .....Education .....

SCHOOL OF ENGINEERING OF MILWAUKEE
103-373 Broadway Milwaukee, Wis.

$427 BUYS THIS "PRESTO-UP" Bolt-Together House



The Wonder Buildings of the Age

GUARANTEED

Purchased after most rigid inspection by some of the largest Steel, Coal and Industrial Corporations in the United States. You are not experimenting. "PRESTO-UP" Bolt-Together Houses are patented, manufactured exclusively by us and sold at money saving prices.

Seven different types of walls to choose from. Wind and weather proof. Invisible joints inside and out. Extremely simple to bolt together. Wonderful strength. Better construction than regularly constructed houses. Exceptionally good lumber. Cement coated nails. Fifteen Year Guaranteed Slate Coated Roofing. Well painted, and best of all, neat in appearance and so simple to bolt together that it is a pleasure to do the work.

Send for CATALOG FX-412 TODAY

Houses—Garages—Barns—Out Buildings, etc. Also Harris Fresh Air Canvas Houses

HARRIS BROTHERS CO., Chicago



ARTIST

Earn $25 to $100 per week. Cartooning, Illustrating, Designing successfully taught by mail through new Instruction method. Entire outfit free to new students. Write today for beautiful new book, "HOW TO BECOME AN ARTIST" and special free offer. Washington School of Art, Inc. 1430 H St., N.W. Washington, D. C.

www.americanradiohistory.com



"THE 100% WIRELESS MAGAZINE"

What "Radio Amateur News" Is:

It is destined to become the greatest Radio magazine in the world. Indeed its first issue, the July number, had a circulation of 15,000 copies. It was necessary to print a second edition of 10,000 copies—so great was the demand. The August issue, of which 20,000 copies are printed, with its 48 pages and cover in two colors, its 125 wonderful illustrations, make it the *greatest and biggest Radio Magazine in print today.*

RADIO AMATEUR NEWS is the only INDEPENDENT monthly wireless magazine in existence. It caters to no commercial interests—it has no boss save its readers. It is "different"—it has the latest radio news. It is a scientific magazine but it caters largely to the RADIO AMATEUR—it is by and for the Amateur. It is publisht by the publishers of the ELECTRICAL EXPERIMENTER, but there will be no duplication of articles in the two magazines. Both are entirely different—but both together will give you ALL the radio news of all the world. Whether you are a Professor or an Amateur, get a sample copy or order it from your News dealer today.

Page size is the same as Electrical Experimenter

For Sale at All News-stands

$100.00 RADIO CONTEST

is announced in the Aug. issue of RADIO AMATEUR NEWS.

"An Ideal Sending Outfit" is the subject of the contest. $100.00 in cash prizes for the best manuscripts submitted.

JUDGES OF THE CONTEST ARE:

Dr. Lee de Forest, Inventor of the Audion
Dr. Greenleaf W. Pickard, Inventor of the Crystal Detector
Dr. Louis Cohen, Ph.D., Radio expert and inventor
Samuel D. Cohen, Amateur Radio expert
H. W. Secor, Assoc. I.R.E., Associate Editor, Electrical Experimenter
H. Gernsback, Editor, Electrical Experimenter & Radio Amateur News
Fritz Lowenstein, Radio expert

48 Pages 125 Illust's

15c The Copy

$1.50 A Year

Canada and Foreign $2.00 A Year

SEND 15c FOR SAMPLE COPY TODAY

SPECIAL OFFER

By request we will accept till August 25th the following special charter subscription rates: 1 year $1.25; 2 years $2.20; 3 years $3.00; 5 years $4.75. (Add 50c a year for Canada & Foreign.) Cut along dotted line and write your name and address on white margin below. Send along with check or money order. We will start subscription with July (Opening issue) or August issue.

EXPERIMENTER PUB. CO., 231 Fulton St., N. Y. C.

Contents of August Issue:

Radio-Telephoning from your Auto. By A. H. Grebe
A 15,000 cycle radio frequency alternator for radio-telephone work. By Homer Vanderbilt.
Ingenious Radio stunts used by Manufacturers. By F. H. Sweet.
Construction of an Audion control panel. By E. T. Jones
High Spark Frequency in the amateur field. By Roland H. Lamb.
Radio activities "over there." By Corporal A. E. Chute.
Multiple Conical Loose Coupler. By John G. Merne.
Loop antenna and direction finders for amateur use. By David S. Brown.
An Exceptional Radio Receiver. By Eugene Dynner.
Low potential radio frequency arc. By Charles W. Noller.
Is the antenna doomed? By E. T. Jones.
Questions and answers.
Developments in wireless Telephony. By Dr. F. B. Jewett.
An efficient hot wire meter. By L. M. Lafave.
New "B" Battery for vacuum tubes.
100 Radio Prize Contest.
Radio Digest.
Latest Radio Patents.
Junior Section.

www.americanradiohistory.com

X-Ray Experiments

(*Continued from page* 319)

zation. This statement is not altogether accurate. Barkla has observed that when a pencil of rays enter an object which scatters them, the scattering is more marked in a direction parallel to the stream of cathode particles. The greatest objection has been advanced by Bragg. He reasons as follows: If a stream of cathode rays striking a target set up some sort of rays which it has been found instigate new cathode particles when they enter some body, it is reasonable to suppose that these rays merely serve as a means of transferring energy from one electron to another. He suggested that they might consist of neutral doublets made up of a *positive* and *negative* charge, which is broken up when the rays strike some object. This theory might explain why only a few and not all of the molecules in a gas are ionized, for as the doublet moved thru the gas only a few of the molecules would come into contact with it and be charged. Later, however, this theory was disproved.

The most important property of the rays is their power of making objects transparent and affecting a photographic plate. Procure about a 5 x 7 plate and carefully wrap it in black paper. Care should be taken that the *film side is placed upward* as the *glass* cuts off a good deal of the radiations. The bulb should be placed about six inches above the plate and the objects to be photographed laid directly upon it. The arrangement is clearly shown in one of the accompanying illustrations, Fig. 4. The bulb may be procured from several leading supply houses. The one shown is not provided with a third electrode. The coil is connected direct to the bulb, no condenser or spark gap being used. When the connections are properly made *the lower half of the bulb will glow a bright green.* If the polarity of the current is wrong, only a *ring of light* will show. The polarity may be corrected by a pole-changer in the primary circuit of the coil.

Radiographs, while once a comparative novelty, are now fairly common—especially since the war. Many interesting skiagrams have been returned from the front showing the invaluable work X-rays have accomplisht. The Customs House has made a novel use of their penetrating power. In order to see if anything such as bombs were concealed in bales of cotton or other apparently innocent objects, the bale would be placed before a powerful X-ray bulb and a man standing on the other side would examine it with a fluoroscope. Of course a small bulb operating on about a 2-inch coil does not possess very great penetrating power, but the reader should experience no difficulty in seeing thru the thick part of the arm. An X-ray picture taken with such apparatus is reproduced herewith. See figure. As was said above, the amount of penetration is proportional to the density, decreasing as the density increases. Use has been made of this fact in determining the atomic weight of unknown elements by measuring their transparency to X-rays. Benoist determined the atomic weight of indium by this process.

Another important property, and the one which gives us the readiest means of measuring their intensity, is their *ionizing* power. This may be easily illustrated by hanging a grounded plate above an electroscope of the ordinary flask type. The arrangement is shown in Fig. 2. *If the intervening air is exposed to x-rays the electroscope will be discharged.*

Another interesting experiment is to take an ordinary hydrometer and remove the float. Fill the bulb and about a third of the tube with water. Put your finger over the end to prevent the air from escaping and squeeze the bulb. It will be noticed that a cloud is formed. This is due to the moisture condensing around the dust particles in the air. After this has been repeated several times all the dust particles will be drawn down into the water and *no cloud will form.* Now, if when this condition has been reached, the apparatus is exposed to X-rays, a dense cloud will be formed. *This is caused by the moisture condensing around the ions, due to the X-rays.* This phenomenon forms the basis of the rain-making apparatus described in the February, 1919, issue of this journal as developed and patented by the Australian inventor and engineer, Balsillie.

Röntgen rays also possess the remarkable property of exciting *secondary rays* in substances which they strike. As this is a rather complicated phenomenon and as there are no experiments in connection with it which the average reader may repeat, it will not be discust here, except to mention that the secondary rays resemble the original cathode rays, only they travel at a slightly slower speed, which is dependent on the hardness of the primary rays. Recently X-rays have found a new application in the analysis of *crystal structure.* It was found that X-rays might be defracted by the cleavage surface of crystals. Using X-rays, it has not only been possible to determine the exact shapes of crystals, but also to actually show the arrangement of the atoms as well as the distance between them.

"Christmas Bullet" Plane to Fly the Atlantic

Another attempt to cross the Atlantic was announced recently by the Cantilever Aero Company, makers of the "Christmas Bullet" airplane.

In the company's plant at Amityville, L. I., assembling has begun on a huge airplane which is expected to start from New York and land within thirty-five hours at Queenstown, London or Brest.

It will have a wing measurement from tip to tip of 180 feet and will be equipt with four 800-horse power motors, giving a speed of 115 miles per hour. These motors are connected in such a way that should one be put out of commission the operation of the machine will not be affected. The engineer will also be able, if necessary, to overhaul any of the motors, clean the spark plugs and make adjustments while the plane is in flight.

The body of the machine will be 14 feet in diameter, insuring comfort and proper housing for the crew, who will not at any time be exposed to the elements.

There will be two three-bladed propellers in front of the machine. Each will be 21 feet in diameter, capable of making 600 revolutions per minute. The weight of the machine with full flying rig is 30 tons. It will be controlled thruout by electricity.

Two pilots will be seated in separate compartments, working alternately, each taking the machine for a certain length of time.

The construction and design of this airplane has been under consideration by the Cantilever Aero. experts for six years and every detail has been tested and approved by the designer and inventor, Dr. William Whitney Christmas, it is stated by the builders.



HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY HANDICAPPED if you lack High School training. You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE This Course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and *meets all requirements* of a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY

Most people *idle* away *fifty* hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within *two years.* You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

TAKE 10 LESSONS FREE So that you may see for yourself how thorough and complete our training is. We invite you to take *ten lessons* in the High School Course—or any Course of specialized training in the Coupon below—before deciding whether you wish to continue. If you are not then satisfied you are not out one cent. *We absolutely guarantee satisfaction.* On that basis you owe it to yourself to make this test. Check and mail the coupon NOW for full particulars and Free Bulletin.

AMERICAN SCHOOL
OF CORRESPONDENCE
Dept. C H 26 Chicago, Illinois

TRAINING—THE KEY TO SUCCESS

Please explain how I can qualify for the position marked X

....High School Graduate	.....Lawyer
.....Electrical Engineer	.....Business Manager
.....Elec. Light & Power Supt.	.....Certified Pub. Accountant
.....Hydroelectric Engineer	.....Accountant and Auditor
.....Telephone Engineer	.....Bookkeeper
.....Telegraph Engineer	.....Stenographer
.....Wireless Operator	.....Fire Insurance Expert
.....Architect	.....Sanitary Engineer
.....Building Contractor	.....Master Plumber
.....Civil Engineer	.....Heating and Vent. Engineer
.....Structural Engineer	.....Automobile Engineer
.....Mechanical Engineer	.....Automobile Repairman
.....Shop Superintendent	.....Airplane Mechanic
.....Steam Engineer	.....General Education Course
.....Draftsman and Designer	.....Common School Branches

Name.....

Address.....

www.americanradiohistory.com

4 Famous Books

EACH ONE A BIG SUCCESS!



THE BOOKS YOU MUST HAVE

Wireless Course in 20 Lessons

By S. Gernsback, A. Lescarboura and H. W. Secor, E. E.

A course that tells you everything you can possibly want to know about "Wireless" starting off in lesson No. 1 by explaining the Principles of Electricity. The second and third lessons are devoted to magnetism, motors, generators and wiring. And then, by simple, easy stages, this wonderful Course takes you into "Wireless". The mysteries of "Wireless" are unfolded to you by the use of such simple language so skillfully used that of necessity you must understand every word. The subject is not treated superficially, however, for there is a whole lesson devoted to the Theory and Mathematics of this epoch marking subject. To lend charm to the Course, the last lesson (No. 20) is devoted to a history of Wireless and the men who developed it.

Size of book is 7 x 10¼ in. 160 pages, 350 illustrations, 30 tables. Postpaid

Flexible cloth cover.....per copy $.50
Stiff cloth cover.....per copy 1.00

Experimental Electricity Course in 20 Lessons

By S. Gernsback and H. W. Secor, E. E.

A Course of the theory and practice of Electricity for the Experimenters. This is undoubtedly one of the most complete and comprehensive treatises of this special subject ever published. The book is written by the same authors as the famous "Wireless Course in 20 Lessons".

Every phase of experimental electricity is treated comprehensively in plain English. It is a book not only for the beginner but for every experimenter and student of Electricity. New Experiments are described and explained and nearly every application of Electricity in modern life is given in simple language.

The book contains 160 pages and more than 400 illustrations.

Flexible cloth cover....per copy $.50
Stiff cloth cover.....per copy 1.00

Postpaid

No. 1. How to Make Wireless Sending Apparatus
No. 2. How to Make Wireless Receiving Apparatus

By 20 Radio Experts.
Two Remarkable Books

Book No. 1 contains 100 pages, size 7 x 5 in. and 88 illustrations, paper bound.

Book No. 2 contains 100 pages, size 7 x 5 in. and 90 illustrations, paper bound.

These two books have been written and published entirely for the wireless enthusiast who wants to make his own radio apparata. They contain more information on how to make it than any other books we know of. Only strictly modern radio apparata are described in these books and the illustrations and descriptions are so clear and simple that no trouble will be experienced in making the instruments.

Book No. 1—How to make Wireless Sending Apparatus 25c
Book No. 2—How to make Wireless Receiving Apparatus 25c
Postpaid

THE EXPERIMENTER PUBL. CO. Book Dept., 233 Fulton St., New York

CARNOTITE

(Radium Mineral.) The American Pitchblende found in Colorado, from which *Radium* is extracted.

A generous piece, enough to conduct experiments, such as affecting photographic plates thru opaque material (similar to X-Ray pictures), first made by Sir W. Crookes and Mme. Curie, is furnished in neat, wooden box.

URANIUM ORE (*Radio-Active*)

Containing about 35% of pure Uranium; also Radium and Vanadium. One of the most rare and interesting minerals. Twenty milligrams are furnished in glass vial protected by lead cover.

One box of *Carnotite* and one vial of *Uranium Ore* as described above 50c sent prepaid.

FORMULAS

Luminous Paint—Silver Plating Powder—Liquid Court Plaster—Soap Bubble Liquid—Straw Hat Bleach—Collapsible Tube Tooth Paste—Resilvering Mirror Liquid—Polish for Tan Shoes—Dressing for Tan Shoes—Paint to make Oil Cloth.

These Ten Recipes in sealed envelope for 50c. Sent prepaid.

SIDNEY SPECIALTY CO., 233 Fulton Street New York City

Thunderstorm Electricity

By Rogers D. Rusk, M. A.

(*Continued from page* 307)

ly called *thunder-caps,* or *thunder-heads,* and often the clouds will grow so thickly together that to an observer on the earth they appear as a huge dark rolling-cloud extending across the sky, the tops being obscured except to aërial observers several thousand feet in the air. It is while such clouds as these are forming that the electrical forces are at work which build up enormous charges in a manner which will now be described.

How Rain-Drops Form.

Experiments show that *ions* are nearly always present in the air. Sometimes these are *charged dust particles,* sometimes they are *charged atoms of the gases* of which the air is composed. Experiment further shows that rain-drops condense about *negative ions* much more quickly and easily than about *positive ions.* The earth itself is a very highly charged *negative* body, its charge being estimated at 600,000,000 volts, but the rain that falls is *positively* charged almost as often as it is *negatively,* which may be accounted for by the fact that the *positive* drops, forming more slowly, are larger and heavier and are not retarded so much at times by upward currents of air. It is these upward currents of air in the clouds themselves that produce the charges within the clouds. The *negatively* charged drops being smaller and lighter are carried to the top of the cloud, very often forming a heavy *negative* charge. In a similar manner the heavier *positively* charged drops will fall to the bottom of the cloud forming a strong *positive* charge. In addition the wind may break up the drops into smaller droplets and when this is the case, it is found that the smaller droplets are nearly always *negatively* charged. By these processes of division and formation of charged drops and their separation in the cloud, enormous charges are generated, and the thunder-cloud is seen to be really a huge electrical generator as shown in Fig. 3. And when the charges become sufficiently great the lightning discharge results. This may take place from top to base of cloud which is usually a distance of about a mile, or it frequently takes place between the base of the cloud and the earth which is often a much shorter distance. From cloud to cloud the lightning may flash a distance of *ten or twenty miles,* and at such a time the discharge exercises a powerful *inductive* effect on all nearby clouds, which may cause flashes to occur in rapid succession.

When a *negatively* charged cloud approaches the earth, the *inductive* effect of the earth's charge may cause it to suddenly reverse its charge to *positive,* and the potential become so great that a discharge to the earth follows. Sixty per cent of these discharges to the earth carry *negative* electricity to the earth, while the remaining forty per cent carry *positive* electricity. This shows that sixty per cent of the discharges were from clouds which had built up a higher *negative* charge than the earth itself.

The phenomena of thunder-storm electricity cannot be said to be the product of any one particular cause, or of always exactly the same combination of causes. One thing, however, is certain. All of the above mentioned factors act together and atmospheric conditions are so variable and in such a continual state of change that a definite formula for their operation would be beyond the limits of possibility. The theories of thirty years ago which tried to explain lightning by means of atmospheric friction and other such causes have sunk into oblivion.

www.americanradiohistory.com

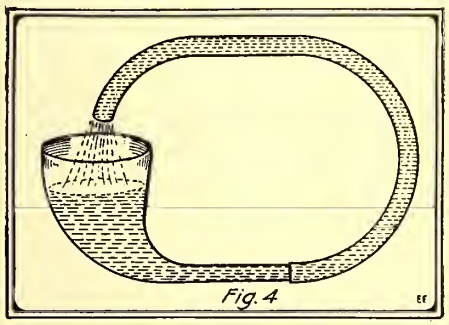
Experiments in Physics

PERPETUAL MOTION

By John J. Furia

(*Continued from page* 315)

See Fig. 6. In Electrostatics we learn that the sharper the point of a conductor, the greater the density of the charge present. Because of the great density, the charge leaves the conductor at the sharp points. If by some means we continually charge a conductor having a shape like that in Fig. 1, then the reaction will cause it to move as indicated by the arrows. The source of the charging can be a static machine (Whimshurst or other type). Why not belt the conductor so as to run our static machine; and sidetrack some of the electricity from the machine to be used for other purposes? One has but to look at the small weight of the conductor and the slow speed



"Perpetual Motion" de Luxe. The Atmospheric Pressure on the Water in the Bowl Will (Theoretically) Force the Water Up Thru the Circular Pipe and Out of Its Open End. Thus the Water Will Circulate Around and Around—Yes It Will—NOT!!!

at which it runs and compare it with the large heavy static machine and the large force required to cause it to give a spark, in order to perceive at once the folly of such an absurd scheme.

Another idea along somewhat similar lines is the following: A screw fits tightly in a cylinder at the top of which is an ordinary rotary lawn sprinkler. As the screw is turned the right way, the water rises in the cylinder. When the water reaches the level of the sprinkler, it comes out from the nozzles and the reaction causes the sprinkler to turn. Once this machine is started it should operate forever, for as it turns, water rises to the sprinkler—while as the sprinkler operates, it turns and causes water to rise in the cylinder. It takes considerable force to cause the sprinkler to rotate due to the reaction; it would require still more force if the sprinkler had to in addition do the work of lifting the water up the cylinder. The reaction due to the water coming out from the level of the sprinkler *with no force behind it* is very small, and not ever sufficient to cause the sprinkler to budge. See Fig. 2.

Fig. 3 represents the cross-section of a cylinder containing grooved curved spokes. Marbles or lead balls rest in the grooves. It will be seen that the marbles at the left are further from the center than those at the right. Consequently because the rotational moment on the left is greater than that on the right (the marble being of the same size and weight) not only will the machine move perpetually and do work, but it will even start itself? By putting a belt around the cylinder, machinery can be driven continually, perhaps?!X! It is true that the moment on the left is greater than that on the right and therefore there is *apparently* a tendency to cause rotation opposite to the rotation of the hands of a clock, but if rotation is to take place the top marbles near the center vertical axis will have to be raised over the bend in the spoke, and the machine having no means of doing this, the scheme fails miserably.

The following is a good example of perpetual motion proposed by one ignorant of the simplest fundamentals of hydrostatics. If a pipe having a very large bowl is connected to a piece of tubing of small diameter, and curled in the shape shown in Fig. 4, when water is placed in the bowl, it should come out from the end of the tubing, thus filling the pipe bowl again and the passage of water from the pipe bowl out thru the stem and tubing back to the pipe again *will be continuous?* This will operate as long as the amount of water in the bowl is large compared with that in the stem and tubing, for then the weight in the bowl will be greater than that in the stem and tubing, and the weight in the bowl will force the water thru the stem and tubing, said early philosophers. This explanation, of course, ignores the fact that it is the pressure in the liquid that counts and not its weight, and since both ends (the bowl and the tubing) are exposed to the atmosphere, they are at atmospheric pressure and hence the liquid will stay at the same level in both.

(NEXT ARTICLE—STAGE TRICKS AND ILLUSIONS)

Jeweled Portal Welcomes N. Y. Fighters

(*Continued from page* 311)

altar on the farther side, making a total width of 110 feet. The bejeweled obelisks rise to a height of eighty feet and are surrounded by great jeweled forms in the shape of sunbursts which are each twelve feet wide and twenty feet in length.

Lighting of the portal was effected by two banks of twelve 18-inch searchlights at Fifty-eighth Street and Sixty-second Street, respectively, which threw shafts both up and down town. This effect of *more than a million candlepower* reflected by the 31,000 jewels, defies description, and New York held its breath and watched the fairy spectacle.

Cut glass jewels, cut scientifically to imitate diamonds, rubies, emeralds and sapphires, are mounted in such a manner as to be kept in motion by the breeze. All the colors of the spectrum gleam from these jewels as the screened lights search out the portal and the tower tops sparkle in veritable glory above.

While the Victory Arch, and the Court of Heroic Dead attracted many thousands of persons, the dazzling effect of the "Jeweled Portal" set the vast crowds astirring, backward and forward in order to obtain a better or different view of the wonderful illumination.

The "Jeweled Portal" cost $40,000 to erect, and after being lighted for the first time was acclaimed the greatest thing New York had ever seen.

Architecturally, the portal is an achievement and an innovation praised without stint by the architects of New York, and reflecting great credit upon Mr. Ryan and Captain Gosling, in whose minds the entire scheme was born.—*Photo Courtesy General Electric Co.*



Be a Doctor of Chiropractic

Build a successful career in this great profession—Chiropractic, the advanced science of treating disease through spinal adjustment. The demand for Chiropractors is constantly increasing. In larger numbers than ever before intelligent, thinking people are becoming convinced that it is the common sense and really scientific way to relieve pain and disease.

Learn At Home We teach you by mail or in class. Instruction under the personal direction of a faculty of competent, practical Chiropractors. You can master this good paying profession and graduate with the degree of Doctor of Chiropractic while holding your present position. No special preliminary study and no more than a common school education are required. The cost is small—terms easy.

$3000 to $5000 a Year

The success of many Chiropractors has come so quickly as to be almost startling. Incomes of from $3000 to $5000 are not rare—some, upwards of $10,000 a year. Dr. M. D. Moore, of Kentucky reports $9000 a year; Dr. L. H. Roche, New Jersey, $5000; Dr. Hanna, of Florida, over $5000. You will receive the same kind of instruction which these Chiropractors received. Your prospects will be as bright as theirs. There is no reason why you should not do as well or better.

22 FREE Charts Lithographed and printed in colors. Actual value, $31.50. On this offer you get them all free. Send coupon for facts about this free offer—also 72-page Free Book which tells all about Chiropractic and its wonderful possibilities. This is your big opportunity to enter a dignified profession, be your own boss, be occupied in pleasant, profitable work and become independent. Mail coupon today.

AMERICAN UNIVERSITY

Manierre Bldg., Dept. 523 Chicago, Ill.

Without cost or obligation send me by mail, your new illustrated 72-page book and your Free Charts Offer.

Name.....

Address.....

City..... State.....

WANTED



$1100 first year

Examinations everywhere Aug. 23, 1919

Common education sufficient

Life Job.

COUPON

Franklin Institute, Dept. H-101, Rochester, N. Y.

Sirs:—Send me at once, free of charge, sample of Aug. 23 Railway Mail Examination questions, list of other U. S. Government positions now open and free book describing them.

Name.....

Address.....

Send To-day for the

"Electrical Worker's Friend"

An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting A.C. motors. **Special at $3.50**

Or write for full particulars of this valuable book.

SMITH & SMITH PUBLISHING CO.
1524 LOWRIE ST., N.S., PITTSBURGH, PA.

www.americanradiohistory.com

Earn $35. to $100. WEEKLY



You can make $35.00 to $100.00 a week. I want hustlers, money-makers, to work with me, to advertise, sell and appoint agents. Biggest thing in years. City conveniences without plumbing. Used in any room. Sells on sight. **Demonstrating tub furnished.** Folds small, self-emptying, non-leakable. Guaranteed 10 years.

AGENTS MAKE SALES EASILY

Two sales daily means $60.00 a week. Leggett, Ohio, "Worked two hours, took two orders, profit $10.00." Hayhurst, Nebr., "Took 11 orders in 4½ days—profit $55.00, ordered 12 more tubs." Manning, Iowa, "Sold 10 tubs in one day—profit $50.00." DeHut, Nebr., "Sold 12 tubs in three days—profit $60.00." And hundreds of others making big money. 70 per cent of homes have no bath tubs. Experience and capital unnecessary. Credit given to the right man. Get full particulars and "special plan;" all Free.

H. S. Robinson, Pres., THE ROBINSON CABINET MFG. CO.
5013 Factories Building TOLEDO, OHIO



SLIGHTLY USED STANDARD MAKE TIRES

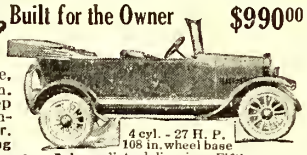
Size	New Tube	Price	Size	New Tube	Price
30x3	$1.85	$ 4.50	35x4½	$3.00	$10.25
30x3½	2.00	5.00	36x4½	3.50	10.50
31x3½		5.50	35x5	3.75	11.00
32x3½	2.25	6.00	36x5		11.50
31x4	2.75	6.50	37x5	4.00	12.00
32x4	2.40	7.50			
34x4	2.70	8.50	Special—Brand New		
34x4½	2.85	10.00	32x3½, Cord		$12.25

Order now. Shipment made the same day. $1 deposit required with each tire order, balance C. O. D., subject to your examination. Specify whether you desire to have clincher or straight side tire.

Special cash discount of 5 per cent if full amount accompanies order.

CENTRAL TIRE & VULCANIZING CO.,
2309 S. STATE ST., Dept. E. E. CHICAGO

The Seneca MOTOR CAR Built for the Owner $990.00



Simple, Sturdy construction. Low cost of up-keep and operation. Cantilever springs in rear. **Comfortable E-Z riding**

Dealers Wanted Immediate deliveries. Fifth successful year. Increased output. Liberal newspaper advertising in dealers' territory. Wonderful opportunities. **Write or Wire NOW.**

THE SENECA MOTORCAR CO., 48 Seneca Factory, FOSTORIA, OHIO

Learn Autos and Tractors



Wonderful opportunities constantly offered trained men; we train you thoroughly to start your own business or make good money as motor expert, driver, shop foreman, etc.

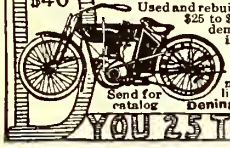
5000 Graduates making good. Catalog Free.

Cleveland Automobile School, 1807 E. 24th St., Cleveland, O.

DENINGER WILL SAVE YOU $40

BIG MONEY SAVINGS FOR YOU

Used and rebuilt motorcycles, single and twins, $25 to $100. Used bicycles, $5.00; tandems, $10. All machines guaranteed in good working order. New bicycles and motorcycles at Factory prices. You save dealers' profits. Motorcycle and automobile tires too, $3.00. Complete line of parts and supplies.



Send for catalog

Deninger Cycle Co., Rochester, N.Y.

YOU 25 TO 50 DOLLARS

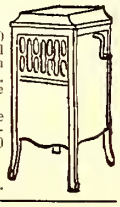
SECURE A MOTOR-CYCLE AT LOW COST



by putting a RELIABLE STEFFEY MOTOR on your wheel. Easy to attach. Costs less to run than an expensive motorcycle. Write at once and secure low factory prices.

STEFFEY MFG. CO.
Dept. E, 5025 Brown St., Philadelphia, Pa.

CLEARTONE PHONOGRAPHS
$4.00 to $200.00 Retail



Needles 45c per thousand in lots of 500,000 Motors $1.35 to $14.75 each. Tone Arms and Reproducers $1.30 to $5.75 per set. Main Springs 20c to 90c each. Records, Needles, Sapphire Points and Parts at reasonable prices.

Write for our 84 page catalogue, the only one of its kind in America, illustrating 33 different styles of Talking Machines and over 500 different Phonographic Parts.

LUCKY 13 PHONOGRAPH COMPANY
Export Dept. 46B E. 12th St., N. Y., U.S.A.

Learn Watchwork, Jewelrywork and Engraving A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL Department, Bradley Institute, Peoria, Ill., for our latest catalog.

Peacetime Uses for War Inventions

By H. Winfield Secor

(Continued from page 365)

gines of the distant vessel is picked up by a sound-sensitive electrical instrument, known as a *microphone*. By turning the microphone in different directions, and noting carefully the position where the maximum sound is heard in the receivers, the spot from which the sound originally emanated can readily be determined even to within a fraction of a degree, it is claimed. For locating icebergs or other obstructions, which of course do not produce any sound themselves, there is required a *sound producer* such as an under-water electric bell or siren. The sound waves radiate from this device, mounted between two microphones on a rotatable arm secured to the vessel, as the illustration shows, travel outward until they impinge against the iceberg or other impediment, when they are *reflected* as the arrows show. These reflections, or the "echoes," are listened for by the aid of microphones and sensitive telephone receivers connected with them. By swinging the bar supporting the microphones and siren in different directions, the position of the obstruction is at once determined. Its distance can also be ascertained with some of the more highly developed apparatus of this class, by direct reading instruments, or else by the relative strength of the sound heard in the receivers.

The *Radio Compass*, as it is called, has come greatly to the fore in the past three years. Prior to the World War it existed mostly in the laboratorial stage. But at the close of the war radio compass stations were to be found not only in the principal coastal regions in the vicinity of shipping activities, but they were also to be found on the great battlefields of Europe, where they were used for the purpose of accurately locating "enemy" radio stations. The radio compass should, we might almost say, find even a greater field of useful application in peacetime than it did during the war. It promises to become one of the most important scientific developments in wireless telegraphy, particularly for the navigation of aircraft. We were recently informed by a naval radio expert that the English Navy had the radio compass scheme worked out to wonderful perfection, and that during the war they were actually able to steer vessels up the entrance to the Liverpool Harbor, one of the most treacherous harbor entrances in the world, on the darkest and most foggy nights, without ever having a collision. See Fig. 9. To do this, a series of radio compass stations were situated on either shore at short intervals, and these stations sent out predetermined radio signals at successive intervals. This expert also mentioned that it was very easy for any Allied war vessel to instantly obtain her location and bearings if she was anywhere about the coast of England or Ireland, utilizing the service of the radio compass stations which dot these coasts. If the vessel wished to know her location, the radio code signal for interrogative "L" was sent out twenty times. This was the official notice to nearby radio compass stations that the ship calling wished to know her location. At least two land compass stations then took readings of her signals, and by triangulation and by means of wire or wireless communication between the two stations which had a fixt base line, the triangle was solved in a few minutes, and the exact location of the ship was transmitted to her radio officer from one of the land stations. The ship received her location figures in latitude and longitude about five minutes after sending out the call letter aforementioned.



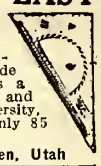
SPECIAL KON-VER-TER SLIDE RULE

The Hamilton KON-VER-TER slide rule has over 8000 graduations and over 1800 charactera on it, will handle anything in Arithmetic, Algebra, Geometry or Trig. This slide rule is in use in all parts of the world and is much simpler to operate than others of similar lines. Does not require a wizard to use it.

Eventually you will get this rule, get it now and save the extra bother and expense. Utility rules $1.00. Special De Luxe, white ivory celluloid $2.50, instructions free. Leatherette case 50c extra.

J. C. HAMILTON & CO.,
Dept. B 7 Water St., Boston, U.S.A.

MATHEMATICS MADE EASY



The Arcascope—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 85 cents Postpaid. Order today before you forget.

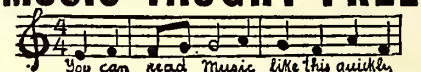
Dept. J, L. J. LEISHMAN CO., Ogden, Utah

"Hang Your Own Lighting Fixtures"

One Light Bracket $1.05—4 Light Shower $6.15 Semi-Bowls $5.85—Plate & Ball 85c, complete with glassware, Wired, Fine finishes. Send for Photos complete line.

ERIE FIXTURE SUPPLY CO.
Sta. C., Erie, Pa.

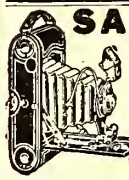
MUSIC TAUGHT FREE



In Your Home. Write today for our booklet. It tells how to learn to play Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced pupils.

American School of Music, 57 Lakeside Bldg., Chicago

SAVE 25% to 60%
on slightly used
GRAFLEX-KODAKS



Cameras and Lenses of every description. Equal to new. Save money. Write now for **Free Bargain Book and Catalog** listing hundreds of money-saving bargains in slightly used and new cameras and supplies. **All goods sold on 10 days' Free Trial.** Money back if not satisfied. You take no chances dealing with us. We have been in the photographic business over 16 years. Write now.

CENTRAL CAMERA CO., Dept. 178 124 S. Wabash Ave., Chicago

A NEW AND EASY WAY TO PAINT
SIGNS and SHOW CARDS
OUR PATTERNS DO THE WORK

No experience required. Anyone can paint all kinds of signs, banners, cards, etc., on any surface with our new and easy system of lettering. Complete outfit containing eight alphabets of letters, assorted styles and sizes from two to twelve inches high, also four sets of figures, etc., not printed but life size patterns cut out of durable tag board which can be used over and over again for years, also brushes, colors and book of instructions. Satisfaction guaranteed. PREPAID ------- **$7.50**

ACME SALES CO., Empire Bldg., Denver, Colo.

Be FREE From STAMMERING

Home Exercise Course. Results GUARANTEED or NO PAY. Write for full particulars.
SUTHERLAND COURSE,
Educational Bldg., 70 Fifth Ave., New York.

Want to Make Money? Send for our big July and August Sale By Mail. You'll save many dollars on your summer purchases of Cameras, Jewelry, Auto Supplies and Traveling Goods.

DAVID STERN COMPANY
1027K Madison St., CHICAGO, U. S. A.

DO YOU NEED MONEY Out of work? Got a lot of spare time? We want MEN or WOMEN in every city to do special local advertising. No experience necessary. Will not interfere with your regular work or household duties. Hundreds are now making $15 to $35 weekly. Write me for particulars.

ALBERT MILLS, Mgr. 1182 American Bldg., Cincinnati, O.

158 Genuine Foreign Stamps—Mexican War Issues, Venezuela, Salvador and India Service, Guatemala, China, etc., only **10c.** 100 all diff., fine, 15c; 200 all diff., 25c. FINEST APPROVAL SHEETS 60% to 80%. AGENTS WANTED. Big 72-page Lists FREE! We Buy Stamps. Est. 25 years. C. E. HUSSMAN STAMP CO. Dept. 67 ST. LOUIS, MO.

Handy Binder

FOR THE ELECTRICAL EXPERIMENTER

Holds and preserves 12 issues, each of which can be inserted or removed at will, without tools. Will keep your magazines perfectly for all time or just preserve them permanently. Made of heavy material, extra strongly reinforced at the back and covered with handsome green cloth, suitably lettered in gold. **65c**

Add postage for 2 lbs.

Experimenter Pub. Co., Inc. Book Department 233 Fulton St., N. Y.

www.americanradiohistory.com



MAKE UR OWN BATTERIES
(PATENTS PENDING)

NOW you can have a FRESH FLASHLIGHT BATTERY when you need it. *Make it yourself in a few minutes.* So simple a child can make it! With the MAKE-UR-OWN Flashlight Service Outfit you can now have

A YEAR'S SUPPLY OF BATTERIES FOR ONLY $1.00

ready to use as soon as made. Never fails. Better light. Lasts longer. 25% cheaper, and your flashlight always ready when you want it. ABSOLUTELY GUARANTEED, OR MONEY BACK. 400 *per cent more flashlight service for less money.* Get outfit now for your outing, use around house, garage, car, anywhere.

Batteries will fit any standard flashlight case of corresponding size.

Send coupon with remittance. Amount enclosed will tell us which outfit you want. Sent prepaid, securely packed on receipt of price.



DESCRIPTION and PRICES

Stuart Flashlight Service Outfit consisting of flashlight case, 1 1-2 X 6 1-2, fibre, heavily nickeled brass parts, equipped with Mazde 2.7 volt lamp, parts to make 6 cells, or three MAKE-UR-OWN 2-cell or two 3-cell batteries. **No. 240 Complete Outfit.....$2.35**

Make-Ur-Own Battery Outfit consisting of parts to make six cells, or three 2-cell or two 3-cell batteries. Absolutely harmless. Every boy will want one. **No. 6404 Renewal Battery Outfit, $1**

AGENTS WANTED.

Serviceable Battery Co.,
2415 Indiana Ave.,
Dept. E,
Chicago, Ill.

MAIL COUPON NOW

SERVICEABLE BATTERY CO.,
2415 Indiana Ave., Dept. E, Chicago, Ill.
Please send me Complete Outfit No. 240, for which find enclosed $2.35. Renewal Battery Outfit No. 6404, $1.00.
(*Cross out the one you don't want*)
It is understood you guarantee these goods and will refund money if not satisfactory.
Name .....
Address .....
City ..... State .....
State make of battery you now use.

BIG PROFITS for YOU in HB BATTERY CHARGING

NEW LOWER PRICES NOW IN EFFECT
Make $100 to $200 Clear Profit Each Month

Lower cost—smaller cash payment—BIGGER PROFITS. Start NOW to build big money-making business charging auto batteries. No experience or electrical knowledge necessary. This HB 500 watt Charger recharges 1 to 7 6-volt batteries at once for 10c to 15o each. Owner pays 75c to $1.50; figure those profits.

Small Payment at New Lower Price Puts this Charger in Your Shop

Balance on easy monthly terms. Profits will easily pay for outfit. No burnouts, no expensive renewels—steady 24 hours a day service with BIG PROFITS. Absolute Money-Back Guarantee. Tear out this ad and mail TODAY for information.

HOBART BROTHERS COMPANY
Box 81E Troy, Ohio
Successful Manufacturers Since 1893



TIRES at WHOLESALE

Not Seconds—Fully Guaranteed



Genuine "Capitol" or the new **"Rib-Skid" Beacon** Tires **$13.60** up. Red Tubes or **"Inside Armor" $2.90** up. Write at once for full description, **samples of material,** and "Direct-To-You" **wholesale prices** on these **absolutely First Quality Fully Guaranteed** 5000 mile Tires, Tubes, Armor, etc. Avoid tire trouble, and **save one-third your Tire expense by** sending **size of your tires** and name of car today.

MODERN TIRE CO.
659 7th St., Racine, Wis.

Electricians Get up-to-date in HOUSE WIRING! Save TIME, MONEY, LABOR and MATERIAL by using our 98 GENUINE BLUE PRINT DRAWINGS, containing all the lateet diagrems and connections known in house wiring—every diagram and connection up-to-the-minute as used by first class electricians for wiring BELLS, BURGLAR ALARMS, LIGHTS, ANNUNCIATORS, FIRE ALARMS and ELECTRIC GAS LIGHTING. These drawings are bound in the form of a flexible book (9 x 12) for convenience in using on the job. Send for them, and if they don't make you more efficient as a wireman and seve you many times their cost as a contractor, return them and money will he refunded—you cen't efford to be without them. ONE DOLLAR postpaid. Send for circulere on other sets of drawings.

PATENT SPECIALTY COMPANY
P. O. Box No. 583, San Francisco, Cal.



INSYDE TYRES Inner Armor for Auto Tires. Double mileage, prevent blowouts and punctures. Easily applied to any tire. Thousands sold. Details free. Agents wanted. Amer. Accessories Co., Dept. 53, Cincinnati

Airplane Photography was pre-eminently one of the most highly developed sciences brought out by conditions imposed by the World War. Complete sections of the battlefront often had to be photographed in a single day's time, and by means of camera guns, and other extremely rapid photographic devices, thousands of pictures could be taken within a few hours in such a manner that when the films were developt and prints made, which took a short time with the perfected apparatus used by the Army in the field, these prints could be matched up by map experts so as to give a true composite photograph of an entire region. The work done by the Photographic Department of the Army in this respect was nothing short of miraculous. At a recent exhibit of this Department's work, one of the composite aërial photographs showed the entire city of Washington, D. C., and environs. The airplane flew over Washington in a certain prescribed course and took all of the photographs which composed the composite view in a little over *two hours!* The individual prints making up the composite view usually measured about three inches square. Imagine how easy it now becomes to obtain actual physical maps of such regions as the Rocky Mountains and other inaccessible and treacherous localities so that our geographies of tomorrow may indeed prove a marvelous revelation to the school students of today. Airplane photography in its modern aspect and with the high speed available should lend itself well to the requirements of mapping real estate, large farms, railroad sites and hundreds of other localities for many kindred purposes. See Fig. 10.

Gas Masks, as well as *Gas Detectors,* find many uses in our everyday life. The gas masks are useful to firemen and rescue squads and prove particularly efficacious for use in entering gas-filled mines and other subterranean passages. Gas detectors are not so well known to the general public, as these proved one of the extremely valuable keys to the success of the Allied soldiers. One ingenious form of electrical gas detector is illustrated in Fig. 11. This detector, which also permits of the measurement of the amount and strength of the gas present, comprises a pair of sensitive detecting wires, also a pair of resistance coils and a galvanometer, forming a Wheatstone bridge system, as the diagram shows. At the bottom of the apparatus is shown a metal block in which there are two cavities, each containing a gas detecting wire, and the gas reaches one of these wires thru a series of perforations placed in the external wall of the block. This clever patent has been granted to Gilbert A. Shakespear of Birmingham, England (U. S. patent number 1,304,208).

Depth Bombs apparently seem to be one of those peculiar inventions which follow the old adage—"killing two birds with one stone." Not only did they prove the undoing of the career of many U-boats, but they likewise show great promise of performing many useful peacetime tricks as well. Among other things, the depth bomb should prove uniquely successful in blasting ice jams in river gorges, etc. And as one of our naval officer friends recently told us, thousands of fish are stunned and killed every time a depth bomb is detonated on the water. See Fig. 12. Therefore, why fish with nets in the ocean, when by means of a few depth bombs detonated thirty to forty feet below the water you can stun or kill thousands of fish? Then by a simple suction arrangement pull them into the fishing smack so fast that it would take seventeen bookkeepers and three adding machines to keep account of the catch. Another practical use for depth bombs is the clearing away of derelicts or other obstructions in harbors, lakes or on the ocean.

BOYS



Learn Drafting

Employers everywhere are looking for skilled draftsmen. They are offering good salaries to start with splendid chances for advancement.

Drafting offers exceptional opportunities to a young man because drafting itself not only commands good pay, but it is the first step toward success in Mechanical or Structural Engineering or Architecture. And drafting is just the kind of work a boy likes to do. There is an easy delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving boys just the training they need for success in Drafting and more than 200 other subjects. Thousands of boys have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you.* Choose the work you like best in the coupon, then mark and mail it. This doesn't obligate you in the least and will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6196, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

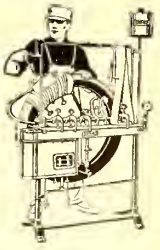
☐ MECHANICAL DRAFTING	☐ SALESMANSHIP
☐ STRUCTURAL DRAFTING	☐ ADVERTISING
☐ SHIP DRAFTING	☐ Show Card Writer
☐ ELECTRICAL DRAFTING	☐ Sign Painter
☐ ARCHITECTURAL DRAFTING	☐ ILLUSTRATING
☐ SHEET METAL DRAFTING	☐ Cartooning
☐ BOILERMAKER DRAFTING	☐ BOOKKEEPER
☐ BRIDGE DRAFTING	☐ Stenographer and Typist
☐ MACHINE DESIGN	☐ Cert. Public Accountant
☐ ELECTRICAL ENGINEER	☐ TRAFFIC MANAGER
☐ Electric Lighting and Railways	☐ Railway Accountant
☐ Electric Wiring	☐ GOOD ENGLISH
☐ Telegraph Engineer	☐ Teacher
☐ Telephone Work	☐ Common School Subjects
☐ MECHANICAL ENGINEER	☐ Mathematics
☐ Machine Shop Practice	☐ CIVIL SERVICE
☐ Gas Engine Operating	☐ Railway Mail Clerk
☐ CIVIL ENGINEER	☐ AUTOMOBILE OPERAT'G
☐ Surveying and Mapping	☐ Auto Repairing
☐ STATIONARY ENGINEER	☐ PLUMBING AND HEATING
☐ Marine Engineer	☐ Textile Overseer or Supt.
☐ ARCHITECT	☐ CHEMIST
☐ Contractor and Builder	☐ Navigation ☐ Spanish
☐ Concrete Builder	☐ AGRICULTURE ☐ French
☐ Structural Engineer	☐ Poultry Raising ☐ Italian

Name .....
Present Occupation .....
Street and No. .....
City ..... State .....

AN EASY WAY TO MAKE MONEY Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business. One man says "I made $60.00 the first day." Others average $200 to $500 a month. Very little capital needed. Jobs plentiful. Every motorist a possible customer. No experience needed. We teach you.

SHALER Tire Repair Outfit

Improved Wrapped Tread Method Used by Tire Manufacturers



Does as good work as the big high priced vulcanizing outfits. A boy can use it. It's the only vulcanizer that has Automatic Heat Control, and can't undercure or overcure a tire. Requires no watching or regulating.

FREE Book

"How to Open a Tire Repair Shop." It tells how to make big money. Don't delay. Write quick.

C. A. SHALER CO.
2207 Fourth St. Waupun, Wisconsin

www.americanradiohistory.com

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section seven cents a word for each insertion. No advertisement for less than 50c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency.

Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the September issue must reach us not later than July 22.

The Circulation of the Experimenter is over 115,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Automobile Accessories.

Battery Charging Pays Big Profits. City current or gas engine operates. Easy terms. Hobart Brothers, Troy, Ohio.

Lubricant Carbon Remover. Cleans your engine and keeps it clean. Results guaranteed, $1. Circular. Lewis Gilbert, Skaneateles, N. Y.

Fords run 34 miles per gallon with our 1919 carburetors. Use cheapest gasoline or half kerosene. Start easy any weather. Increased power. Styles for all motors. Runs slow high gear. Attach yourself. Big profits for agents. Money back guarantee, 30 days' trial. Air-Friction Carburetor Co., 270 Madison St., Dayton, O.

Auto Motors and Supplies. Buick, Hupp, Franklin, Michigan, Everett, Hudson, Chalmers. Both water and air cooled motors, $40 each and up. Bosch Magnetos, $15 each and up. Presto Tanks, $5. Coils, Carburetors, Head Lamps, Horns, Air Compressors, Generators, Starters. Write for bargain bulletin second-hand auto accessories. Johnston, West End, Pittsburgh, Pa.

Power Increased; Carbon Eliminated; results guaranteed; write for booklet. No-Leak-O Piston Ring Co., Baltimore, Md.

Agents Wanted.

Beginners. Complete "Mail Order System." C, Box 1005, Atlantic City.

Agents Wanted to sell these rubless washing bars. Save soap and money. Agents making good. Le Hunt, 756 23rd St., Newport News, Va.

Big Money Made every day selling our automobile accessories. Every autoist a customer. Most remarkable inventions in the accessory line. Demonstration proves every claim. Particulars free. Exclusive territory if you act quick. The Embee Co., Wilkinsburg, Pa.

$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Ave. D, Decatur, Ill.

Signs for store and office windows. $50 a week easily made. Chicago Sign System, G 326 River St., Chicago.

Wonderful Chance—Men's shirts and furnishings at wholesale rates, or make $10 daily starting real business. Goodell Co., Duratex Bldg., New York.

10 to $25 a day profit. Biggest summer seller. Concentrated fruit drinks. Just add water. Delicious drink in a jiffy. Six popular flavors. Bestever Products Co., 2426-SE-8 Polk St., Chicago.

Agents. Big returns, fast office sellers; particulars and samples free. One Dip Pen Co., 12 Daily Record Bldg., Baltimore, Md.

Insyde Tyres, inner armor for automobile tires, double mileage and prevent punctures and blow-out. Quickly applied. Costs little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, O.

Help Wanted.

Auto Experts Wanted. $35 week. Learn easily while earning. Write immediately. Franklin Institute, Dept. H 806, Rochester, N. Y.

Detectives make big money. Travel; be your own boss. Either sex. We instruct, small cost. Write Johnson's Detective School, 232 Sheldon Ave., Grand Rapids, Mich., Dept. A.

U. S. Government wants Railway Mail Clerks. Hundreds needed. $1,100-$1,600 year. Examinations everywhere, Aug. 23. Sample questions free. Write immediately. Franklin Institute, Dept. H 26, Rochester, N. Y.

Agents 200% Profit. Wonderful little article. Something new; sells like wildfire. Carry right in pocket. Write at once for free sample. Albert Mills, Mgr., 1287 American Bldg., Cincinnati, Ohio.

Fishing.

Julian's Liquid Fishing Lure. Doubles your catch. By mail One Dollar. Circular for stamp. George Julian, Albany Bldg., Boston, Mass.

Postcards.

Five Prettiest Women Cards, hand colored, 25c. Chas. Durso, Dept. 41, 25 Mulberry St., New York City.

Stammering.

St-Stu-t-t-tering and Stammering cured at home. Instructive booklet free. Walter McDonnell, 105 Potomac Bank Bldg., Washington, D. C.

BUFFALO SHOE COMPANY
OUTDOOR FOOTWEAR

Seneca and Ellicott Streets

BUFFALO, NEW YORK, U. S. A.

142 Oxford Ave., Buffalo, N. Y.

The Experimenter Pub. Co.,
233 Fulton St., New York City.

Dear Sirs:

Find inclosed a bill for 98c and also money for same. Kindly send receipt. Please pardon me for not sending it sooner.

It was the best ad I ever had and if I ever have any other instrument to dispose of I will advertise in your columns. I received 24 answers inside of 4 days.

Yours for success,

(Address) J. Rife Barbusser,

Exchange Ads.

For Sale—Electro Importing Co. Loose Coupler $6. Never used. James Walker, Pontiac, Mich.

Sacrifice: Large Camera, large Scientific book. Want: Wireless Apparatus. Stamp for list. Weniger, Brownsdale, Minn.

Exchange, Buy, Sell. Wireless, electrical goods, etc. Large list 6c. State what you have and want. Zehrbach, Box 600, Hiram, O.

Boys' Books for chemical or electrical apparatus. Stamp for list. Homer Votaw, Raymond, Wash.

For Sale—One new bicycle motor. Makes your bicycle a motorcycle. Walter Van Schaick, Lake Benton, Minn.

For Sale—One pair Murdock phones with cord, "Regular" Headband, two thousand ohms. Second-hand, but very sensitive. Twelve "Electrose" Ball insulators. New Six "Electrose" strain insulators. New one six hundred volt ground switch, 6 lbs., new. Thirty feet high tension cable 7/16 inch diameter, twenty thousand volts discharge. New six lbs. Copper Clad Wire, 510 feet. Best and latest Wire, new. Cash. Twenty Dollars, or make offer on part of equipment. H. K. Tryon, Berlin, New York.

$5 Electrical Water Purifier; want Film camera. Prints—or offers. Clarence Skinner, Topeka, Kansas.

For Sale—Wireless and electrical apparatus, also other articles. Cheap. List free. Write quick. Atley Maurek, Box 157, Austin, Minn.

Cheap—Twenty-three dollar Omnigraph. Arnold and Murdock Couplers. Load. Detectors. Meeker, 1632 University Ave., N. Y.

Exchange pair 1,500 receivers, headband, 100 Amp. switch, 9-4" insulators, fixed condenser, 2 lbs. aluminum wire No. 14, spark gap, 15 ft. ground wire; for folding camera like Kodak, value $10 (2¼x3¼). Maron, 390 Highland Ave., Malden, Mass.

For Sale—Complete unused analytical and industrial I. C. S. Chemistry Course. First $20 takes it. Nicholas Michel, 217 South 4th St., St. Charles, Mo.

5 H.P. 2 cycle single cylinder air cooled engine. Coil ignition. New piston rings and spark plug, good carburetor. Guaranteed A-1. $25. Money with letter. James E. Walker, Box 63, Marfa, Tex.

For Sale—"Ranger Arch-Frame" bicycle; 22-inch, three-speed, clincher tires, nearly new, $43. Stamp for answer. Gerald Willard, Heron Lake, Minn.

Exchange Ads—Cont'd

For Sale—2 K.W., D.C. 110 V. Dynamo. Marble slab with 0-150 V. Meter field rheostat and switch attached. Price $100. Or part in wireless receiving apparatus. S. R. McClure, Helm, Ky.

Wanted—Everything. Motor-wheels, cyclecars, anything. R. Place, Sprague, Fall River, Mass.

Attention, Experimenter—Brand new books, "Radio Telephony," by Alfred Goldsmith, $1.25 (sells for $2.00). "Practical Wireless Telegraphy," by E. E. Bucher, $1.25. Arthur E. Reider, 348 E. 15th St., N. Y. C.

Your Opportunity to Save Money. I have Printing Outfit; cost $150; is almost new; will sell for $100 cash. Have lots of Electrical Wiring Supplies; will sell at my cost (wholesale prices). Paid $80 for Smith Motor Wheel; very good condition; will sell for $45 cash. Above statements and your complete satisfaction fully guaranteed. Privilege to return within 10 days. H. L. Baer, Van Wert, Ohio.

Bargain—1,200-mile Receiving set, includes loose coupler, loading coil, condenser, silicon detector, buzzer code. Mounted; for $7. Money Order. Merle Doan, Vera, Oklahoma.

For Sale or Exchange: Six copies of Hawkin's Guides, $3.90; 1 400-day clock in first class condition, $5; 1 1 K.W. Thordarson Transformer, $18.90; 1 ¼" Spark Coil, $1; 1 1-K.W. Tesla Coil, $15; 1 Crystaloi Detector, Type AA, $5; 1 E. I. Co. loose coupler, $2; 1 Navy Type loose coupler, $4. All in first class condition. Address Walter Franseen, Woodhull, Ill.

For Sale—$40 Cabinet Set. Receives any 1 K.W. set in States. Uses bulb detector. Two loading coils free. $20. $35 Rotospeed Duplicator and equipment, $20. No. 3 Box Brownie, $2. Any article C. O. D. upon 25% payment. No trades. J. C. Gilliland, Munhall, Pa.

For Sale—½ K.W. Wireless Transformer complete with rotary motor gap and one battery charging outfit; will charge 3 six-volt batteries at once. Will sell all of above for $75. A good bargain for someone. E. L. Forslund, Madrid, Iowa.

Sell—3 1-qt. size Wet batteries, 75c each; 2-plunge batteries, 75c; telegraph outfit, $1.00; Selenium cell outfit, $1.00; loose coupler, $3.00; 6 bar magneto 110 volt generator, $4.00; telephone set, $3.00; Structo Auto Builder, $4.50. Raymond Fiedler, 70 Sargent Street, Lawrence, Mass.

Sale—1" coil, $2.50; O. K. motor, $1.00; step-down Thordarson, $3.50; ¼ K.W. transformer, $5.00. Also wire, silicon steel, etc. R. P. Hanger, Sherwood Ave., Staunton, Va.

Motor Winders. See ad under "Blueprints." Charles Chittenden.

Motor Generator for Sale. 220 volt, 60 cycle, single phase motor, 30 ampere, 36 volt generator. Specially wound for battery charging; 1 to 24 batteries charged at one time. Used very short time; good as new. Price, including switchboard and 4 charging rheostats, $230. Earl Hotchkiss, Forestville, Conn.

For Sale—High grade regenerative receiver with phones. Will sell parts separately. Also have key, large oil condenser, half-inch coil, motor, etc. Write for prices and description. E. H. Hartnell, Salem, Wis.

For Sale—$8 Loose Coupler, $6; 2,000 Ohm receivers, $4; $4.50 Variable Condenser, $3.50; $3.50 Variable Condenser, $3; $1 Fixed Condenser, 60c; $4.50 Detector, $3; $2.25 Transformer Key, $1.50. All Murdock goods. 2" Spark Coil, $6; Gernsback Interrupter, $1.85; 2 ½-pt. Leyden Jars, $2; $5 Vacuum Bulb, $3; 6 Volts 6 Amp. Dynamo, $1. Guaranteed all new. Send money order. K. Jennings, 106 Blue Hill Ave., Mattapan, Mass.

For Sale—One I. C. S. Heavy Electric Fraction Course without bound volumes. Highest cash price takes. Elwood Little, Decatur, Ill.

Wanted—Wireless goods for 3¼x4¼ Premo Camera. G. Kostka, 2215 St. Louis Ave., Chicago.

Will trade I. C. S. Mechanical Engineering Course for Chemical Laboratory. Herbert Langlois, 2414 Cleveland Ave., Everett, Wash.

For Sale—Steel Radio Tower, 115 ft. high. A bargain. W. Turnor Lewis, Racine, Wis.

Sell. Set of Ford Spark Coils, $7.50. Extension Desk Phone, $6. 2000 ohm Receivers, $2. Phillip Stout, 1621 Riverside Drive, Knoxville, Tenn.

www.americanradiohistory.com

Business Opportunities.

Start a Profitable Business manufacturing "Puffed Crisp." Delicious confection. Whirlwind money-maker. Machine, Instructions complete $6.50. Samples 10c. Bestever Products Co., 2426-PE-8 Polk St., Chicago.

$30 a Week. Evenings I made it with a small Mail Order Business; continued my regular job daytime. Free Booklet Tells How, 2c postage. Albert W. Scott, Cohoes, N. Y.

Enter a New Business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks at small expense; no further capital required; no goods to buy; job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston, Mass.

Anyone Interested in making $100.00 month in spare time at home? Send 25c. (coin). L. Stutz, Middletown, Md.

$1 Does It. Bank references furnished. Investigate us thoroughly, that's all we ask. Results count. Our plan $1 down, $2 monthly few months gives you Warranty Deed to land. May pay profits $200 or more monthly. Maps, reports, established facts free. Address Sourlake Texas Oil Co., 867 De Menil, St. Louis, Mo.

Build Up an Income in Oil. Others are doing it—Why not you? Today is the opportunity. Join our easy monthly payment plan now—it may mean hundreds in profits. Write for information. National Oil Drilling Co., Dept. K, Houston, Texas.

Dollars Yearly in Your Back Yard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. Metz, 313 East 89, New York.

Manufacturers of Electric Vibrators and Hairdryers are requested to send us price lists at once and conditions of payment and delivery. I. Calvete, Ltd., 46, Newman Street, Oxford Street, London, W. I. England.

We Write Ads. that pull. Send outline for advice. Sales Letter $2. Jacobus Advertising Service, 1073 Sanford Ave., Irvington, N. J.

Victory. Mechanical Toy Soldier window attraction. 30 inches high. Salutes, turns head, points with finger, etc., as set. Well made, nicely dressed officers, privates, Uncle Sam, etc. Electrically operated. Does some stunt every half minute or oftener as set and will salute soldier and pay no attention to other if desired. Representative wanted in each city and town. Write for prices. The John M. Biggs Co., Box 324, Chattanooga, Tenn.

We will start you in the cleaning and dyeing business; little capital needed; big profits. Write for booklet. The Ben-Vonde System, Dept. H, Charlotte, N. C.

Open for proposition. R. A. Holmes, 1934 Edmondson Avenue, Baltimore, Maryland.

Break Into the Newspaper Game as correspondent or city reporter. Our correspondence course indorsed by leading editors. We give instruction and actual experience in gathering and writing news. Write for details. American Institute of Journalism. "A Newspaper School Run by Newspapermen." Dept. E, 22 Hawley St., Boston.

Your Money Back within ten days if not satisfied. Only one dollar per share for undivided interest in Sinking Ship Saver Patent. Two full pages illustrated description on second and third pages, news section, in 1918 June issue Illustrated World and first full page July, 1918, Popular Mechanics Magazine. Send $10, $25, $50, $100, or $1000 for as many shares and copy of patent. Inspect them and if not satisfied return to me within ten days and get your money back. C. Stewart Henslee, Inventor and Patentee, Chattanooga, Tenn.

Money-Making Farms. 19 States. $10 to $100 acre. Stock, tools, crops, often included to settle quickly. Write for big illustrated catalog. E. A. Strout Farm Agency, 150 E C Nassau St., New York.

The Enricht Chemical Technical Laboratories at Farmingdale, N. Y., offer their services to Manufacturers in Research work to improve and cheapen their output. Terms moderate. Correspondence solicited. Results guaranteed or no charge.

"Quick-Action Advertising—How It Is Building Business for the Progressive Advertisers of America"; A little story of results told by the advertisers themselves—not the publishers. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 W. 39th St., New York.

Blue Prints

236 A. C. Motor Connections, 2 to 12 poles, contains 54 single, 42 two phase, 50 three phase Star, 40 Delta, 12 Star-Delta. Appendix 38, changes of voltage, phases, speed, cycles, etc. Particulars and sample free. Charles L. Chittenden, 811 West 18th Street, Kansas City, Missouri.

Motors, Engines & Dynamos.

Gas Engines. Marine, stationary and cycle motors for bicycle attachment, rebuilt and guaranteed. Don't fail to get our price list before buying. Prices 50% lower than others. Write. United Motor Repair & Supply Company, 305-309 Broadway, New York.

Small Motors and Generators from bankruptcy and receivers' sales. Motors for all phases of current. Immediate delivery. Less than one-half regular prices. See display ad on page 259. Johnston, West End, Pittsburgh, Pa.

Gasoline Engine, marine or stationary, ¾ horse. Castings, $8. Speed Lathe complete, $2.75. Send 12c for blueprints. M. & J. Specialty Co., 252 Parke St., Pontiac, Mich.

Miscellaneous

For Sale. Choice Silver Black breeding foxes. Reid Bros., Bothwell, Ont., Canada.

Wanted. Small gasoline and steam engines, small lathes, drill presses and other light machinery. Will pay high cash prices for good material. Johnston, West End, Pittsburgh, Pa.

Here, Boys! Jersey Skeeter, flies 100 feet; see our ad page 344. Nifty Novelty & Toy Co., Newark, N. J.

Mansfield's Automatic water and oil finder a proved success, silver medal awarded. Particulars from Edwin A. Mansfield & Co., 94 Victoria Road, New Brighton, England.

Let me send you a harmless and agreeable recipe to stop the odor and relieve your sore feet for one dollar. Guaranteed or money refunded. Louis Burchard, 119 East Vermijo St., Colorado Springs, Colo.

Breed Canaries. Profitable pastime. Particulars free. Bird Farm, Lynnhaven, Virginia.

Motion Pictures.

Electric Arc Generator halves expense. Your engine operates. Easy terms. Hobart Brothers, Troy, Ohio.

Photoplays Wanted. Big prices paid. You can write them. We show you how. Free particulars. Rex Publishers, Box 175, E14, Chicago.

News Correspondents.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Song Poems Wanted.

Write the Words for a Song. We write music and guarantee publisher's acceptance. Submit poems on war, love or any subject. Chester Music Co., 920 So. Michigan Ave., Room 265, Chicago, Ill.

Write the Words for a Song. We revise poems, write music and guarantee to secure publication. Submit poems on any subject. Broadway Studios, 197C Fitzgerald Bldg., New York.

Stamps & Coins.

Stamps—12 different from warring nations, 10c; 10 different foreign coins, 15c; 10 Uruguay stamps, 10c. Lists free. Toledo Stamp Co., Toledo, O.

California Gold. Quarter size, 27c.; Half dollar size, 53c.; dollar size, $1.10; large cent, 1820, and catalogue, 10c. Norman Shultz, Kings City, Mo.

1844 cent, 10c. 727 McClellan Ave., Detroit, Mich.

Stamps—61 All Different Free. Postage, 3c. Mention paper. Quaker Stamp Co., Toledo, O.

100 Different Stamps 12c.; 200, 27c. Michaels, 5600 Prairie, Chicago.

Lusitania Medals. Exact duplicates of German medal celebrating murder of innocents. Everlasting proof of Hun's damnable duplicity. 50c each; three for $1.00; $3.00 per dozen. C. E. Mahood, Warren, Pa.

Best One Cent Approvals in America. F. P. Hand, 1117 So. 60th St., Philadelphia, Pa.

Rare Coin Over 100 Years Old, 12c. Bohn, Crafton, Pa.

Approval Applicants, 65 different stamps Free. Reference—5 cents. Harland Burgett, 419 Spring St., Lima, Ohio.

Old Money Wanted.

We Buy and Sell Old Coins. $2 to $500 each paid. Keep All Old Money; you may have valuable coins. Send 10c. for New Illustrated Coin Value Book, 4 x 6. Guaranteed prices. Get posted. Clarke Coin Co., Box 110, Le Roy, N. Y.

Telegraphy.

Telegraphy (both Morse and wireless) and Railway Accounting taught thoroughly and quickly. Big salaries now paid. Great opportunities. Oldest and Largest School—est. 45 years. Catalog free. Dodges Institute, 7th St., Valparaiso, Ind.

Cameras, Supplies—Photo Developing.

Clean, Neat, Perfect Kodak Finishing at the lowest prices. Work returned the same day received. Send film for sample print and copy of catalogue on developing, printing, enlarging and hand coloring, also copy of Photo Craft Magazine, which will help you make better pictures. Photo Craft Co., Box 69, Ann Arbor, Mich

For 15c we will develop and furnish prints from one, six or eight exposure film or enlargement 8x10, your favorite negative, 20c to show quality and service. Associated Photo Company, Sta. A 12, Cincinnati, Ohio.

Mail us 15c with any size film for development and six velvet prints. Or send six negatives, any size, and 15c for six prints. Or send 35c for one 8 x 10 mounted enlargement. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke, Va.

Health.

Cigarette, pipe or chewing habit conquered. Nature's method. Guaranteed. Write for free brochure. Edw. J. Woods, TA-300, Station F, New York.

Tobacco or Snuff Habit Cured or no pay; $1 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

Tobacco, Cigarette Habit Quickly Overcome. Eniram Remedy Co., Anderson, Ind.

Pyorrhea. H. E. Kelty, D.D.S., M.D., pyorrhea specialist for 15 years, has developed a successful home treatemnt for pyorrhea. Purifying, healing, preventative. Full month's treatment and booklet $1. Circular free. Dr. H. E. Kelty, 106 Gladwin Ave., Leonia, N. J.

Chemicals.

Chemicals in Sets, $13.50 to $54.25. Apparatus in sets, $11.75 to $55. Write for particulars. Ziegler Experimental Laboratory, Rochester, N.Y.

Chemicals. Special, 35 different chemicals, one ounce of each, including mercury, acids, etc. Sent express prepaid $2.50. Jos. Simpson, 3880 Windsor Place, St. Louis, Mo.

Amateurs and Experimenters—We can supply you with any chemicals and apparatus at the lowest prices. Write for our price list. Jos. Simpson, 3880 Windsor Pl., St. Louis, Mo.

Chemists. Send 75c for a complete set of 150 labels for your chemicals. Reginald Pitts, 103 Third St., Hanover, Pa.

Standard Chemicals and laboratory apparatus, cheap and reliable. July list and 10 formulae 6c. Frane, Eureka, Ill.

Potassium Sulphocyanide C. P. at 50c per oz., postpaid. Ziegler Experimental Laboratory, Rochester, N. Y.

Electrical Supplies & Appliances.

Castings, Blueprints, Engines—Gas and Steam, ⅛ H.P. up. Gears, Pulleys, Pumps, Fittings, Small Boilers. Complete circulars for stamp. Latest models. Universal Gas Motor Co., 364 Monadnock Block, Chicago.

Obtain a Vial of Radium to complete your outfit. Used for illuminating light bulbs, keyholes, watch dials, etc. Price 1.00. Address G. Raymond Laboratories, 298 Broadway, N. Y. C.

Motor Connections. See ad under "Blueprints." Charles Chittenden.

Magnets: Large Horseshoe Magnets. Will lift 12 lbs. Mail $1, stamps or Money Order. Parcel Post Prepaid to all parts of U. S. or Canada. West Side Novelty Co., Drawer No. 8 Wabash P. O., Pittsburgh, Pa.

Battery Charging pays big profits with HB Equipment. Electric Light Generators and Motors can also be furnished on easy payments. Full information free. Hobart Brothers, Troy, Ohio.

Storage Batteries charged by alternating current. Inexpensive, Simple and Efficient; Instructions and Print $1. K. & S. Engineering, Box 124, Sewickley, Pa.

Electrical Workers and all others who are interested in Electrical Work in the Reconstruction that is taking place. To send us their name and receive descriptive literature of our Modern Blue Print Chart Method of Electrical Wiring. Souvenir information card included. Electrical Wiring Diagram Co., Box C. 173, Altoona, Pa.

"Danditoy" Transformers, 2½-27½ volts, $2.98. Description sent. Eagleco, Darien, Conn.

For Sale—2,000 Standard Signal Corps Audion B. Batteries, Type BA-2, each 22 volts, 50c each while they last, postage extra, 1 lb. Herman Silber, 164 Ross St., Brooklyn, N. Y.

Lava Insulation is not molded but individually sawn, lathe turned, milled, drilled, threaded. No limitation on form, only on size. Kilned at two thousand degrees. Hard, strong, accurate, fire, acid proof. Ask for hook. American Lava Insulator Company, Chattanooga, Tenn.

Continued on page 382

www.americanradiohistory.com

For Inventors.

Inventors join National Institute of Inventors, 118 Fulton St., New York City; membership society 1,900 strong; will help protect, develop, finance and market your invention. Absolutely no charge. Write for booklet.

"Sell or Finance Inventions." Read Money Talks Magazine. Send for free sample copy. 70-B Park Place, Newark, New Jersey.

Inventors write me about patents. My fees payable monthly. Booklet free. Frank Fuller, Washington, D. C.

Inventors. Protect yourselves. Record your idea before exposing it to anyone, even to me. Paul Klein, M.E., Consulting Engineer, Registered Patent Attorney, 21 Park Row, New York.

We manufacture Patents, Stampings, Armature Discs. Write us. C. C. Elsener Mfg. Co., Harvey, Ill.

600 Mechanical Movements, also illustrations and explanations of 50 perpetual motions. My book, Inventors' Universal Educator, 4th edition, tells how to procure and sell a patent for your new invention. Government and other costs. Covers the matter from A to Z. 140 pages elegantly bound. Contains noted Court decisions on Patent cases. Mechanical Movements greatly assist inventors—suggest new ideas that might prove of great aid in perfecting inventions. Tells how to select an attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers. Price $1. Postage free. Fred G. Dieterich, 603 Ouray Bldg., Washington, D. C.

Patent Drawings $2.00 the sheet. Applications $10.00. 12-16 inch tracings $3.00. Edw. F. Dowis, Huntington, W. Va.

Patent Attorneys.

Inventors. Send sketch of your invention for advice regarding patent protection. Twenty years' experience. Handbook on patents sent free. Talbert & Talbert, Patent Lawyers, 4822 Talbert Bldg., Washington, D. C.

Patents Procured, Trade Marks Registered. A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C., or 2278-T Woolworth Bldg., New York.

John M. McLachlen, Atty. at Law, Patents, Trade Marks, Copyrights, 410 McLachlen Bldg., Washington, D. C.

M. F. Miller, Ouray Building, Washington, D. C., Patent Attorney, Mechanical and Electrical Expert. Best quality of work and results. Moderate charges. Advice free.

Patents promptly procured by personal expert service. Information on request. James D. Lyles, Washington, D. C.

Patent Attorney. Electrical engineer, mechanical expert; thorough personal service. Frank Ledermann, 21 Park Row, New York.

Patent Your Own Inventions. Save attorney's fees; we prepare applications; furnish full instructions and give satisfaction. Free information. Carl Larsen Co., Park Row Bldg., New York City.

Patents—My fee payable in monthly installments. Send sketch for advice. Booklet free. Frank Fuller, Washington, D. C.

Inventors' Adviser. Sent free on request. Wm. C. Linton, 918 F St., N.W., Washington, D. C., 363 University St, Montreal, Canada.

Millions Spent Annually for Ideas! Hundreds now wanted! Patent yours and profit! Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. 212 Patent Dept., American Industries, Inc., Washington, D. C.

Printing.

Printing? We do it right and at reasonable prices. Write for quotation and samples. Parcel Post Printery, Dept. A, Kinmundy, Ill.

100 Bond Letterheads and Envelopes, $1.25 Postpaid. Garland Miller, Trimble, Ohio.

100 Engraved style visiting cards, 50c.; 100 emblem cards, 70c. H. Gregory, Warwick, N. Y.

Phonographs and Supplies.

Don't destroy worn Phonograph records. Send $1 for bottle of Record Renewer. Treats 50 records. Reduces scratching, revives tone. Cleans polishes and preserves record. Record Chemical Co., West Mansfield, Ohio.

Build Your Phonograph. "Perfection" high-quality spring and electric motors, tone arms, reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Ind.

Make Your Own Phonograph. Particulars free. DeSelO-PhonE, P. O. Box 720, Attica, Indiana.

Build Your Own Phonograph and manufacture them for profit. Drawing instructions, parts, price list, blueprints, etc., complete, sent free upon request. Write today. Associated Phonograph Co., Dept. E-1, Cincinnati, Ohio.

Patents for Sale.

My Patent, Window-Shades-Operating-Levers, for sale outright. Operates window shades electrically. William Lee, 3327 Ave. L, Galveston, Texas.

Personal.

Get Vital Strength. Retain youthful vigor. Wonderful results. Intensely interesting booklet free. Winslow H. Chase, Washington, D. C.

Tricks, Puzzles and Games.

Tricks, Puzzles, Jokes, toys, games, novelties, doll and cane racks, plays, wigs, stage supplies, escapes and illusions. Large 1917 catalogue free. Oakes Magical Co. Dept. 549, Oshkosh, Wis.

Magic. Entertain at home. Tricks, puzzles, novelties. Big Catalogue A, 25c. Martinka & Co., Inc., Harry Houdini, President, 493 Sixth Avenue, New York City.

Black Art Hindoo experiments. 1919 edition, 25c. Invisible ink. Free trick. Catalogue each order. Lindhorst Magic X Shop, St. Louis.

Magic—Card Tricks. Sensational escapes, jokes, novelties. Everything in the amusement line. Large illustrated catalogue of a thousand tricks free. Write today. Largest amusement goods manufacturers in the world. Heaney Magic Co., Desk 204, Berlin, Wis.

Stage Tricks with 500 Illustrations. Catalog 15c. Small catalog free. Hornmann Magic Company, 304 West 34th St., New York.

All Magicians are reading the leading magical magazine. You'll like it, too! Send 25c. for three months' trial. Sample copy, 10c; one year $1. The Eagle Magician, Dept. EE, Minneapolis, Minn.

Instruction

Wellington Laboratories announce Radio Service Department. All Wireless questions thoroughly considered and answered: 25 cents and postage each. Radio formulas and diagrams: 50 cents upward. 194 Verona Avenue, Newark, New Jersey.

Make Patent Drawings. Big demand; big pay. Complete instruction book only $1. Patent Drafting Syndicate, Post Box 858, Schenectady, N. Y.

Make Dry Batteries. Simple, practical instructions, with blue print, 25c. Derigo Sales Company, Bath, Maine.

Stuck? What is it? A question, problem or experiment in physics, chemistry, biology, electricity, mathematics, radio, X-Ray, etc. Prompt and accurate information furnished by us. Enclose 25c to cover expenses. Address Association Amateur Scientists Bureau of Technical Information, 225 Lynch Street, Brooklyn, N. Y.

Attention! Improve your handwriting! Easy mail lessons. Write today. C. G. Prince, 130 W. 104th St., New York.

Wireless.

Wireless Coils—Transformer and Spark Coil Secondaries, Induction, Tuning and Loose Coupler Coils wound to order by machinery. Also Model Building for inventors. R. D. Wylie, No. 7 Oregon Yacht Club, Milwaukie, Oregon.

Amateurs! Receiving instruments made to order. Loading Inductances, Loose Couplers and Tuners a specialty. Southern Wireless Co., 801 Silver Ave., Greensboro, N. C.

Radio Apparatus of Quality. Manufactured to your own specifications. Radio Engineering Company, Baltimore, Md.

Primaries and Secondaries for loose couplers $2.50 per set. Complete instrument $4.50. Coil for tuner $1.50. Complete $2.50. Goods prepaid. Leon Pennell, 75 Ellsworth St., Brockton, Mass.

Men—Learn Wireless in Ten Weeks. Thousands of positions now opening for men and boys qualified as radio operators, electricians, mechanics, inspectors and draftsmen. Beginner operators now averaging $150 per month; no previous experience or wireless education necessary to enter. Opportunity to travel and see the world. Oldest and largest radio school in America; established 1914. We train you through our correspondence course or at our local school to qualify for official license and help you secure a position on land, sea or aerial mail. Wireless outfit **free** for home practice. Free catalogue on request. National Radio Institute, Dept. 89, 14th and You Sts., Washington, D. C.

Experimenters—Special gray seamless cardboard tubing, 5" and 5¾" diameter, 25c per foot. Postage extra. Send stamp for complete price list. Maier & Co., 335 East 93rd St., New York.

Sale of Multi-Audi-Fone radio telephone transmitters. 3 ampere, $6.00; 2 ampere, $4.00. Limited quantity. Order now. Satisfaction guaranteed. Modern Radio Equipment Company, Elizabeth, N. J.

Switch Points. Binding posts, switch levers, and small parts, send 2c. for catalogue describing these and other goods. A. W. Bowman & Co., 23 Church St. (Harvard Square), Cambridge, Mass.

Books.

Twelve Easy Wireless Lessons, $.50. Order yours Now. Stratton Electric, 215 Federal Greenfield, Mass.

Books. Osteopathic, Chiropractic, Sex, etc. For practitioners. Circulars sent. Murray Publishers, Elgin, Ill.

Dear Reader. If Occult, New-Thought and Scientific books appeal to you, send for my catalog, it's free. I have books on Personal Magnetism, Concentration, Spiritualism, Clairvoyance, Seership, Will, Mind, Hypnotism, Messmerism, Character Reading, Healing, Mysticism Success, Salesmanship, Mechanics, Entertainment, etc. A. W. Martens, J-49, Burlington, Iowa.

Crucified Anne Cath. Emmerich and visions, nativity, Egypt, Cana; 4 books, 20c. Klein Co., Brandon, Minn.

World-Romic System. Masterkey to all languages. Six textbooks, $1.44; French chart, 37c.; Spanish, 37c.; aviation dictionary, $1.50; French-English aviation dictionary, 61c. Languages, 143 W. 47th St., New York.

"Chicago Mysteries" Illustrated Book, 25c. Catalogue, 2c. Paul Duff, 2713 Mozart, Chicago, Ill.

Nature Laws every married and engaged person should know. Two volumes complete, 50c. (No stamps.) Central Company, 599 Ninth Ave., New York.

To Get Better Pictures. Read the amateur photographers' weekly; illustrated; weekly prize competitions; print criticisms; many unique features; $1.50 per year; three months' trial subscription 25c. Abel Publishing Company, 401 Caxton Bldg., Cleveland, O.

Old E. E. Back Numbers. We have some valuable old E. E. back numbers on hand as follows: 1915—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec., price each 35c. 1916—Jan., Feb., March, May, June, Nov., Dec., price each 35c. 1917—Jan., April, May, June, Aug., Nov., Dec., each 35c. 1918—March, May, June, July, Aug., 35c; Sept., Oct., Dec., each 20c. 1919—Jan., Feb., Mar., Apr., May, June, July, 20c. We can fill orders at once upon receipt of your remittance and if you have not these numbers already, now is your chance to get them, as they probably will be snapped up very quickly. Experimenter Publishing Co., 233 Fulton St., New York City.

Formulas.

Worth-while Formulas—Egg Substitute, Orangeade Powder, Mechanics' Soap. Entire collection 10c. Norman M. Ovri, Dept. 3, Hemet, California.

500 Formulas—Resilvering Mirrors, Renewing Dry Batteries, Luminous Paint, Mechanics' Soap, 25c. Catalogue 2c. Ideal, 5501-E North Robey, Chicago.

Money Making Secrets, 5c each. Book of twenty, price reduced to 25c. E. Forrest, 302 Millman St., Peoria, Ill.

500 Successful money-making formulas and trade secrets. Postpaid 25c. Charles Dynes, Winchester, Ind.

For Men.

Detectives Earn Big Money. Travel. Great demand. Experience unnecessary. We train you. Write for free particulars. American Detective System, 1968 Broadway, N. Y.

Send us your dull razor blades. We re-edge them Good as New, any kind, 2½c each. Prompt service and satisfaction guaranteed. Dealers wanted. Keenedge Company, Inc., 184 Washington St., Chicago, Ill.

Dredge's Necktie Valet removes wrinkles (without ironing) from neckties. Sample 25c. Dept. E, 190 Pilgrim, Highland Park, Mich.

For the Hair.

I Was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have good hair-growing results. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E. 32nd St., BA-300, New York.

For Advertisers.

We Write Ads. that pull. Send outline for advice. Sales letters $2. Jacobus Advertising Service, 1073 Sanford Ave., Irvington, N. J.

Free Advertising. Send dime for sample copy of The Trading Post, and details of free advertising. Trading Post, Box 24, Hiram, Ohio.

"Quick-Action Advertising"—How it is Building Business for the Progressive Advertisers of America"; A little story of results told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th St., New York.

www.americanradiohistory.com

GREATEST TOY SENSATION OF THE DAY!

FIGHTING DREADNAUGHT

SENSATIONALLY REALISTIC!!!

Here is a model of Uncle Sam's fighting monsters. Eight big guns, each of which flashes, at correct intervals, from twelve to twenty times. Extra ammunition always obtainable. Absolutely harmless. Can be operated indoors or out. Now boys! Here's your chance to see a battleship in action, and the best of it is you can OWN the ship and command the firing yourself! By getting two or more Battleships, you can arrange EXCITING NAVAL BATTLES in your own home. **Price of Warship and Ammunition, 15c, three for 40c, or a fleet of 4 ships for $1.50 postpaid. Extra ammunition, 5 cents per doz.**

TOOTH-ACHE STOP

BEST TO USE

Stops the Pain; Stops the Tooth

Squeeze a little in hollow of tooth; the **Asha Stops instantly** the paste hardens, forming an antiseptic Filling. Absolutely painless. Have it ready for the next bad attack. **25c per tube, postpaid.**

"SAFETY 1st" PINS

A clever novelty. The National Safety Pirate. Wear one and show your sympathy with the movement. Also handy for wearing at amateur theatricals and the like. Size 2½ in. (gold plated) and 1¾ in. (nickel-plated) 6c each, two for 10c p. pd.

Mysterious Ghost

This is not a pretty object, but it is a perfect delight for people who like practical jokes. The Ghost, when placed in a perfectly dark place, glows with a ghastly cold bluish radiance, very apt to give one a "creepy" sensation even when you know all about it, but a regular shudder for those who come upon it unexpectedly. A great joke to play on your mother-in-law. **Price only 15 cents each, 3 for 40 cents.**

INKLESS PEN

WRITES with WATER 600 words to every time you dip. Makes its own ink. Writes fashionable violet color. Better and cheaper than fountain pens. Writes a long letter with one dip in plain water. No trouble—no bother—no muss. A pleasure to use. With Nickel Plated Reversible Holder **10 CENTS.** 3 for 25c

SIMPLEX TYPEWRITER ONLY $2.50

Cheap But Good. So Simple a Child Can Use It. We Guarantee the Writing.

Though so marvelously cheap, this machine is a **thoroughly practical Typewriter** and we guarantee it to produce writing equal in every respect to that of any $100 machine. It does not seem reasonable that we can send you a specimen of its work and you will be convinced. With reasonable care it will last a lifetime. It is so simple that a child just able to read can write with it. You can learn all there is to know about it and write a letter within five minutes, and the practice will make you an **expert operator.** Every business man must have a typewriter. It is legible and writes in handsome script and means the impression that the firm is a no-account and slow-going concern. We assure you that the Practical Typewriter fully deserves its name as it fit to the correspondence of any business or profession, and to do it we should not have the chance of securing a customer again. The letters of the alphabet, the numerals 1 to 10, and punctuation marks are so arranged that the letters most used are before the operator most of the time, enabling him to write rapidly. The rollers hold the paper in position while writing and at the end of each line a slight turn of the roller moves the rachet which makes a click and forces the paper forward, giving the proper line spacing, so that the lines are all an equal distance from each other; so desirable in letter writing. Each machine is packed in a neat box, with full printed instructions for use. Price complete, $2.50 sent by mail postpaid.

Johnson Smith & Co., Dept. E10, 3224 N. Halsted St., Chicago

SQUIRT RING

You may have a lot of fun with this Sparkling Gem Squirt Ring. It consists of a handsomely plated ring, attached to a rubber ball, as arranged that the latter is quite out of view when the ring is in proper position. Such an attractive looking gem or ring cannot fail to be the center of attraction. While the victim is absorbed in getting a closer view, you just squeeze the rubber ball and the observer experiences a very great surprise. **PRICE 20 CENTS,** three for 50c as a postpaid. J. S. & Co.

Wonderful X-Ray Tube

A wonderful little instrument producing optical illusions of such surprising and startling. With it you can see what is apparently the bones of your fingers, the lead in a lead pencil, the interior opening in a pipe stem, and many other similar illusions. A mystery to your friends and be seen able to satisfactorily explain. Price 10 cents; 3 for 25 cents; 1 dozen, 75 cents. Sent by mail, postpaid.

Sneezing Powder

Place a very small amount of this powder on the back of your head, and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear the remarks, as they never suspect the real source, but think they have caught it one from the other. Between the laughing and sneezing you yourself will be having the time of your life. For parties, political meetings, car rides, or any place at all where there is a crowd it is positively fit is the greatest joke out. Price 12c or 3 for 30c.

By Express Only

STAGE MONEY

With a bunch of these bills, it is easy to create the impression that you are a prosperous appear prosperous. By flashing a roll of these bills at the proper time and peeling off a genuine bill or two from the outside of the roll, the effect created will be found to be just what you desired. **Prices, postpaid: 10 Bills 10c, 50 Bills 25c, 125 for 50c, or $3.50 thousand.**

NEW BOOK ON ROPE SPLICING

USEFUL KNOTS, HITCHES, SPLICES, ETC.

How Different Knots Are Made and What They Are Used For. Knots to Use and Knots to Avoid.

A most practical handbook giving complete and simple direction for making all the most useful knots, hitches, rigging, splices, etc. Over 100 illustrations. All about wire rope attachments, lashing, blocks, tackles, etc. 37 Heraldic Knots illustrated. Of great value to mechanics, riggers, campers, boatmen. Price 20c p. p. Stamps taken.

Johnson Smith & Co., Dept. E10, CHICAGO

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night The very latest discovery in the scientific world. Hitherto, practically unobtainable except at an exorbitant price, we have at last succeeded in producing this remarkable LUMINOUS PAINT, which, applied to the surface of any article, renders it plainly visible in the darkest night. THE DARKEN THE NIGHT, THE MORE BRILLIANT IT SHINES. Quite simple to use. Anyone—you can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. Also to the buttons or switch plates of your electric light, match boxes, and innumerable other articles; make your automobile number plate visible at night. Bottle containing sufficient to coat several small articles, **Price 25c, Larger sizes 50c and $1** postpaid. Johnson Smith & Co., Dept. E10

MUSICAL KAZOO

With the Musical Kazoo you can, without previous practice whatsoever, play any tune right off, imitate any bird or animal, bagpipe, snare drum, Punch and Judy, etc. No holes to fuss with, the instrument itself. Produces excellent music. You do not blow into it, but sing, speak, laugh or make any desired imitation. Used with astonishing results at society meetings, home, club or church entertainments, dances, serenades, picnics, outings, nurseries. Just the thing for theatres and shows, bicycle and marching clubs, etc. Excellent for vocal or instrumental accompaniments, either with or without other musical instruments. **Price 15cn. pd.**

MAGIC FLUTE

Wonderfully Sweet Toned and Musical

A marvelous musical instrument. This instrument produces sweeter music than it be the joyous notes of a quick-step or the solemn strains of a church hymn—in fact, any class of music can be played upon the Humanaphone without practice, as it almost a self-playing instrument. When played with a piano accompaniment, or any other musical instrument, the effect is charming. Full printed instructions for playing sent with each instrument.

Post Paid 15c

All the Latest Surprising and Joke Novelties

Pharo's Serpents Eggs, box	10c	Cover the Spot Trick, a secret	10c
Miniature Water Pistol	10c	X Ray Novelty	10c
Cleopatra's Snake (very lifelike)	15c	Trick Pencil	10c
False Mustache (fool your friends)	6c	Rubber Tacks (a good joke)	10c
Ford Auto Puzzle (Latest)	15c	Mesmerized Penny (defies the law of gravitation)	20c
Mysterious Ghost, shines at night	10c	Mysterious Tumbler and Vanishing Coin Trick	25c
Razor Razor (very formidable)	20c	Magic Mirror (shows one peep)	25c
Rubber Dagger (sensational)	20c	Magic Plate Lifter	25c
Window Smasher (great joke)	20c	Imitation Gold Teeth	5 for 10c
Lookback Periscope (see behind you)	15c	Great Surprise Puzzle	10c
Great Mind Reading Mystery Co.	10c	Wire Puzzles, 10c. 22 different,	$1.95
Thurston's Mysterious Trick Cds.	10c		
Fighting Roosters, pair	10c		

JOHNSON SMITH & CO., Dept. E10, 3224, N. Halsted St. CHICAGO

Boys, you can have Movies at your own home with this latest model

MOVING PICTURE MACHINE

Uses Standard Films same as the larger machines. Very easily managed. Simply turn the handle. Good Variety of Films always obtainable

PRICE Complete ONLY **$2.65** Postage 15c. extra Including Film.

Extra Films, 15c each postpaid

THIS IS A GENUINE MOVING PICTURE MACHINE and the motion pictures are clear, sharp and distinct. The Moving Picture Machine is finely constructed, and carefully put together by skilled workmen. It is made of Russian Metal, has a beautiful finish, and is operated by a finely constructed mechanism. The projecting lenses are carefully ground and adjusted, triple polished, standard double extra reflector, throwing a ray of light many feet, and enlarging the picture on the screen up to three or four feet in area. The light is produced by a safety carbide generator, such as is used on the largest automobiles. This throws a dazzling white light on the screen.

It is a solidly constructed and durable Moving Picture Machine. The mechanism is exceedingly simple and is readily operated by the most inexperienced. The pictures shown by this marvelous Moving Picture Machine are not the common, crude and lifeless Magic Lantern variety, but are life-like photographic reproductions of actual scenes, places, and people which never tire its audiences. This Moving Picture Machine has caused a rousing enthusiasm wherever it was used.

JOHNSON SMITH & CO.

Dept. E 10 3224 N. HALSTED ST., CHICAGO

ANARCHIST BOMBS

Consists of a little glass vial, containing a liquid form a chemical which will produce a most horrible odor. One dropped in a room full of people will cause more consternation than a kingsize bonfire. The smell will entirely disappear in a short time. 3 Boxes for 25c, shipped by express only with a Dollar's worth of other merchandise.

ITCHING POWDER

This is another good practical joke; the intense discomfiture of your victims is certainly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and then a fingerful of the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still more scratch. 8 Boxes for 25c. Sent only by express. (Must order at least One Dollar's worth of other merchandise.)

INVISIBLE INK

The most confidential messages can be written with this ink, and the writing MAKES NO MARK. Cannot be seen unless you know the secret. Invaluable for many reasons. Keep your pockets and other private memorandums away from prying eyes. Great fun for playing practical jokes. **Only 15c Bottle**

LOVE LETTER INK

Writing written with this remarkable ink vanishes entirely in a few weeks (sooner if desired), leaving the paper QUITE BLANK. 15c p. pd.

LUMINOUS INK Writing can be READ ONLY IN A DARK ROOM; writing shines like fire. Quite invisible at daytime. **Price 15c per bottle; 3 for 40c postpaid.**

JOHNSON SMITH & CO.

MULTIPLYING BILLIARD BALLS

The Best Feat of its Kind

This trick is an effective and surprising. The performer handles around the ball for examination, and is convinced that it is returned to him he seizes it by the tips of his thumbs and fingers and a second ball mysteriously appears. This is held in full view of the audience by the tips of the fingers of the left hand, and even while being held in position, another ball unexpectedly makes its appearance. Finely the magician apparently suffers from some kind of a spasm and yet another ball is the result. The feat can then be reversed, the balls disappearing one after another until none remains. A very interesting trick that is quite easily performed by following the directions that accompany the apparatus. **Price, 25 CENTS, POSTPAID.** JOHNSON SMITH & CO.

GOOD LUCK RING

Quaint and Novel Design

A VERY striking and uncommon ring. Of massive solid silver. Skull and crossbone design, with two brilliant Jet Black Stones sparkling out of the eyes. Is never failing object of interest. It is said by many to bring Good Luck to the wearer. Hence its name. **Good Luck Ring,** a id whilst we cannot positively guarantee that, it is certainly a very unique ring that you will take a pride in wearing. They were made to order for a special occasion so will supply them to customers mentioning this paper. **ONLY A FEW LEFT. 25 CENTS. POSTPAID.** JOHNSON SMITH & CO.

LOADED CIGARETTES

Just Like Ordinary Cigarettes, But Such Real Starters.

A box containing ten apparently genuine Cigarettes. They contain a cap which causes a report when every third is smoked.

They appear real, and afford as good a smoke (while they last) that the victim is taken entirely by surprise. A great laugh producer and extremely funny. **Price, box of ten, 30 cents, costpaid.**

Johnson Smith & Co., Dept. E10

THE "LITTLE GIANT" TYPEWRITER

A First Class Writing Machine For $1.25

A per cent little typewriter for $1.25? Yes, there are thousands of persons who would like to use a typewriter but whose needs and business do not warrant the expense at school or to the purchase and use of a fifty or seventy-five dollar machine. We confidently recommend our Little Giant. It is strongly made, but simple in construction, so that any one can quickly learn to operate it, and write as rapidly as they would with pen and ink. The letters of the alphabet most frequently used being grouped so as to enable one to write rapidly, the numerals 1 to 10, and the punctuation marks being together. With this machine you can send your best girl typewritten love letters, add-ress envelopes, make out bills, and do almost any kind of work not requiring a large expensive machine. With each typewriter we send a full printed instructions for using the machine. Price complete $1.25 by mail postpaid.

SERPENT'S EGGS

Each box contains 12 Eggs, which are no larger than a grain of oats. When lit with a match, however, each egg grad-ually hatches itself into a Snake several feet long, which curls and twists about in a most lifelike manner. **Price per box 10c, postpaid.** Johnson Smith & Co.

MYSTIC SKELETON

A jointed figure of a skeleton 14 inches in height, will dance to music and perform various gyrations and movements while the operator may be standing at a distance from it. The figure may be manipulated by the operator. When handed back to the operator it is only necessary to sit down, stand up, dance, etc. We send full direction with each Skeleton, for the aid of which anyone can readily make it perform. **10c postpaid.**

CIGARETTE ROLLER

Very neat and handy. Weighs less than a quarter of an ounce. It makes better cigarettes than you can buy and makes them easily and quickly. You can use just the tobacco you prefer and thus have nicer "smokes" than ready made, and more of them besides saving about half of your money. Just try one and make your cigarettes just to your liking. **Price only 10c or 3 for 25c postpaid,** with full instructions for use. JOHNSON SMITH & CO.

MIDGET ILLUSTRATED BIBLE

A Great Curiosity

The Smallest Bible in the World

The Midget Bible is a perfect gem, and a work of art. It is about the size of a postage stamp, and contains TWO HUNDRED AND FIFTY PAGES of the NEW TESTAMENT, profusely illustrated. This little Bible is a wonder. It is said to be the smallest in the world. Every one should have one to be appreciated. **Price, only 12 cents, three Bibles for 30 cents are dozen Bibles for $1.00 or 100 for $8.00.** Good agents wanted. Sample Bible 15c postpaid. Bibles amongst friends, church acquaintances, Sunday schools, bazaars, etc. Send for a few and try it.

The CONJURER'S CASKET

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment

ANYONE CAN DO THEM 50c

It is great fun mystifying your friends. Get this Conjurer's Casket, and you will be the cleverest fellow in your district. It contains the apparatus for seven first-rate tricks, including The Disappearing Coin Box (a coin is placed in the little wooden barrel, and when opened again, is found to have vanished entirely, or can be made to change into a coin of another denomination); The Famous Mesmerized Penny that defies the law of gravitation (suspends from the palm of the hand, nose, cheek, wall, clothing, etc.); The Glass Goblet and Vanishing Coin Trick (a coin is dropped into a glass of water, and when the water is poured out the coin has vanished). With the seven tricks described above we send full printed instructions for performing each trick, so that anyone can readily perform all these tricks to the great amusement of their friends or the public. Any boy of ordinary intelligence with this Cabinet of Tricks in his possession, can give a parlor entertainment not inferior to some regularly advertised performances. Remember the tricks contained in the Cabinet, there are twenty-five other feats and illusions fully explained with full printed instructions, for which you can easily procure the necessary apparatus. Among them are The Mouse in a Pack of Cards, The Drawn Card, The Hat Trick, To Knock a Tumbler Through a Table, One Cent Rubbed into Two, To Find the Number Thought of, Mysterious Wedding Ring etc. We also send the secret of performing three wonderful stage tricks, as follows: The Act of Cremation of a Woman, Walking on the Ceiling of a Room, and the Disappearing Lady, together with an article on legerdemain and valuable hints to amateur conjurers. **PRICE COMPLETE ONLY 50 CENTS.**

JOHNSON SMITH & CO., Dept. E10, 3224 N. Halsted Street, CHICAGO

The Newest Novelty Aerial Balloon

Flies gracefully in or outdoors. This is the VERY LATEST SENSATION IN BALLOONS. A brightly colored balloon that measures sixteen inches in length. Blown up in the usual manner, when released, the air pressure sends the balloon SOARING UPWARD with a high pitched propeller SPINNING AROUND AT A LIVELY RATE. The effect is startling. It is a graceful flier that makes the youngsters WILD WITH JOY. May be used repeatedly indoors or outdoors. An immensely interesting toy. **Price 10c each, 3 for 25c ppd.**

JOHNSON SMITH & CO., Dept. E10, 3224 N. Halsted Street, CHICAGO

"The Baby" Double Action Hammerless Revolver

A HANDSOME AND MOST EFFECTIVE WEAPON

$6.50

Measures but 4¼ inches long

Takes regular .22 calibre cartridges

The new **Baby Double Action Hammerless Revolver** has been produced to meet the ever increasing demand for a revolver that would combine small size and light weight with the essential features of **Efficiency and Practicability.** It is small in size, yet is just as effective and serviceable as the most expensive weapon you can buy. Every lady should have a revolver and should know how to use it, and there is no safer or better one made than this. A great feature is its safety action that guards against accidental discharge, making it quite safe for young men and ladies. The illustration gives an idea of its appearance, but it must be seen and used to be thoroughly appreciated. The ammunition used is the regular .22-calibre short cartridge obtainable anywhere, or you may obtain the cartridges from us. Cartridges can be shipped only by express. The revolver fires six shots in one loading. The operation of the charging mechanism is extremely rapid and absolutely reliable; six well aimed shots may be fired in as many seconds. The revolver is very well constructed, with finest nickel plated fluted barrel of cylinder, and it weighs only 4½ ounces. **The Price of the Revolver is only $6.50, sent by mail postpaid to any address. JOHNSON SMITH & CO.**

THE EXPO WATCH CAMERA

The most wonderful and ingenious Camera made

It is but little larger than a watch, which it closely resembles. You can carry the **Expo** about in your pocket, and take pictures without any one being the wiser.

One Cent a Picture

The Expo loads in daylight with 25 Exposure Films, costing 25c. Each one a picture, taking part of a whole day's outing may be had for the nominal sum of 25c—One cent o picture. 10 Exposure Films also obtainable. It is simplicity itself to operate. Takes pictures through the stem, where the **Rapid Fire Lens** is located. The photos (5/8 x 7/8) may be enlarged to any size.

Price $2.50

QUICK AS A FLASH

Time and instantaneous shutters! Weight but 8 ounces, nickel plated. Endorsed by amateurs and professionals the world over. Thoroughly practical—printing and developing of films just the same as ordinary cameras—daily used by the police, newspaper reporters, detectives, and the general public. Important beats have been secured with the Watch Camera by enterprising reporters. Produces clear, sharp negatives indoors or outdoors equal to those of the market, also or price notwithstanding.

Expo Watch Camera $2.50 FILMS, 10 Exposures 15c, 25 Exposures, 25c Postage 10c Anywhere Pocket Carrying Case, 35c

Johnson Smith & Co., Dept. E10, 3224 N. Halsted St., Chicago

BOYS!



Would you like to earn one of these magnificent Bicycles absolutely without costing you one cent? FREE!

HUNDREDS OF OTHER EXPENSIVE PRESENTS ALSO GIVEN

We have secured an enormous quantity of very beautiful colored pictures, consisting of art, floral, landscape, religious, patriotic, etc, and are going to sell them at less than half their value. Many stores would charge from 25 to 50 cents each for them, but a very fortunate purchase permits us to sell them at the astonishingly low price of 10 cents each, at which price they are irresistible, and will sell like hot cakes at that price.

Now all you have to do is to send us your name and address and we will send you 25 of these beautiful pictures, without any charge whatsoever. These pictures you are to sell at 10 cents each. When sold, send us the money, and we will send you records of YOUR OWN SELECTION from our 300 page catalog to the value of $2.50. Remember, you get these goods as a premium for selling the pictures and sending us the money. You don't have to pay a cent for them. Many of our agents have sold the whole 25 pictures in one day, some have sold them in the evening. One agent sold six on the way home from the post office, another sold some before he got out of the post office. Another agent sold the entire lot in one house. People are will to get these pictures once they see them, and you will have no difficulty in disposing of them if you will only show them.

Remember, you have your entire catalog to select your premiums from, and there are hundreds of useful presents such as Air Rifles, Guns, Moving Picture Machines, Musical Instruments, Cameras, Printing Presses, Typewriters, Books, Puzzles, Games, Tricks, Toys and Novelties, rubber stamps, household labor-saving devices, etc., and we are sure you would like to get many of them, especially if you can do so without having to pay any money for them.

By continuing the sale of our pictures you can earn the magnificent Bicycle illustrated. We will give you presents of equal value to the pictures you sell. Send in your application at once, and we will send you the first lot of pictures immediately, accompanied by our big catalog of over a thousand different articles to select your premiums from. You don't have to send any money. We trust you absolutely

JOHNSON SMITH & CO., Dept. E10, 3224 N. Halsted St., CHICAGO



PIANO PLAYING MADE EASY

New Vamping Card

No Teacher Needed Surprising System

Persons having perfected their Musical Education need not despair, for with the aid of our new VAMPING CARD (placing the card upright over the piano keys), you can at once play a song away to thousands of Songs, Ballads, Rag Times, etc., etc., equal to a Professional Musician. No knowledge of music is required. After using it a few times, you will be able to dispense with the aid of the Vamping Card entirely. **Only 15 cts. p. pd.** Johnson Smith & Co., Dept E10

SHARPEN-M-ALL

SAFETY RAZOR STROPPER

SHARPENS EVERY KIND OF SAFETY RAZOR BLADE

Sharpens the Gillette and Durham Duplex both edges at one time

ALSO SHARPENS THE GEM JUNIOR, EVER READY, KEEN KUTTER, MARK CROSS, CLARK, AUTOSTROP, STAR CRUSTEEL, AND ALL OTHERS



IT SHARPENS THEM ALL

By using the SHARPEN-M-ALL STROPPER, you will not only get BETTER SHAVES, but you will SAVE MONEY, as one blade can be made to get from 150 to 200 shaves from one blade, and the last shave will be as keen as the first. The construction is simple and will last a lifetime. There are no parts that can possibly get out of order. Any novice can use it just as well as the most expert barber. To use, simply turn the handle, raising the leves on handle as shown in the illustration. It has two spiral rollers that travel the full length of the strop, and are revolved, giving the CORRECT DIAGONAL STROKE. There is no adjustments, or any kind of tinkering necessary, to operate the machine. The rollers are made of a special material that STROP AND HONE the blade at the same time. The safety razor only needs to be drawn across the stropper. The SHARPEN-M-ALL is packed in a handsome case, 4x2¼x1¾ in. with three holders and full instructions. The weight of the complete machine is but eight ounces. Price, only $1.00, postpaid.

JOHNSON SMITH & CO., DEPT E10 3224 N. HALSTED STREET CHICAGO



Potmend

Stops a leak in a minute

The finest repairer for ironware, Agateware, Enamelware, etc. Good for kettles, pots, pans, boilers, and every kind of ironware, also for tin, copper, aluminum, ice boxes, iron pipes, cracks in stoves, broken china, porcelain, bric-a-brac, bisque, crockery, woodenware, marble, etc. Will not chip, fry, bake, bake or boil out. THE MEND IS THE STRONGEST SPOT IN THE POT. Could not be simpler: just mix the powder with water. HARDENS LIKE IRON. Fire-proof, Water-proof. You can fill a big hole or a small crack. Mended places stronger than new. Replaces chipped enamel. Anyone can do it. FAILURE IS IMPOSSIBLE. Better and easier than solder. Three sizes, 15 cents, 25 cents and 50 cents.

Johnson Smith & Co., Dept. E10 3224 N. Halsted St., Chicago

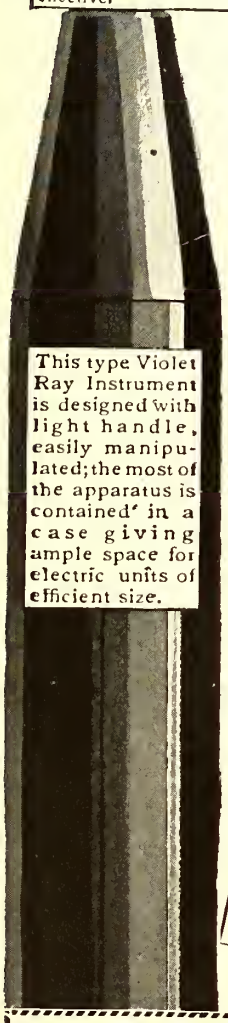
www.americanradiohistory.com

Regain Your Health Thru Renulife VIOLET RAY Treatments at Home



Unequaled for neuritis and rheumatism

More Than 25,000 Volts
No pain, shock or muscular contraction. Entirely harmless — powerfully effective.



This type Violet Ray Instrument is designed with light handle, easily manipulated; the most of the apparatus is contained in a case giving ample space for electric units of efficient size.

There is no "quackery" or uncertainty about *Renulife Violet Ray.* It is not claimed to be a "Cure All," but it has proved in thousands of cases a practical health-producing, revitalizing agent—powerful in restoring normal physical conditions—yet gentle, soothing and perfectly safe. *You* can treat yourself. Get full information regarding uses shown on coupon below.

Users Get Wonderful Results

(Voluntary Testimonials)

"The Renulife Violet Ray High Frequency Generator is superior in efficiency because of its perfect character and control of current, compactness and perfect insulation. The smallness and lightness of Electrode holder is also a great advantage." "The doctor told me that the trouble was hardening of the arteries. I wish I had got it a year ago. I would not be without it for all the money in the world." "I cannot recommend it too highly." "I have been using mine now for a week for Sciatica and I am highly pleased with results." "I think it is one of the best little machines that was ever invented." "I have used it with excellent results for the restoration of hair and stiff and sore rheumatic finger joints." "Am well pleased with the Generator, and the kind treatment received from your Company." "My Generator has stopped my neuritis." "Every house should have a Renulife Violet Ray High Frequency Generator, for the treatment of Neuralgia, Neuritis, Sore Throat, Kernels in Neck, Cramps, Headache, Stiff Neck, Muscular Soreness, Rheumatism, Paralysis—in short, pains of all kinds."—M. D. "I have been much relieved by the use of your Violet Ray Generator." "It is fine for Insomnia." "I find it such a help in nervousness." "I would not part with it for five times the price. It is sure a little wonder." "I am more than pleased with the Generator; the whole family are using it." "A neighbor lady was suffering from lumbago and could not move, and my wife brought over the Generator and in less than ten minutes the lady was greatly relieved." "Your Generator is just the thing for me. That tired feeling has left me, and I feel like myself again." "It has relieved me of the nervousness and also it has helped me a great deal in using it for the treatment of rheumatism."

How Renulife Benefits

Science has demonstrated a strange relation between electricity and life cells. This instrument harnesses a tremendous current of electricity and applies in the form of Violet Rays so that the body welcomes and responds to it in a marvelous manner—no pain—shock or the slightest harmful effects. A few seconds of Renulife Violet Ray gives more benefit than hours of the old time battery methods—because a thousand times as much voltage is made use of.

The irresistible, revitalizing powers of *Renulife Violet Ray* reach every nerve cell, fibre and part of body. Blood is enriched and purified by a flood of oxygen, giving added vitality and strength. Assimilation and digestion improved—functions retored to normal—extra supply of fresh blood quickly brought to area treated, removing congestion and supplying nourishment. While relieving pains and aches, the manifest results of disorders, it removes the deep seated cause, combines the benefits of electricity, vibration, exercise, stimulation and oxidation.

Get Book "Health via Violet Ray"

Learn the whole marvelous story of the Violet Ray—this method that works with nature to restore and build up. Learn how you, at home, can now use these great curative forces of Violet Ray—heretofore only available at big expense from physicians or beauty doctors. Send coupon or postal card now and receive free book describing uses, quoting low prices (within the reach of all) and explaining liberal *Trial Plan.*

Renulife Electric Co., Inc.
1208 Marquette Bldg., Detroit, Mich.

Canadian Renulife Electric Co., Ltd., 1208 Netting Bldg., Windsor, Ont.
Toronto office, 614 C. P. Building.

Live Sales Representatives write for proposition



Increases energy and vitality



Treatment for nervousness and general debility



Ozone most beneficial for catarrh, throat and lungs. Also anemia



Stops falling hair — promotes hair growth. Wonderful beauty aid

BOOK **FREE**



Lowest Prices Efficient VIOLET RAYS — 3 Models for Home Use



COUPON FOR BOOK and Special Information

RENULIFE ELECTRIC CO.,
1208 Marquette Bldg., Detroit, Mich.
Please send without obligation, your book "Health," explaining Violet Ray treatments with Renulife Generators; also give full particulars as to its application for ailments checked below.

TREATS SUCCESSFULLY

..Abscesses	..Facial Neuralgia	..Piles
..Anemia	..Falling Hair	..Pimples
..Asthma	..Goitre	..Pyorrhea
..Arteriosclerosis	..Gout	..Rheumatism
..Baldness	..Hay Fever	..Scars
..Blackheads	..Infantile Paralysis	..Sciatica
..Brain Fag	..Insomnia	..Skin Diseases
..Catarrh	..Lameness	..Throat Diseases
..Colds	..Locomotor Ataxia	..Sprains
..Chilblains	..Lumbago	..Toothache
..Dandruff	..Nervous Affections	..Weak Eyes
..Deafness	..Neuralgia	..Wrinkles
..Eczema	..Neuritis	..Warts and Moles
..Enlarged Prostate	..Paralysis	

Write your name and address in margin below and cut out with coupon

Copyright, 1919, R. E. Co.

www.americanradiohistory.com

SEPTEMBER
1919
20cts.

ELECTR A
EXPERIM N'IER

OVER
175
ILLUST.

SCIENCE AND INVENTION

YOU TOO CAN DO THIS ON "EROS"

SEE PAGE 398



000 COPIES MONTHLY AVERAGE CIRCULATION OF ANY ELECTRICAL PUBLICATION

Fred J. Budwey,
56 Middle St.,
Orono, Maine
EAK 760.52

A Direct Route to BIGGER PAY

NO MONEY DOWN

SMALL MONTHLY PAYMENTS

THROUGH ELECTRICITY you can earn more. The salary of the electrical worker is steadily advancing. Especially is this true of those who are educating themselves in the finer points of electrical practice.

Fit yourself for one of the really big jobs by knowing electrical practice complete, including inside and outside work, central stations, and the whole subject. It takes long years to do this in practice only, whereas, with the aid of the CROFT LIBRARY OF PRACTICAL ELECTRICITY it takes only months.

No matter how much nor how little you know of electricity, the Croft Library will be found of assistance every day. You will immediately recognize the fact that the author is a practical man. You will immediately see the great difference between these and other books on the subject you possess.

READ THIS—

McGraw-Hill Book Company, Inc.,
239 West 39th Street, New York, N. Y.

Gentlemen: In an attempt to express myself about CROFT'S NEW LIBRARY OF PRACTICAL ELECTRICITY, I have never seen and do not believe there was ever printed in the English language, a more comprehensive set of books. It is a library that is just as valuable to the novice as to the expert, because it is all practice.

Respectfully,

GUY H. PEIFER.
Chief, Doplan Silk Corporation, Hazelton, Pa.

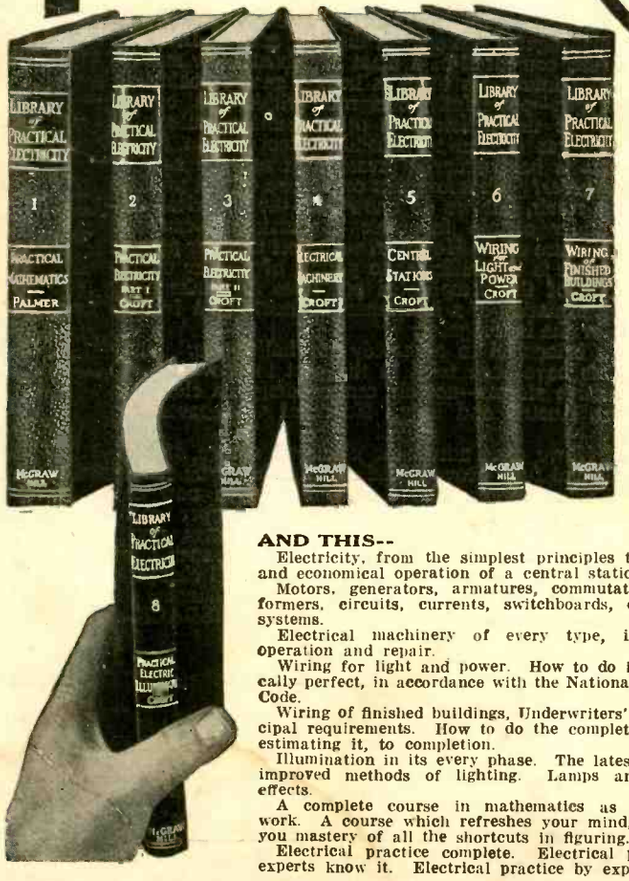
ELECTRICAL PRACTICE COMPLETE

AND THIS—

McGraw-Hill Book Co., Inc.,
239 W. 39th St.,
New York.

Gentlemen: The CROFT LIBRARY OF ELECTRICITY more than came up to my expectations. I have been in the electrical business for fifteen years, and know the general run of electrical books. Terrell Croft's Library is the best I have had the pleasure of examining.

Yours truly,
EDWARD T. HOFF,
713 3rd Ave.,
Asbury Park, N. J.



The Croft Library adheres closer to actual practice than anything of the kind ever attempted. It is the most complete set of books on electricity ever published. It is clearest in word and illustration. It has no equal in every-day helpfulness. It cannot be compared in any way with other sets of books on this subject.

Just return the coupon—

Fill out the coupon below and return to us. We will immediately send the eight volumes, charges prepaid, for ten days' use in connection with your work. Don't bother to send any money. We do not want a cent from you until you have examined the books and decided that they are a direct route to bigger pay. Then you can send us $2 per month for eight months.

McGraw-Hill Book Co., Inc.
239 West 39th St., New York

MAIL THIS COUPON TO-DAY

AND THIS--

Electricity, from the simplest principles to complete and economical operation of a central station.

Motors, generators, armatures, commutators, transformers, circuits, currents, switchboards, distribution systems.

Electrical machinery of every type, installation, operation and repair.

Wiring for light and power. How to do it mechanically perfect, in accordance with the National Electrical Code.

Wiring of finished buildings, Underwriters' and municipal requirements. How to do the complete job from estimating it, to completion.

Illumination in its every phase. The latest and most improved methods of lighting. Lamps and lighting effects.

A complete course in mathematics as applied to work. A course which refreshes your mind, and gives you mastery of all the shortcuts in figuring.

Electrical practice complete. Electrical practice as experts know it. Electrical practice by experts.

McGraw-Hill Book Co., 239 W. 39th St., New York

Gentlemen:—Please send me the Library of Practical Electricity (shipping charges prepaid), for 10 days' free examination. If satisfactory, I will send $2 in ten days and $2 per month until $16 has been paid. If not wanted, I will write you for return shipping instructions.

Name .....

Home Address .....

City and State .....

Where Employed .....

Occupation Ex9-19

Electrical Experimenter

233 FULTON STREET, NEW YORK

Publisht by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer; R. W. DeMott, Sec'y;) 233 Fulton Street, New York.

Vol. VII. Whole No. 77 **Contents for SEPTEMBER, 1919** **No. 5**

YOU TOO CAN DO THIS ON "EROS".....Front Cover
From a painting by George Wall
SILHOUETTE MOVIES, By H. Gumpel..... 395
AN ELECTRIC SIGN IN MID-AIR..... 396
SPEEDING UP THE AIRSHIP, by H. Gernsback..... 397
POPULAR ASTRONOMY — INTERESTING PHENOMENA OF GRAVITATION..... 398
By Isabel M. Lewis of the U. S. Naval Observatory.
WORLD'S BIGGEST TURBINE DYNAMO—100,000 HORSEPOWER 401
By William H. Easton.
HOW THE R-34 CROST THE ATLANTIC..... 402
UNDER-WATER SURVEYING BY REFLECTED SOUND WAVES. 405
By H. Winfield Secor, Associate Member of A. I. E. E.
A TELLTALE SUBMARINE NET..... 406
ELECTROCUTING HUGE LEOPARD..... 406
PSYCHICAL RESEARCHES OF SIR WILLIAM CROOKES..... 407
By Hereward Carrington, Ph. D.
TELEPHONE SOLVES "LOWER BERTH" SQUABBLE..... 408
200,000 HORSEPOWER IN ONE HOUR, by Joseph H. Kraus..... 409
POSSIBILITIES OF HIGH FREQUENCY CURRENTS..... 410
By John E. Pritchard.
A NEW PHOTO-ELECTRIC CELL TO REPLACE SELENIUM..... 411
ELECTRIC COOKERY—A SNAP!..... 412
By Grace T. Hadley of the Society for Electrical Development.
NEW THINGS ELECTRICAL..... 413
RECORDING YOUR CHAUFFEUR'S JOY RIDES, by Thomas Reed 414
TRY THESE ON YOUR AUTO..... 415
THE MYSTERY OF ATMOSPHERIC ELECTRICITY..... 416
By Rogers D. Rusk, M.A.
EXPERIMENTS IN PHYSICS—NO. 2, ILLUSIONS..... 417
By John J. Furia, A.M.
PRACTICAL CHEMICAL EXPERIMENTS—PART 2—CLEANING AND WASHING AGENTS, by Albert W. Wilsdon..... 418
THE CONSTRUCTOR—THERMO-ELECTRICITY EXPERIMENTS. 419
By Thomas W. Benson.
MAKING A MACHINE FOR TELEGRAPHING PICTURES..... 421
By Leroy J. Leishman, Telephotographic Expert.
HOME-MADE COMPOUND MICROSCOPE, by Carl F. Muckenhoupt 422
EXPERIMENTAL MECHANICS—MACHINE SHOP PRACTISE, THE REAMER, Continued, by Samuel D. Cohen..... 423
"HOW TO MAKE IT" PRIZE CONTEST..... 424
WRINKLES, FORMULAS AND RECIPES, Edited by S. Gernsback.. 425
RADIO DEPARTMENT—"FOG WARNING" RADIO TELEPHONE 426
NEW 1 K.W. QUENCHED GAP TRANSMITTER, by Lester F. Ryan 427
VACUUM VALVE CONSTRUCTION, by R. H. Shaw..... 429
THE HOW AND WHY OF RADIO APPARATUS—NO. 12, RADIO ANTENNA CONSTRUCTION, by H. Winfield Secor..... 430
ECCENTRIC ANTENNAE, by Eugene Dynner..... 432
LATEST PATENTS DIGEST..... 433
AMATEUR LABORATORY PHOTO CONTEST..... 434
SCIENCE IN SLANG—THE ALTERING OF ALTERNATING CURRENT, by Emerson Easterling..... 435
THE ORACLE—QUESTION AND ANSWER COLUMN..... 436
DEVELOPING AN IDEA, by Nelson Hall..... 455

EDITORIAL

HAIL

EVERY year millions of dollars' worth of crops and property are destroyed by hailstorms. Not infrequently human beings and cattle are killed, due to their inability to reach shelter in time. Of course such occurrences are not very frequent, which is explained by the fact that the average size of a hailstone is not much larger than a small hazelnut. But hailstones the size of a man's fist are by no means uncommon. Stones weighing two pounds have been observed, but these are very rare. But whatever their size or weight, hailstones are exceedingly destructive. Hurled from a great height, with a powerful wind accelerating their own speed, these frozen ice-pellets destroy vegetation at an appalling rate annually. Fruit on trees, crops and all vegetables are mowed down over great areas several times each year.

In the United States there is an average of over three hailstorms a year—Ohio leading with over ten such storms annually. Now the curious and outstanding fact about hailstorms is that nearly all of them occur during the summer, and practically none occur without thunder and lightning. There is nothing new contained in this statement—every child knows it. But here the writer would like to inject a new thought: namely, that the formation of hailstones is directly due to certain and as yet not clearly understood electrical processes. In other words, the formation of these round ice stones is the product of the electric current or static electricity.

This theory can be upheld by a few very simple arguments. In the first place, the height at which hail-clouds move is very low—never high enough to permit water to freeze. Proof: During all hailstorms rain always falls amid the hailstones, *and this rain is quite warm.* If the hail were formed by a sudden cold air wave, as our text-books want us to believe, where do the warm raindrops come from—or why does it not snow at least? However, it never does, particularly during the summer season.

But this is not all of the story. According to Jaentr, who investigated the subject thoroly, each hailstone is, as a rule, composed of a mass of mixed snow and ice in whose interstices there is held a gas—probably air or oxygen—powerfully comprest within the central cavity. If the hailstone is opened under water, the enclosed gas is seen to expand. According to Jaentr this gas is held under a pressure of as high as *fifty atmospheres!* We know that cold alone cannot produce such a result, but we do know that the electrical current under certain favorable circumstances can and does produce cold. However, we admit that our present knowledge is not sufficient to permit of a clear understanding of the complicated processes that take place in the formation of a hailstone. It should be a fruitful field for the investigator.

This brings us to a remedy for hailstorms. Many methods have been tried in the past to prevent these destructive storms—notably cannonading the clouds in France, Austria and Italy. No relief whatsoever was had.

But if we once admit the electrical nature of hailstorms and fully prove it, the remedy should be simple. Huge kites, larger than those built up to now and capable of carrying a thick, stranded copper cable, should be sent aloft immediately when storm clouds gather. At a ridiculously low cost a dozen such kites, spaced a mile apart, could draw the electrical charge to earth, thus emptying the clouds of their danger. It is worth a trial at least.

H. GERNSBACK.

The ELECTRICAL EXPERIMENTER is publisht on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions. Canada and foreign countries, $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 20 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. A green wrapper indicates expiration. No copies sent after expiration.

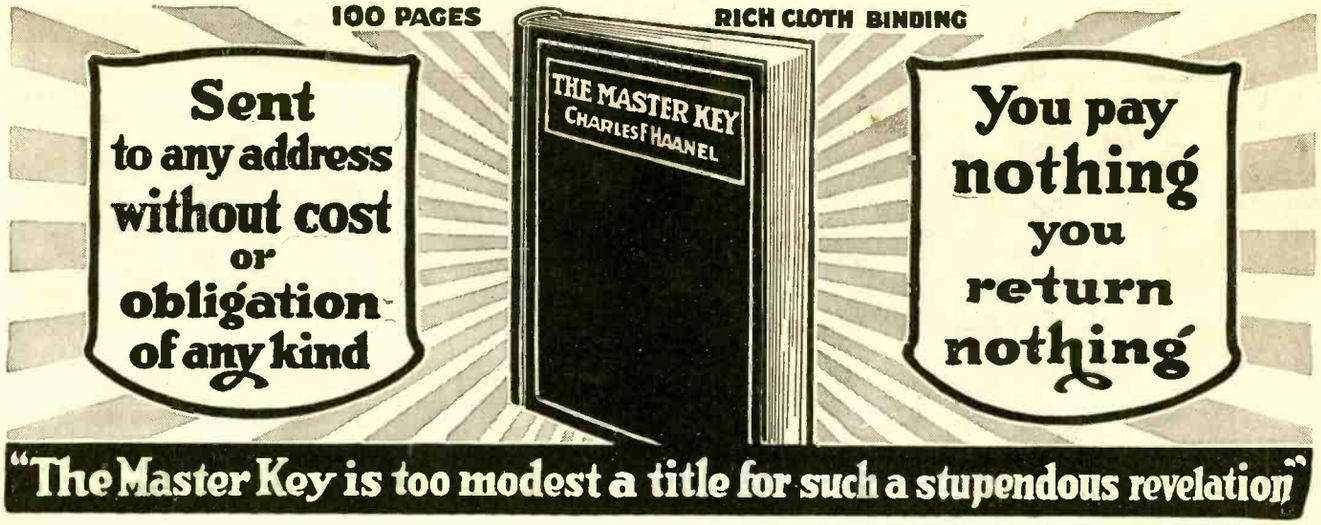
All communications and contributions to this journal should be addrest to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

ELECTRICAL EXPERIMENTER, Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered U. S. Patent Office.

Copyright, 1919, by E. P. Co., Inc., New York. The Contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.

The ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris.

Member of the Audit Bureau of Circulation.



SOME men and women seem to attract success, power, wealth, health and attainment with very little conscious effort; others conquer with great difficulty, still others fail altogether to reach their ambitions, desires and ideals.

Why is this so?

"The Master Key" will tell you why. No one can read it and not be a changed man or woman. None but who will emerge from its magic pages with a firmer grasp of the future—a surer understanding of what he can do.

"The Master Key" is a key with which many are converting loss into gain, fear into courage, despair into joy, hope into fruition.

A copy of this magnificent, richly bound 128 page book will be sent to you, without cost or obligation of any kind, if you address

Charles F. Haanel, 423 Granite Bldg., St. Louis, Mo.

You should send for a Master Key.

New Way to Learn

The World's Greatest ELECTRICAL BOOKS

IT'S no longer necessary to serve an apprenticeship or go to school to learn electricity. With this new library of PRACTICAL APPLIED ELECTRICITY you learn right at home—in your spare time without interfering with your present work. You can pick out any good, paying job that requires a trained man and fit yourself to fill it in a very short time by spending an hour or two a day with these books. There's no tiresome lessons and a lot of higher mathematics for you to wade through. No theory and historical data that you will never use. Nothing but plain English and common everyday figures anybody can understand. It's a home study course for the beginner and a handy reference guide for the expert combined.

Here Is What You Learn

Here are 100 different subjects selected at random from the eight big volumes. This is just a small part of the total number of things explained. Several thousand propositions are treated.

VOLUME I. **Elements of Electricity:** Magnetism—Static Electricity—Current Electricity—Battery Circuits—Electromagnets—Principles of Dynamos and Motors—Induction Coils—Telephone Principles. **Principles of D. C. Dynamos:** Field Magnets—Armatures—Voltage Regulation. **Principles of D. C. Motors:** Comparison with Generator—Operation—Design. **Storage Batteries:** Maintenance—Commercial Applications.

VOLUME II. **Alternating Current Machinery:** Instruments—Armature Windings—Regulation—Output—Tests—Commercial Types—A. C. to D. C. Current—Converters—Switchboards—Synchronizers.

VOLUME III. **D. C. Dynamo Design:** Efficiency—General Principles. **Armature Winding:** Calculations. **Design of Small Motors:** D. C. Design—A. C. Design—Induction Motor Design. **Transformers:** Operation—Efficiency—Construction.

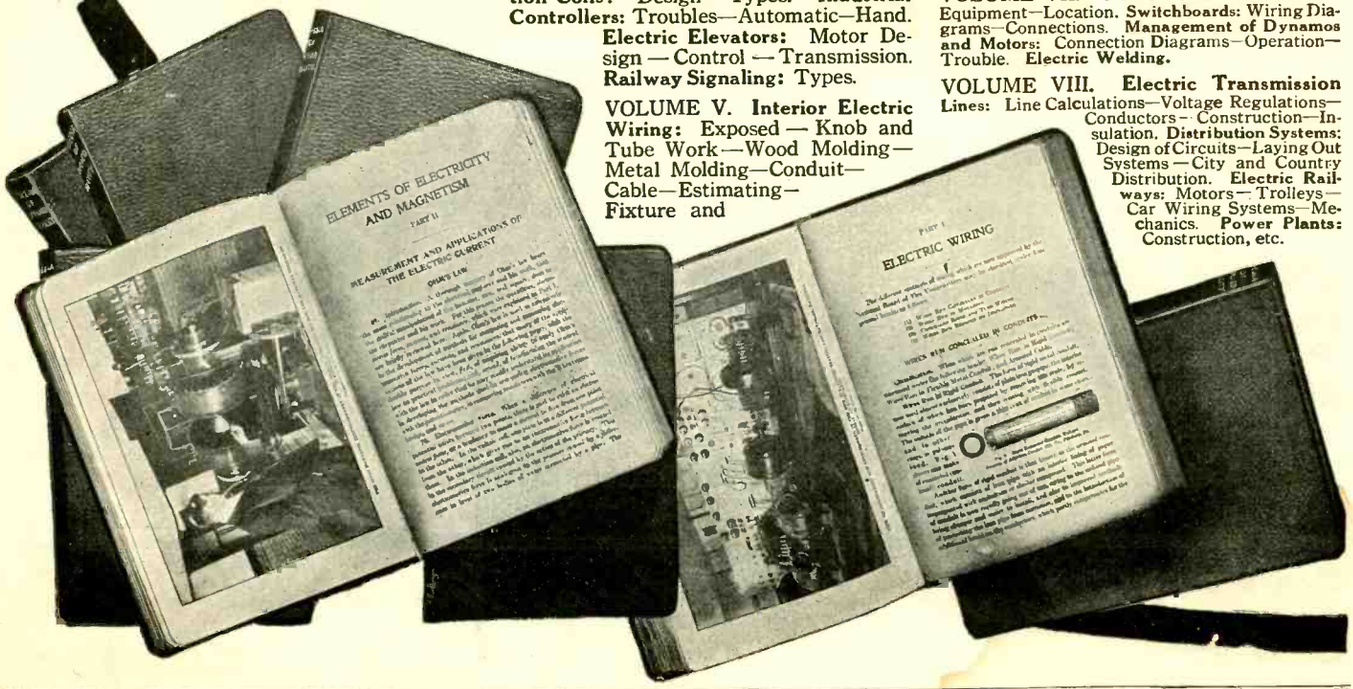
VOLUME IV. **Electrical Measurements and Meter Reading:** Instruments—Methods—Voltage—Current—Testing—Watt-Hour Meters. **Electromagnets and Induction Coils:** Design—Types. **Industrial Controllers:** Troubles—Automatic—Hand. **Electric Elevators:** Motor Design—Control—Transmission. **Railway Signaling:** Types.

VOLUME V. **Interior Electric Wiring:** Exposed—Knob and Tube Work—Wood Molding—Metal Molding—Conduit—Cable—Estimating—Fixture and Fixture Wiring—Theatres—Moving Picture Machines—Materials. **Underwriters Requirements:** National Electric Code—**Outside Wiring:** High-tension Lines—Ground Circuits—Controlling and Protecting Devices.

VOLUME VI. **Electric Lighting:** Planning Systems—Cost—Estimating. **Interior Lighting:** Offices—Stores—Windows—Factories—Residences. **Exterior Lighting: Railway Car Lighting:** Material—Maintenance. **Applied Electrochemistry:** Electric Furnaces—Metal Refining.

VOLUME VII. **Power Stations:** Cost—Equipment—Location. **Switchboards:** Wiring Diagrams—Connections. **Management of Dynamos and Motors:** Connection Diagrams—Operation—Trouble. **Electric Welding.**

VOLUME VIII. **Electric Transmission Lines:** Line Calculations—Voltage Regulations—Conductors—Construction—Insulation. **Distribution Systems:** Design of Circuits—Laying Out Systems—City and Country Distribution. **Electric Railways:** Motors—Trolleys—Car Wiring Systems—Mechanics. **Power Plants:** Construction, etc.



Electricity

Electricity of Tomorrow
Very Latest Methods

THIS is the 1920 edition—new from cover to cover—every one of the eight big volumes is chuck full of the latest methods and discoveries in this fascinating field. 27 of the greatest electrical engineers and experts in the business wrote these books just to help you who are interested in electricity realize your ambitions. To make you successful. It's not one man's ideas and experience, but the combined knowledge of the world's greatest electrical master minds. The seven volumes bound in genuine, flexible American Morocco, contain 3800 pages and more than 3000 pictures, diagrams, etc., illustrating everything known to electricity. See the list of things the books teach you—the list of big jobs that are open to men with the "know how" and our FREE offer that puts the whole set in your home for a week without costing you a cent.

Big Pay for Trained Men

Jobs paying from $1500.00 to $5000.00 yearly are waiting for men who can qualify as Electrical Engineers—Substation Operators—Trouble Men—Switchboard Operators—Dynamo Tenders—Electricians

Practical Knowledge Always in Demand

Electricity is the greatest force in the world and it is growing bigger and bigger every day. The multitude of uses it is now put to and the marvelous things it does for us is as nothing compared to what it will be in a few years from now. Just think what it means to us in our simple daily life. It runs our street cars and automobiles. It makes the telephone and tele graph possible. It lights our homes and gives us the "movies" too. Thousands of men—highly paid men—are needed to handle this wonderful force. Why don't you get into this big paying field now?

Good Jobs Waiting for Men Who Know

If you are trained in some branch of electricity you will never have to look for a job. The job and the big pay that goes with it will be looking for you. You can't dodge a good job if you have the "know how" under your hat. Don't go along year after year depending on a small raise now and then. It takes a lifetime to get you anywhere that way. Learn electricity and JUMP ahead. Let these 27 great engineers help you on your way with their books. Sending the coupon below is your first jump on the road to real success.

FREE Examination—No Risk

You can have this wonderful library to use in your own home or shop for a whole week FREE. It won't cost you one cent. DON'T SEND ANY MONEY. Just fill out and mail the coupon today and the entire set of eight volumes will come to you by express collect. You be the judge and find out for yourself what the books will do for YOU. Use them as you please. Go into every volume thoroughly. Show them to your friends and get their opinion. Then, if you have any doubt about their value, send them back at our expense; you won't owe us anything. If you like the books after a week's examination, you pay us only $2.00 and the same amount every month until $24.80 is paid. This is only 50 cents a week or 7 cents a day. Most of us waste more than this every day of our lives. Can you afford to pass up a better job and higher wages when it costs only 7 cents a day for a short time to get it? Of course you can't. Mail the Coupon Now—TODAY.

Only 7 cents a day

Special Offer!

A membership in this Society costs $12.00 a year, but we will give a one year membership FREE to everyone who buys a set of these books. This gives you the right to consult the engineers the Society retains on any electrical subject at any time. Write as often as you please. Ask as many questions as you please.

American Technical Society Dept. E-256 Chicago

AMERICAN TECHNICAL SOCIETY, Dept. E-256 Chicago

Send me the eight volume library of PRACTICAL APPLIED ELECTRICITY for a week's free examination by express collect. I will either send you $2.00 within a week as first payment and $2.00 each month until $24.80 is paid, or return the books at your expense. If I keep the books I am entitled to a one year membership in your Society free.

Name .....

Address .....

Reference ..... (Please fill out all three lines.)

No-Money Coupon



"THE 100% WIRELESS MAGAZINE"

CONTENTS OF SEPTEMBER ISSUE:

Grand Opera by Wireless. By H. Gernsback.
Guarding the Ether During the War. By P H. Boucheron.
Construction of an Audion "B" Storage Battery. By Herbert Webb.
Static Eliminator of Considerable Merit. By Edgar Terrain Johnstone.
Wireless Telegraphy with the Canadians at the Front. By J. W. Caucor.
The Double Deck Receiver.
A. B. C. of Wireless Reception. By H. K. Dunn.
The Latest Design Antenna Switch. By E. T. Jones.
The Lure of Radio. By Eugene Dynner.
Some Real Ideas.
Wrinkles for the Experimenter. By W. Hanlon.
A Pocket Size Receiver. By J. E. Aiken.
Value of the Radio Compass. By L. A. Pollock.
Use of Screws, Drills and Taps in Radio Construction. By J. Stanley Brown.
Junior Radio Course—Lesson 1. By E. T. Jones.
Club Gossip.
Questions and Answers.
Radio Digest.
Latest Radio Patents.
Junior Section.

What "Radio Amateur News" Is:

With its third issue RADIO AMATEUR NEWS holds the field undisputedly as the greatest radio magazine in print today. In point of circulation, number of articles, illustrations, RADIO AMATEUR NEWS now leads all other wireless magazines. Take for instance the August issue with its forty-eight pages; there were thirty-nine separate purely radio articles and 115 illustrations. *Over twenty thousand copies were printed and circulated.*

Each issue of the RADIO AMATEUR NEWS now contains 48 pages (or more) and an artistic cover in two colors. The illustrations average 125 every month and there are from 40 to 50 up-to-date articles, some by our biggest radio scientists, in every issue.

RADIO AMATEUR NEWS is the greatest and biggest radio magazine in print today.

RADIO AMATEUR NEWS is the only INDEPENDENT monthly wireless magazine in existence. It caters to no commercial interests—it has no boss save its readers. It is "different"—it has the latest radio news. It is a scientific magazine but it caters largely to the RADIO AMATEUR—it is by and for the Amateur. It is publisht by the publishers of the ELECTRICAL EXPERIMENTER, but there will be no duplication of articles in the two magazines. Both are entirely different—but both together will give you ALL the radio news of all the world. Whether you are a professor or an Amateur, get a sample copy or order it from your Newsdealer today.

Junior Radio Course

By E. T. JONES
Associate Editor

A distinctly new feature begins with the September issue in our new **Junior Radio Course.** In this issue Lesson No. 1 will appear complete. This course is intended for the beginner and everything presented will be in plain English, even the merest tyro in radio will find no trouble in understanding and assimilating the knowledge. The series is a very important one and nothing like it has ever appeared in print before. Everyone owes it to himself in this new age to know something about wireless and this course will enlighten all laymen. Profusely illustrated with pictures that anyone can understand.

15c
The Copy
$1.50
A Year
Canada and Foreign
$2.00 A Year

SEND 15c FOR SAMPLE COPY TODAY

48 PAGES
125 ILLUSTRATIONS

SPECIAL OFFER

Gentlemen:

Please enter my subscription for RADIO AMATEUR NEWS for the term of one year for which I enclose herewith $1.50. For this you will send to me immediately your great Wireless Course, containing 160 pages, 350 illustrations, size 6¾ x 10" with fine flexible cloth cover. I have added 5c extra for postage. (I have written my name and address in margin below.)

EXPERIMENTER PUB. CO., 231 Fulton St., N. Y. C.



Miss Evelyn Gosnell
in "Up in Mabel's Room"

Are You a Blond?

The Secret of Making People Like You



Wallace Reid
Star in "The Valley of the Giants"
A Paramount-Artcraft Picture

THE greatest asset any man can possibly have is the faculty for making people like him. It is even more important than ability.

The secret of making people like you lies in your ability to understand the emotional and mental characteristics of the people you meet.

Did you know that a blonde has an entirely different temperament than a brunet?—that to get along with a blond type you must act entirely different than you would to get along with a brunet?

When you really know the difference between blonds and brunets, the difference in their characters, temperaments, abilities and peculiar traits you will save yourself many a mistake—and you will incidently learn much you never knew before about yourself.

* * * * * * *

PAUL GRAHAM was a blond, and not until he learned that there was all the difference in the world between the characteristics of a blond and those of a brunet did he discover the secret of making people like him.

Paul had been keeping books for years for a large corporation which had branches all over the country. It was generally thought by his associates that he would never rise above that job. He had a tremendous ability with figures—could wind them around his little finger—but he did *not* have the ability to mix with big men; did *not* know how to make people like him.

Then one day the impossible happened. Paul Graham became popular.

Business men of importance who had formerly given him only a passing nod of acquaintance suddenly showed a desire for his friendship. People—even strangers—actually went out of their way to do things for him. Even *he* was astounded at his new power over men and women. Not only could he get them to do what he wanted them to do, but they actually anticipated his wishes and seemed eager to please him.

From the day the change took place he began to go up in business. Now he is the Head Auditor for his corporation at an immense increase in salary. And all this came to him simply because he learned the secret of making people like him.

You, too, can have the power of making people like you. For by the same method used by Paul Graham, you can, at a glance, tell the characteristics of any man, woman or child—tell instantly their likes and dislikes, and YOU CAN MAKE PEOPLE LIKE YOU: Here is how it is done.

Everyone you know can be placed in one of two general types—blond or brunet. There is as big a difference between the mental and emotional characteristics of a blond and those of a brunet as there is between night and day. You persuade a blond in one way—a brunet in another. Blonds enjoy one phase of life—brunets another. Blonds make good in one kind of a job—brunets in one entirely different.

To know these differences scientifically is the first step in judging men and women; in getting on well with them; in mastering their minds; in making them like you; in winning their respect, admiration, love and friendship.

And when you have learned these differences—when you can tell at a glance just what to do and say to make any man or woman like you, your success in life is assured.

For example, there's the case of a large manufacturing concern. Trouble sprang up at one of the factories. The men talked strike. Things looked ugly. Harry Winslow was sent to straighten it out. On the eve of a general walkout he pacified the men and headed off the strike. And not only this, but ever since then, that factory has led all the others for production. He was able to do this, because he knew how to make these men like him and do what he wanted them to do.

Another case, entirely different, is that of Henry Peters. Because of his ability to make people like him—his faculty for "getting under the skin" and making people think his way, he was given the position of Assistant to the President of a large firm. Two other men, both well-liked by their fellow employees, had each expected to get the job. So when the outside man, Peters, came in, he was looked upon by everyone as an interloper and was openly disliked by every other person in the office.

Peters was handicapped in every way. But in spite of that, in three weeks he had made fast friends of everyone in the house and had even won over the two men who had been most bitter against him. The whole secret is that he could tell in an instant how to appeal to any man and make him well-liked.

A certain woman who had this ability moved with her family to another town. As is often the case, it is a very difficult thing for any woman to break into the chill circle of society in this town, if she was not known. But her ability to make people like her soon won for her the close friendship of many of the "best families" in the town. Some people wonder how she did it. It was simply the secret at work—the secret of judging people's character and making them like you.

* * * * * * *

YOU realize, of course, that just knowing the difference between a blond and a brunet could not accomplish all these wonderful things. There are other things to be taken into account. But here is the whole secret.

You know that everyone does not think alike. What one likes another dislikes. What pleases one offends another. And what offends one pleases another. Well, there is your cue. You can make an instant "hit" with anyone, if you say the things they want you to say, and act the way they want you to act. Do this and they will surely like you and believe in you and will go miles out of their way to PLEASE YOU.

You can do this easily by knowing certain simple signs. In addition to the difference in complexion, every man, woman and child has written on them signs as distinct as though they were in letters a foot high, which show you from one quick glance exactly what to say and to do to please them—to get them to believe what you want them to believe—to think as you think—to do exactly what you want them to do.

Knowing these simple signs is the whole secret of getting what you want out of life—of making friends, of business and social advantage. Every great leader uses this method. That is why he IS a leader. Use it yourself and you will quickly become a leader—nothing can stop you.

You have heard of Dr. Blackford, the Master Character Analyst. Many concerns will not employ a man without first getting Dr. Blackford to pass on him. Concerns such as Westinghouse Electric and Manufacturing Company, Baker, Vawter Company, Scott Paper Company and many others pay Dr. Blackford large annual fees for advice on dealing with human nature.

So great was the demand for these services that Dr. Blackford could not even begin to fill all the engagements. So Dr. Blackford has explained the method in a simple, seven-lesson course, entitled, "Reading Character at Sight." Even a half hour's reading of this wonderful course will give you an insight into human nature and a power over people which will surprise you.

Such confidence have the publishers in Dr. Blackford's course, "Reading Character at Sight," that they will gladly send it to you on approval, all charges prepaid. Look it over thoroughly. See if it lives up to all the claims made for it. If you do not want to keep it, then return it and the transaction is closed. And if you decide to keep it—as you surely will—then merely remit five dollars in full payment.

Remember, you take no risk, you assume no obligation. The entire course goes to you on approval. You have everything to gain—nothing to lose. So mail the coupon NOW, and learn how to make people like you, while this remarkable offer is still open.

FREE EXAMINATION COUPON

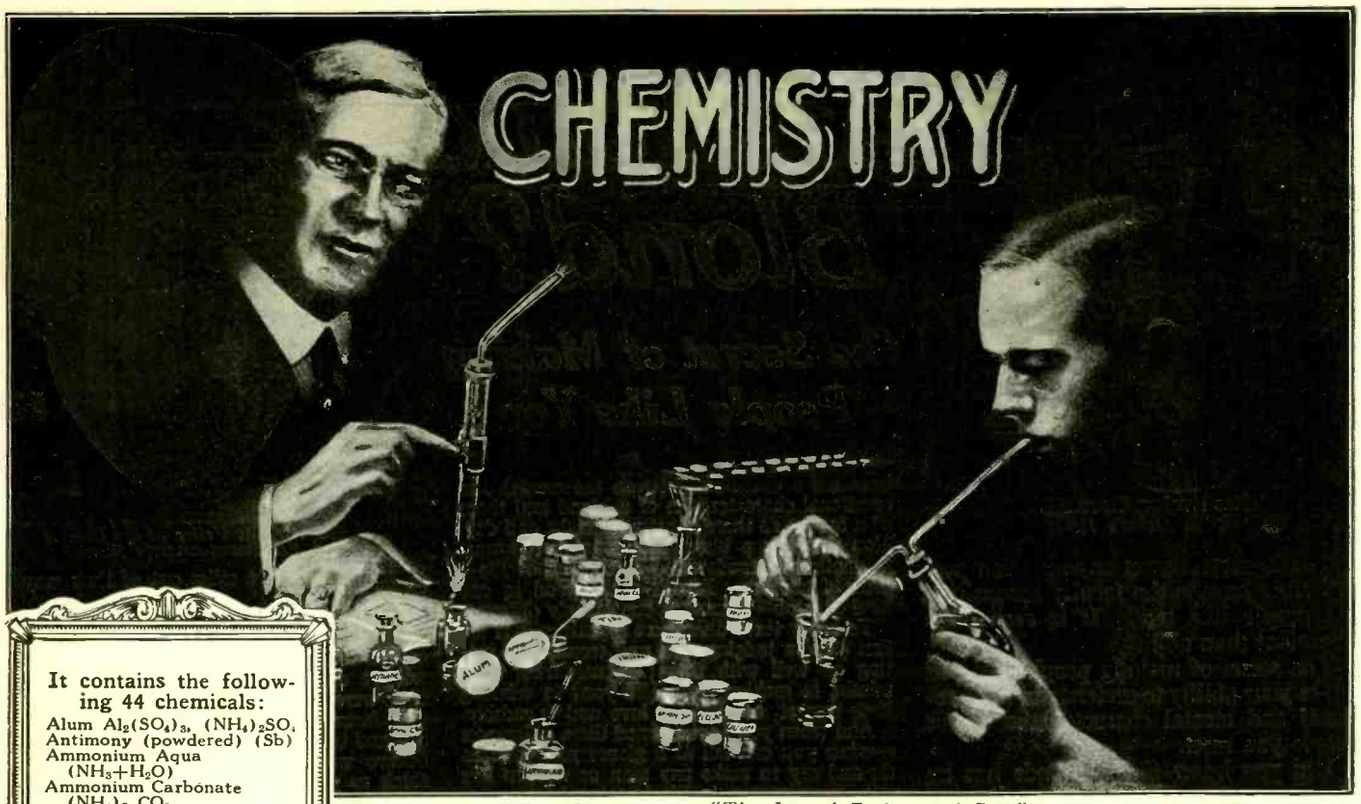
Independent Corporation
Publishers of The Independent Weekly
Dept. B-1109, 119 West 40th Street, New York

You may send me Dr. Blackford's Course of seven lessons entitled "Reading Character at Sight." I will either remail the course to you within five days after its receipt, or send you $5 in full payment of the course.

Name .....

Address .....

.....Elect. Exper. 9-19



"The Joy of Father and Boy."

Chemical Laboratory

We present herewith to our friends our new **E. I. Co. Chemical Laboratory** which contains **real** chemicals and apparata to perform **real** chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a **Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.**

DESCRIPTION OF THE OUTFIT:

The outfit consists of forty-four (44) Chemicals all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) enough to make dozens of experiments with each. See list of Chemicals herewith.

The apparata furnished are all of the best obtainable make and of standard laboratory size and shape. A list of the 17 pieces of apparata furnished with this outfit is printed also herewith.

The Instruction book is a real Chemistry Course for the Beginner. Some of the Contents are: **Division of Matter:** This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. **Chemical Nomenclature:** This explains in simple language the derivation of the chemical names of the Elements and their compounds. There is a chapter on **Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms,** etc.

A good part of the book is devoted to Weights and Measures. The Metric System, the English system and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights. Volume, Capacity and Length; Per Cent solutions; Conversion of Measure expressed in parts; Poisons and their antidotes; Technical and common name of chemical substances; Formulas for Cleaning various substances, etc., etc.

Among the **100 Experiments** are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to Make Chlorine Gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

The price is still $5.00. **Shipping Weight 10 lbs.** **(Can be shipped by Express only.)**

It contains the following 44 chemicals:

Alum $Al_2(SO_4)_3$, $(NH_4)_2SO_4$
Antimony (powdered) (Sb)
Ammonium Aqua (NH_3+H_2O)
Ammonium Carbonate $(NH_4)_2\ CO_3$
Ammonium Chloride (NH_4Cl)
Ammonium Sulphate $(NH_4)_2\ SO_4$
Barium Chloride ($BaCl_2$)
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride ($CaCl_2$)
Calcium Oxide (CaO)
Calcium Sulphate $(CaSO_4 2H_2O)$
Charcoal (Carbon) (C)
Chloride of Zinc ($ZnCl_2$)
Copper Sulphate ($CuSO_4$)
Ferrous Sulphate ($FeSO_4$)
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5(OH)_3$
Hydrochloric Acid (HCl)
Iodine (I)
Iron Chloride ($FeCl_2$)
Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
Magnesium Carbonate ($MgCO_3$)
Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
Nickel Chloride ($NiCl_2$)
Oxalic Acid ($H_2C_2O_4$)
Sodium Bicarbonate ($NaHCO_3$)
Sodium Borate ($NaBO_2$)
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate ($NaNO_3$)
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride ($SnCl_2$)
Sulphate of Nickel ($NiSO_4$)
Sulphate of Zinc ($ZnSO_4$)
Sulphuric Acid (H_2SO_4)
Tin (Granulated) (Sn)
Zinc (Metal) (Zn)
Zinc Carbonate ($ZnCO_3$)

The following apparata are furnished:

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube
Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure
Glass Tubing
One book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

TRADE MARK

THE ELECTRO IMPORTING CO., Mfrs.

231 FULTON STREET NEW YORK CITY

TRADE MARK

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

I enclose herewith 6 cents in stamps or coin, to cover postage, for which please send me your latest Cyclopedia Catalog No. 20 as described.

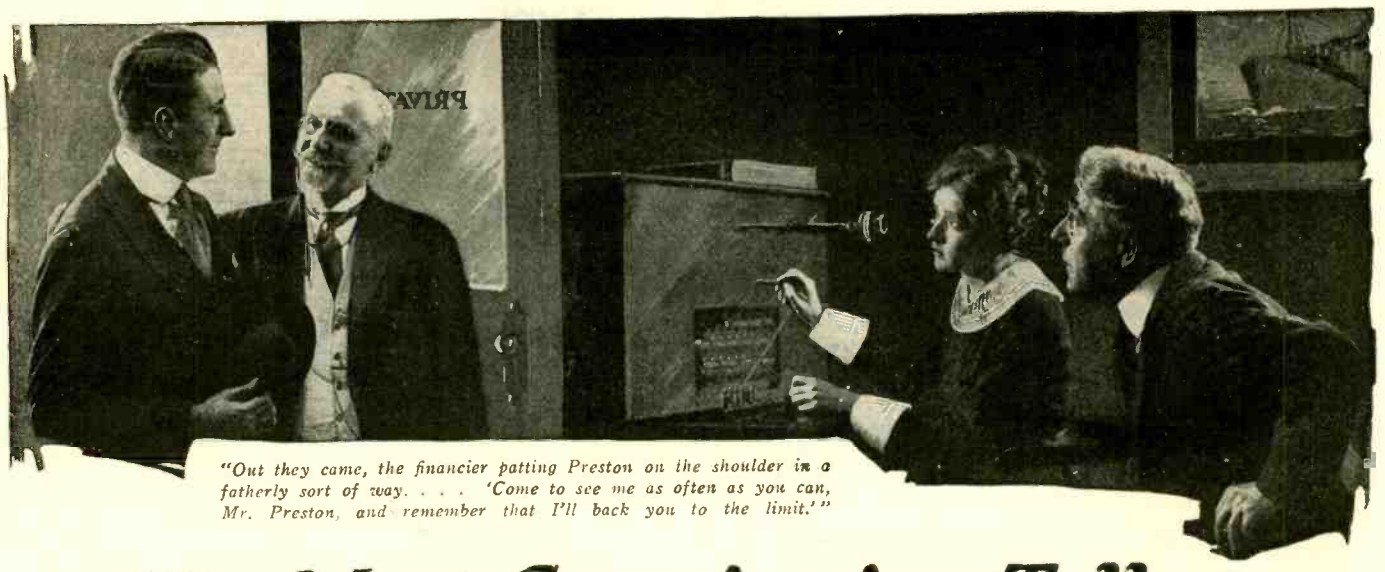
NAME .....

ADDRESS .....

STATE..... E. E. 9-19

"THE LIVIEST CATALOG IN AMERICA"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 176 Big Pages, 400 illustrations. 300 instruments and apparatus, etc. Big **"Treatise on Wireless Telegraphy."** 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 20 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.



"Out they came, the financier patting Preston on the shoulder in a fatherly sort of way. . . . 'Come to see me as often as you can, Mr. Preston, and remember that I'll back you to the limit.'"

The Most Convincing Talker I Ever Met

Everywhere this man goes, people shower him with favors and seek his friendship. Things which other people ask for and are refused, he gets instantly. How he does it is told in this amazing story.

LET me ask you this: There is a big business deal to be put through. It involves millions of dollars. Putting it through depends wholly on one thing—getting the backing of a great financier.

But this man is bitterly opposed to your idea and to your associates. Seven of the most able men and women in all America have tried to win over this financier. They failed dismally and completely.

Now, could you, a total stranger to this man, walk in on him unannounced, talk for less than an hour, and then have him take your arm as a token of friendship, and give you a signed letter agreeing to back you to the limit?

Could you?

ASTOUNDING? Yes! But it *WAS* done. And I'll tell you how. Here is the way it all came about. For a long time the directors of our company had felt the handicap of limited capital. We had business in sight running into a million dollars a month. But we couldn't finance this volume of sales. We simply had to get big backing, and that was all there was to it.

Because of trade affiliations, one man—a great financier in New York—controlled the situation. Win him over and the rest was easy. But how to win him?—that was the question. No less than five men and two women—all people of influence and reputation—had tried. They were all repulsed—turned down cold and flat.

You know how a thing of this sort grows on you and how bitter utter defeat is. Well, we were talking it over at a board meeting when one of our directors announced that he knew of only one man who could possibly put through the deal—a man by the name of Preston.

So it was agreed that Preston was to be sounded out at luncheon the following day. He proved to be a fine type of American. At 34 years of age he had become president and majority stockholder of a thriving manufacturing business rated at three-quarters of a million dollars.

Preston was deeply interested, as anyone would be over the prospect of closing such a big deal. The director in question said casually, "Why don't you run down to New York and take a shot at it, Preston?" Preston looked out of the window for a moment, and then quietly answered, "You're on."

I WENT along with Preston simply as a matter of form to represent our interests. Aboard the 10:25 train out of Chicago we headed for the smoker and got to talking with the crowd there.

Then I noticed something. Preston had dominated them all. Everyone was eagerly hanging on his words, and looking at him with open admiration. No sooner would he stop talking than one of the men would start him up again. And as the men dropped off at stations along the way they gave Preston their cards, with pressing invitations to look them up. No doubt about it, Preston was *THE* man aboard that car.

The colored porter, too, came under his sway. For that night, when the berths were being made up, the porter came unasked to Preston, told him that his berth was right over the car trucks, and insisted upon changing it to a more comfortable one.

And so it went all the way to New York. Everyone who met Preston took a great liking to him the instant he spoke. They seemed to be eager for his companionship—wanted to be with him every minute, openly admired him, and loaded him with favors.

Even the usual haughty room clerk at the hotel showed a great interest in Preston's welfare. He showered us with attention while a long line of people waited to register.

The next morning we called on the great financier—the man who was so bitterly against us and had flatly turned down seven of our shrewd influential representatives.

I waited in the reception room—nervous, restless, with pins and needles running up and down my spine. Surely Preston would meet the same humiliating fate?

But no! In less than an hour out they came, arm in arm, the financier patting Preston on the shoulder in a fatherly sort of way. And then I heard the surprising words, "Come to see me as often as you can, Mr. Preston, *and remember that I'll back you to the limit!*"

AT the hotel that night sleep wouldn't come. I couldn't get the amazing Preston out of my thoughts. What an irresistible power over men's minds he had. Didn't even have to ask for what he wanted! People actually competed for his attention, anticipated his wishes and eagerly met them. What a man! What power! . . . Then the tremendous possibilities of it all—think what could be done with such power!

What was the secret? For secret there must be. So the first thing next morning I hurried to Preston's room, told him my thoughts, and asked him the secret of his power.

Preston laughed good-naturedly. "Nothing to it—I—well—that—is—" he stalled. "I don't like to talk about myself, but I've simply mastered the knack of talking convincingly, that's all."

"But how did you get the knack?" I persisted.

Preston smiled, and said, "Well, there's an organization in New York that tells you exactly how to do it. *It's amazing!* There's really nothing to study. It's mostly a knack which they tell you. You can learn this knack in a few hours. And in less than a week it will produce definite results in your daily work.

"Write to this organization—The Independent Corporation—and get their method. They send it on free trial. I'll wager that in a few weeks from now you'll have a power over men which you never thought possible . . . but write and see for yourself." And that was all I could get out of the amazing Preston.

WHEN I returned home I sent for the method Preston told me about. It opened my eyes and astounded me. Just how he had won over the financier was now as clear as day to me. I began to apply the method to my daily work, and soon I was able to wield the same remarkable power over men and women that Preston had. I don't like to talk about my personal achievements any more than Preston does, but I'll say this:

When you have acquired the knack of talking convincingly, it's easy to get people to do anything you want them to do. That's how Preston impressed those people on the train—how he got special attention from the hotel clerk—how he won over the financier—simply by talking convincingly.

This knack of talking convincingly will do wonders for any man or woman. Most people are afraid to express their thoughts; they know the humiliation of talking to people and of being ignored with a casual nod or a "yes" or "no." But when you can talk convincingly, it's different. *When you talk people listen and listen eagerly.* You can get people to do almost anything you want them to do. And the beauty of it all is that they think they are doing it of their own free will.

In committee meetings, or in a crowd of any sort you can rivet the attention of all when you talk. You can force them to accept your ideas. It helps wonderfully in writing business letters — enables you to write sales letters that amaze everyone by the big orders they pull in.

Then again it helps in social life. Interesting and convincing talk is the basis of social success. At social affairs you'll always find that the convincing talker is the centre of attraction, and that people go out of their way to "make up" to him.

Talk convincingly and no man—no matter who he is—will ever treat you with cold, unresponsive indifference. Instead, you'll instantly get under his skin, make his heart glow and set fire to his enthusiasms. Talk convincingly and any man—even a stranger—will treat you like an old pal and will literally take the shirt off his back to please you.

You can get anything you want if you know how to talk convincingly. You've noticed that in business ability alone won't get you much. Many a man of real ability, who cannot express himself well, is often outdistanced by a man of mediocre ability who knows how to talk convincingly. There's no getting away from it, to get ahead—merely to hold your own—to get what your ability entitles you to, *you've got to know how to talk convincingly!*

THE method Preston told me about is Dr. Law's "Mastery of Speech," published by the Independent Corporation. Such confidence have the publishers in the ability of Dr. Law's method to make you a convincing talker that they will gladly send it to you wholly on approval.

You needn't send any money—not a cent. Merely mail the coupon, or write a letter, and the complete Course "Mastery of Speech," will be sent you by return mail, all charges prepaid. If you are not entirely satisfied with it, send it back any time within five days after you receive it and you will owe nothing.

But if it pleases you, as it has pleased thousands of others, then send only five dollars in full payment. You take no risk. You have everything to gain and nothing to lose. So mail the coupon now before this remarkable offer is withdrawn.

Independent Corporation

Publishers of the Independent Weekly

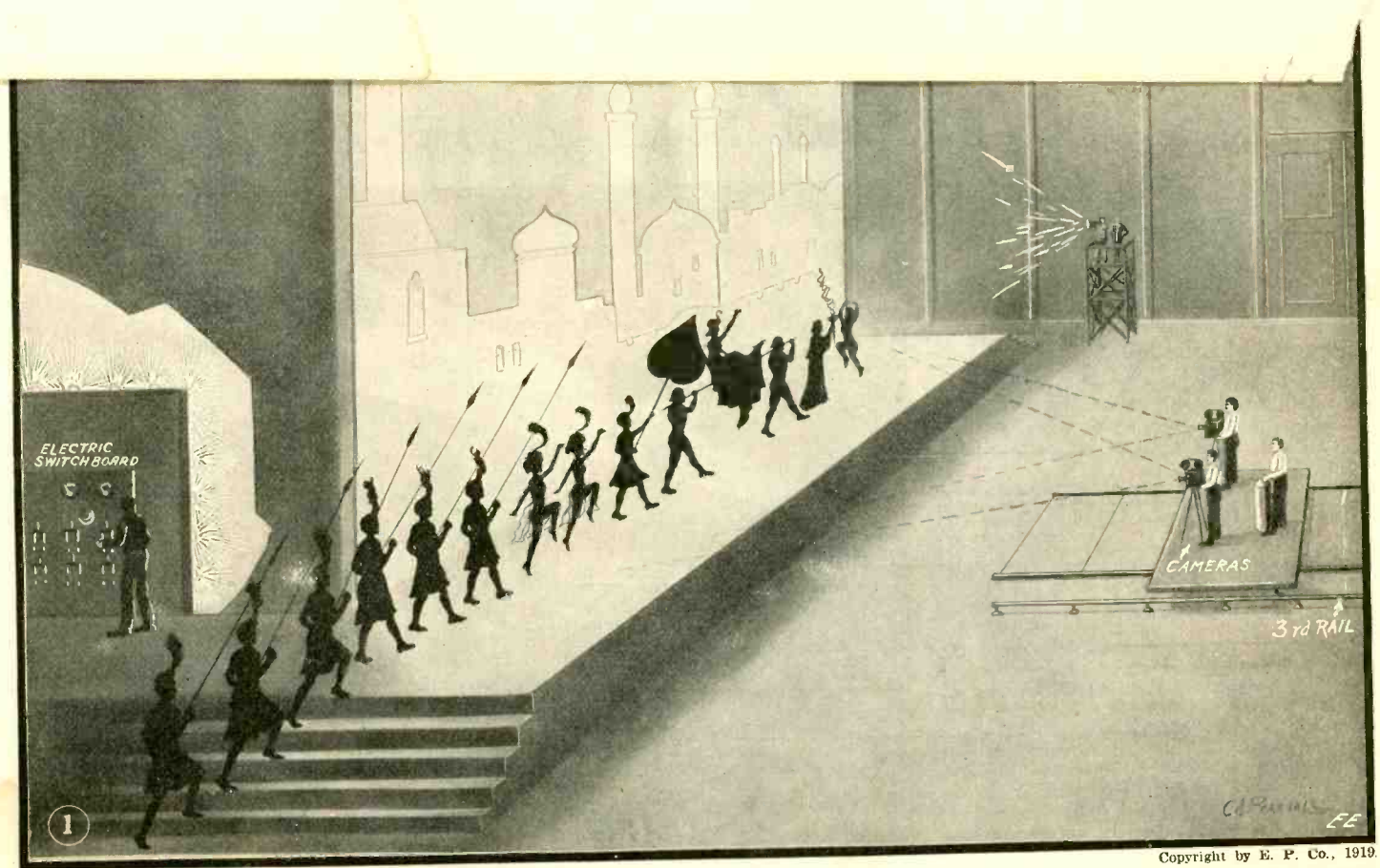
Dept L1109 119 W. 40th St. New York

Please send me Dr. Frederick Houk Law's "Mastery of Speech," a Course in Business Talking and Public Speaking in eight lessons. I will either remail the Course to you within five days after its receipt, or send you $5 in full payment of the Course.

Name .....

Address .....Elect. Exper. 9-19

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.



Copyright by E. P. Co., 1919.

The Latest in "Silhouette Movies." They Are Made from Life in the Manner Here Illustrated. The Stage Screen Is Highly Illuminated from the Rear and the Actors Appear Before It Drest in Black Clothes. The Camera Car Can Be Rapidly Moved Toward or Away from the Studio Stage by Means of an Electric Motor Attached to the Car Axle and Controlled by the Operators or a Third Man as Shown. Current Is Supplied the Motor Thru a Third Rail.

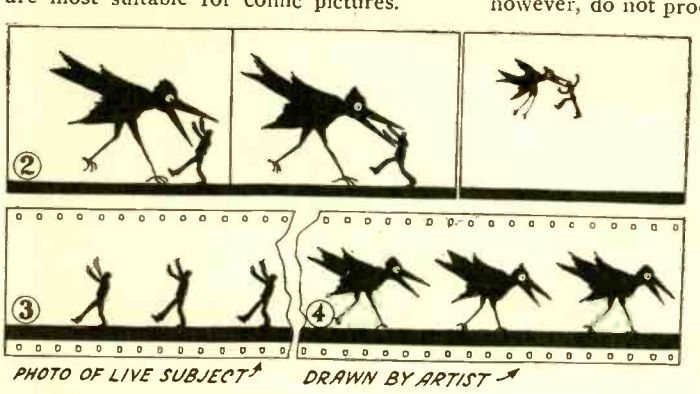


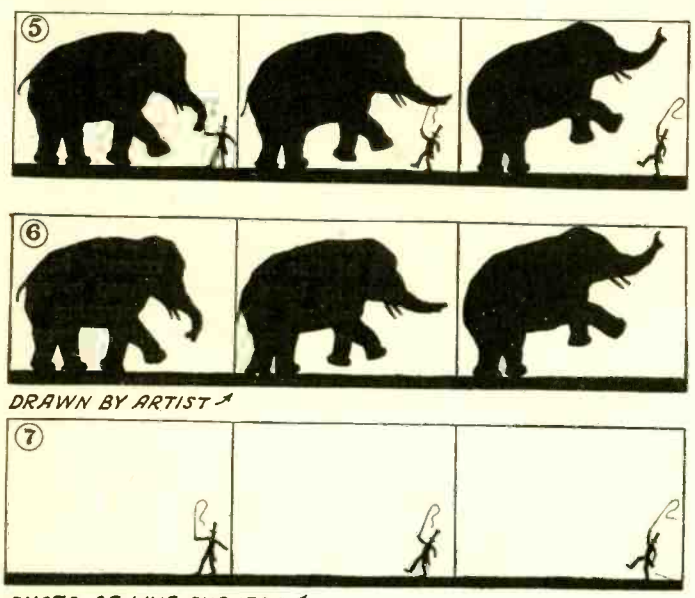
Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates

produce the weird and unusual effect of *black people* moving in a *black world,* they are most suitable for comic pictures.





A New Way to Make Silhouette Movies. The Man in the Pictures Shown Is Photographed as in Fig. 1 from Life, While the Giant Bird and the Elephant Are Drawn by an Artist in the Proper Scale and then Photographed. Figs. 2 and 5 Show the Combined Effects Clearly.

Silhouettes could be produced by shadows thrown on a light screen. Shadows, however, do not produce a sufficiently sharp image. Gilbert's method consists rather of directly photographing the actors. They present the appearance of silhouettes by having their movements performed in front of a powerfully illaminated screen. The method used is shown in figure 1. Here we have a stage upon which actors are moving before the transparent screen, behind which lights are arranged to give the necessary illumination, but without throwing direct light rays thru the screen.

The screen forms the front of a box or small chamber in which the light is produced, but projected from the white painted walls to the screen. The side wings of this box carry banks of powerful electric lights which brilliantly illuminate the rear side of the transparent screen. The arrangement is such as to prevent shadows from falling from actors upon the screen. Their position is indicated in figure 1. If the lights are of sufficient intensity, pictures taken by means of a motion-picture camera in front of the stage, as shown in figure 1, will be in silhouette. This method of producing the pictures presents the advantage of giving the actors entire freedom of movement, without reference to the illuminating arrangement.

Gilbert's method admits of various interesting applications, by which novel effects can be produced. Figure 2, for instance, shows the picture of a tremendous bird eating a man. The actions of the man have been actually picturized (to use the language of the "movie" industry), as shown in figure 3, in a separate film. The bird, however, and his "cruel" actions have been produced by the pen of an artist according to figure 4. Then both films have been combined into the final working film, figure 2, with its weird impressions. In a similar way films, figure 5, of an elephant and his trainer have been composed by combining figures 6 and 7. The trainer has here been an actual man, but the elephant, no matter how natural he may look, has been originated by an artist. In this case it is decidedly more economical to arrive at the elephant's picture by employing the skill of an artist than by having an actual elephant on the stage.

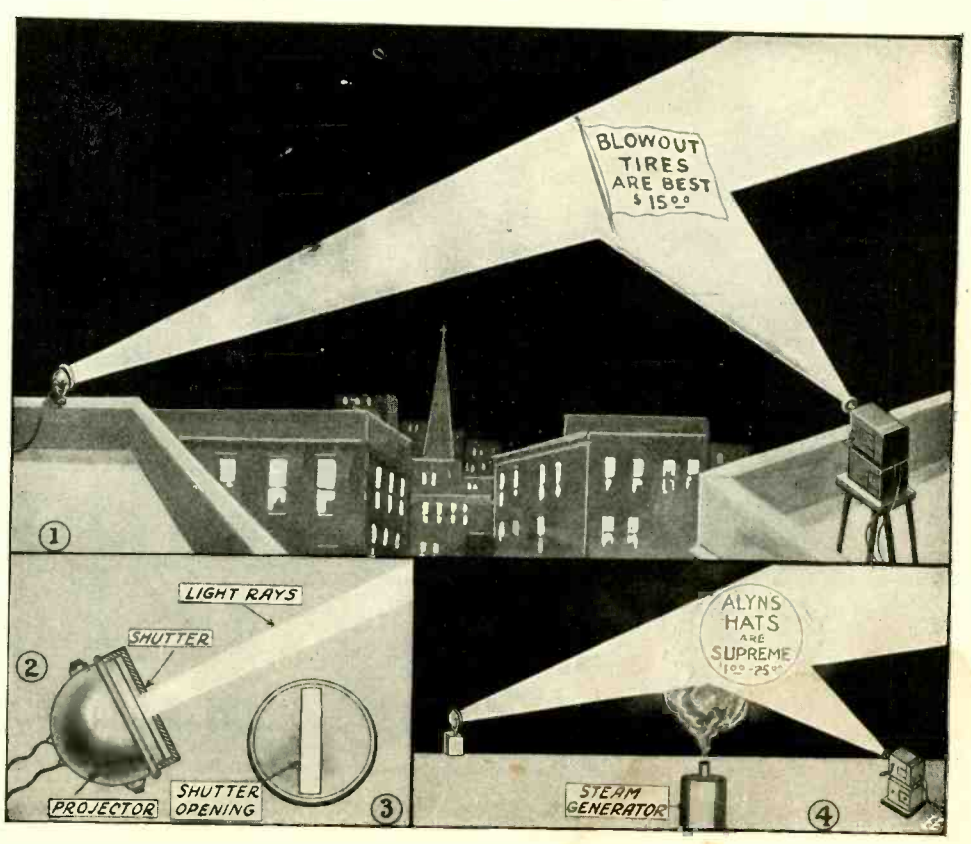
The background of the picture, consisting let us say of buildings, is frequently produced by having a permanent drawing painted on the screen before which the actors appear. A picture of this kind is illustrated in figure 1. In this case it is not necessary to combine two films into one, which naturally adds to the production expenses. It is often possible, however, to make the background a natural picture, such as a street scene, and this can then be combined with a comic silhouette picture produced by means of the Gilbert process.

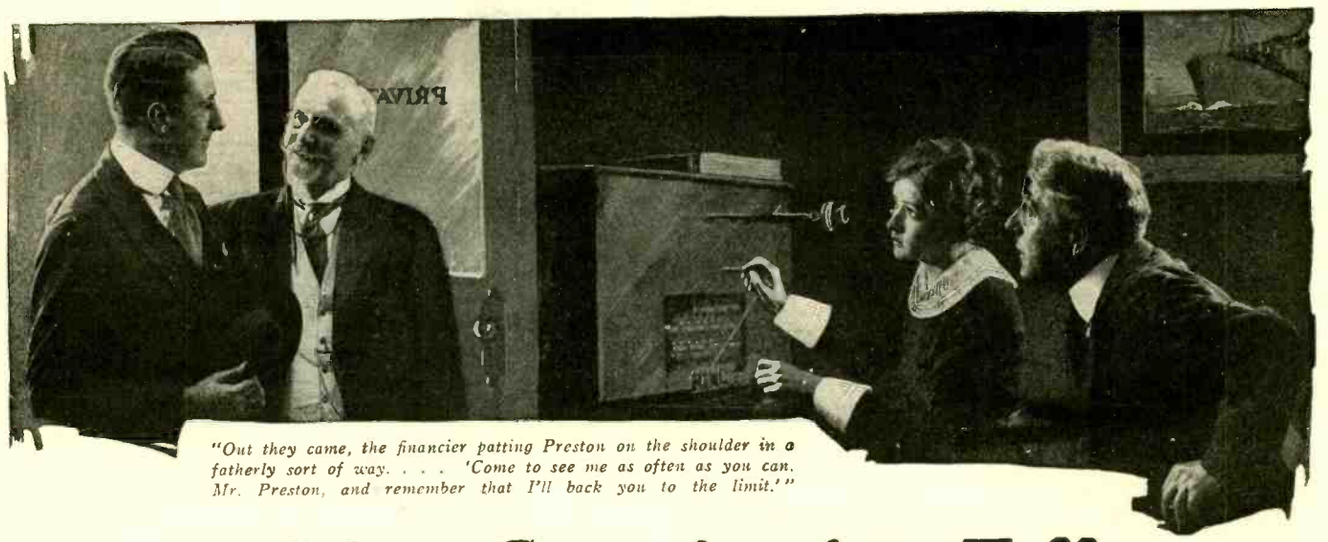
An Electric Sign in Mid-Air

The accompanying illustration shows a recent invention of Mr. Frank H. Ellison, of New York City, who proposes an advertising scheme susceptible to many advertising adaptations whereby two powerful beams of electric light are flashed into space at right angles, causing thereby an image in the form of an advertisement, flag, etc., to be cast up at the juncture of the two beams. The main shaft of light may be thrown from a powerful electric searchlight projector, or other source of intense illumination, while the crosswise beam

The Accompanying Illustration Shows a New Invention, Which Is as Radical as It Is Novel in Its Conception. The Inventor Proposes to Throw an Image of a Flag or an Advertisement in Mid-Air at the Interception of Two Powerful Beams of Light, as Here Illustrated.

projector, carrying the image, may be in the form of a stereopticon, in which different slides can be placed and quickly changed, as desired. In the event that an atmosphere containing water vapor, as in the East, is not available it becomes possible to provide an artificial medium for the purpose, by employing a small steam generator or boiler under the spot where the image is desired. A single steampipe or two may be run a considerable distance above the roof of a high building in the vicinity, and when it is desired to throw the image or script in the air, the steam is turned on and thus forms a very good medium for the purpose.





"Out they came, the financier patting Preston on the shoulder in a fatherly sort of way. . . . 'Come to see me as often as you can, Mr. Preston, and remember that I'll back you to the limit.'"

The Most Convincing Talker I Ever Met

Everywhere this man goes, people shower him with favors and seek his friendship. Things which other people ask for and are refused, he gets instantly. How he does it is told in this amazing story.

LET me ask you this: There is a big business deal to be put through. It involves millions of dollars. Putting it through depends wholly on one thing—getting the backing of a great financier.

But this man is bitterly opposed to your idea and to your associates. Seven of the most able men and women in all America have tried to win over this financier. They failed dismally and completely.

Now, could you, a total stranger to this man, walk in on him unannounced, talk for less than an hour, and then have him take your arm as a token of friendship, and give you a signed letter agreeing to back you to the limit?

Could you?

ASTOUNDING? Yes! But it *WAS* done. And I'll tell you how. Here is the way it all came about. For a long time the directors of our company had felt the handicap of limited capital. We had business in sight running into a million dollars a month. But we couldn't finance this volume of sales. We simply had to get big backing, and that was all there was to it.

Because of trade affiliations, one man—a great financier in New York—controlled the situation. Win him over and the rest was easy. But how to win him?—that was the question. No less than five men and two women—all people of influence and reputation—had tried. They were all repulsed—turned down cold and flat.

You know how a thing of this sort grows on you and how bitter utter defeat is. Well, we were talking it over at a board meeting when one of our directors announced that he knew of only one man who could possibly put through the deal—a man by the name of Preston.

So it was agreed that Preston was to be sounded out at luncheon the following day. He proved to be a fine type of American. At 34 years of age he had become president and majority stockholder of a thriving manufacturing business rated at three-quarters of a million dollars.

Preston was deeply interested, as anyone would be over the prospect of closing such a big deal. The director in question said casually, "Why don't you run down to New York and take a shot at it, Preston?" Preston looked out of the window for a moment, and then quietly answered, "You're on."

I WENT along with Preston simply as a matter of form to represent our interests. Aboard the 10:25 train out of Chicago we headed for the smoker and got to talking with the crowd there.

Then I noticed something. Preston had dominated them all. Everyone was eagerly hanging on his words, and looking at him with open admiration. No sooner would he stop talking than one of the men would start him up again. And as the men dropped off at stations along the way they gave Preston their cards, with pressing invitations to look them up. No doubt about it, Preston was *THE* man aboard that car.

The colored porter, too, came under his sway. For that night, when the berths were being made up, the porter came unasked to Preston, told him that his berth was right over the car trucks, and insisted upon changing it to a more comfortable one.

And so it went all the way to New York. Everyone who met Preston took a great liking to him the instant he spoke. They seemed to be eager for his companionship—wanted to be with him every minute, openly admired him, and loaded him with favors.

Even the usual haughty room clerk at the hotel showed a great interest in Preston's welfare. He showered us with attention while a long line of people waited to register.

The next morning we called on the great financier—the man who was so bitterly against us and had flatly turned down seven of our shrewd influential representatives.

I waited in the reception room—nervous, restless, with pins and needles running up and down my spine. Surely Preston would meet the same humiliating fate?

But no! In less than an hour out they came, arm in arm, the financier patting Preston on the shoulder in a fatherly sort of way. And then I heard the surprising words, "Come to see me as often as you can, Mr. Preston, *and remember that I'll back you to the limit!*"

AT the hotel that night sleep wouldn't come. I couldn't get the amazing Preston out of my thoughts. What an irresistible power over men's minds he had. Didn't even have to ask for what he wanted! People actually competed for his attention, anticipated his wishes and eagerly met them. What a man! What power! . . . Then the tremendous possibilities of it all—think what could be done with such power!

What was the secret? For secret there must be. So the first thing next morning I hurried to Preston's room, told him my thoughts, and asked him the secret of his power.

Preston laughed good-naturedly. "Nothing to it—I—well—that—is—" he stalled. "I don't like to talk about myself, but I've simply mastered the knack of talking convincingly, that's all."

"But how did you get the knack?" I persisted.

Preston smiled, and said, "Well, there's an organization in New York that tells you exactly how to do it. *It's amazing!* There's really nothing to study. It's mostly a knack which they tell you. You can learn this knack in a few hours. And in less than a week it will produce definite results in your daily work.

"Write to this organization—The Independent Corporation—and get their method. They send it on free trial. I'll wager that in a few weeks from now you'll have a power over men which you never thought possible . . . but write and see for yourself." And that was all I could get out of the amazing Preston.

WHEN I returned home I sent for the method Preston told me about. It opened my eyes and astounded me. Just how he had won over the financier was now as clear as day to me. I began to apply the method to my daily work, and soon I was able to wield the same remarkable power over men and women that Preston had. I don't like to talk about my personal achievements any more than Preston does, but I'll say this:

When you have acquired the knack of talking convincingly, it's easy to get people to do anything you want them to do. That's how Preston impressed those people on the train—how he got special attention from the hotel clerk—how he won over the financier—simply by talking convincingly.

This knack of talking convincingly will do wonders for any man or woman. Most people are afraid to express their thoughts; they know the humiliation of talking to people and of being ignored with a casual nod or a "yes" or "no." But when you can talk convincingly, it's different. *When you talk people listen and listen eagerly.* You can get people to do almost anything you want them to do. And the beauty of it all is that they think they are doing it of their own free will.

In committee meetings, or in a crowd of any sort you can rivet the attention of all when you talk. You can force them to accept your ideas. It helps wonderfully in writing business letters — enables you to write sales letters that amaze everyone by the big orders they pull in.

Then again it helps in social life. Interesting and convincing talk is the basis of social success. At social affairs you'll always find that the convincing talker is the centre of attraction, and that people go out of their way to "make up" to him.

Talk convincingly and no man—no matter who he is—will ever treat you with cold, unresponsive indifference. Instead, you'll instantly get under his skin, make his heart glow and set fire to his enthusiasms. Talk convincingly and any man—even a stranger—will treat you like an old pal and will literally take the shirt off his back to please you.

You can get anything you want if you know how to talk convincingly. You've noticed that in business ability alone won't get you much. Many a man of real ability, who cannot express himself well, is often outdistanced by a man of mediocre ability who knows how to talk convincingly. There's no getting away from it, to get ahead—merely to hold your own—to get what your ability entitles you to, *you've got to know how to talk convincingly!*

THE method Preston told me about is Dr. Law's "Mastery of Speech," published by the Independent Corporation. Such confidence have the publishers in the ability of Dr. Law's method to make you a convincing talker that they will gladly send it to you wholly on approval.

You needn't send any money—not a cent. Merely mail the coupon, or write a letter, and the complete Course "Mastery of Speech," will be sent you by return mail, all charges prepaid. If you are not entirely satisfied with it, send it back any time within five days after you receive it and you will owe nothing.

But if it pleases you, as it has pleased thousands of others, then send only five dollars in full payment. You take no risk. You have everything to gain and nothing to lose. So mail the coupon now before this remarkable offer is withdrawn.

Independent Corporation

Publishers of the Independent Weekly

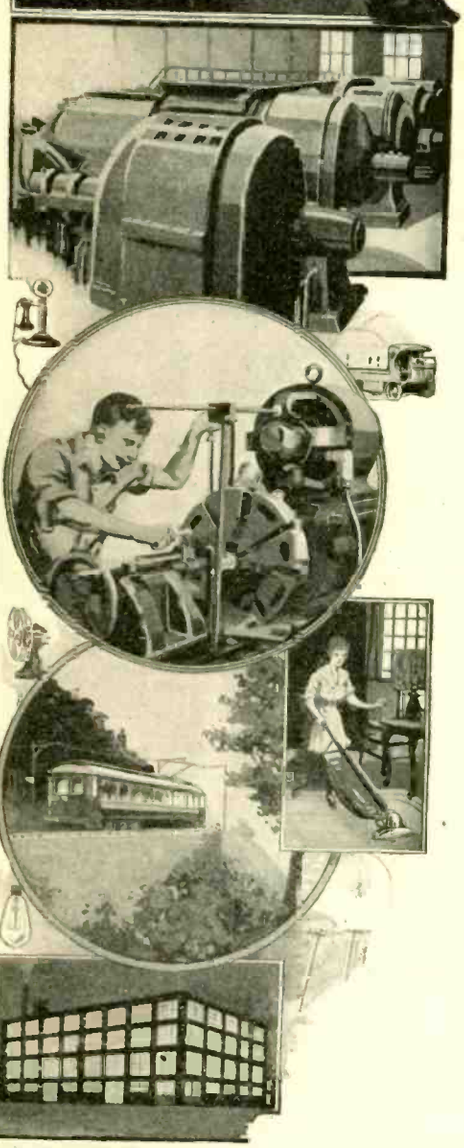
Dept L1109 119 W. 40th St. New York

Please send me Dr. Frederick Houk Law's "Mastery of Speech," a Course in Business Talking and Public Speaking in eight lessons. I will either remail the Course to you within five days after its receipt, or send you $5 in full payment of the Course.

Name .....

Address .....Elect. Exper. 9-19





Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 5,500 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Special Automobile Ignition Course

We have just installed a special automobile ignition course for auto mechanics, garage men and owners. The course covers completely ignition, starting, lighting and other electrical equipment in connection with automobiles, motor boats, etc.

Let us explain our complete courses to you in person. If you can't call, send now for 64-page book—it's FREE to you.

New York Electrical School
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

.....(NAME)

.....(ADDRESS)

New York Electrical School

29 West 17th Street, New York

ELECTRICAL EXPERIMENTER

H. GERNSBACK – EDITOR
H. W. SECOR – ASSOCIATE EDITOR

Vol. VII. Whole No. 77 SEPTEMBER, 1919 No. 5

Silhouette Movies

By H. GUMPEL

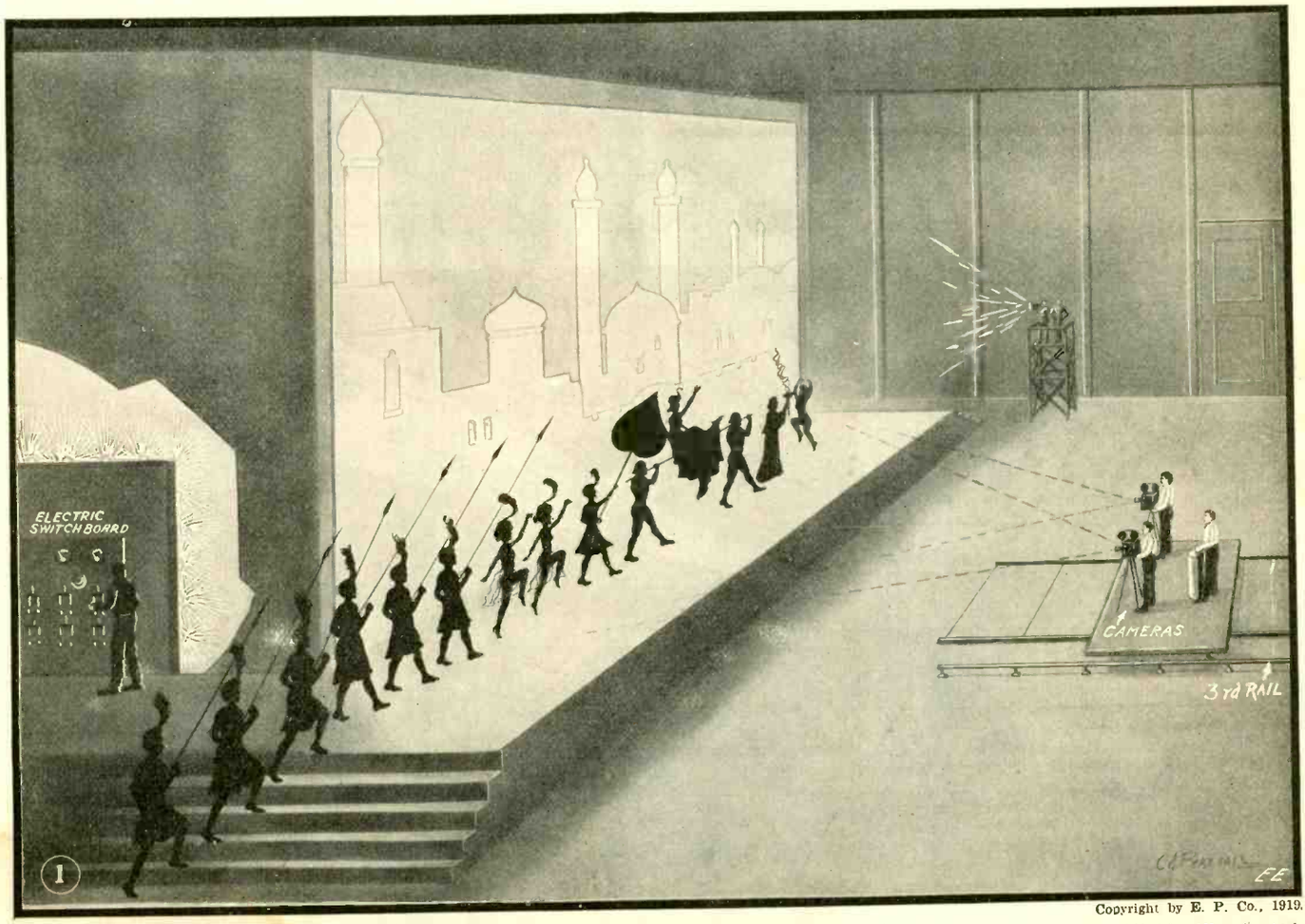
PROGRESSIVENESS, combined with resourcefulness and inventive ingenuity, are counting for much to-day in the production of live motion-picture films. The public wants to be entertained during their leisure hours. Something radically new has to take the place of the old, constantly, to suit the "movie" fans and keep the theaters filled. The greatest attractions of to-day will lose their interest and novelty to-morrow. It

Mechanical Production of Moving Picture Films in "Silhouette"

is therefore self-evident that in this atmosphere of changeability there is a great field open for wide-awake inventors.

The latest novelty in the film world is the photographic production of *silhouette pictures* recently patented by C. A. Gilbert. Pictures of this kind until recently had to be drawn by hand. From fifteen to eighteen individual pictures illustrating the progress in action are needed per second. The individually drawn comic picture is therefore expensive in manufacture.

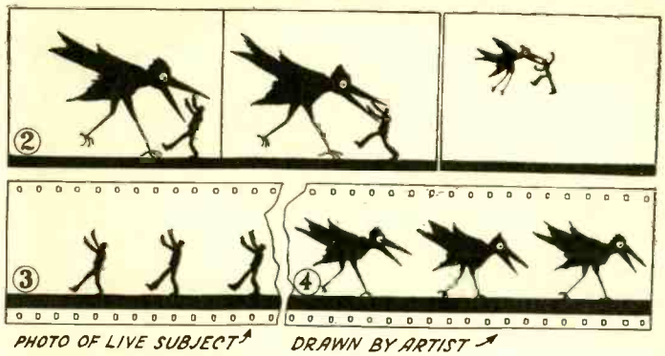
Gilbert is using silhouettes. Since these

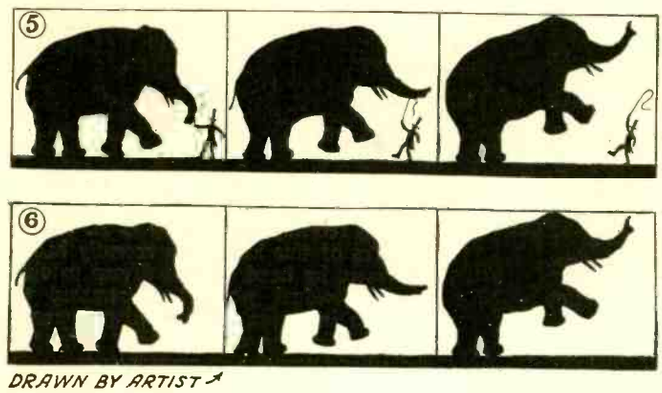


Copyright by E. P. Co., 1919.

The Latest in "Silhouette Movies." They Are Made from Life in the Manner Here Illustrated. The Stage Screen Is Highly Illuminated from the Rear and the Actors Appear Before It Drest in Black Clothes. The Camera Car Can Be Rapidly Moved Toward or Away from the Studio Stage by Means of an Electric Motor Attached to the Car Axle and Controlled by the Operators or a Third Man as Shown. Current Is Supplied the Motor Thru a Third Rail.

produce the weird and unusual effect of *black people* moving in a *black world*, they are most suitable for comic pictures.





A New Way to Make Silhouette Movies. The Man in the Pictures Shown Is Photographed as in Fig. 1 from Life, While the Giant Bird and the Elephant Are Drawn by an Artist in the Proper Scale and then Photographed. Figs. 2 and 5 Show the Combined Effects Clearly.

Silhouettes could be produced by shadows thrown on a light screen. Shadows, however, do not produce a sufficiently sharp image. Gilbert's method consists rather of directly photographing the actors. They present the appearance of silhouettes by having their movements performed in front of a powerfully illuminated screen. The method used is shown in figure 1. Here we have a stage upon which actors are moving before the transparent screen, behind which lights are arranged to give the necessary illumination, but without throwing direct light rays thru the screen.

The screen forms the front of a box or small chamber in which the light is produced, but projected from the white painted walls to the screen. The side wings of this box carry banks of powerful electric lights which brilliantly illuminate the rear side of the transparent screen. The arrangement is such as to prevent shadows from falling from actors upon the screen. Their position is indicated in figure 1. If the lights are of sufficient intensity, pictures taken by means of a motion-picture camera in front of the stage, as shown in figure 1, will be in silhouette. This method of producing the pictures presents the advantage of giving the actors entire freedom of movement, without reference to the illuminating arrangement.

Gilbert's method admits of various interesting applications, by which novel effects can be produced. Figure 2, for instance, shows the picture of a tremendous bird eating a man. The actions of the man have been actually picturized (to use the language of the "movie" industry), as shown in figure 3, in a separate film. The bird, however, and his "cruel" actions have been produced by the pen of an artist according to figure 4. Then both films have been combined into the final working film, figure 2, with its weird impressions. In a similar way films, figure 5, of an elephant and his trainer have been composed by combining figures 6 and 7. The trainer has here been an actual man, but the elephant, no matter how natural he may look, has been originated by an artist. In this case it is decidedly more economical to arrive at the elephant's picture by employing the skill of an artist than by having an actual elephant on the stage.

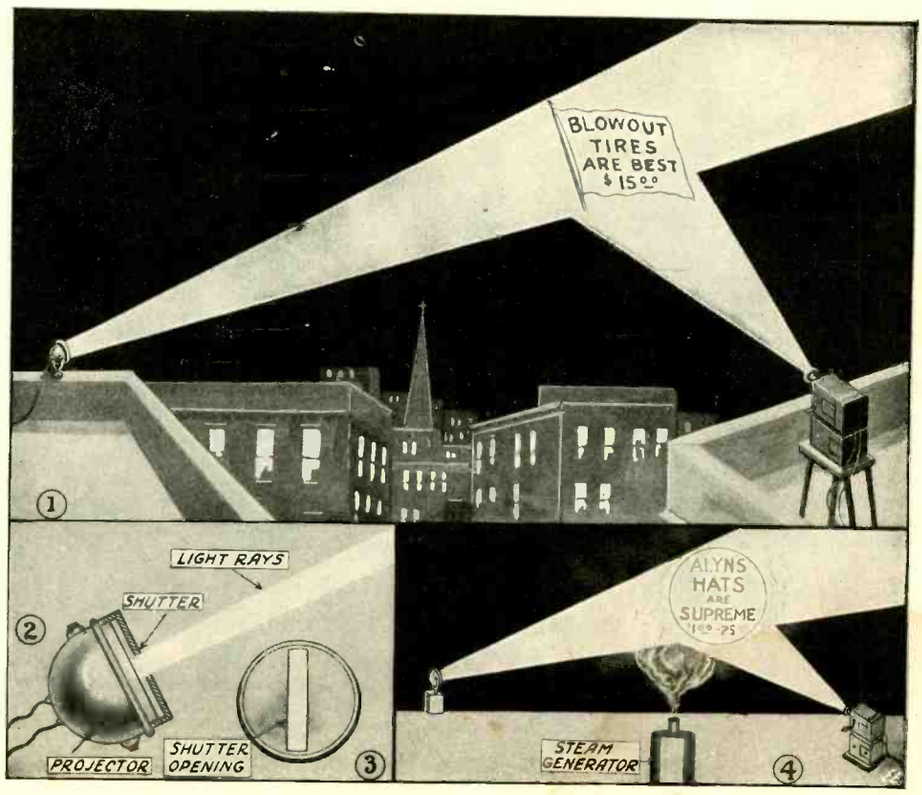
The background of the picture, consisting let us say of buildings, is frequently produced by having a permanent drawing painted on the screen before which the actors appear. A picture of this kind is illustrated in figure 1. In this case it is not necessary to combine two films into one, which naturally adds to the production expenses. It is often possible, however, to make the background a natural picture, such as a street scene, and this can then be combined with a comic silhouette picture produced by means of the Gilbert process.

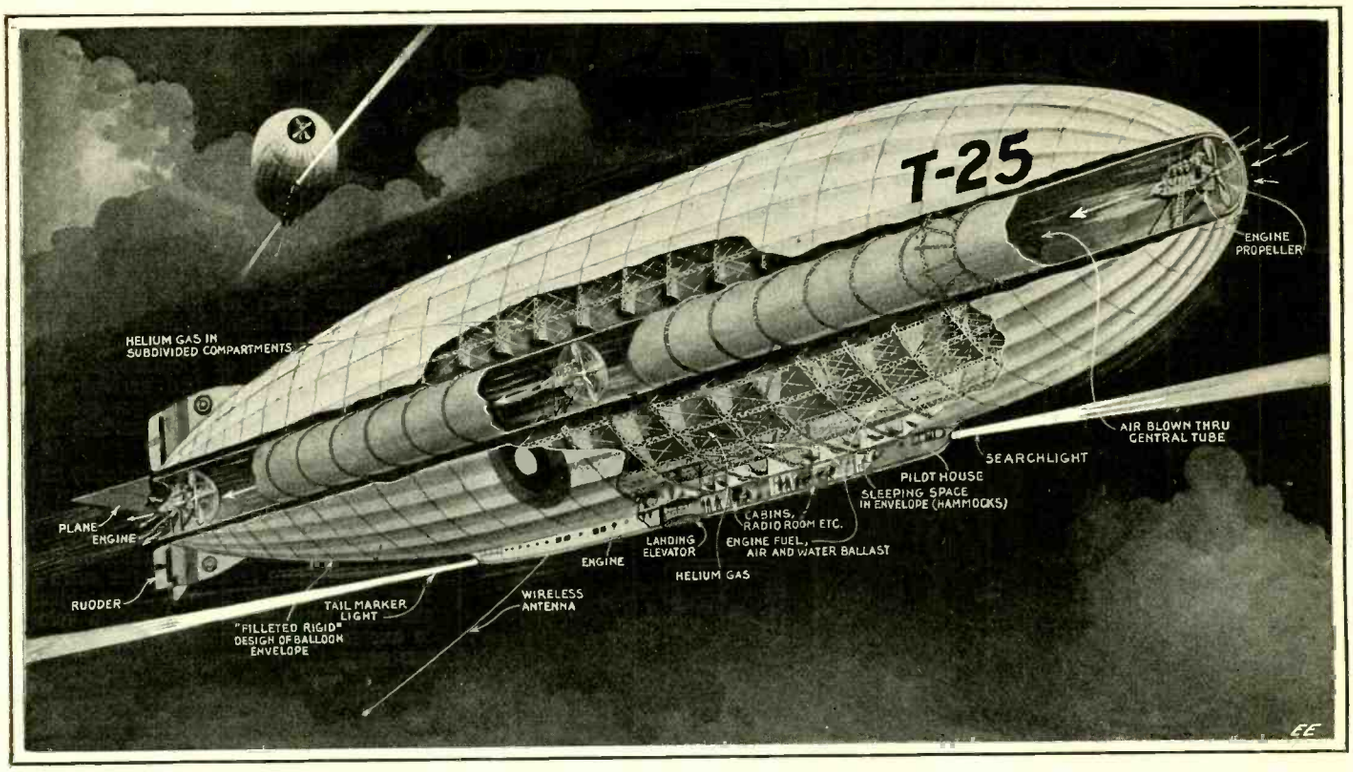
An Electric Sign in Mid-Air

The accompanying illustration shows a recent invention of Mr. Frank H. Ellison, of New York City, who proposes an advertising scheme susceptible to many advertising adaptations whereby two powerful beams of electric light are flashed into space at right angles, causing thereby an image in the form of an advertisement, flag, etc., to be cast up at the juncture of the two beams. The main shaft of light may be thrown from a powerful electric searchlight projector, or other source of intense illumination, while the crosswise beam

The Accompanying Illustration Shows a New Invention, Which Is as Radical as It Is Novel in Its Conception. The Inventor Proposes to Throw an Image of a Flag or an Advertisement in Mid-Air at the Interception of Two Powerful Beams of Light, as Here Illustrated.

projector, carrying the image, may be in the form of a stereopticon, in which different slides can be placed and quickly changed, as desired. In the event that an atmosphere containing water vapor, as in the East, is not available it becomes possible to provide an artificial medium for the purpose, by employing a small steam generator or boiler under the spot where the image is desired. A single steampipe or two may be run a considerable distance above the roof of a high building in the vicinity, and when it is desired to throw the image or script in the air, the steam is turned on and thus forms a very good medium for the purpose.





This Illustration Shows a Recent Development In Simplifying the Airship and at the Same Time Making for More Efficiency all Around. The Idea Is To Do Away Entirely With the Underslung Power Gondolas, Such as are Used on the English and German Airships of the Zeppelin Type. The Engines are Housed in a Wind Tunnel Running Thru the Center of the Airship as Shown. Propellers Which are from Fifteen to Twenty Feet in Diameter Create a Sort of Vacuum Within the Tube, and the Airship Therefore will Virtually Suck Its Way Thru the Air at an Increased Speed.

Speeding Up the Airship

By H. GERNSBACK

ON its historic cruise to the United States the R-34, while making a splendid achievement, disappointed many for the reason that it had been hoped that the dirigible would make a westerly passage much quicker than it actually did. Of course, the airship had to battle against head-winds nearly all the way over, which is best proven by the fact that on its return trip it accomplisht the eastward passage in 75 hours.

One reason, and the entire reason, that Brown and Alcock flew across the ocean in sixteen hours with an airplane, while the quickest trip of the airship took over four times as long, is explained in one word—friction. The airplane offers but little surface to the wind, due to the fact that its surfaces not only are comparatively small, but cutting like a knife, they do not offer much resistance to the air. The airship on the other hand, due to its large and cumbersome bulk, gives rise to enormous friction not only head on, but along its sides as well. In this capacity it stands on a par with the big ocean liner that sinks deep into the water, and consequently needs an enormous power to move it, whereas the little motorboat-hydroplane, when provided with suitable vanes, will actually skim above the water, hardly touching the latter, at a speed many times that of the ocean liner. Here we have the same comparison. It is simply a matter of reduced friction of the mechanical birds and their natural element, the air. We therefore find that if we can do away with all unnecessary friction on the huge airship, we will be able to propel it much faster. Take the case of the R-34 with its four gondolas; these take up quite a good deal of room and make for air resistance when the airship is in flight. While to the layman this appears trifling, it tends to retard the total speed of the airship very considerably, and if we can do away with these gondolas and their engines, we will increase the speed of the airship by just so much.

Also, if we can diminish the resistance created by the nose of the airship as it plows its way thru the air, we will again increase its speed. This, of course, is apparent, and the following experiment, which anyone may try himself, ought to prove it abundantly. Take a pail of water and try to drag it with the open side thru a stream of water. You will meet with an enormous resistance. Take the same pail and make a hole of about half the diameter in the bottom of the pail. You will now find that you can drag the pail with considerable ease, for the reason that the water flows right thru it. In the former experiment it was necessary to first fill the pail with water, and after this move (displace) a column of water represented by the diameter of the pail.

With these things in view, the writer offers a novel idea in which it is proposed to speed up dirigibles considerably. The idea is made clear in the accompanying illustration. It will be seen that this airship has no gondolas whatsoever, and the power plant is not hung underneath the airship, as is common in all Zeppelin types. Instead, the center of the airship is hollow, forming a wind tunnel extending clear thru the entire length of the airship. This air tube, of course, is not a small affair, but is anywhere from 15 to 25 feet in diameter, as will be noted. The three engines are stationed, the first at the nose, the second at the tail end, and the third in the center of the wind tunnel. The propellers must be of the same diameter as that of the tunnel, and the object is to have all three of them working at the same time in order to suck in the air at the nose of the ship and form a sort of vacuum. The air will then flow thru the tunnel, the same as the water flows thru the pail after we made a central opening in its bottom. From this it will be seen that the airship will *virtually suck its way thru the air*, and it should be possible for such a craft to make much greater speed than with the former methods. Moreover, as the engines are not exposed to the elements, it would also seem that not so much engine trouble should develop, as is the case with the under-slung type. Another very important consideration is that inasmuch as the air is rushing right back of the engines, the cooling of the latter is infinitely better than at present. And as every engine man knows, the better an engine is cooled the less likelihood there is of trouble developing.

In the aërial liner of the future, in order to do away with all unnecessary head resistance, the crew's quarters, etc., will probably be located at the bottom of the airship, and as will be noted in the illustration, the entire living quarters are fashioned with stream lines, to minimize all unnecessary air resistance.

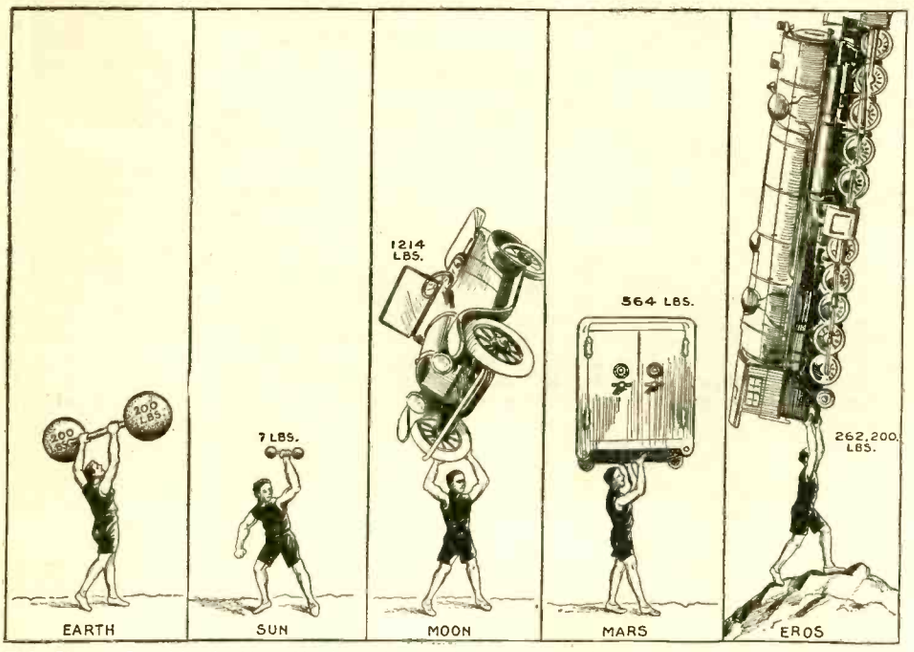
Hydrogen gas will probably not be used much longer, as already Zeppelin types in Germany demonstrated that these huge bags are not safe with the enormous quantities of inflammable gas stored within their metallic girders. Electric sparks set up by the electrical machinery of wireless apparatus are a constant danger to the explosive gas, and the same is true should lightning hit the dirigible. The airship of the future for this reason will use Helium gas in its subdivided compartments, or some other

(*Continued on page* 446)

Popular Astronomy

By ISABEL M. LEWIS
Of the U. S. Naval Observatory

Interesting Phenomena of Gravitation



This Shows Graphically How Much a Human Being Would Be Able to Lift on the Various Heavenly Bodies. This Illustrates That a Pound Does Not Weigh a Pound Everywhere in the Universe, But Changes According to the Mass and Density of the Heavenly Body upon Which It Is Placed.

THE earth is revolving around the sun in an orbit that is almost a perfect circle with a velocity of *eighteen and one-half miles per second.* If for any reason this orbital velocity should suddenly cease or be brought to *zero,* the earth would fall into the sun and the time of falling would be sixty-four and one-half days. If its orbital velocity should be brought *almost* to zero, that is if the earth still possest a slight motion at right angles to the line connecting it with the sun, it would describe an extremely narrow ellipse with the sun at the further focus (see diagram 1), and would return to the point where its velocity had changed after one hundred and twenty-nine days.

If the orbital velocity should be increased more and more, the ellipse would become wider and wider, and the period of the earth's revolution longer and longer. When the orbital velocity reached eighteen and one-half miles per second the earth would be revolving around the sun in a circular orbit in a period of 365¼ days (as it does now). If the orbital velocity should increase still more the earth's orbit would become elliptical again with the sun now at the nearer focus and the width of the ellipse would increase as the velocity increased.

THE EARTH COULD LEAVE SOLAR SYSTEM.

When the orbital velocity reached 26.2 miles per second (the velocity from infinity or parabolic velocity for the earth), the earth would escape the control of the sun and leave the solar system on the curve of a parabola never to return. If the orbital velocity should exceed 26.2 miles per second the earth would also escape from the solar system, but the curve would be hyperbolic instead of parabolic in form.

Now each planet in the solar system has its parabolic velocity or, as we might call it, velocity of escape from the solar system, and as this varies inversely as the square root of the planet's distance from the sun, it becomes less and less as the planet's distance from the sun increases.

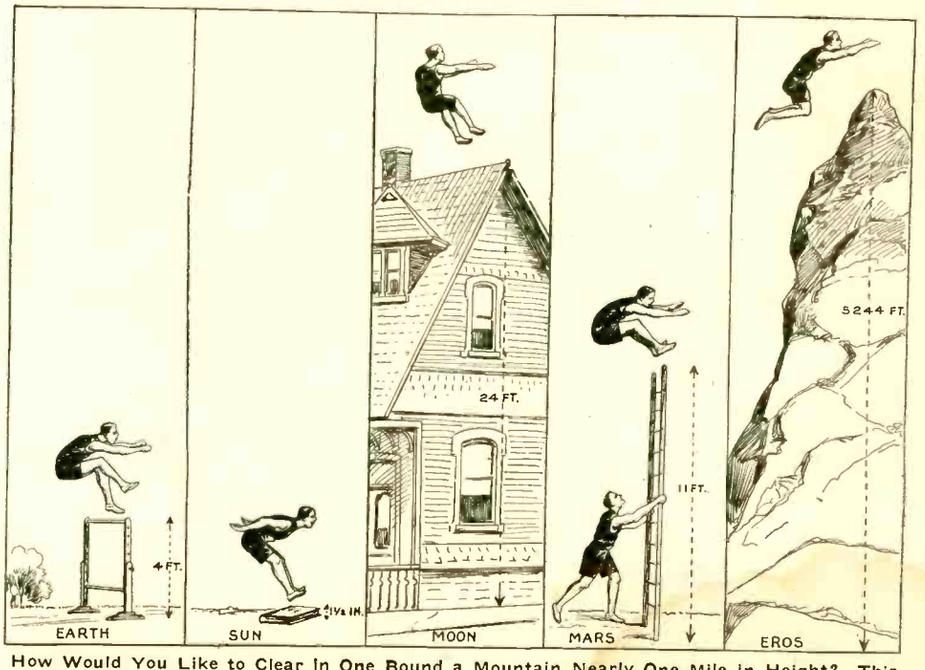
For Neptune the parabolic velocity is only 4.7 miles per second. If its orbital velocity of three and one-third miles per second should be increased to this parabolic velocity Neptune would escape from the solar system.

If a body should fall from infinity or the distance of the stars toward the sun under the force of the sun's attraction *alone,* it would have acquired a velocity of 4.7 miles per second by the time it had reached the orbit of Neptune, 26.2 miles per second when it had arrived at the earth's orbit and 383 miles per second by the time it had reached the surface of the sun.

Let us consider now what velocity an object at the surface of the sun must possess in order to escape the sun's attraction and pass off into space. Evidently this would be the same as the parabolic velocity or velocity from infinity for the sun's surface, 383 *miles per second.* Any object at the solar surface endowed with a velocity in excess of this amount would leave the sun never to return.

THROWING A STONE INTO INFINITY.

Since it can be shown that this velocity of escape varies directly as the square root of the mass of the attracting body, it is possible to compute the velocity of escape for objects on all of the planets in the solar system as well as for objects on the sun. These values are given in Table I. Objects on any of the planets possessing these velocities or greater velocities escape from the control of their respective planets and either become satellites of the sun or leave the solar system entirely, depending on the excess of their velocities over the critical value. It will be noted from a glance at these critical velocities given in Table I that it would be easily possible to fire a cannon ball from Ceres, the largest asteroid, that would pass off into space, never touching the surface of the asteroid, while on Eros a stone could be thrown from the hand with sufficient velocity to enable it to escape the control of the asteroid.



How Would You Like to Clear In One Bound a Mountain Nearly One Mile In Height? This Is Exactly What You Could Do If You Were on Eros, the Small Asteroid. If You Could Jump Four Feet High on Earth, You Could Jump Over One Mile on Eros. Even on the Moon You Could Jump Over a House Without Much Trouble, with One Bound.

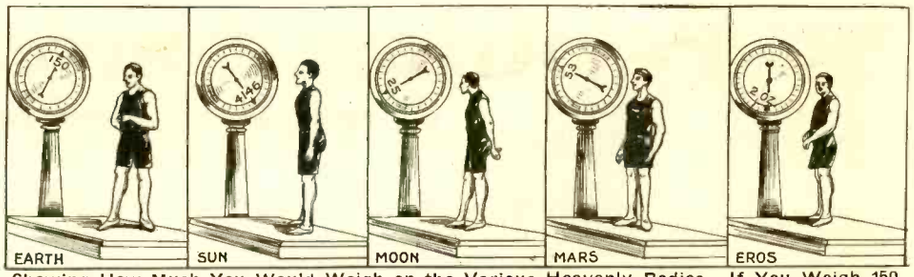
SHOOT A CANNON BALL FIVE MILES A SECOND AND YOU HAVE A NEW MOON.

In the last column in Table I is given the velocities for satellites grazing the surfaces of the various planets, the sun or moon, in circular orbits. It can be shown that these values are equal to the critical velocities or velocities of escape multiplied by the square root of one-half. It will be noted that for the sun this value is 271 *miles per second,* that is, an object hurled from the sun with a velocity of 271 miles per second would become a satellite of the sun, moving close to its surface in a circular orbit. An object hurled from the earth's surface with a velocity of 5 miles per second would likewise become a satellite of the earth, revolving around it in a circular orbit close to the surface.

It is interesting to consider in this connection what would be the course of projectiles hurled from the earth or other planets with varying velocities.

If an object should be thrown from a mountain or some other elevated position on the earth's surface *horizontally* (neglecting resistance of air) with a very slight initial velocity, it would fall almost straight downward, and if the earth were concentrated at a point at its center the object would move in a very narrow ellipse around the earth's center, returning to the point of departure again after 30 minutes. If the velocity is increased more and more the object falls further and further to one side, and if the earth were concentrated at its surface so the object would not encounter the surface; it would move in an elliptical path, always returning to the original point. The widths of the ellipse would increase with the velocity (see diagram II). Finally when the velocity with which the object is hurled reaches 5 miles per second it leaves the earth entirely and becomes a satellite of the earth, moving in a circular orbit with a period of 1 hour 25 minutes. If the velocity is increased beyond 5 miles per second the object continues to revolve around the earth in an elliptical orbit whose width increases with the velocity until a velocity of 7 miles per second is reached, when the object flies off on a parabolic curve, escaping the earth's attraction entirely and becoming a satellite of the sun. The same principle holds for all the other members of the solar system as well as for the earth, and a reference to table I will show the velocity of escape for each member of the solar system as well as the velocity with which an object must be thrown from the surface in order to make it a satellite of the planet in question.

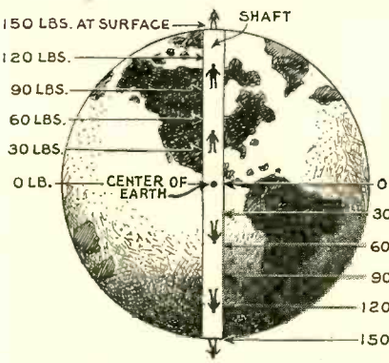
It is interesting to consider in this connection what would happen if the earth should suddenly explode. All particles that received an initial velocity *under seven miles per second,* the velocity of escape, would come back to the scene of the catastrophe *repeatedly* in elliptical orbits, and those that were ejected with *equal velocities* would come back *at the same time,* however different the directions of their ejection or the width of their orbits. If the velocity of ejection equaled or exceeded seven miles per second, they would not return.



Showing How Much You Would Weigh on the Various Heavenly Bodies. If You Weigh 150 Pounds on Earth, Your Weight Would Shrink to 2 Ounces on Eros. While on the Sun You Would Weigh over 2 Tons and You Would Not Have Sufficient Strength to Lift Your Own Body.

WEIGHT ON OTHER PLANETS.

Let us consider now some of the interesting phenomena arising from the fact that the surface gravity of a planet, or its attraction for objects at its surface, is proportional to its mass or the quantity of matter that it contains. This affects directly the weight of objects at the surfaces of the planets and the amount of work that can be performed against the attraction of gravity on the various planets.



Do You Know That if There Were a Shaft Drilled Right thru the Earth, and if You Were to Descend into Same, You Would Weigh Nothing When You Arrived at the Center? Our Illustration Shows How Much You Would Weigh at the Different Levels in the Shaft.

Taking the earth's attraction for objects at its surface as the unit, the relative surface gravity for all other planets, the sun, and the moon, has been computed (see Table I) by multiplying the density by the radius, both quantities relative to the corresponding values for the earth.

We then find what a man weighing 150 lbs. on the earth would weigh if it were possible for him to exist on the sun, moon or other planets, to what height he could jump against the attraction of gravity and what weights he could lift; also with what velocity an object must be endowed to enable it to escape from the planet and under what condition it would become a satellite of the planet revolving close to its surface in a circular orbit.

We note (Table I) that a man who weighs 150 lbs. on the earth would weigh 4,146 lbs., or over *two tons,* on the sun. If he could jump to a height of four feet on the earth he would find himself unable to raise his body even two inches by his own energy, against the sun's surface gravity. He would be, indeed, crushed by his own weight, lifting his arms and feet and moving about only with the greatest effort. He would have as much difficulty in lifting a weight of seven pounds on the sun as in lifting a weight of two hundred pounds on the earth.

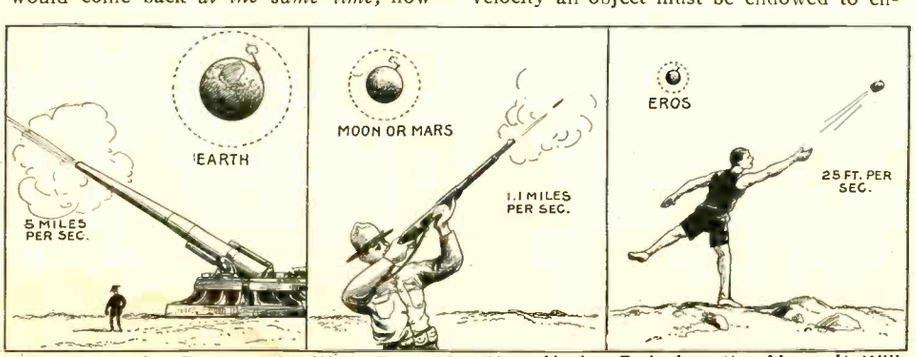
On the asteroid Eros on the contrary his weight would be but *two ounces.* He could jump to the height of a mile as easily as he could jump to a height of four feet on the earth, and he could lift *one hundred and thirty tons* as easily as he would lift two hundred pounds on the earth.

It will be noted that the weight of the large engine on the cover drawing is given as 684,000 pounds. This corresponds to a weight of 500 lbs. on Earth. This is probably the limit a professional strong man could lift on earth.

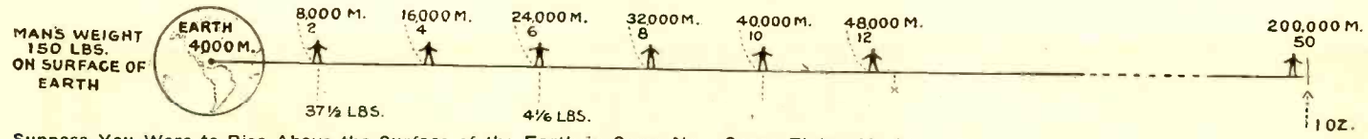
LIVING IN A VACUUM.

This brings us to the interesting subject as to what would happen if we were to visit one of our small planetary bodies on which there is no atmosphere, such as for instance our moon and any of the Asteroids. Being that the gravitational pull is so small on these bodies, the atmosphere—if they had any—probably escaped aeons ago. Consequently, if we were to visit any of these heavenly bodies, we would be placed in an absolute vacuum much greater than we can procure with our best vacuum pumps on earth. How, then, could we walk on such a body and exist? We must always remember that every square inch of our body on earth is weighed down with an atmospheric pressure of 14.7 pounds. The total pressure upon the human body is therefore enormous, amounting to 47,040 lbs. Remove this pressure and our blood vessels would burst like an automobile tire.

The thing to do then, if we are ever enabled to visit the moon or one of the Asteroids, would be to encase ourselves in a strong rubber fabric by having strips of thick rubber sheeting wrapt all around our body, as suggested in our cover drawing. These rubber strips would be wrapt around the body and limbs similar to what our soldiers do with their puttees. It would, of course, also be necessary that we should bring along our own air, and this, too, is suggested in our cover drawing, where a compress air tank is strapt to the back of the man, an automatic air valve regulating the air supply as it is consumed. By means of suitable chemicals the air could be renewed automatically for an indefinite time. In order that we can see about us, it would also be necessary for us to provide a sort of helmet fitted with a thick glass plate adjusted air-tight to the helmet. The whole contrivance would then be strapt to the body.



This Illustration Depicts with What Force You Must Hurl a Body Into the Air so It Will Never Return,—in Other Words, Becoming a New Satellite. If You Could Build a Cannon to Shoot a Projectile into the Air Going at the Rate of Five Miles per Second, It Would Become a New Moon Gravitating Around the Earth In an Orbit of Its Own. On Mars the Velocity Need Only Be 1.1 Miles per Second, While on Eros You Could Throw a Stone into the Air So That It Would Never Return.



Suppose You Were to Rise Above the Surface of the Earth in Some New Space-Flying Machine. This chart Shows How Much Weight You Would Lose as You Get Away from the Gravitational Attraction of the Earth.

The feet as well as the hands would also have to be encased in very snug-fitting rubber, as no part of the human body should be exposed to the vacuum which would draw out the blood immediately. It is well known that when aviators ascend to a great height blood begins to flow out from underneath the finger nails, due to the reduced pressure. It can be easily imagined what will happen if all the pressure was removed and the hand was exposed to the vacuum.

His greatest difficulty, granted he were able to withstand the lack of air and atmospheric pressure, would be experienced in retaining a foothold upon this insecure mass of rock spinning thru space, for so slight is the attractive force that holds him to the surface that *it would be possible for him to jump with sufficient initial velocity to escape from the asteroid,* the velocity of escape being only thirty-six feet per second, and the height to which he is able to jump against the force of gravity being 1 mile.

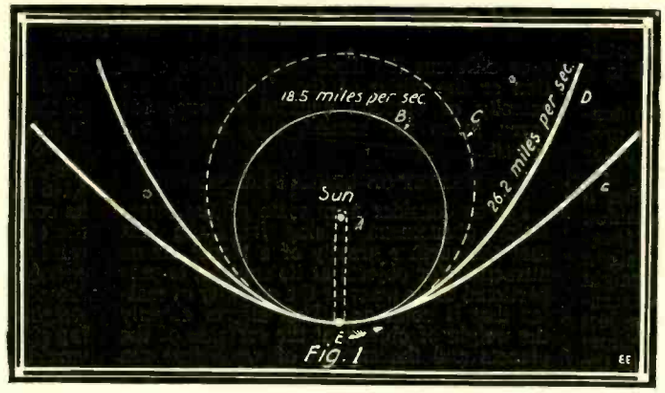
Referring to Table I, we note that the surface gravity of Uranus is nearest to that of the earth and that a man who weighs 150 lbs. on the earth would weigh 149 lbs. on Uranus and would be able to do practically the same amount of work. This arises from the fact that the greatly *increased radius* of Uranus, three and eight-tenths that of the earth, is offset by its greatly *decreased density,* which is only one-quarter that of the earth, the product of the two giving the surface quantity of Uranus. This is also true in a less degree with Saturn and Neptune. The huge bulk of Jupiter, however, considerably overbalances its low density, and a man who weighs 150 lbs. on the earth would find his weight of 378 lbs. a burden to him on Jupiter.

MAN WEIGHS 53 POUNDS ON MARS.

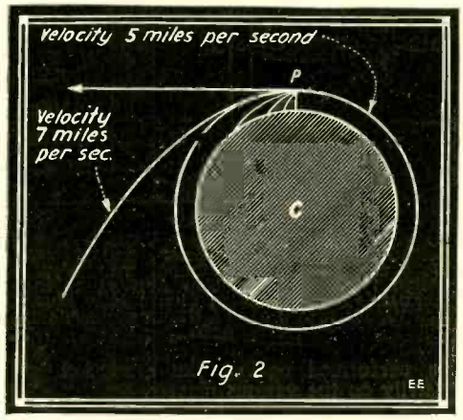
On Mars, on the other hand, he would find he weighed only 53 lbs. and that he could jump nearly three times as high as he could on the earth and lift loads nearly three times as heavy. On the moon he would weigh only one-sixth as much as on the earth and could throw a ball six times as far and jump six times as high. He would lift six hundred pounds as readily as he would lift one hundred pounds on the earth.

Venus most closely resembles the earth among the terrestrial planets and a man would find, if he were suddenly transferred to Venus, that he would only lose twenty-two pounds in weight by the change. He could lift weights fifteen per cent heavier and jump fifteen per cent. higher than on the earth.

Let us note in passing the low velocity of escape for the moon, Mercury and Mars. This is believed to have an important bearing upon the possibility of these bodies possessing and holding atmospheres. The molecules of gases in the atmosphere are moving in all directions at high velocities. It has been computed that the molecular velocity of oxygen is 1.8 miles per second at zero centigrade, of nitrogen 2.0 miles per second, of water vapor 2.5 miles per second, of helium 5.2 miles per second and of hydrogen 7.4 miles per second. Evidently then the earth could not *permanently* hold free hydrogen in its atmosphere or the moon and Mars any of these gases. Even if Mars were originally clothed with an extensive atmosphere it is, according to the kinetic theory of gases, losing it molecule by molecule. Moreover, in inter-planetary space there must be wandering molecules of gases that have deserted the bodies in the solar system that have low velocities of escape. Of course upon even the largest asteroids there could not be any of the atmospheric gases of the earth, as the velocity of escape is so excessively low for all of these bodies.



This Illustrates What Would Happen If the Earth's Orbital Velocity, 18.5 Miles per Second, Were to Change Suddenly. A, If the Velocity Would Almost Cease. B, Present Velocity of Earth. C, Velocity Greater Than 18.5 Miles per Second. D, Velocity 26.2 Miles per Second. E, Velocity Greater Than 26.2 Miles per Second. At This Speed the Earth Leaves the Solar System Never to Return.



To Illustrate Course of Projectiles Hurled Horizontally from P, a Point on the Earth's Surface (Neglecting Friction of Air) at Different Velocities in Direction of Arrow. If Velocity Is Less Than 7 Miles per Second, Projectile Moves in Elliptical Curve Whose Width Depends Directly on Initial Velocity with Which Projectile Is Hurled. If Velocity Equals T Miles per Second, Projectile Becomes a Satellite of the Planet, and if Velocity is 7 Miles per Second or Greater, the Projectile Escapes Earth's Attraction and Goes Off Into Space.

WEIGHT INSIDE OF EARTH.

Let us consider now, in concluding, what would be the effect upon a man's weight if he should fall toward the earth's center thru a circular shaft (see diagram III), assuming that the earth's density is uniform thruout. Since surface gravity is equal to the density times the radius, his weight at the surface will be decreased as he falls toward the center proportionally directly to his *distance below the surface.* At a distance below the surface equal to one-fifth of the radius his weight will be decreased one-fifth of the value for the surface, that is a man who weighs 150 lbs. on the surface would weigh 120 lbs. one-fifth of the distance to the center or eight hundred miles below the surface. Two thousand miles below the surface or one-half the distance to the center his weight would be one-half the surface value or seventy-five pounds and *at the earth's center*

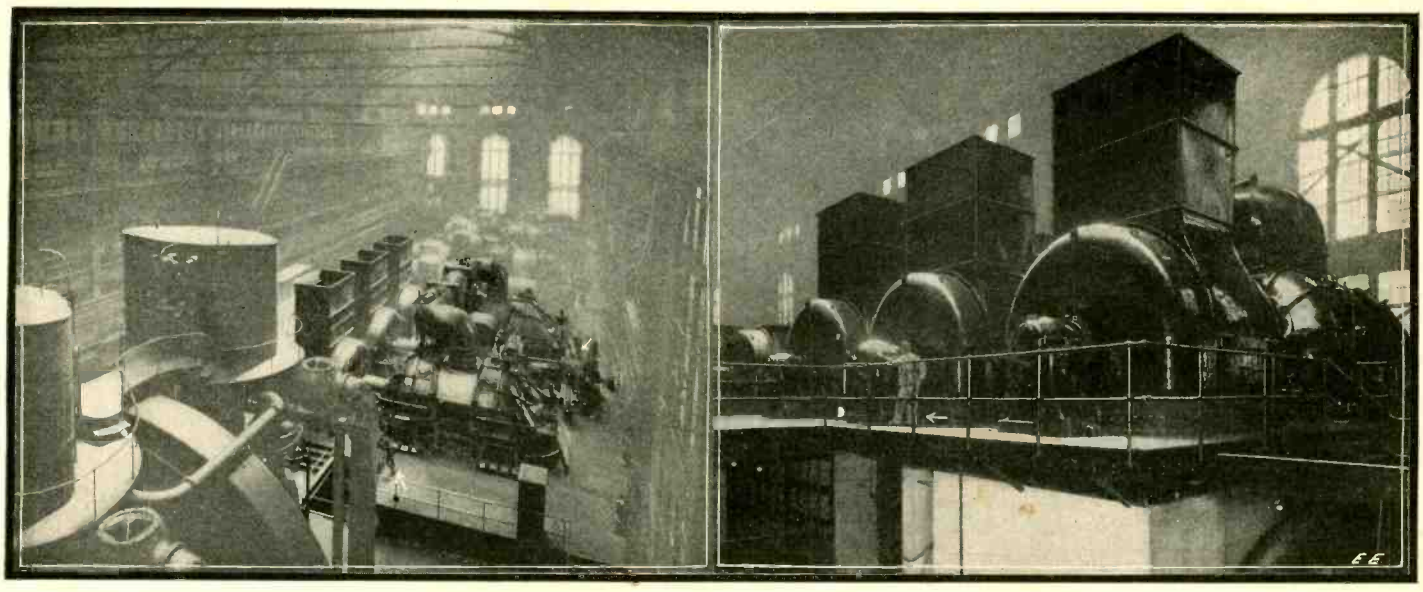
(*Continued on page* 449)

TABLE I.

	Diameter (In Miles)	Density (Relative to Earth's)	Radius (Relative to Earth's)	Surface Gravity (Relative to Earth's)	Man's Weight in Pounds	Height Man can Jump	Weight Man can Lift	Velocity of Escape	Velocity with which object must be projected to become a satellite moving close to surface in perfect circle
Earth	7,918	1.00	1.00	1.00	150 lbs.	4 feet	200 lbs.	7 mi. per sec.	5 mi. per sec.
Sun	864,392	.25	109.17	27.64	4,146 "	1.7 in.	7 "	383 "	271 "
Moon	2,160	.60	.27	.16	25 "	24 feet	1,214 "	1.5 "	1.1 "
Mercury	3,009	.81	.38	.31	46 "	13 "	650 "	2.2 "	1.6 "
Venus	7,701	.88	.97	.85	128 "	5 "	234 "	6.6 "	4.7 "
Mars	4,339	.65	.55	.35	53 "	11 "	564 "	1.5 "	1.1 "
Jupiter	88,392	.23	11.16	2.52	378 "	1.6 "	79 "	37 "	26 "
Saturn	74,163	.11	9.37	1.07	160 "	3.75 "	187 "	22 "	16 "
Uranus	30,193	.26	3.81	.99	149 "	4.0 "	201 "	13 "	9 "
Neptune	34,823	.20	4.40	.87	130 "	4.6 "	231 "	14 "	10 "
Ceres (largest asteroid)	485	.60	.0606	.036	6 "	108 "	5,406 "	1736 ft. per sec.	1228 ft. per sec.
Eros (small asteroid)	10	.60	.00126	.00076	2 oz.	5,244 feet (almost 1 mile)	262,200 " (130 tons)	36 " (*See Note*)	25 "

Note:—Objects leaving surface with velocity greater than values given here would not return.

Note:—The surface gravity is the product of the planet's density by its radius (relative to corresponding values for the earth's), that is, Col. 4 is the product of Col. 2 and Col. 3.



New York City Can Now Boast of the Largest Steam Turbine-Dynamo Generating Unit in the World—100,000 Throbbing Horse-Power. It Comprises a Triplex Turbo-Alternator, Occupying About One-Fourth the Space of the Old-Type Reciprocating Engine Shown at the Extreme Left of the Photo Herewith. The Comparative Size of the 100,000 H.P. Turbine Unit May Be Judged by the Man Standing Beside It—See Arrows. The Old Reciprocating Steam Engine Towered 75 feet into the Air; the New Turbine-Dynamo Stands But 20 Feet in Height. The Current Delivered Is Three Phase, 25 Cycle Frequency, at a Potential of 11,000 Volts.

World's Biggest Turbine-Dynamo--100,000 H. P.

By WILLIAM H. EASTON

TO her already long list of "greatest things in the world," New York City can now add another item, for the Interborough Rapid Transit Company has recently placed in operation at its 74th Street power house a triplex turbine-generator that is as superior to its rivals in power as the Woolworth Building is in height or the arch of the Hell Gate Bridge in length of span.

One hundred thousand horsepower is the amount of power this great engine can develop when pushed to its maximum. It is difficult to find an example that will convey an adequate impression of this figure, but the following may be of some assistance. Suppose our army now abroad, which consists of about a million men, has been landed over night and is marching up Fifth Avenue. Visualize the parades you have seen and then realize that it will take over three days and nights for this particular one, moving steadily forward in regular formation, to pass thru the Arch of Victory. Now, in a contest of strength between the turbine and all of these men taken together, the turbine would probably win.

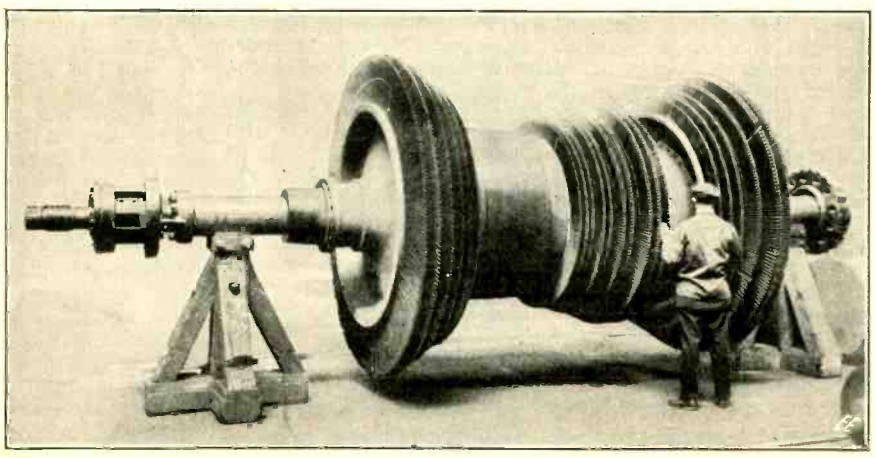
How the Turbine Operates.

The visitor, journeying to 74th Street to see this great turbine, will probably be disappointed in its appearance. It has, indeed, a massiveness that speaks of immense power within, but in size it is dwarft by the old vertical reciprocating engine, of one-twelfth its capacity, beside which it stands; and in addition, since all its working parts are enclosed, it is entirely lacking in the fascination that visual movement imparts. But its deficiencies as a spectacle are real virtues in the eyes of the engineer, for they mean lower first cost, smaller space occupied, reduced installation and operating charges, and a high degree of reliability.

The very conspicuous difference in size between the turbine and the reciprocating engine is due to their different operating principles. The reciprocating engine consists essentially of a cylinder in which a piston is pushed up and down by the steam. The main parts of the turbine, however, are a spindle, carrying hundreds of small vanes, and a casing which encloses the spindle. The steam acting upon the vanes of the spindle revolves it as the wind turns a windmill. The motion of the turbine is, therefore, rotary and as there are no heavy parts to be stopt and started at the end of every stroke, as there are in a reciprocating engine, very high speeds are permissible, thus making it possible to develop great power from a comparatively small machine. The speed of this particular turbine is 1,500 revolutions a minute.

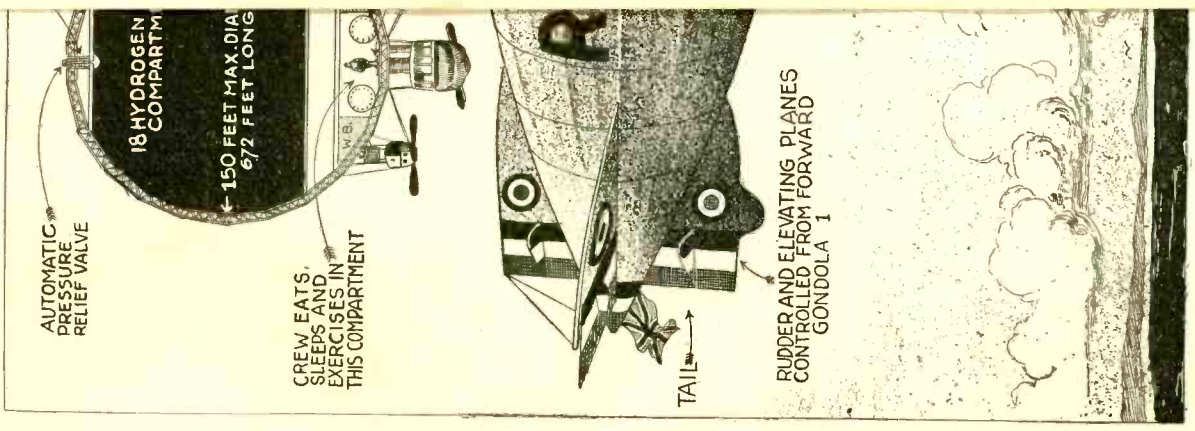
As has been said, the turbine is triplex; that is, it consists of one *high pressure* element and two *low pressure* elements, each connected to a separate electric generator. This gives it the appearance of three distinct machines, but it is actually a *single unit* and all three elements are started and controlled as one. The triplex arrangement is employed because it is mechanically greatly superior to the single element design for a machine of such great power. There is also the very decided additional advantage that, in an emergency, any one or two of the elements can be shut down without stopping the others. All the power eggs are, therefore, not in one basket, and the high efficiency of a single large ma-

(*Continued on page* 453)



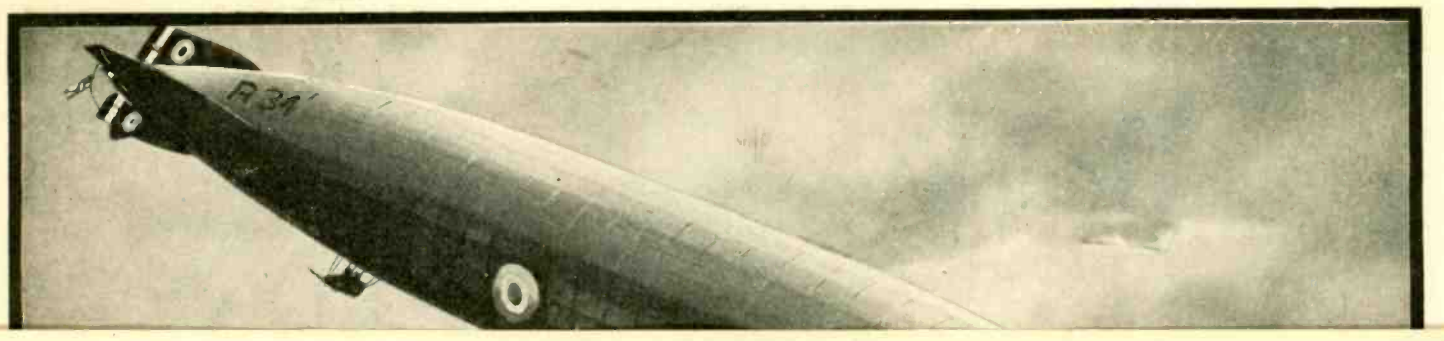
A Close View of the Rotating Blades or "Rotor" of One of the Steam Turbines Comprising the Triplex 100,000 Horse-Power Generating Unit Recently Installed for the Interborough Rapid Transit Company, New York City, at Its 74th Street Power House. Almost Beyond Conception Is the Delicacy and Accuracy of Balance of This Wonderful Blading. It requires the Highest Degree of Workmanship to Build Such a Rotating Mass, Which Shall Be Perfectly Balanced When Revolving at 1,500 Revolutions per Minute.

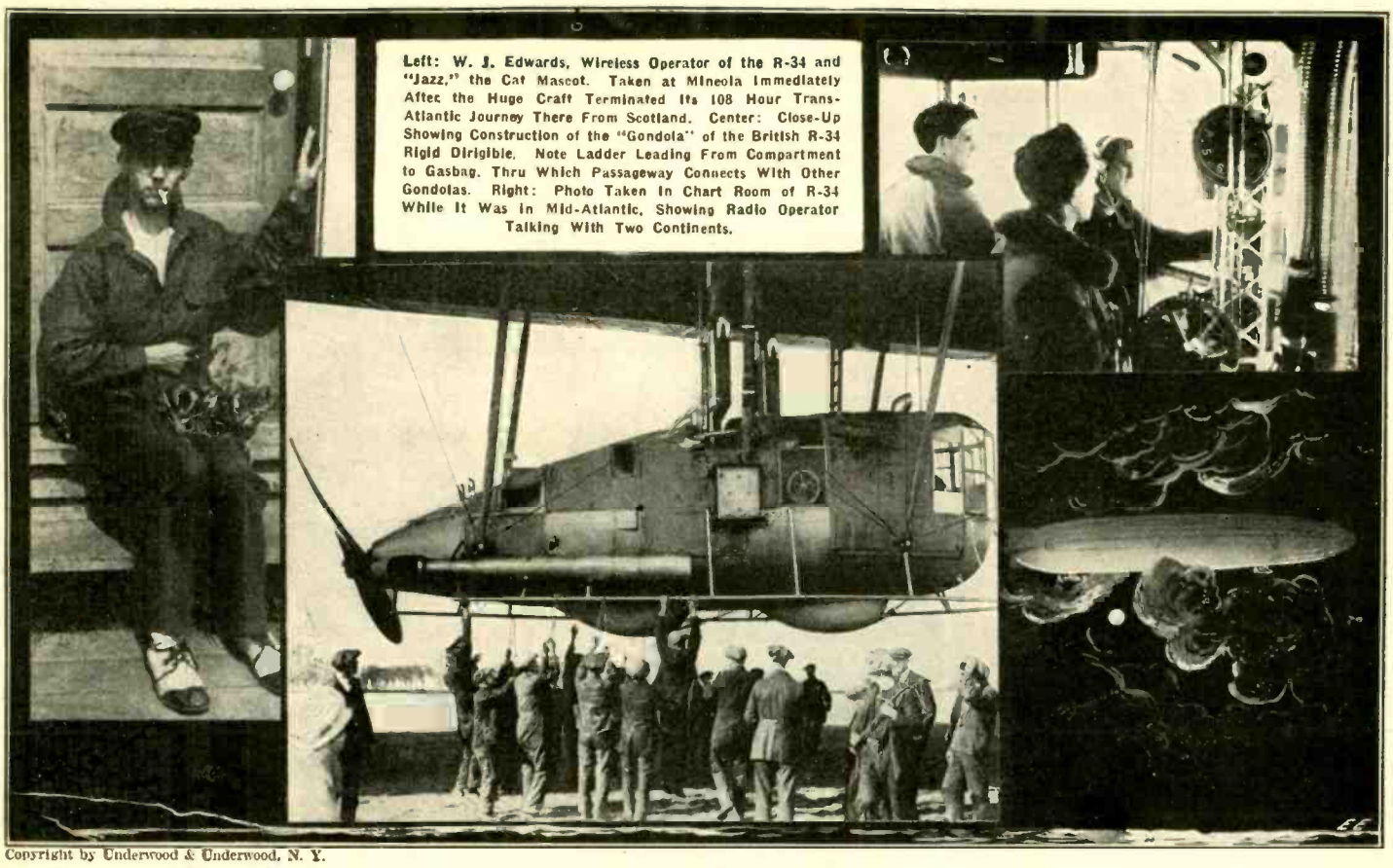
The Rotor Member Here Shown Is Driven Around by High Pressure Steam Flowing Thru the Rows of Blading. A reaction Force Is Set up Owing to the Steam Passing First Between Stationary Blades and Then Thru a Set of Rotor Blades, Etc., Etc., Repeatedly. There Are Two Low Pressure and One High Pressure Stages In This Triplex Turbine Unit. The Steam Enters the High Pressure Chamber First, Then Expanding, It Passes Into the Low Pressure Elements, Thence Passing to the Giant Condensers.



THE "INSIDES" OF

Imagine a gigantic airship resembling a huge sausa man, measuring 672 feet in length, is nearly as high as high as the Eiffel Tower. The giant British airs to Mineola, L. I., N. Y., and return, was piloted l England to America, her commander unconsciously England, and who would not be cheated out of the The English Government has plans under way to build its size. The R-34 carried approximately 2,000,000 of the novel features in this first "Leviathan" of the along the lower side of the gas envelope. The dir four suspended gondolas carried propellers and pet any of the gondolas as occasion required, by mea





Left: W. J. Edwards, Wireless Operator of the R-34 and "Jazz," the Cat Mascot. Taken at Mineola Immediately After the Huge Craft Terminated Its 108 Hour Trans-Atlantic Journey There From Scotland. Center: Close-Up Showing Construction of the "Gondola" of the British R-34 Rigid Dirigible. Note Ladder Leading From Compartment to Gasbag. Thru Which Passageway Connects With Other Gondolas. Right: Photo Taken In Chart Room of R-34 While It Was In Mid-Atlantic, Showing Radio Operator Talking With Two Continents.

Copyright by Underwood & Underwood, N. Y.

the valves should get stuck, something might happen. They have a manometer by which they read the pressure in the hydrogen tanks Ten millimeters is dangerous. Should the valves refuse to work a fire might start and the crew be forced to land or leap for life.

EIGHTEEN HYDROGEN TANKS

The eighteen hydrogen tanks are made of goldbeaters' skin, which is the intestines of calves. The final inflation—that is, the loading of petrol and hydrogen—takes place at the minimum temperature after the sun goes down. Flying over a warm city causes expansion, and over the sea, where it is cold, the bag is caused to contract. On the way over, while flying over the ice floes around Newfoundland, there was a contraction of 40 per cent.

When the machine starts to rise and the guy ropes are thrown off, she rises until she finds her equilibrium. It may be 500 and then it may be 3,000 feet. When she finds her equilibrium, the motors start. Meanwhile the wind carries her wherever it pleases. That is the reason why in most cases a start is made between midnight and dawn.

There are eighty-one tanks on board which contain petrol, and weigh approximately 500 pounds each. The capacity of each is seventy gallons. Sixteen of these tanks are fixed to the framework. The others are called "slip-tanks," and have double functions, acting at times as ballast. The water ballast is carried in canvas containers. There are eight emergency containers—that is, four forward and four aft. The water is put in these emergency bags in accordance with the atmospheric conditions. They carry ballast weighing from 500 to 3,000 pounds.

There are three tanks of drinking water and one reserve tank containing distilled water, used in case of a shortage of drinking water. On the way over, the men were limited to a pint of water a day toward the end of the journey.

EATING AND SLEEPING QUARTERS.

The dining room is in the center of the ship, the only place where the deck is wide. It is about twenty feet long and eight feet wide. There are three tables on hinges fastened to the framework, the same as on ocean liners. Of course the officers and men use the same dining room. The food is already prepared but the men could cook if they wanted to by means of an electric stove in a gondola. They have to stand while they eat. The pantry is small, approximately two by four by eight.

The sleeping quarters are not very comfortable. The men sleep in light hammocks suspended from the framework. There are about ten hammocks, which are woven from Italian hemp. There is not much feeling of stability. If a man fell out of one, he would fall thru the fabric and out into the clouds. One cannot get a good, deep, untroubled slumber.

At the extreme end of the envelope there are no gas compartments—that is, for about twenty-five feet from the bow and from the tail there is vacant space. There are only two stationary electric lights inside the envelope, making it necessary for the men to carry electric flashlights.

The cockpits fore and aft are equipt with heliographs. The observer is not comfortable. He is compelled to stand upon an aluminum ladder with his head above the ship. The extra clothes carried by the crew are strapt to the side of the envelope. The crew of the R-34 brought only their dress uniforms with them on their voyage as extra clothing.

PARACHUTES FOR CREW.

Running along the deck inside the envelope are the parachutes and life-belts. These appliances are kept in canvas containers. The life-belts are inflated with air. They go around the chest, and when wrapt up look like a bundle of clothes. Both the parachutes and life-belts are always available. If overland the men were forced to leave the ship, the parachutes might save them, while if over the sea the parachutes and life-belts would both be used and might possibly save them.

It is not comfortable on the ship at all. The static electricity in the air might cause a fire and explosion. For this reason the men wear rubber slippers, sometimes cloth, for fear that the sparks from the nails in leather shoes might start a fire. The lightning rod is a piece of steel cable with a tassel on the end.

THE RADIO EQUIPMENT.

The R-34 is probably the largest of the lighter-than-air machines. It is exclusively of British design and construction, and is navigated entirely by the navigation officer from the forward gondola. This officer works from a bridge, much the same as the bridges on trans-Atlantic steamers, and controls the airship. In back of the navigation officer's headquarters is the "Wireless Room" fitted with four wireless sending and receiving outfits, the range of these varying considerably.

Lieut. R. F. Durrant of the *Royal Air Force* claims the following ranges for his Radio apparata: With a three-step ampli-

(*Continued on page* 438)

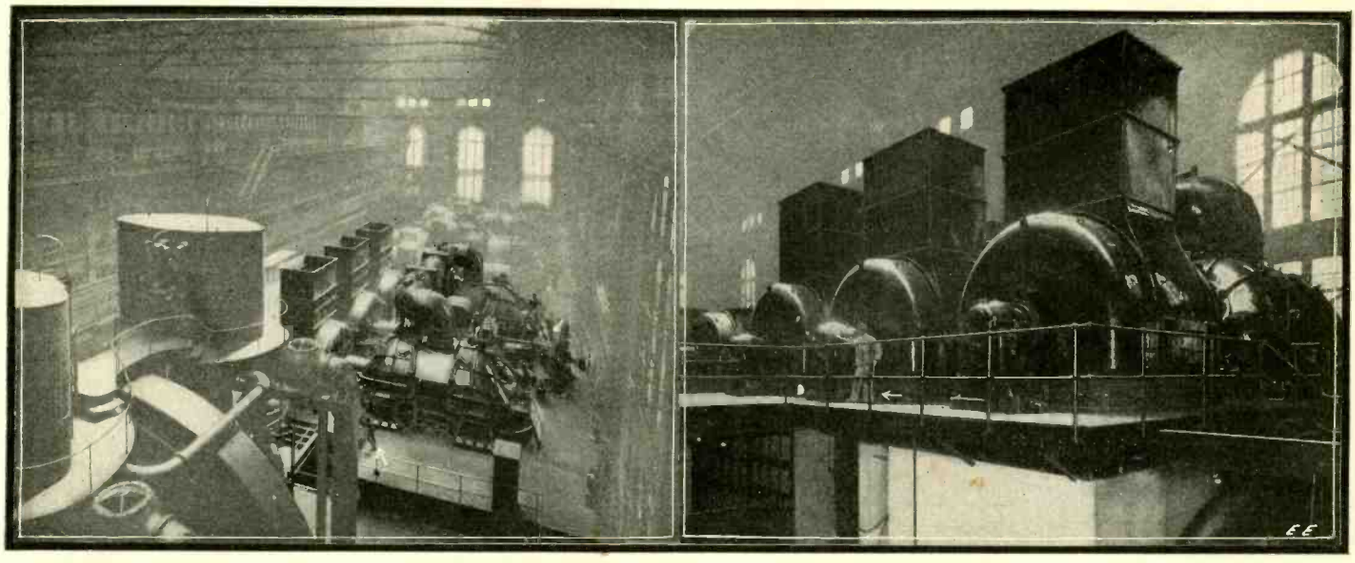
To the Editor of the Electrical Experimenter:

I regret that owing to circumstances beyond my control it was deemed advisable to postpone the publication of the article which I had intended for your August number. But the objections to its appearance will be shortly removed and I shall be pleased to forward it in due course for embodiment in your October issue.

Irrespective of this, I think it well on this occasion to notify your readers, as a precaution, that I am not one of those who display the sign "Do it now" on their desks and office doors. My motto is "Do not do it now. Think it over".

Very truly yours,

N. TESLA.



New York City Can Now Boast of the Largest Steam Turbine-Dynamo Generating Unit in the World—100,000 Throbbing Horse-Power. It Comprises a Triplex Turbo-Alternator, Occupying About One-Fourth the Space of the Old-Type Reciprocating Engine Shown at the Extreme Left of the Photo Herewith. The Comparative Size of the 100,000 H.P. Turbine Unit May Be Judged by the Man Standing Beside It—See Arrows. The Old Reciprocating Steam Engine Towered 75 feet into the Air; the New Turbine-Dynamo Stands But 20 Feet in Height. The Current Delivered Is Three Phase, 25 Cycle Frequency, at a Potential of 11,000 Volts.

World's Biggest Turbine-Dynamo--100,000 H. P.

By WILLIAM H. EASTON

TO her already long list of "greatest things in the world," New York City can now add another item, for the Interborough Rapid Transit Company has recently placed in operation at its 74th Street power house a triplex turbine-generator that is as superior to its rivals in power as the Woolworth Building is in height or the arch of the Hell Gate Bridge in length of span.

One hundred thousand horsepower is the amount of power this great engine can develop when pushed to its maximum. It is difficult to find an example that will convey an adequate impression of this figure, but the following may be of some assistance. Suppose our army now abroad, which consists of about a million men, has been landed over night and is marching up Fifth Avenue. Visualize the parades you have seen and then realize that it will take over three days and nights for this particular one, moving steadily forward in regular formation, to pass thru the Arch of Victory. Now, in a contest of strength between the turbine and all of these men taken together, the turbine would probably win.

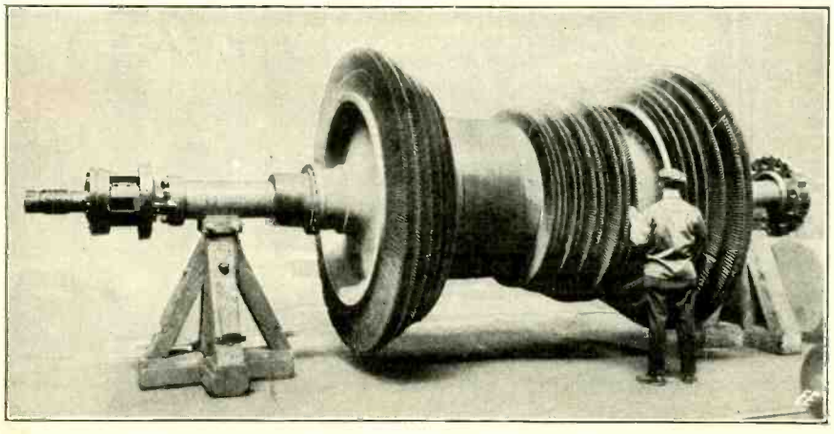
How the Turbine Operates.

The visitor, journeying to 74th Street to see this great turbine, will probably be disappointed in its appearance. It has, indeed, a massiveness that speaks of immense power within, but in size it is dwarft by the old vertical reciprocating engine, of one-twelfth its capacity, beside which it stands; and in addition, since all its working parts are enclosed, it is entirely lacking in the fascination that visual movement imparts. But its deficiencies as a spectacle are real virtues in the eyes of the engineer, for they mean lower first cost, smaller space occupied, reduced installation and operating charges, and a high degree of reliability.

The very conspicuous difference in size between the turbine and the reciprocating engine is due to their different operating principles. The reciprocating engine consists essentially of a cylinder in which a piston is pushed up and down by the steam. The main parts of the turbine, however, are a spindle, carrying hundreds of small vanes, and a casing which encloses the spindle. The steam acting upon the vanes of the spindle revolves it as the wind turns a windmill. The motion of the turbine is, therefore, rotary and as there are no heavy parts to be stopt and started at the end of every stroke, as there are in a reciprocating engine, very high speeds are permissible, thus making it possible to develop great power from a comparatively small machine. The speed of this particular turbine is 1,500 revolutions a minute.

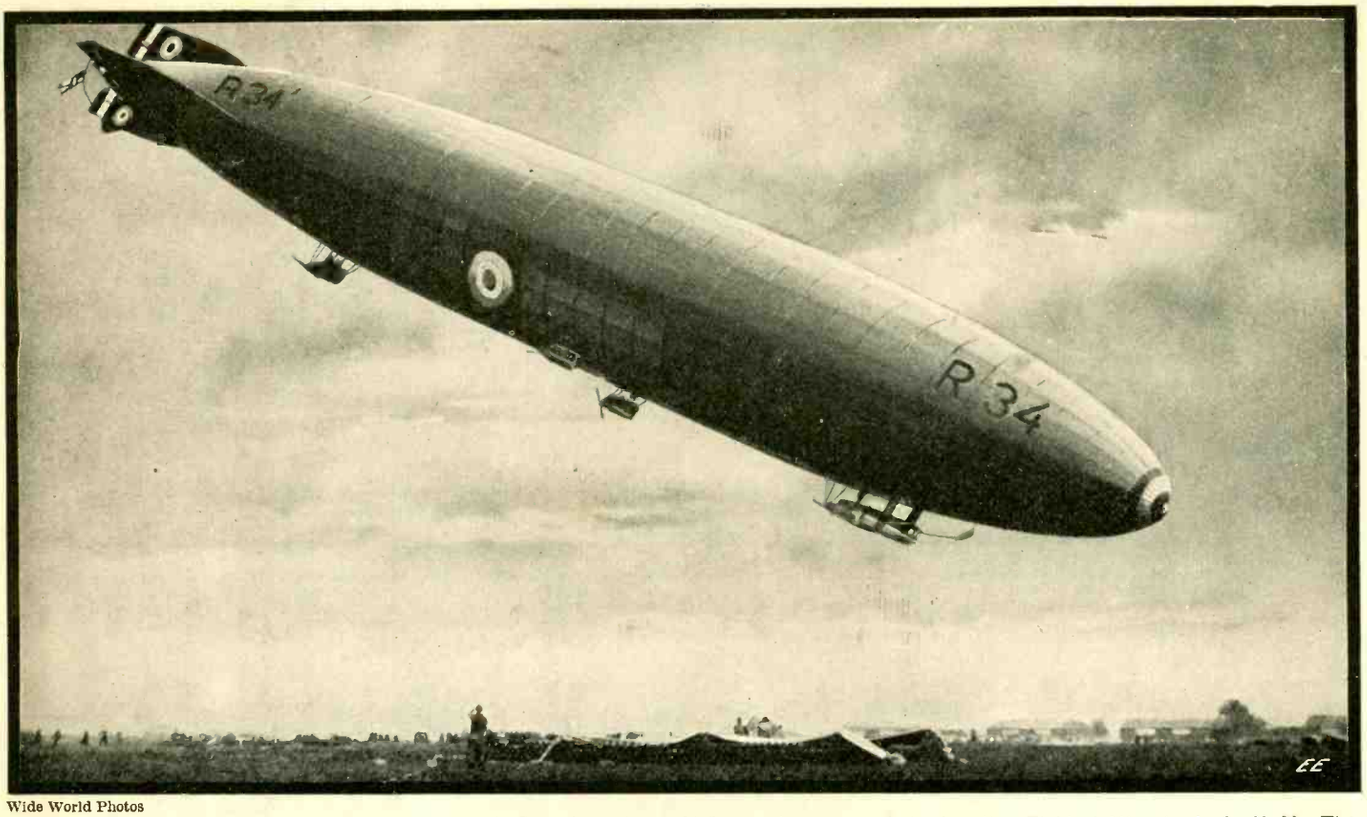
As has been said, the turbine is triplex; that is, it consists of one *high pressure* element and two *low pressure* elements, each connected to a separate electric generator. This gives it the appearance of three distinct machines, but it is actually a *single unit* and all three elements are started and controlled as one. The triplex arrangement is employed because it is mechanically greatly superior to the single element design for a machine of such great power. There is also the very decided additional advantage that, in an emergency, any one or two of the elements can be shut down without stopping the others. All the power eggs are, therefore, not in one basket, and the high efficiency of a single large ma-

(*Continued on page* 453)



A Close View of the Rotating Blades or "Rotor" of One of the Steam Turbines Comprising the Triplex 100,000 Horse-Power Generating Unit Recently Installed for the Interborough Rapid Transit Company, New York City, at Its 74th Street Power House. Almost Beyond Conception Is the Delicacy and Accuracy of Balance of This Wonderful Blading. It requires the Highest Degree of Workmanship to Build Such a Rotating Mass, Which Shall Be Perfectly Balanced When Revolving at 1,500 Revolutions per Minute.

The Rotor Member Here Shown Is Driven Around by High Pressure Steam Flowing Thru the Rows of Blading. A reaction Force Is Set up Owing to the Steam Passing First Between Stationary Blades and Then Thru a Set of Rotor Blades, Etc., Etc., Repeatedly. There Are Two Low Pressure and One High Pressure Stages In This Triplex Turbine Unit. The Steam Enters the High Pressure Chamber First, Then Expanding, It Passes Into the Low Pressure Elements, Thence Passing to the Giant Condensers.



Wide World Photos

An Exceptionally Fine Picture of the Giant British Dirigible—the R-34 Descending Toward the Landing Field at Mineola, L. I., N. Y. The Engines Are Kept Running While Descending, and the Rudders Altered to Steer the Ship Up or Down.

How the R-34 Crost the Atlantic

Details of the Giant 2,000,000 Cu. Ft. Trans-Atlantic Blimp

THE plucky English fliers succeeded in flying across the Atlantic Ocean, a course extending over 3,000 miles, in a gas bag known variously as a dirigible and blimp, and finally as her commander termed her, a "filleted rigid," meaning a rigid or framed gas filled balloon, having filleted or flat segmented sides. After making a successful landing at Mineola, L. I., N. Y., she sailed away on her return to England and landed there after a record-breaking voyage of 75 hours.

At Mineola the R-34 was hauled down and held by powerful cables, a large force of several hundred enlisted men being required to watch her day and night, in the event of wind gusts, storms, change of buoyancy due to the heat of the sun expanding the gas with which she was filled, and a hundred and one other expected but uncertain capers which the gigantic 670-foot "blimp" might cut up.

Some idea of her great bulk can be ascertained from the accompanying semi-sectional view of her, which shows the steering, eating and sleeping quarters, as well as many other interesting features.

LANDING TOWERS FOR DIRIGIBLES.

On her successful return to England the great airship was "anchored" to a new device designated by British Air Force engineers a "landing tower." Several of these towers are now in use in England for "anchoring" these giant lighter-than-air machines. They are provided with elevators to bring the crew and passengers to earth. The airship is held by the "nose" in such a manner as to ride a storm much more safely than if held to the ground. Such a device was described and illustrated in the July issue of this magazine.

Automatic landing and mooring are essential before airships can be put up as a commercial proposition.

Three points are being studied by the British technical departments now. One is moving the airship in the open, the second is the economy of man power required in landing, and the third the necessity for a good reserve of speed. This last is not a question of petrol supply, but of horsepower and the size of the ship.

A recent trial trip of the R-32 gave from 67 to 70 miles an hour, and she has 1,550,000 cubic feet capacity.

The R-34 has 2,000,000, and on her Atlantic trip reached approximately 60 miles an hour, but this is not going to be the speed of the future airship.

Major Scott, before he sailed, said he had no doubt that 100 miles an hour with proportionate "dispersal" lift, which is 50 per cent of the actual lift, would be obtained from airships that would be built with a capacity of 5,000,000 cubic feet.

Unless the size of the airship is increased, engines for this higher speed cannot be fitted, so that the experiments which the Admiralty is going to carry out will be vital to the commercial interests of the future.

Some idea of the wonderful aerial engineering features incorporated in the R-34, the first blimp to cross the Atlantic Ocean, can be gained from the following excellent description by Capt. Samuel T. Moore, commander of the balloon troop helping care for the transatlantic airship.

The forward gondola is the navigator's office and it is from this that the ship is controlled thru speaking tubes, electric bells and signals. The steering gear is also controlled from this gondola, as well as the rudder. On the side of this cabin are "elevator wheels" which control the elevators for changing the altitude when necessary. There is a table in the navigator's office on which charts are made while a flight is in progress. Many scientific instruments are on it, as well as the controller for the radio station. There is an engine in it, and immediately behind it are two more engines on either side. One or two of these engines work while the other sleeps. All the engines on the ship could be kept working if it were necessary, but as a general rule one of them is stopt and cleaned while the dirigible is in operation.

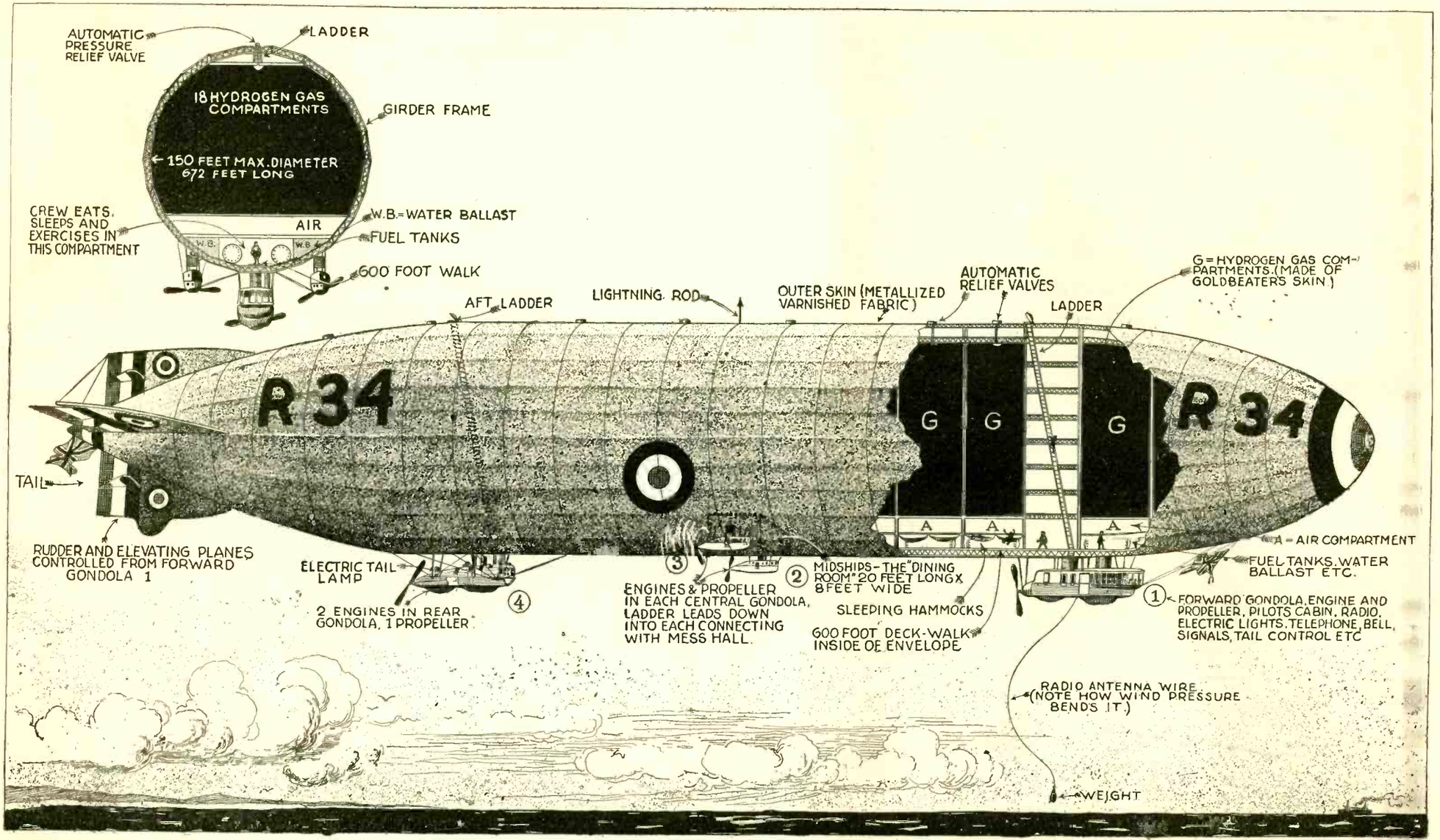
In the aft gondola are two more engines, making five in all—one in bow, two amidship and two at the stern. There are, however, only four propellers, the two engines at the stern having only one propeller. Two men are at work at the engines during the flight, one man operating and the other oiling.

DECK WALK 600 FEET LONG.

Inside the huge envelope there is a deck just 600 feet long and very narrow, covered with linoleum. It is not difficult for a man to balance himself as he walks along this deck, but it would be difficult for two men to walk it.

There are eighteen hydrogen gas compartments inside the shell, as shown in the semi-sectional view herewith. Nine of them have automatic valves, while the other nine are equipt with hand valves. The pressure of the hydrogen is not constant, but varies according to atmospheric conditions, with heat causing an expansion and cold contraction. This is regulated by the valves. If

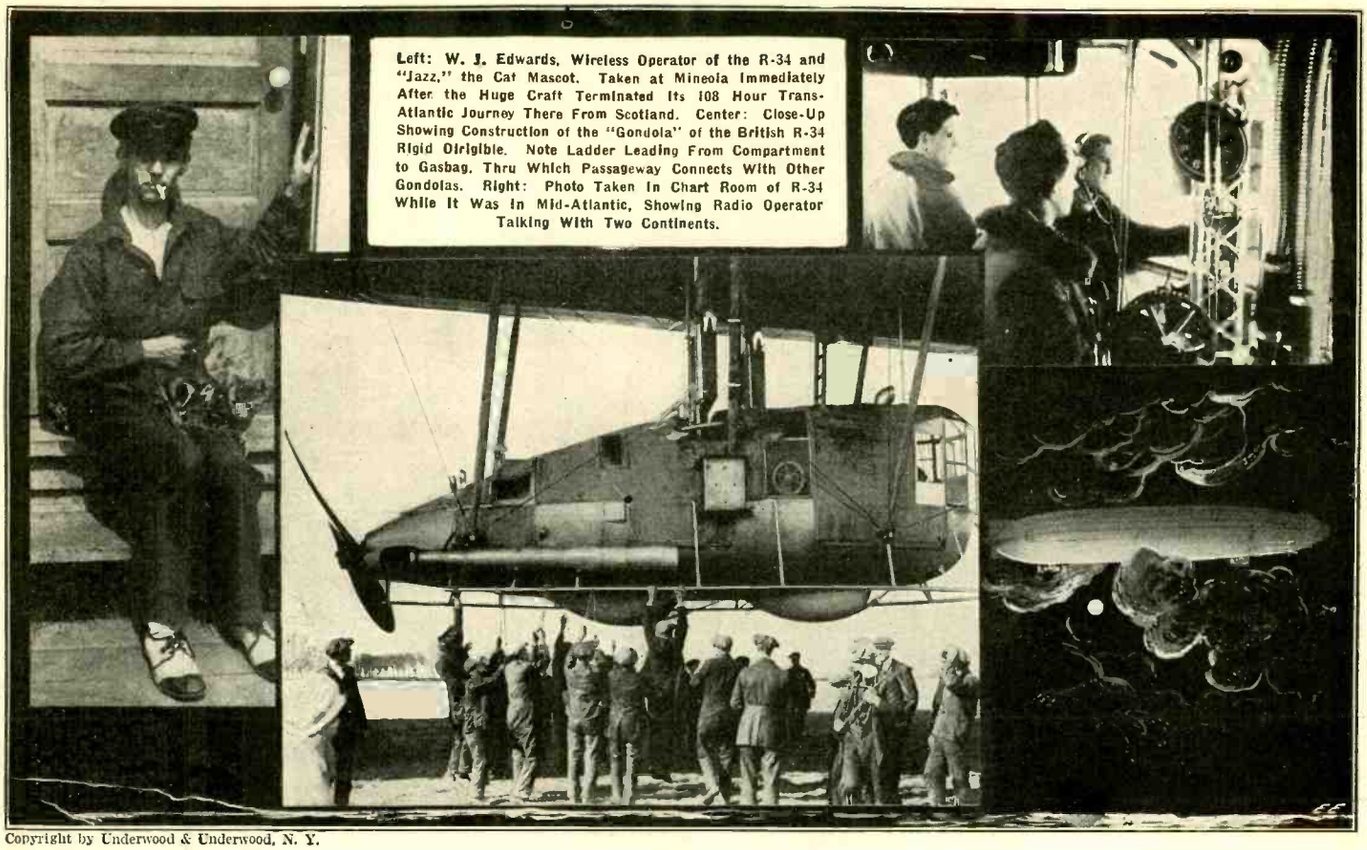
(*Continued on page* 404)



Copyright by E. P. Co.

THE "INSIDES" OF THE TRANS-OCEANIC AIRSHIP—THE R-34. THE FIRST DIRIGIBLE TO FLY ACROSS THE ATLANTIC

Imagine a gigantic airship resembling a huge sausage floating lazily thru the air over your head. This wonderful invention of man, measuring 672 feet in length, is nearly as high as the fifty-five story Woolworth Building in New York City, or three-quarters as high as the Eiffel Tower. The giant British airship, which successfully made the trip across the Atlantic Ocean from England to Mineola, L. I., N. Y., and return, was piloted by Major G. H. Scott and a crew of thirty men. On the trip over from England to America, her commander unconsciously carried a stowaway, a former mechanic who had worked on the ship in England, and who would not be cheated out of the first trans-Atlantic trip. The ship also carried a tabby cat as a mascot. The English Government has plans under way to build several new dirigible gas-filled airships similar to the R-34, but about twice its size. The R-34 carried approximately 2,000,000 cubic feet of gas. The accompanying illustration shows comprehensively some of the novel features in this first "Leviathan of the Air". The crew dined, slept and exercised in the long compartment running along the lower side of the gas envelope. The dining room is placed amidships and is 20 feet long by 8 feet wide. All the four suspended gondolas carried propellers and petrol motors for operating them, and the members of the crew had access to any of the gondolas as occasion required, by means of covered ladders leading down from the 600-foot walk and passageway at the base of the gas envelope. The crew slept in hammocks suspended from the framework of the envelope, just above the 600-foot walk, as shown in the diagram. In rising from the ground at the start, ships of the R-34 class do not operate their engines, but simply throw off their mooring cables, when they rise rapidly to a considerable height,—8,000 to 9,000 feet elevation. The big ship then finds her natural "equilibrium" point, and the commander gives the order to start the engines and propellers. The giant blimp, termed a "fileted rigid" by her commander, Major G. H. Scott, then comes under perfect control. To cause the ship to descend, is simply a matter of shifting the water ballast and raising or lowering the horizontal tail rudders. The ship is kept on an even keel by vertical tail rudders. Astronomical observations, such as "shooting the sun" with a sextant, are carried on by one of the officers, who climbs up an 80-foot ladder to the top of the airship, there being two of these ladders, fore and aft. The range of the special wireless apparatus is remarkable, signals having been transmitted from the R-34, 1200 miles, from off the Azores to England. Signals from England and America were copied in mid-ocean. Four distinct wireless sets were carried, including one "wireless telephone" set. The Dirigible has a much greater lifting capacity than the NC planes, and can not only carry a higher powered radio set, but can support a longer antenna when desired.



Left: W. J. Edwards, Wireless Operator of the R-34 and "Jazz," the Cat Mascot. Taken at Mineola Immediately After the Huge Craft Terminated Its 108 Hour Trans-Atlantic Journey There From Scotland. Center: Close-Up Showing Construction of the "Gondola" of the British R-34 Rigid Dirigible. Note Ladder Leading From Compartment to Gasbag, Thru Which Passageway Connects With Other Gondolas. Right: Photo Taken In Chart Room of R-34 While It Was In Mid-Atlantic, Showing Radio Operator Talking With Two Continents.

Copyright by Underwood & Underwood, N. Y.

the valves should get stuck, something might happen. They have a manometer by which they read the pressure in the hydrogen tanks Ten millimeters is dangerous. Should the valves refuse to work a fire might start and the crew be forced to land or leap for life.

EIGHTEEN HYDROGEN TANKS

The eighteen hydrogen tanks are made of goldbeaters' skin, which is the intestines of calves. The final inflation—that is, the loading of petrol and hydrogen—takes place at the minimum temperature after the sun goes down. Flying over a warm city causes expansion, and over the sea, where it is cold, the bag is caused to contract. On the way over, while flying over the ice floes around Newfoundland, there was a contraction of 40 per cent.

When the machine starts to rise and the guy ropes are thrown off, she rises until she finds her equilibrium. It may be 500 and then it may be 3,000 feet. When she finds her equilibrium, the motors start. Meanwhile the wind carries her wherever it pleases. That is the reason why in most cases a start is made between midnight and dawn.

There are eighty-one tanks on board which contain petrol, and weigh approximately 500 pounds each. The capacity of each is seventy gallons. Sixteen of these tanks are fixed to the framework. The others are called "slip-tanks," and have double functions, acting at times as ballast. The water ballast is carried in canvas containers. There are eight emergency containers—that is, four forward and four aft. The water is put in these emergency bags in accordance with the atmospheric conditions. They carry ballast weighing from 500 to 3,000 pounds.

There are three tanks of drinking water and one reserve tank containing distilled water, used in case of a shortage of drinking water. On the way over, the men were limited to a pint of water a day toward the end of the journey.

EATING AND SLEEPING QUARTERS.

The dining room is in the center of the ship, the only place where the deck is wide. It is about twenty feet long and eight feet wide. There are three tables on hinges fastened to the framework, the same as on ocean liners. Of course the officers and men use the same dining room. The food is already prepared but the men could cook if they wanted to by means of an electric stove in a gondola. They have to stand while they eat. The pantry is small, approximately two by four by eight.

The sleeping quarters are not very comfortable. The men sleep in light hammocks suspended from the framework. There are about ten hammocks, which are woven from Italian hemp. There is not much feeling of stability. If a man fell out of one, he would fall thru the fabric and out into the clouds. One cannot get a good, deep, untroubled slumber.

At the extreme end of the envelope there are no gas compartments—that is, for about twenty-five feet from the bow and from the tail there is vacant space. There are only two stationary electric lights inside the envelope, making it necessary for the men to carry electric flashlights.

The cockpits fore and aft are equipt with heliographs. The observer is not comfortable. He is compelled to stand upon an aluminum ladder with his head above the ship. The extra clothes carried by the crew are strapt to the side of the envelope. The crew of the R-34 brought only their dress uniforms with them on their voyage as extra clothing.

PARACHUTES FOR CREW.

Running along the deck inside the envelope are the parachutes and life-belts. These appliances are kept in canvas containers. The life-belts are inflated with air. They go around the chest, and when wrapt up look like a bundle of clothes. Both the parachutes and life-belts are always available. If overland the men were forced to leave the ship, the parachutes might save them, while if over the sea the parachutes and life-belts would both be used and might possibly save them.

It is not comfortable on the ship at all. The static electricity in the air might cause a fire and explosion. For this reason the men wear rubber slippers, sometimes cloth, for fear that the sparks from the nails in leather shoes might start a fire. The lightning rod is a piece of steel cable with a tassel on the end.

THE RADIO EQUIPMENT.

The R-34 is probably the largest of the lighter-than-air machines. It is exclusively of British design and construction, and is navigated entirely by the navigation officer from the forward gondola. This officer works from a bridge, much the same as the bridges on trans-Atlantic steamers, and controls the airship. In back of the navigation officer's headquarters is the "Wireless Room" fitted with four wireless sending and receiving outfits, the range of these varying considerably.

Lieut. R. F. Durrant of the *Royal Air Force* claims the following ranges for his Radio apparata: With a three-step ampli-

(*Continued on page* 438)

To the Editor of the Electrical Experimenter:

I regret that owing to circumstances beyond my control it was deemed advisable to postpone the publication of the article which I had intended for your August number. But the objections to its appearance will be shortly removed and I shall be pleased to forward it in due course for embodiment in your October issue.

Irrespective of this, I think it well on this occasion to notify your readers, as a precaution, that I am not one of those who display the sign "Do it now" on their desks and office doors. My motto is "Do not do it now. Think it over".

Very truly yours,

N. TESLA.

Under-Water Surveying by Reflected Sound Waves

By H. WINFIELD SECOR

ASSOCIATE MEMBER AMERICAN INSTITUTE ELECTRICAL ENGINEERS

LOCATING invisible objects at distances of several miles under water is not such a new scientific fact, as several schemes for carrying out the detection of submarines by these sound waves, radiated from the propeller and engine of the undersea craft, were conceived and applied more or less successfully during the progress of the World War, and enemy submarines were trailed by means of submerged microphones or electrical sound detectors. But it has not been possible heretofore to utilize ordinary apparatus, such as a *single* sound detecting instrument located at a *single* point, to *accurately locate any object at an appreciable distance to within a few feet.* However, a New York inventor and electrical engineer, Mr. E. E. Ries, has been working for a number of years on a most ingenious *reflected-sound* scheme for locating various objects such as submarines, icebergs, charting ocean and river beds, etc., and the present article deals with the remarkable principle of sound wave triangulation, as evolved and perfected by Mr. Ries.

Our readers may probably remember having read several years ago of an "iceberg detector" operating on the sound wave principle, devised by Mr. Ries, in which two sensitive microphones fitted with horns were mounted at the extreme ends of a yardarm high up on the mast of a ship. To locate the distant iceberg, even in a fog or at night as well as day-time, a powerful siren placed exactly midway between the

The Ries Under-water Sound Detector and How it Works.

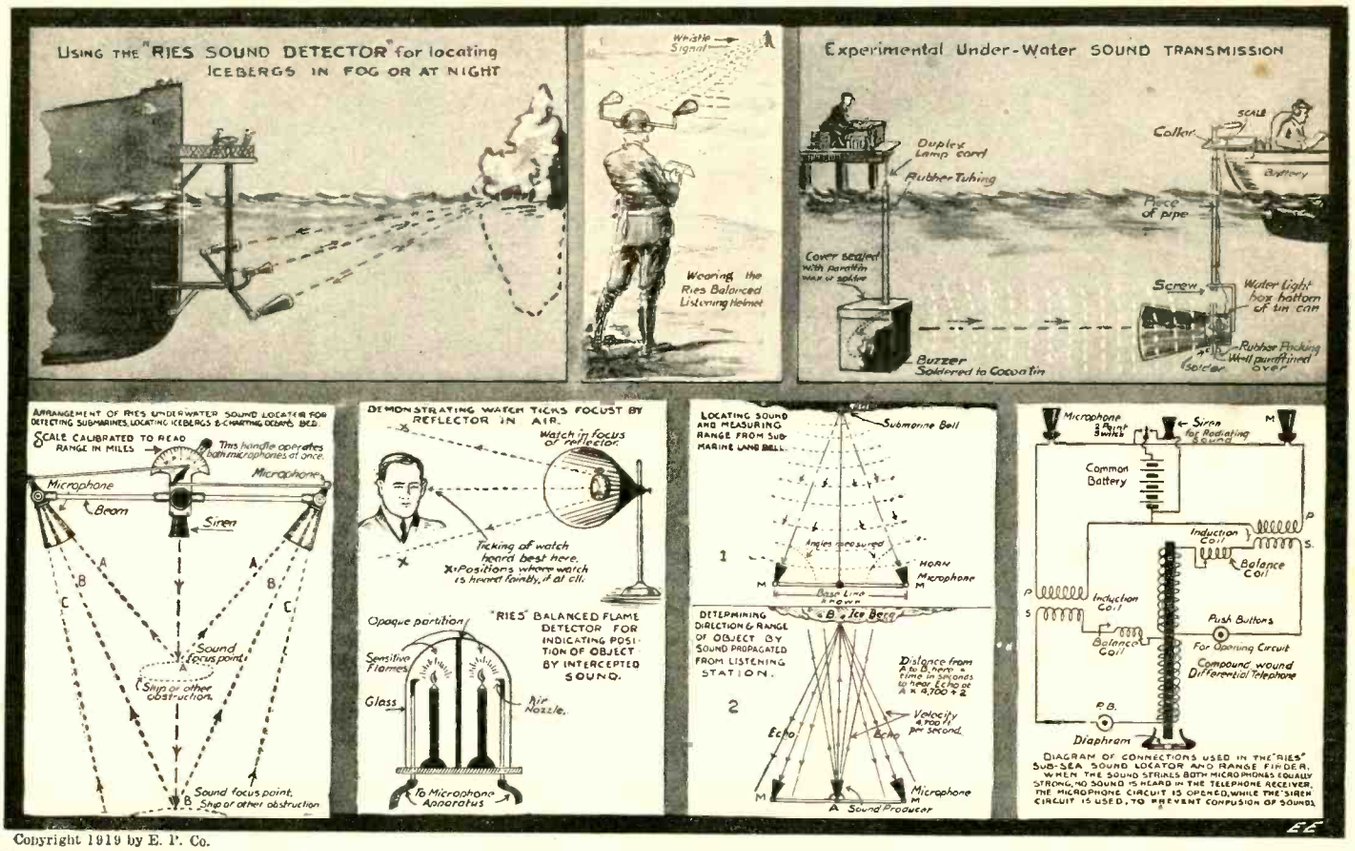
microphones on the yardarm or spar, was sounded. The yardarm carrying the microphones was then swung on the mast as an axis, until the "echo" reflected from the iceberg was picked up several seconds later in the microphones. By a special scale device attached to the pivoted microphone elements, the angles which they subtended when both were focust on the spot from which the echo rebounded, showed the distance in feet or yards, as the case might be.

Before going further into the details of Mr. Ries's most ingenious and promising system of "Subaqueous Surveying" by means of reflected sound waves, it will prove interesting to look into some of the principles of sound wave physics underlying the functioning of this latest scientific achievement. Moreover, as Mr. Ries pointed out, his system of sound wave triangulation overcomes all the weaknesses of the single, straight-line sound detectors, by utilizing a greater base line in his triangular determination of the source of the sound or echo, and by this means he confidently believes that ships, submarines, icebergs or other obstructions, including the depth, contour and nature of the ocean bed or rocky coast, *can be located quickly and precisely to within a few feet, even at a distance of eight to ten miles or more.* This seems all the more probable when the wonderful principle on which his system operates is more fully understood.

SOUND WAVES IN AIR AND WATER.

In the original scheme for locating icebergs or other objects projecting above the water, as devised by Mr. Ries some years ago, the propagation and reflection of sound waves, i.e., the echo, was based on the phenomenon of sound wave transmission thru the air. Sound travels thru the air at a speed of approximately 1,120 feet per second; it is well to keep in mind also that a sound traveling toward a certain point such as a rock or iceberg and rebounding from the surface of said object by reflection, will cause an echo traveling at the same speed also, or 1,120 feet per second. Hence, when listening for the echo, which you may sometimes do in parks or in mountainous regions where there is a rocky formation which will give a good clear echo at a considerable distance, you may time the distance with an ordinary watch provided with a second-hand, by counting the seconds required to hear the echo. But the time noted should be divided by two, and then multiplied by 1,120 in order to get the distance in feet. Sound wave propagation thru water is very much the same as that thru air, with the difference, however, that sound travels thru water at a much greater velocity than thru air, owing

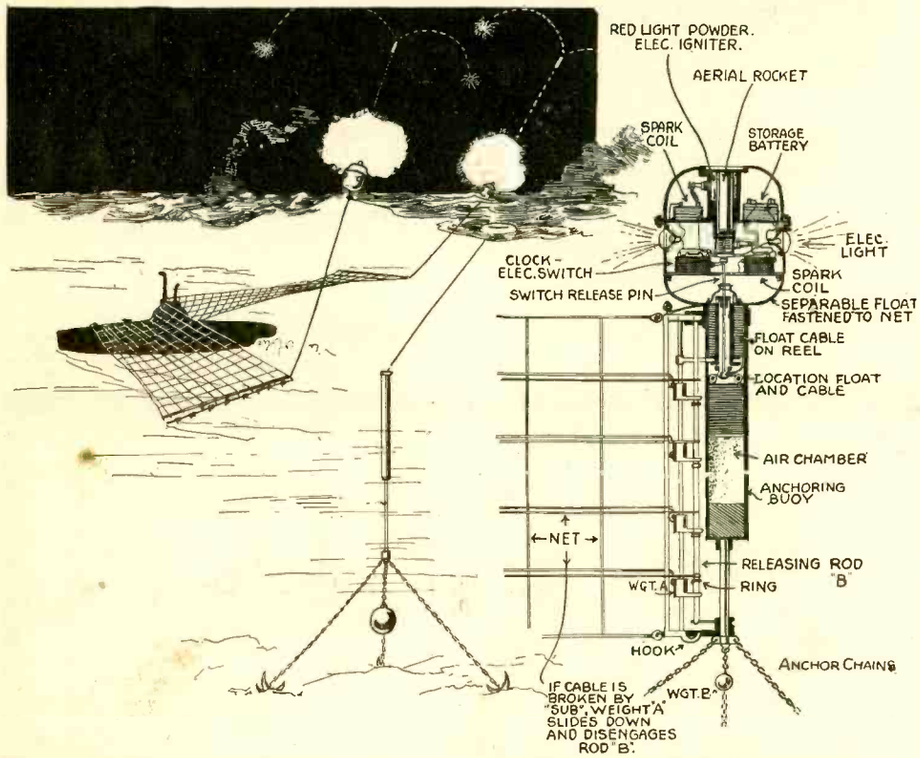
(Continued on page 454)



Copyright 1919 by E. P. Co.

The "Ries" Improved Under-Water Surveying and Locating Scheme, Utilizing Reflected Sound Waves Propagated thru the Water, Promises to Solve Many of Our Greatest Problems. Among These We Find the Locating of Sunken Ships, the Charting of River and Harbor Beds, Detecting and Locating of Enemy Submarines to Within a Few Feet of Their Actual Location, Etc. The Principle of Triangulation Employed Makes the Invention Extremely Feasible and Precise.

A Telltale Submarine Net



Submarines Will Have to Become Almost Human to Get Thru the Under-Water Nets and Mines Barrages of To-morrow. Here's a Telltale Net That Entangles the "Sub" and Sends up Rockets Signaling the Fact. Electric Light "Markers" Are Also Brought into Play.

THE vast experience gained by naval designers and inventors during the progress of the great war has taught them many things. The various means of protection against submarines have been quite extensively tried out, and while many theorizers have predicted failure for *anti-submarine nets,* still many hundred miles of nets were constructed and successfully employed during the war. A new form of *telltale submarine barrier* or net was recently invented and patented by one John P. Geraghty, of Jersey City, N. J. His invention covers a system of detecting submarines solely by the use of protective nets, so that anti-submarine operations can be carried out directly, and a few dozen "ash cans" (depth bombs) let go on the spot where the submarine is eventually located by the sub-sea microphones, et cetera, as now used by all of the leading navies.

The outstanding features of Mr. Geraghty's invention are that as soon as a submarine touches the net and tries to cut its way thru, or else bumps the net so hard that it carries it away, telltale signals will instantly be given, and which are effective either by day or by night. At night, rocket signals are shot forth from the anchor buoys of the net as soon as the net has been damaged or carried away by the lurking enemy sub-sea craft engaged on a surreptitious visit to the harbor or bay thus protected.

In this form of anti-submarine protective net, the net, which is of special design, is detachably fastened to sturdy anchoring devices, so that when a submarine strikes the net it can, with ordinary pressure, tear the latter away from the anchorages, which immediately causes signals or telltale means to be operated so that patrol boats, such as submarine chasers and destroyers, can at once give battle to the unseen enemy. The anchoring devices are provided with clever releasing catches, which when a certain amount of pressure is applied to the net, collapse and allow the net to be released from the anchorages. As soon as this happens, however, the collapse of the catches

(*Continued on page* 483)

Electrocuting Huge Leopard

It was a "shocking" affair, but those members of the Los Angeles moving picture colony who are in the habit of working with animals are breathing sighs of relief, for David, the big leopard of the "movie" jungle is no more. Sentenced to death by a jury of his peers, the big cat paid the extreme penalty by being electrocuted. According to Mr. Edwards, manager of the film company who owned the beast, most of the animals used in film work are very tame, but David had been acting treacherously for several months, and rather than risk the injury of anyone who might be acting with him it was decided to end his career. At first shooting with a high-powered rifle was considered, but fearing that this would disfigure the beautiful pelt which the company wished to preserve, the engineer of a large electric power station nearby was consulted and electrocution was decided upon. A large steel plate was placed on the floor of the cage and connected to a 6,000-volt power line at the power house. David was then placed on the plate, and another wire fastened to his leg, the juice turned on, and David was no more.

The execution of animals has received considerable investigation, especialy in the city of Boston, Mass., where there is located a specially equipt institution for electrocuting horses, cats, dogs, etc. The apparatus and special provisions arranged to carry out this work were described some time ago in the ELECTRICAL EXPERIMENTER. The method is not only advantageous in many different ways, such as the ease and certainty which which the animal may be killed, but also has received the highest commendation from humane investigators and scientists. The theory of electrocution tends to show that the high velocity of the current travels faster than the nerve wave itself, and therefore the animal is dead before any shock can be felt.

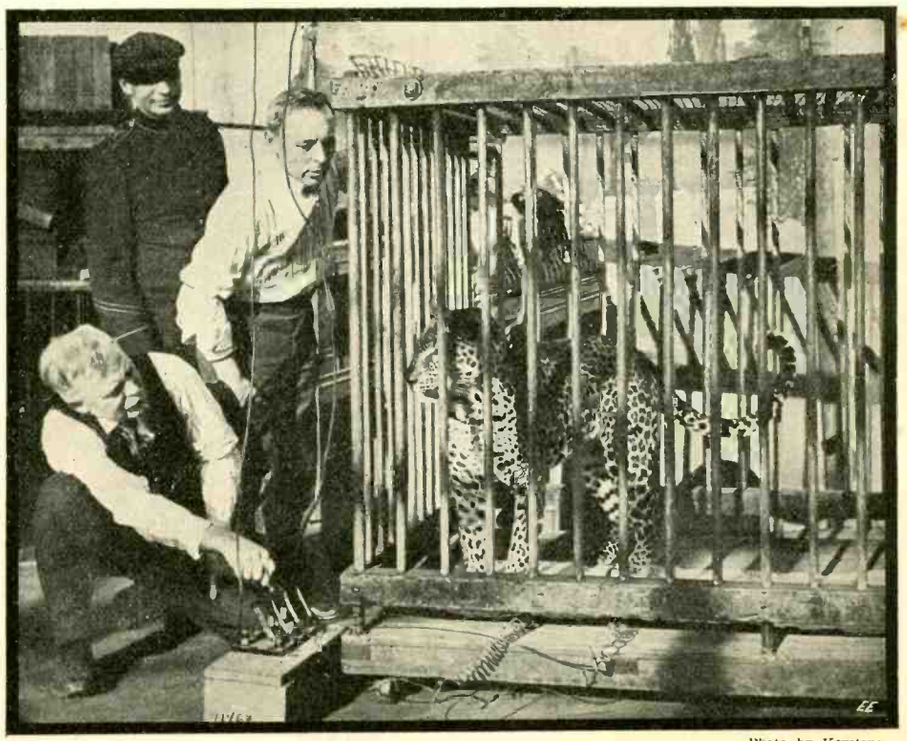


Photo by Keystone

"David"—the Big Leopard of the "Movie" Jungle—About to Breathe His Last. One Throw of the Switch and He Paid the Final Penalty for His Treachery, Which Had Endangered the Actors' Lives.

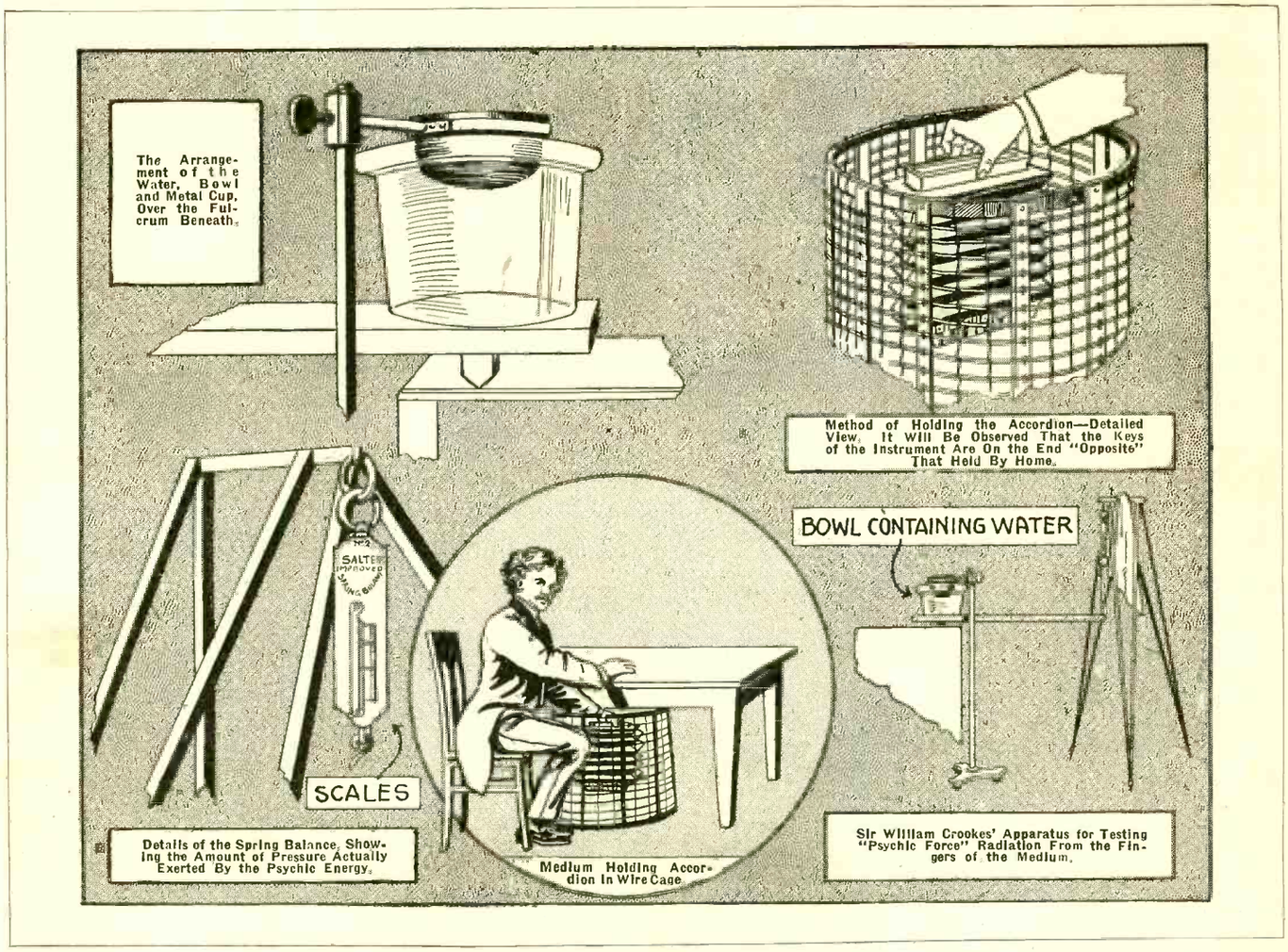
Sir William Crookes' Psychical Researches

By HEREWARD CARRINGTON, Ph. D.

THE late Sir William Crookes, O.M., F.R.S., will always be regarded as one of the greatest scientists—as he was one of the greatest "psychical" students—of all time. His achievements in the fields of chemistry and physics alone insure the perpetuation of his name in scientific circles. He was the discoverer of the element thallium; he it was who first investigated many of the phenomena of radiation, which led to the ultimate discovery of the "Crookes tubes"—named after him—and which in turn have led to many important discoveries in the realms of chemistry, physics and medicine (the X-rays, etc.). He made many valuable contributions to the study of radium; he invented the "radiometer," which we now see in nearly every oculist's shop; he wrote many standard works upon chemical analysis, sugar manufacture, dyeing, printing, metallurgy, sewage, diamonds, and many other topics—thereby establishing his name as one of the finest, most ingenious and most practical scientific minds in the world, and leaving to posterity a veritable monument, in the shape of lasting and valuable achievement, of great practical benefit and value to mankind.

Sir William Crookes, however, was known not only for his interest in the problems of physics and chemistry, but also by reason of his interest in "psychic" phenomena, and his book "Researches in Spiritualism" is a classical manual on the subject, oft quoted, and a model of clarity and impartiality. Curiously enough, his researches into the phenomena of spiritualism were being undertaken during the very years (1870-74) when, in the opinion of many physicists, Sir William was doing his best work in chemistry, so that the charge cannot be brought against him that "he only became interested when in his dotage"; on the contrary, he was then in his prime—about forty years of age. It is true that Crookes maintained his interest to the day of his death, but he *wrote* very little upon the subject, contenting himself with patient research and investigation, which tended but to confirm his earlier researches. A brief summary of these cannot fail to be of interest.

Scientific Proof of Psychic Force or Spiritualism



IN publishing this article, we are aware that it is a very unusual subject to appear in a scientific magazine. We however, have approached the matter with an open mind, neither condemning nor upholding it. The reader must be the judge. We do not publish it with the mental reservation that "there might be something in it, after all," but we do believe that anything at all in science over which there has been a great controversy should be discussed as intelligently as it is possible. The author of the present article, Dr. Hereward Carrington, is a member of the Society of Psychical Research, and he is also the author of several interesting books, among others "Death: Its Causes and Phenomena;" "The Problems of Psychical Research;" "The Coming Science;" 'Psychical Phenomena and the War."

Sir William Crookes, one of the greatest scientists that ever lived, became converted to spiritualism after long and exhaustive experimental evidence which today seems irrefutable. Dr. Hereward Carrington clearly describes some of Sir William's experiences in this article, which should prove of unusual interest to our readers, whether it will convince them or not.

The majority of these experiments—which were chiefly conducted in Sir William's own home or laboratory—were made with the medium Mr. D. D. Home—a medium who produced extraordinary "physical" manifestations, and who was never detected in fraud in all his long career (Home was an intelligent man, who wrote several excellent books upon the subject himself). One of the earliest experiments was that with an accordion, held lightly between the thumb and fingers of Home's hand by the end *opposite* the keys. His other hand was visible and rested on the table. The accordion, thus held, was placed within a circular wire cage, which could be charged

(*Continued on page* 440)



Ever Hear the Tale of the Man (and Oh! Lawdy! the Woman) in "Upper Ten?" The Worries of the Traveling Public That Must Sleep En Route in Those Sardine Box Atrocities Known as "Berths" Are Finally Reduced to a Minimum; by Means of This New Telephone Checking System the Chance of Finding Your Berth Already Occupied by a Duplicate Ticket Holder Is Obliterated, Forever, We Hope.

Telephone Solves "Lower Berth" Squabble

THOSE of you who have tried in vain to obtain a *lower berth* on a railroad train, only to find out that a friend of yours purchased one from a different window *after* you applied for yours, will doubtless be interested in the new method of booking applications which is in use at the present time at one of the large railroad terminals in New York City.

According to the old method, diagrams of each pullman car, with blank spaces for each berth, were distributed among the various stations and ticket offices. When you purchased your ticket, the number of your train ticket was entered in the space representing your berth, In this way the ticket agent knew just what berths were occupied and which were not. Yes, he did!

When the train left the station these cards were handed to the pullman conductor, who settled disputes as to the occupancy of the berths, according to the ticket number entered on his card. If two people claimed the same berth, the one whose ticket number appeared on the card was the fortunate individual.

(*Continued on page* 481)

New Continuous Panorama Advertising Display

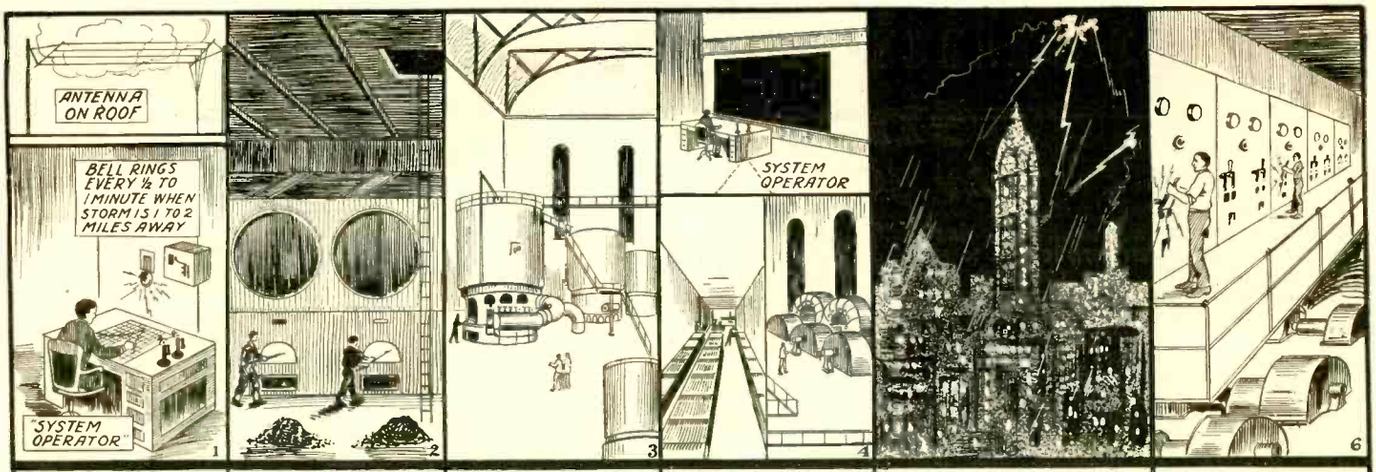
It is undoubtedly a fact that the long suffering public has been wont to see many advertising devices both good and bad exhibited in store windows, etc., designed with the intention (?) of securing their attention. Of these some have been rather unique and served their purpose admirably, but there have been many that have fallen by the wayside.

With these few words of introduction to our plot we come up against the difficult task of describing this new advertising device that to all intents and purposes eclipses them all. The main difficulty is to find a way that will make the explanation reasonably clear. It is called the "Endless" display machine, and as an advertising specialty it seemingly surpasses anything heretofore shown, in that it presents to a manufacturer, dealer or storekeeper a very neat and attractive way of telling the history of the manufacture of the goods he may be selling, with a wonderful grouping of photos much the same as a moving picture or panorama. It is only by some such means that customers are usually interested, as the eye readily transmits a picture to the mind that is bound to stick. In addition to the continuous moving picture there are a number of shelves provided at the base for the display of small wares.



A Mystifying Show Window Attraction—the Scene on the Revolving Disc Constantly Changes.

The circle covered by the moving disc is thirty inches in diameter, and is capable of showing three separate pictures on each sheet. It is adapted to display any advertising matter which is now used or has been used in posters, car cards, phrases, and in fact all written, printed or photographic matter. Each machine can hold 20 or more sheets each thirty inches in diameter; they are notched around the edge with a tough linen border which precludes their becoming torn or mutilated while passing thru the machine. The discs are slit and joined end to end in a flat pile inside the machine with the two free ends joined in a sort of twist, thereby enabling the action to be continuous both back and front. They are held in place both by a pivot in the center and also by the driving motor, which is of 1/40 horse-power and so geared that two friction pulleys bear on each side of the machine. Between these pulleys are set the edges of two discs and by a simple gearing process, each set of friction pulleys works in the opposite direction, thus making possible the continuously moving panorama.

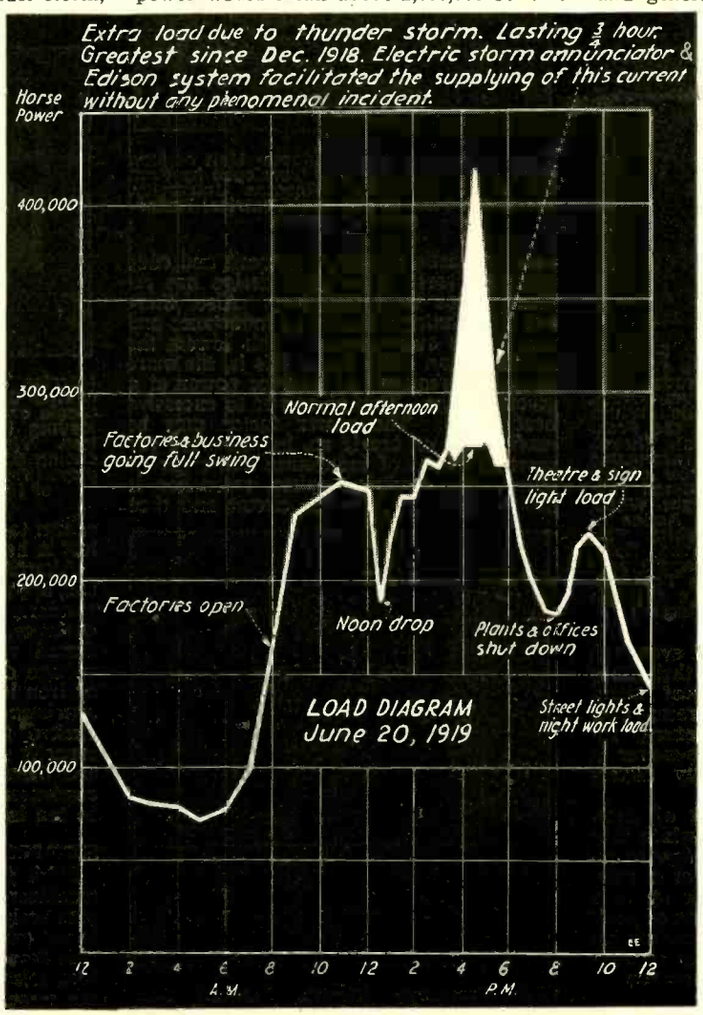


200,000 Horse-power in One Hour

ON Friday, June 20th, 1919, the electric light and power service of the New York Edison Company was put to the severest test which the Waterside Station had ever experienced since December, 1918. This was a day on which a summer thunder-storm, coming up in midafternoon enveloped the city in darkness equal to that of 10 o'clock at night, the consequence being that about 2,000,000 electric lights were turned on almost instantaneously and the Edison Company had to meet this demand for more "juice." It occurred when factories and offices were going at full swing, hundreds of which suddenly switched on all the lights when the storm broke. Several factors enabled the company to supply the enormous demand for current. One of these we have described in a previous issue of the ELECTRICAL EXPERIMENTER — the "wireless storm announcer," which again stood in good stead.

This consists of a slightly modified form of an early model wireless receiving station, using a *coherer* and a bell as a decoherer, together with the necessary relays. In addition in the aërial circuit, are two spherical balls resembling a spark gap. These are placed 1-64th inch apart, and are used to prevent the causing of a false alarm by the surges emanating from nearby wireless telegraph sending stations. A condenser is placed in the ground circuit to prevent stray currents and a short-circuiting switch is used to silence the bell and protect the apparatus from heavy surges due to electrical storms, which may harm the apparatus and materially impair its usefulness.

The demands of this generating station were raised by this increase in the use of current from approximately 250,000 horsepower, which is the normal daily business load, to nearly 425,000 horsepower, and due to the fact that all offices and factories were "carrying on" at the time, this load would naturally be almost exclusively of a lighting nature. From these figures an increase of 175,000 horsepower would mean about 2,000,000 50-watt lamps being turned on suddenly. Naturally enough, something had to be done in order to meet this demand, and inasmuch as the change from normal to the *peak* load came within less than an hour, it involved a close race against time to get the boilers and generators into operation in time to meet the approaching darkness that the coming storm would bring.



This Daily Load Chart Shows How the New York Edison Company's Output Increased Nearly 100% During a Recent Thunder-Storm.

At a large generating station such as at Waterside, there is generally one man and his assistants, who are able to conduct the affairs of the station with remarkable skill and precision—the "system operator," as he is called at Waterside. The system operator invariably keeps posted on the demands that are or may be made on the station for power and light, so as to direct the disposal of all generating machinery. Thus the station will afford the highest quality of service and will operate with maximum efficiency, i.e., he ascertains how many boilers should be maintained under load, and how many should be "banked," which machines shall carry the load and which shall remain idle. He also directs the switchboard operators as to which feeders shall be used to dispose of the output. As this routine is an everyday affair, it is conducted quite automatically, but the life of the system operator also has some of its thrills, especially when a storm approaches the city at a rate of about 45 miles an hour. The little thunder-storm detector, a view of which is reproduced here, does its share of the work. When a storm is approaching, and about one to two hours away, the gong on this storm announcer will strike about every fifteen or twenty minutes. This is only a "warning," and not much attention is paid to it, as it is very probable that the storm

(*Continued on page* 450)

Possibilities of High Frequency Currents

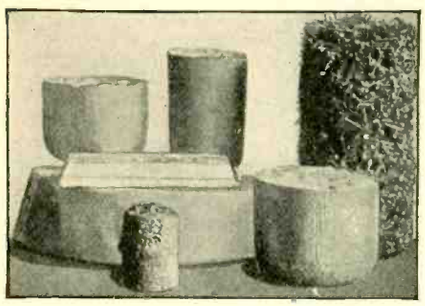
By JOHN E. PRITCHARD

IN all branches of human endeavor there has been that characteristic trait to attain perfection. This condition has never been reached and never will; but like a variable approaching a limit, the difference between perfection and non-perfection can be made very small.

In the early development of electrical application, it was generally conceded that direct current transmission was a marvelous advance toward the ideal method of power delivery. Its flexibility over all others was evident, at that time. This advancement opened a new field of industrial engineering. Investigators were spurred on by successes, so naturally the field became extensive. Then the *disadvantages* of direct current became prominent. Economy demanded that power units be centralized. It was found that to transmit large currents long distances at low voltage, required very *large conductors* to reduce the heat losses, which are equal to the current squared, multiplied by the resistance. This draw-back was partially surmounted by the high voltage direct current generator; but due to the mechanical as well as current transformation difficulties, it has not been widely adopted.

LOW FREQUENCY ALTERNATING CURRENTS

Low frequency 60 cycle A. C. machinery, thru persistent research, has to-day reached



Melts From the High Frequency Furnace, Some of Which Resist Fusion Up to Temperatures as High as 1700° Centigrade. Such Include Tin, Lead, Zinc, Aluminum, Brass, Copper, Iron Cast and Electrolytic (Which Was Melted in Vacuum Without the Presence of Carbon, Even in Traces), Nickel, and High Silica Glass. As an Interesting Indication of the Unique Character of the Induction Possible, a Mass of Small Iron Nails Is Shown at the Extreme Right, Which were Cintered Together by the Action of Powerful "Eddy Currents." While This Action Is Proceeding, During the Early Stages of the Melting, Small Arcs and Sparks Tend to Weld the Many Particles Together. This Effect Is Obtained Only In a Crucible That Is Electrically Non-conducting.

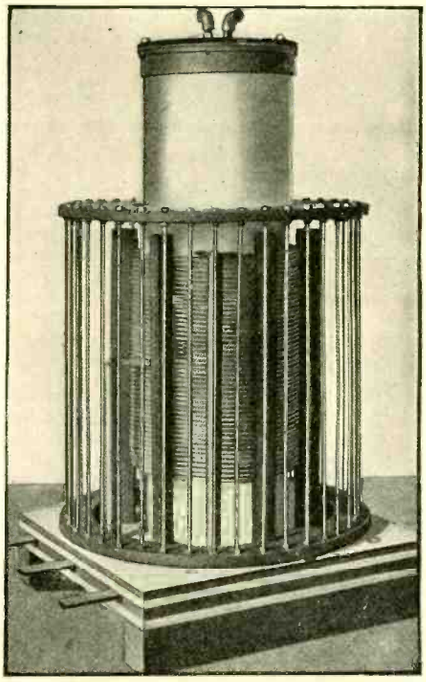
a high degree of perfection. But even with our great power houses and their long transmission lines lighting great cities, propelling ponderous electric trains over high mountains and furnishing energy for every conceivable form of prime-mover in the industries, there exist many factors detrimental to perfection.

The reason for the great use of alternating currents is the ease with which they can be *transformed from one voltage to another*. They can be generated at a comparatively low voltage and stept up to a higher voltage. In the transmission of great power at *high voltage* there is required but a *small current*, and this, in turn, requires only *conductors of small cross-section*.

RESONANCE IN A. C. CIRCUIT.

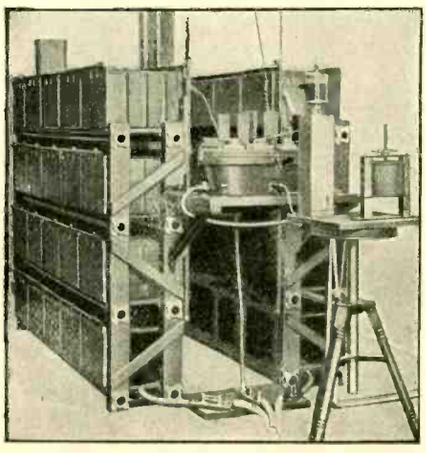
Transformation is accompanied with

The High Frequency Furnace and Electric Power Transmission



Typical Vacuum-Type Inductor Unit of New High Frequency Furnace Developed by Prof. Dr. E. F. Northrup, Princeton University, Marking a New Era in the Electrical Refinement of Metals.

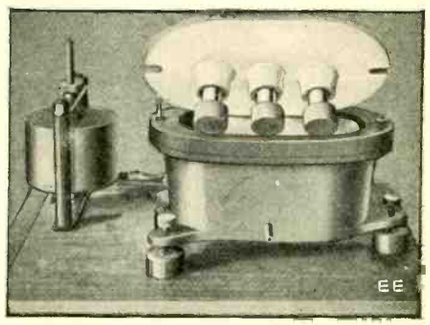
heat, magnetic leakage, hysteresis and eddy current losses. First class design has reduced these to a minimum. Also, there are *disadvantages* caused by inductance and capacity in every circuit. This lowers the *power factor*. The lower this is, the more current is required to produce power at a given voltage. This gives rise to excessive heat losses. The power factor may be made unity or nearly so, by *balancing* the reactive effects of inductance and capacity. When this condition exists, resonance is said to take place in the circuit and then



High Frequency Electric Furnace Condensers and Spark Gap. These Furnace Outfits Have Been Built In Sizes Up to 50 Kilowatts.

Ohm's law holds true, C=E/R. It is very desirous not to have this in practise, due to the great strain placed on the circuit. The voltage, as well as the current, may reach abnormal values under such conditions. In fact, the potential on a long transmission line may be 10 per cent higher at the distant end than at the generator end, due to these resonance conditions. In one case a 10,000-volt A. C. transmission line showed 11,000 volts at the distant or load end of the circuit.

This phenomenon may be illustrated by the mechanical analogy of a pendulum six feet long, on the foot of which is hung a weight of one hundred pounds. Strike the weight with a force of ten pounds. Call this the *positive* impulse. When it has traveled the full length of its arc, give it another ten pound blow. This is the *negative* impulse. Now the pendulum will oscillate freely. The time for a single vibration will always be equal, regardless of the length of its arc; therefore the impulses will occur at equal intervals of time and will be analogous to an alternating current delivered to a resonant circuit. The amplitude of the swing will get greater and greater until finally the energy represented in the moving weight is *many times larger than the individual impulses*. These are called *free vibrations*. But if the forces are not applied at the instant of the weight's



Interior View of Discharge Gap. The Discharge Gap Shown Is Adapted for Either Single or Two-Phase Operation. It has No Moving Parts and Is Substantially Noiseless. The Gap Is Very Effective in Producing Strong Oscillations and May Be Employed for the Conversion of Large Amounts of Power Into Oscillatory Currents.

return to center, part of the energy will be lost in heat. These are *forced vibrations*.

Alternating currents, in present day practise, applied to induction motors and transformers, are impeded by resistance, inductance, and capacity; giving rise to these forced vibrations. This condition causes voltage drop, low power factor, hysteresis or iron losses, and eddy current losses. A *synchronous motor* on the line with an over-excited field, furnishes an equivalent of capacity and tends to neutralize inductance and thereby makes the vibrations free. A condenser would do the same, but it would be too large to be practical.

HIGH FREQUENCY ALTERNATING CURRENTS.

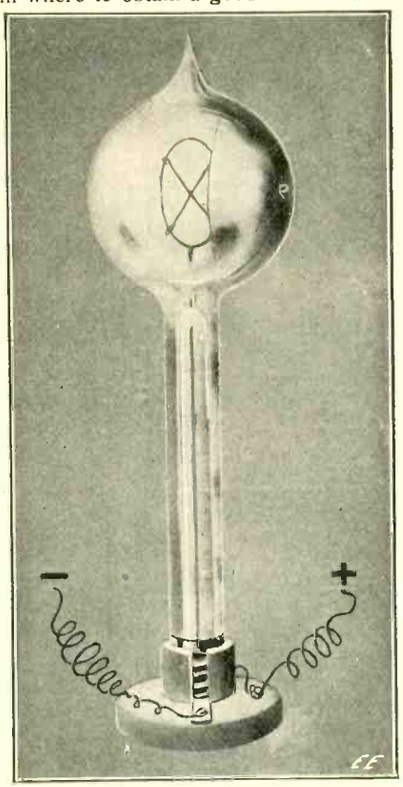
High frequency alternating currents and machinery for producing them are comparatively new. This field of application is not extensive. There has been considerable development on the large scale in wireless telegraphy and telephony. But here the power has not, up to the present time, exceeded a few hundred kilowatts, and it

(*Continued on page* 474)

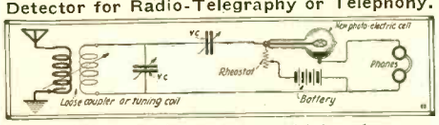
NEWEST ELECTRICAL DEVICES

PHOTO-ELECTRIC CELL SUPPLANTS SELENIUM.

Experimenters in many fields of science, including those interested in astronomy and certain branches of the electrical and radio arts, have very often faced the problem where to obtain a good selenium cell—



New Light-Sensitive Photo-Electric Cell and Below—a Diagram for Using the Cell as a Detector for Radio-Telegraphy or Telephony.



the well-known instrument which, when exposed to light, lowers its electrical resistance, thereby causing a relay connected with it to operate one or more local circuits. Not only was the question of where to obtain the cell often unanswerable, but the best selenium cells which have been available now and then on the American market have left much to be desired. This is so for several reasons. First, the element *selenium*—even tho it possesses a most wonderful natural quality of changing its electrical resistance in proportion to the amount of light thrown on it, and raising its resistance as the degree of darkness is increased—does not do this instantaneously, nor anything like it.

The newest advance in science is the *photo-electric cell.* This device, which has only recently been perfected so as to be available on the commercial market, is shown in the accompanying illustration and diagram. Not only is it useful where *light-operated* circuits are necessary and desirable, but it can moreover be used for receiving radio signals, as its designers have pointed out. Its arrangement in the radio receiving circuit is shown in the accompanying diagram.

The photo-electric cell apparatus is somewhat similar in principle to the selenium cell, in that it changes its inherent electrical resistance in proportion to the amount of light falling upon it. As its designers and builders state, the cell is not liable to lag as in the case of selenium, and there is no dark current whatsoever. It is said to be very constant and reliable in its action, and can be used to great advantage in stellar photometry. The applied potential for this cell is 220 volts. A cell of this type has a wider field of usefulness in many respects than a selenium cell, and it will carry a considerably larger current.

This photo-electric cell is very cleverly made up with a screw base fitting a candelabra socket. The rubidium screen inside the bulb connects to one terminal of the screw base, while a wire leads down from the silvered glass electrode facing the screen to the second contact member of the screw base. All that is necessary in connecting up the cell is to attach the two circuit wires to each of the two terminal screws on the base.

MAKING YOUR OWN FLASHLIGHT BATTERIES.

One of the latest advances in the flashlight art is the home-made battery outfit illustrated in the accompanying photograph. These outfits are priced so as to give about 25 per cent reduction in the cost of the batteries if purchased in the regular way, and each outfit will make three *two-cell batteries* or two *three-cell batteries,* there being suitable materials included to make up six flashlight battery cells. The outfit is supplied in two styles—one battery outfit includes a tubular flashlight, while the second outfit has a renewal equipment only, comprising the necessary parts, chemicals, etc., to make the six single cells as aforementioned.

As the makers point out in their instruction brochure accompanying the battery outfit, one of the principal advantages of this set is that the cells do not deteriorate in the least while they are standing, and so the person using these flashlight batteries has the satisfaction of knowing he is adding from 50 to 100 per cent to the life of his flashlight battery, which ordinarily is wasted, so far as the life of the battery is concerned, by standing on dealers' shelves, and in transit between the factories and dealers.

The liquid solution used in mixing the paste for the cells is placed in a graduated bottle. The proper quantity for each cell is marked off on a graduated label, which shows just what quantity to pour into each cell. Next, a chemical powder is placed in the solution and stirred well with a mixing stick accompanying the set. The carbon element, after being immersed in water for a few moments, is placed down



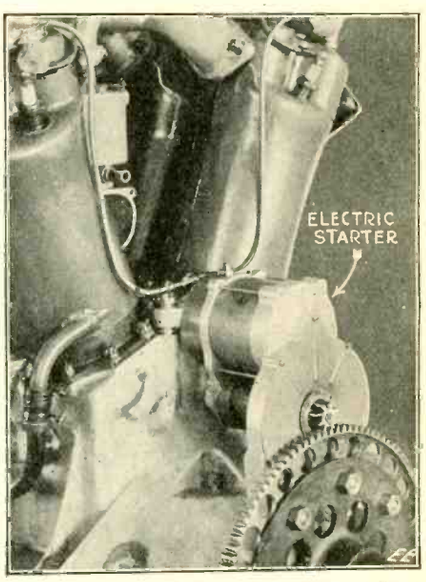
The Latest in Flashlights! Make Your Own Batteries.

into the zinc cylinder containing the solution, which has been thoroly stirred, and by pressing the cork supporting the carbon element down flush with the zinc cup, it is held firmly in place by bending over three zinc prongs. A cardboard cylinder suitable for holding three cells accompanies the outfit.

NC PLANES HAD ELECTRIC SELF-STARTERS.

It is not generally known that the NC flying boats which accomplisht the successful trans-Atlantic flight were the first heavier-than-air machines in this country to be equipt with electric self-starters for each of their big Liberty engine motors.

The result of the Navy Department's decision to so equip its seaplanes undoubtedly aided the success of the enterprise, for the NC-3, lost in the sea and fog near the



The Famous "NC" Planes Had Their Liberty Motors Fitted with Electric Self-Starters, as Shown in the Photo Herewith.

Azores, all her engines stalled, wet and cold, would never have been able to taxi into Ponta Delgada under her own power without the assistance of mechanical means for starting her propellers.

The picture shows this little starter attached to the propeller shaft of one of the big Liberty motors which drove our seaplanes thru the air.

This little device consists of a small 12-volt electric motor operated by a storage battery, connected thru a geared reduction to an automatic screw drive. On the end of the screw shaft is cut an 8-tooth pinion which meshes with a larger gear mounted on the propeller shaft. The starter will turn over the engine at 40 to 50 R.P.M. with a consumption of 100 to 110 amperes and a maximum of 1,300 foot-pounds is available on the engine crank shaft, for breaking loose a cold engine. When the engine begins firing the screw drive automatically demeshes from the crank shaft gearing. The storage battery weighs 26 lbs., and has a rating of 24 ampere-hours—or sufficient to supply enough current to make 150 starts on one charging.

An interesting incident of the American trans-Atlantic flight was that all three planes carried extra propellers, intending if one should break to descend to the water, change propellers, and start off again. They depended on the starter to make this possible.

It is also said that the C-5 (Blimp) met such strong headwinds on her trip from Montauk Point, Long Island, to Newfoundland, that the force of the wind stopt her propellers, and it was necessary to ascend to a higher level to avoid them, the starter with which she was equipt starting the engines while in mid-air.

Photo courtesy Westinghouse Electric and Manufacturing Company.



Even This Chinese Chef Likes to Cook on the Modern Electric Range. Meals Are Prepared on This Range for Workers on a California Ranch.



How Cool and Orderly the Electric Range Kitchen Looks. No Heat Wasted Here in Warming Up the Kitchen and No Smoke, Gas or Smell.

Electric Cookery—A Snap!

By GRACE T. HADLEY

Society for Electrical Development

THE history of human culture might be said to be largely the science of food preparation. Thru the ages the arts of fire were slowly developed. Wood, coal, oil and gas have been successively used in the production of artificial heat for the purpose of cookery. Until the last century fire was the most useful thing in the service of man.

To-day electricity is doing all that fire ever did, and is doing it better. Electric cookery is as superior to fire cookery as the electric light is to the tallow dip. Electricity is performing tasks beyond the limits of flame. Fire to-day yields motive power with many times the economy it did one hundred years ago. This motive power is the source of modern electric currents. This power as electric current enters silently and swiftly into the modern home and is the source of electric heat in the modern cook stove.

As refinement of living increases, electric cookery solves the problem of easy control, of elimination of waste, the uncertainties of temperature. The heat can be regulated with almost mathematical precision. When it is no longer needed the current can be turned off and no waste occurs. The time is close at hand when cookery will cease to be carried on by "guess-work." Many women already realize that it pays to put this work on a more scientific basis.

The temperature factor in cookery is one that ought to be thoroly standardized. In the art of baking a loaf of bread, for instance, there are many factors that must be precise, in order to insure best results. There is no reason, if conditions are exactly the same, especially temperature conditions, why the cook should not be successful with her baking, regardless of "wind in wrong direction."

The objects of cookery are to render food more digestible, to make the food more appetizing and to improve its appearance. In the cooking of animal food, the improvement of appearance and flavor is most important. Cooking foods rich in protein may decrease digestibility to some extent, but the increased attractiveness of well-cooked meat may render it more digestible by causing greater flow of digestive juices.

ROASTING.

Roast Beef.—Remove the baffle plate. Turn both oven switches to *High* and let oven heat twenty minutes. Place the roast on the rack in the dripping pan, rub with salt and dredge the meat and pan with flour. Put in the roast to sear for about four minutes to each side. Then put in the baffle plate and turn *lower* oven switch to *Medium*. After twelve or fifteen minutes turn the *upper* oven switch to *Medium*. The total time of roasting should be fifteen minutes to the pound. If the meat is lean, put drippings or hot water in pan for basting.

There is said to be a saving of about 15 per cent in roasting meat electrically. Considering the price of meat to-day, this is quite an item. The following actual test of a 4 pound roast is interesting, illustrating the exact steps in the process of roasting the meat and the actual loss of weight by shrinkage:

Weight of roast, 4 pounds.

Preheat oven to "4," requiring twelve minutes at 110 volts.

Prepare roast; turn upper unit off.

Roast on "Full" five minutes per pound (lower unit).

Roast on "Medium" five minutes per pound (lower unit).

Roast on retained heat one hour.

Weight after roasting process, 3 pounds, 7 ounces.

Time of roasting, 1 hour 40 minutes.

Watts, 990.

Roast Chicken.—Turn the oven switches on *High* for twenty minutes in advance. Rub the chicken over with soft butter and salt, dredge chicken and pan with flour. When the flour is well browned reduce the oven heat to *Medium;* baste well. When the breast meat is tender the chicken is sufficiently cooked. A chicken requires about one and a half hours, or about twenty-three minutes to the pound.

BAKING.

Biscuits.—The best results are obtained by having a hot oven to start with, so turn oven switches on *High* for thirty minutes in advance. If pans are placed on middle grate the biscuits will bake an even brown on top and bottom in ten minutes. If placed on the top grate the pans will need changing to the bottom grate as soon as the biscuits are well browned on top. Leave the oven switches on *High* during entire baking.

Bread.—Turn oven switches on *High* for thirty minutes in advance. The loaves should begin to brown in the first fifteen minutes of baking, after which the heat should be reduced to *Medium* for thirty minutes.

Muffins.—Turn over switches on *High* for twenty minutes. Bake twelve to fifteen minutes on *Medium* heat.

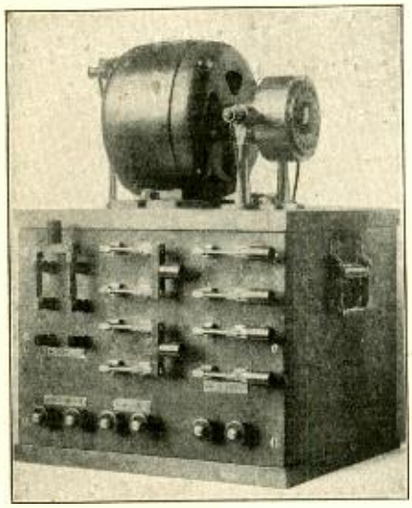
Sponge Cake.—Place the cake in a cool oven. Turn the oven switches on *High* for ten minutes, then to *Medium,* and bake from thirty to forty minutes longer. The cake is done when it falls back to a level and springs to the touch.

Cup Cakes and Pastry Shells.—Turn the

(*Continued on page* 451)

New Things Electrical

A NOVEL ELECTRIC FAULT LOCATER.



A Novel and Efficient Fault Locater for Electrical Testing of Cable and Transmission Circuits. It Detects and Locates Faults On Cables Carrying As High As 15,000 Volts.

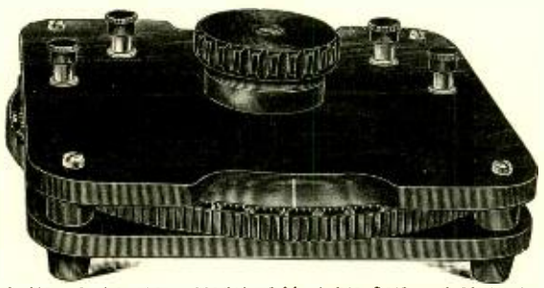
The new electric *fault locater* is a device designed for the purpose of locating all kind of faults that are inherent on overhead electric lighting and power lines carried on poles, and also on lead covered cables insulated with paper, rubber or cambric, which may be drawn into underground conduit systems.

The device is claimed to be capable of detecting and locating the faults upon cables carrying a working pressure up to 15,000 volts, alternating current, 60 cycles frequency. This apparatus is fitted with a special analyzer and interrupter.

Another valuable feature of this apparatus is that it readily locates grounds and short-circuits on steel taped armored cable, two or three conductor, laid directly in the earth.

A VARIABLE SELF AND MUTUAL INDUCTOMETER.

The inductometer illustrated herewith consists of two pairs of stationary coils and one movable coil, the latter being mounted on a disk placed between two outer plates holding the stationary coils. The disk may be rotated and has two scales, one calibrated in millihenries reading self-inductance and the second in degrees. The instrument is ordinarily provided with a maximum inductance of 50 millihenries, but instruments with higher maximum values or lower values can be obtained.



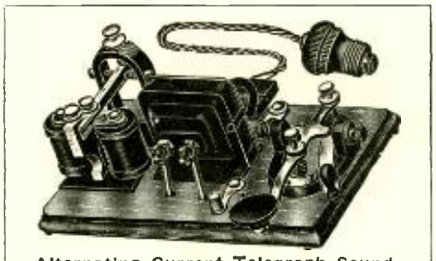
A New Laboratory Model of Variable Self and Mutual Inductance, Having a Maximum Inductance Value of 50 Millihenries. Larger Sizes of the Inductometer Are Available.

The inductometer has six link-shaped coils. The four fixt coils are mounted in pairs in the two outer fixt plates, which are held together by four screws and separating pieces to form the body of the instrument. The two movable coils are mounted on the inner disk and are placed with their long axes at right angles to a diameter. The outer plates and the disk are made of molded bakelite. To use the instrument as a variable mutual inductometer the fixt and movable coils are used as primary and secondary respectively and no connection is made between them. The mutual inductance is found by subtracting a constant from the scale reading and dividing the remainder by two. This constant is given with each instrument, altho it may be readily determined by the user at any time. It is claimed that errors due to stray field effects are eliminated and that the meter has a desirable ratio of maximum inductance to minimum inductance.

ALTERNATING CURRENT TELEGRAPH INSTRUMENT.

This A. C. telegraph instrument consists of A. C. sounder, steel lever key, and step-down transformer, mounted on base, as shown in illustration, with cord and attachment plug. No battery is used with it. It can be used on the 110 volt, 60 cycle alternating current lighting circuit by screwing the attachment plug into lamp socket.

Two or more instruments may be connected in series, just the same as instruments with batteries, by attaching the primaries of the transformers in multiple to the 110 volt 60 cycle lighting circuit with the secondaries and the sounders all in series. which is done by simply screwing the attachment plugs into lamp sockets and connecting the instruments in the usual way, thru their binding screws or terminals. Two terminals or binding posts and a single point switch are mounted on the base of each instrument.



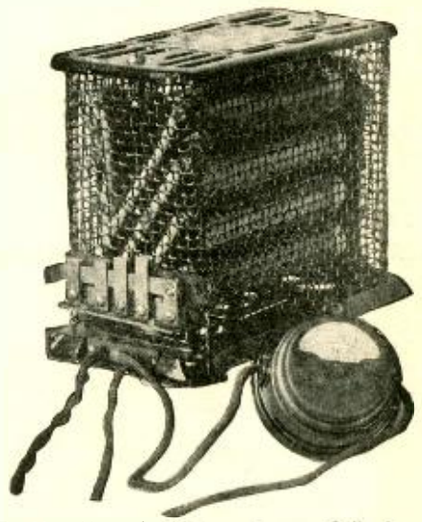
Alternating Current Telegraph Sounder, Key and Step-Down Transformer. Operates by Plugging In On Any 110 Volt, 60 Cycle A.C. Lighting Circuit.

In working two or more instruments on a line, polarity of impulses must correspond. If instruments work independently (with switches closed) but do not work together with the switches open, simply reverse one of the connecting blocks and they will respond properly.

When it is desired to operate two or more instruments on a line, the terminals are used for connecting the instruments in series: when used this way, the single point switches should be left open. Closing a switch localizes the instrument, so that it can be used for practise without interfering or being interfered with by other instruments on the line.

These alternating-current telegraph instruments are coming rapidly to the fore in commercial as well as private practise. They save the initial expense and the heavy maintenance cost of batteries.

NEW D. C. BATTERY CHARGING RHEOSTAT.



Do You Have to Charge Storage Cells from Direct Current Circuits? If So, You Will Find Extremely Valuable This Latest Battery Charging Rheostat and Ammeter. A Switch Varies the Current Strength.

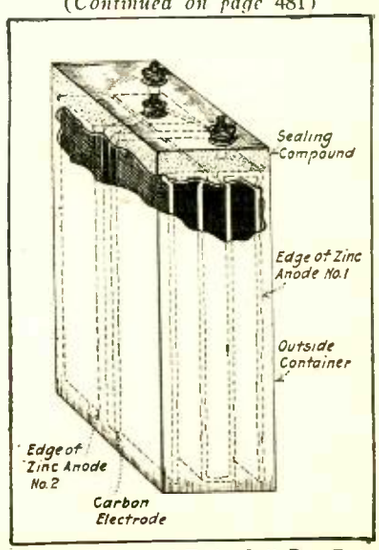
It is the purpose of this new charging rheostat to control the flow of direct current thru the battery, where the voltage of the charging circuit or line is much higher than that of the battery to be charged. This is done by means of a series of special high resistance coils made up in portable form, together with a current regulator switch giving charging rates of 1½, 3, 4½ or 6 amperes.

The voltage range of the rheostat takes in a single cell of battery up to 9 or 12 cells of 18 or 24 volts. The back pressure from a battery of higher voltage than this would cause a slight reduction in the ampere charging rates.

TWIN CELL DESIGN OF DRY BATTERY.

A new design of dry battery which is known as the "Twin Cell" is here illustrated. This design as shown in the illustration contains three electrodes, one positive flat carbon electrode, 7/16 in. thick by 1¾ in. wide, by 6 in. long, and two negative electrodes,

(*Continued on page* 481)



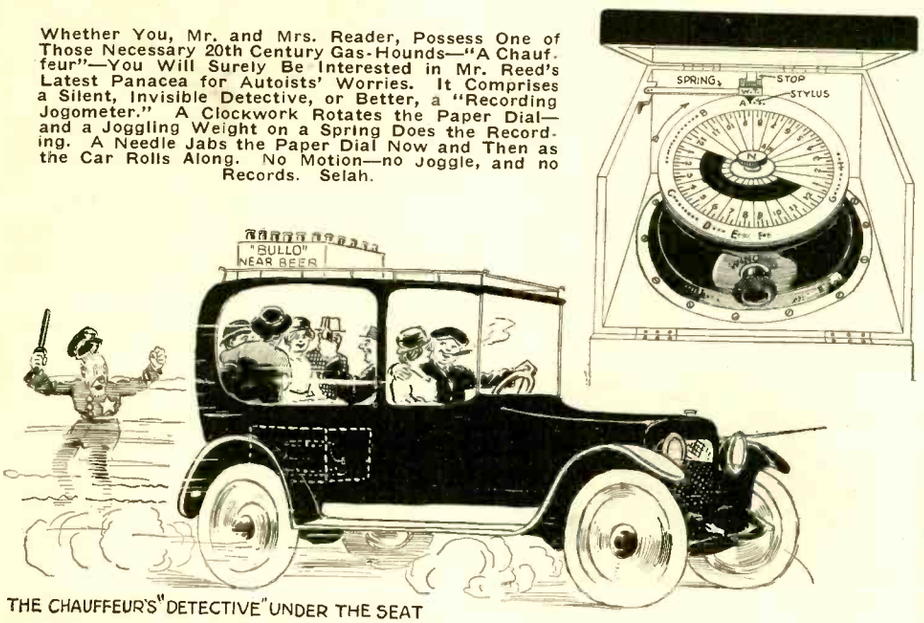
Novel Design of Twin-Cell Dry Battery. It Develops a Voltage of 1.5 to 1.55 Volts On Test and On Short-Circuit a Current of 35 Amperes.

Recording Your Chauffeur's Joy Rides

By Thomas Reed

MY neighbor, Theophilus Marbleback, had a chauffeur named "William," which innocent-sounding name was camouflage for a most guileful nature. "Circumstantial evidence" indicated that he was much addicted to joy-riding, and "Marbleback" desired me to invent an instrument for recording, unknown to "William," the moments devoted to this practise. He said that keeping tabs on the speedometer register was useless. That usually reliable instrument recorded only sorrows, not joys, for "William" deftly disconnected it during his mirthful moments. He didn't disconnect the gasoline bill, which came in at the end of the month robust and hearty, showing (if you integrated it only with the legitimate journeyings) a mysterious mileage of about five to the gallon; but apart from that, he was a busy and efficient little disconnector, and I was advised that my detecting device had better not depend upon the car's mechanism in any way, or it would be sure to reverse the excellent principle of the cascaret, and *sleep while "William" workt.*

Whether You, Mr. and Mrs. Reader, Possess One of Those Necessary 20th Century Gas-Hounds—"A Chauffeur"—You Will Surely Be Interested in Mr. Reed's Latest Panacea for Autoists' Worries. It Comprises a Silent, Invisible Detective, or Better, a "Recording Jogometer." A Clockwork Rotates the Paper Dial—and a Joggling Weight on a Spring Does the Recording. A Needle Jabs the Paper Dial Now and Then as the Car Rolls Along. No Motion—no Joggle, and no Records. Selah.



THE CHAUFFEUR'S "DETECTIVE" UNDER THE SEAT

"Marbleback" had a grand theory that if he could once get the goods on "William"—show them to him all registered up on some neat mechanism that would appeal to his fancy—the faithless "gas-hound" would be touched with repentance and mend his punctured conduct. Of course it was a perfectly chimerical idea, because the only result of touching a chauffeur is to make him leave you and go jumping off over the landscape looking for another car-owner who is sane and normal, and will stand for the things he has to stand for. Still, the problem interested me by its very difficulty. You know, if you have a certain amount of success in dealing with relatively simple things like high-frequency currents, you get sort of cocky, and feel like tackling a really complex and baffling job like putting something over on a chauffeur. So I took the matter under advisement.

Falling into the glassy-eyed and muttering condition common to inventors, my reflections were about as follows: "H-m, recording-thing got to move whenever car's going. What'll move it? Can't use gas-explosions, spark-discharges, rotation of wheels; 'William' put kibosh; must be concealed from 'William.' What other motive-power inseparable from car in motion? Aha, rush of air! Nix. 'William' spot anemometer, stick match in works. Oh, hum. What? Say, that's the system—the joggle! Some joggle always present, even on smoothest roads. Pervades every part of car. Hidden joggle-recorder what's wanted. A 'jogometer'—how's that?"

Fig. 1 shows the *recording jogometer* complete. It's an auto-clock in a locked box of strong "William"-resisting material (3-inch armor plate will do) attached immovably inside the tonneau, or caboose, or whatever you call that part of the car where the passengers sit. The clock has no hands, but the hour-arbor is adapted to carry a paper dial, printed with time-divisions, which can be changed by unscrewing the nut N. The hand-gears must be altered so that the dial will revolve once in 24 hours instead of the usual 12.

Poised over the dial is the weight WT, attached to the end of a thin flat spring, free to vibrate between the dial and the stop placed just above. The lower side of the weight is sharpened off into a point, which embosses the paper dial as the weight drums upon it under the influence of the car's vibration.

Now then, let's conduct "William" thru a sample day, and see how it works. Look at the short line of dots "A" between 8.15 and 9 a. m. That's "Marbleback" riding down to his office on a bright sunny morning, full of hope and "pep."

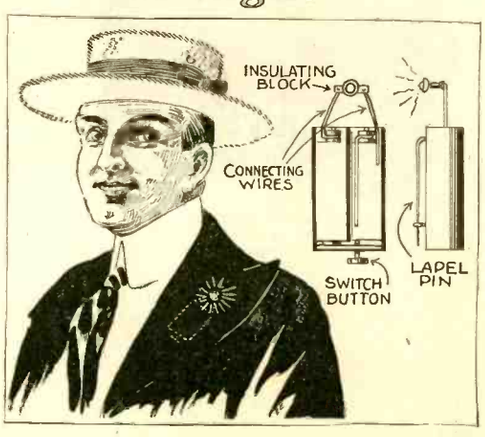
"B," from 11 to 2, shows Mrs. Marbleback shopping among the stores and beauty-parlors, flitting like a bee from flower to flower, so busily that the line appears continuous, and releasing with each fairy touch a little bill, which wings its way toward "Marbleback's" office.

At 2 o'clock ("C") she goes to the matinee, and the car is quiet till 4.30 ("D"), when she takes a turn around the park to see if any fashions have escaped her, calls for "Marbleback," and brings him home before he can "contract" any poker-games or leg-show stare, arriving at 5.30.

Now sound the "creepy music," for here is where the sleuthing starts. On the day in question, the "Marblebacks" past the evening at home, and from the point "D" onward, the record should have been a blank. But what do we see? the telltale arcs "D," "E," "F," "G," and "H," which betray "William's" nocturnal society life! Naughty, naughty "William," we are onto you! At "D," after an hour in the garage to make sure of dismissal, you were riding home to supper. Snatching a hasty meal, you hied yourself at 7.30 ("E") to the home of your blonde enchantress—Sadie Spasm, coffee-pusher and near-movie-queen. But from 8.45 onward ("F") whither, oh whither tends this hour's continuous journey, while Sadie leans back on the silken cushions, with all the inside lights lit, rehearsing "Theda Bara" on her way to the Duke's warehouse after another keg of pearl necklaces? Whither, prithee, but to the Rat's-Nest Inn, hospitable home of the joyous jazz, 40 short miles adown the pike. That blank till 1 a. m. means soup on the tablecloth at Childs' tomorrow, "William," beans for the gent who ordered "ham and," and for you a "head," a grouch, and perchance the can; but what boots it when youth and beauty drive? At "G" the relentless *jogometer* pictures "Theda" returning with the keg and "William" with the jag, and at "H" the car garage-ward plods its weary way. Selah!

A Button-Hole Flashlight

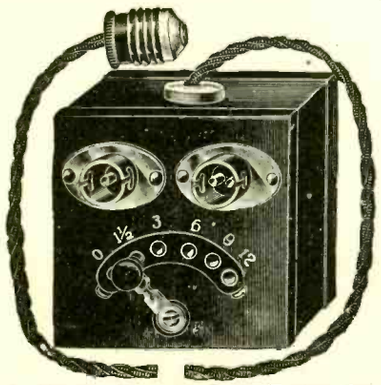
One of the latest innovations in the always convenient and invaluable electric flashlight is the one here illustrated, which fits in your coat lapel. A patent was recently issued to Mr. Edwin Frank Thomas of Meriden, Conn., on this extremely small model flashlight, which operates on a specially built and very compact style of dry battery. The casing holding the battery is fitted with a lapel pin of the same form as that used on brooches and other jewelry, enabling the wearer to easily attach the flashlight to the coal lapel or other garment. The lamp is turned on and off when desired by a simple turning of the switch button fitted in the bottom of the battery casing. The battery is a two-cell unit, and current is carried to the miniature incandescent lamp thru the supporting wires in the manner apparent.



Try These on Your Auto

AUTO BULB-TESTING DEVICE.

A new electrical automobile lamp-testing device is here shown. The tester is designed for all sizes of auto electric lights



A Handy Electric Bulb Tester for Private or Dealer's Use.

fitted with Ediswan bases. When a dealer sells an electric light bulb, he can test it before the customer's eyes, showing that the bulb is good and obviating any dispute afterward when the purchaser puts it in his car and happens to burn out the bulb thru some fault of his own.

PUSH THE BUTTON AND GET YOUR "GAS."

In the accompanying illustration an electrically operated outfit is shown which is intended for use in garages and service stations for pumping gasoline. This outfit is electrically operated, and is controlled by a push-button switch. The electrical control is arranged so that when the push-button is deprest, the pump continuously discharges gasoline at the rate of 25 gallons a minute, or may be reduced to a mere drip. When the button is released, the pumping stops automatically. The rate of flow is regulated by a speed control handle. The electric motor provided is enclosed in a strong iron case which is impervious to moisture or gases, permitting the outfit to be located out of doors. A large filter is built into the outfit to remove water and foreign matter which may be in the gasoline.

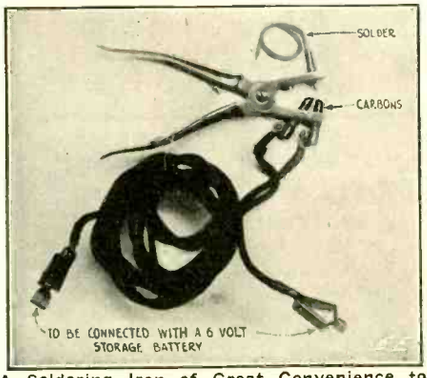


I Want 5 Gallons of "Gas." Alright, Deposit Your Coin, Push the Button and Get Your Gas.

A NOVEL 6-VOLT SOLDERING TOOL

This new soldering tool, which has recently been patented, embodies some features never before employed in an electric soldering device, its inventor claims. The one shown in the photograph is made to be attached to a 6-volt storage battery. It can even be attached to the storage battery in an automobile, or on ordinary lighting voltages in connection with a step-down transformer.

All of the heat is applied at the exact point where it is needed, and just for the instant needed, so it does not require one-tenth of the electrical energy that is used by other soldering irons of equal capacity. One of the features which appeals to the user is that it is always ready for instant use; no waiting to heat up the tool before it can be used. Wire can be soldered together in less than 10 seconds; it is not only soldered but sweated right in.



A Soldering Iron of Great Convenience to Autoists. It Works on a 6 Volt Storage Battery.

This soldering tool is light and simple in construction and the solder is always ready for instant use, as it is carried in the tool.

YOU CAN LOOK RIGHT INTO THIS BATTERY

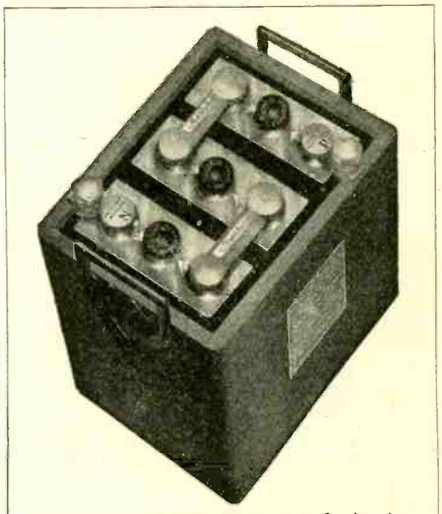
No one would think of buying or living in a light-tight, windowless house. Windows in a storage battery are just as essential. Every battery user will easily recognize the importance of knowing the exact condition of his plates and separators and the quantity of electrolyte in the battery at any moment. This great improvement in storage battery design makes it possible to know always what is going on inside your battery.

In the ordinary storage battery each cell has a hard rubber cover, and when the cells are sealed into their case the only possible view of the interior is thru the small vent hole in the cover. No satisfactory index to the condition of the vital parts can be obtained in this limited way.

The new storage battery here illustrated has a strong transparent cover on each cell. This window is actually stronger than the hard rubber used on other batteries, so there is even less danger of breakage. It is not affected by acid, and the tops and connections can be more readily kept clean and free from corrosion.

The solution, or electrolyte, in a storage battery must always be kept about ¼ inch (but no more) above the tops of the plates. Under no circumstances should the plates be allowed to project above the liquid.

Peep thru the window in this battery and



How High Is the Electrolyte? Look in the Window and See.

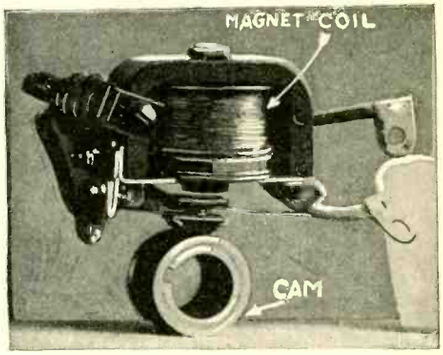
two red arrows will be seen projecting inward from the terminal posts. These indicate the exact level to which the electrolyte should rise in the cell.

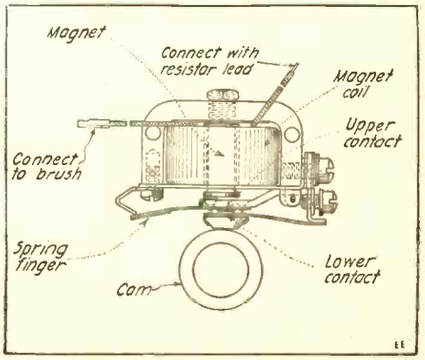
A NEW CAM REGULATOR FOR AUTO DYNAMOS.

By William H. Easton.

Every automobile electric generator must have some means for keeping its voltage fairly constant under all normal operating conditions. Without such a device, the voltage would vary with every change in the speed of the engine and every alteration in the load of the generator and the current generated would be useless for either lighting or battery charging.

(*Continued on page* 483)





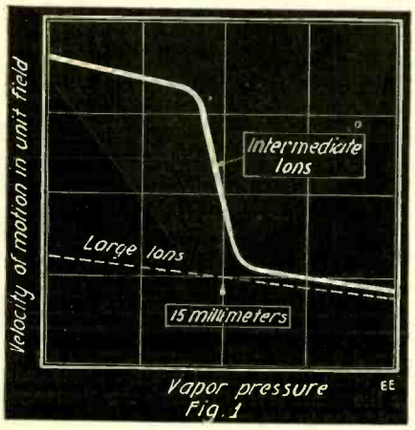
The Simplest Auto Generator Regulator for Maintaining Constant Voltage—a Magnetic—Cam device. Can Be Used With or Without Storage Battery.

The Mystery of Atmospheric Electricity

By ROGERS D. RUSK, M. A.
Late of the Meteorological Section, U. S. Army Signal Corps.

The Physics of Nature's Electricity Simply Explained

THE air is in a continual state of electrification because it contains at all times small particles charged with electricity. Even the scientists themselves do not know just what these particles consist of because they are different from the electrified particles found anywhere else. We are seldom aware of the existence of these particles because of their very small size and due to the further fact that all bodies at or near the surface of the earth *are at practically the same potential as the earth.* However, if all the electricity in the air could be collected for use at one time, there would be more, by far, than we would know what to do with. Benjamin Franklin startled the scientists of his day by bringing lightning down on a kite string, but we can go him one better today.



This Curve Shows Clearly How the "Intermediate" Ions of the Air Change Their Velocity Like Magic at 15 Millimeters Vapor Pressure, and Become "Large" Ions. An Interesting Discussion on This Phenomena Is Here Presented.

ELECTRICITY OUT OF A CLEAR SKY.

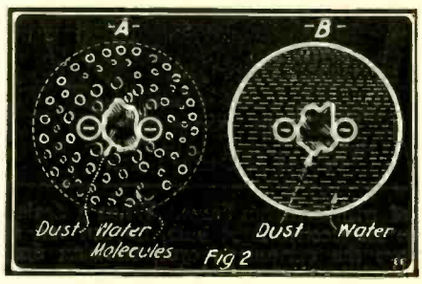
Even on the clearest day, if we send a kite up a few thousand feet, a distinct difference of potential can be noticed between the ends of the kite wire, often enough to give a severe shock. The cause of this electrification has been the subject of much discussion, but the biggest problem is to find just what these minute charged particles consist of.

Ions or small particles charged with electricity can easily be produced in most any gas by means of an electrical discharge or by the influence of X-rays or radium, but the ions found in the air are different from these; in fact, they are different from those found anywhere else, hence it is that they present a puzzling problem to the scientist. In general there are three types of ions which are found in the atmosphere called the *large, small and intermediate.* The small ones which have been known to exist for a long time are the same as those produced in any gas by the means above mentioned. When either an electric discharge, X-rays or radium rays causes an electron or element of electricity to be detached from an atom or molecule to which it belongs, then it leaves that atom or molecule charged with the same amount of electricity of the *opposite* sign, and the charged particle is called an *ion.* Sometimes these particles group themselves together, thus forming ions of larger size. Instead of these, however, there are still larger ions found in the air which could hardly be formed from even large groups of small ions, for reasons to be mentioned later.

The larger ions of the air and the intermediate ones are closely related and are the ones which so far are puzzling the scientists. Aitken, whose work along this line is justly famous, believes that the larger ions of the air are not aggregations of smaller ions, because when the smaller ions are formed by radium in a dust-free gas, the larger ions never appear. For this reason he believes the larger ions are really *dust particles* which have caught a charge of electricity. The word dust, however, is a convenient word to cover up our ignorance of just what the large ions actually are. In fact, they exhibit some properties which make them very interesting, and which show that they are far from being simple particles of dust.

WHAT ARE ATMOSPHERIC "DUST" PARTICLES?

These *dust particles,* if they are such, must not be confused with ordinary wind dust particles such as those blown up from a street. They are much finer and smaller, so much so in fact that they are capable of remaining suspended in the air for a very long time. Such particles are too small to be detected by ordinary means of observation and they can best be observed and counted by the famous *cloud method.* This method is to take a sample of the air and put it under reduced pressure which allows it to expand until the moisture in the air begins to collect around the *dust nuclei,* making them visible. In determining the relative size of the original particles another method must be used, and that is to compare their *mobilities. The mobility of an ion is its rate of motion in an electric field of one volt per centimeter, and is a measure of its mass.* The larger the mass the slower the particle will move under the given force.



A.—An Intermediate Air Ion Consisting of Negatively Charged "Dust Particle" Surrounded by Dense Atmosphere of Water Molecules.
B.—A Large Ion Formed by Water Vapor Condensing to a Liquid About the "Dust Particle."

By this method the larger ions are found to be *over a thousand times larger than the small ions and the intermediate ions about half way between.* It is argued that if these were *dust particles* only, then all sizes would be found instead of *three* distinct types. Recent discoveries tend to show there is something more than dust and electricity in the large ions and that it is this something else which causes the formation of the large ions which are not found anywhere else. It is all due to the discovery, a few years ago, that water vapor may condense in two ways on a rigid surface under certain conditions. Either it may condense in the ordinary way as a pure liquid, or it may condense more slowly and form a very dense atmosphere of separate water molecules about half way between a gas and a liquid, which will suddenly change to a liquid with an increase of the vapor pressure.

Now the significant thing is that if the mobilities of the ions are measured carefully while the pressure of the water vapor in the gas is being increased, a point is reached where the intermediate ions suddenly begin to move slowly like the large ions as shown in Fig. I, and this has suggested to J. A. Pollock and others the following explanation: The larger ions and the intermediate ones are formed of minute, rigid dust-like particles about which a small amount of water vapor has already started to condense. About some of these

(*Continued on page* 473)

October Number of the Electrical Experimenter

A New American Salvaging Machine with which hundreds of vessels sunk during the World War will be raised. A description with elaborate illustrations, prepared by an engineer who walked on the bottom of Long Island Sound in this marvelous machine, by Joseph H. Kraus.

Do Radio Waves Produce Sparks in and Ignite the Gas in Balloons and Dirigibles? This question is answered by an Electrical Expert of high standing.

Sun Spots and the Observatory That Photographed Them—an especially interesting article, by Isabel M. Lewis, of the U.S. Naval Observatory.

Treasure Ships Located by Electricity, by H. Gernsback.

Making a Machine for Telegraphing Pictures—Part 2, by Leroy J. Leishman, Telephotographic Expert.

Investigating Psychical Phenomena with Scientific Instruments, by Hereward Carrington, Ph.D.

"Jerry Up," a thrilling tale by an American searchlight electrician who served in France, by Charles K. Fankhauser, Jr.

Radio Problems in Aviation, by Edward Rice Doyle, late Lieutenant U. S. Army Air Service, U. S. A.

Magnetic Storms—how sunset, wind and other weather phenomena actually cause "magnetic storms," by Prof. Lindley M. Pyle, Department of Physics, Washington University.

How Science Applies the X-ray to Numerous Industrial Problems.

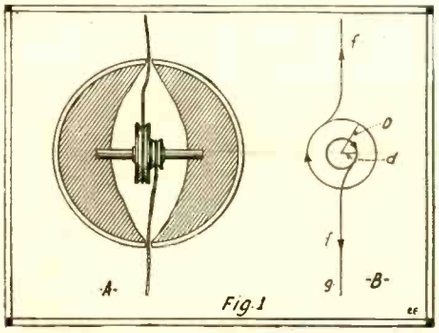
Electric Automobile to Compete with Gas-Driven Vehicles, written by its designer, Harry E. Dey, E.E.

Experiments in Physics

By JOHN J. FURIA, A. M.
DEPARTMENT OF PHYSICS, N. Y. UNIVERSITY

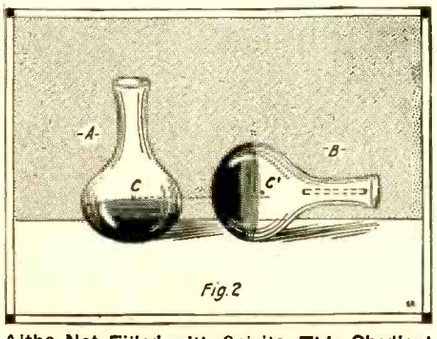
2--Illusions

PRACTICALLY all of the so-called "illusions" that are brought before the public, whether on the stage, at private entertainments, or sometimes in swindles, are based on fundamentals of physics. Hence it is fitting in a series of articles on "Experiments in Physics" to deal with this topic. Illusions may be divided into four classes: (1) Optical, (2) mechanical, (3) chemical, and (4) slight-of-hand. The first two types are of especial interest to us from the standpoint of pure physics.



The "Obedient Ball" and How It Is Made from a Wooden Crochet Ball Hollowed Out as Shown. In This Space Are Placed Two Small Silk Spools with Strings Attached. The Ball Rises or Falls on the String at Command.

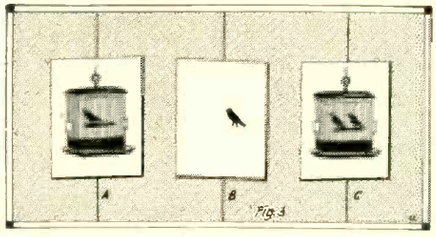
Perhaps the most mysterious of the magician's tricks, and one which appeals to all boys, is the *obedient ball.* All ball players appreciate the value of an obedient ball, especially the kind of ball that will "come to papa." As usually presented to the public from the stage the magician passes a piece of string thru the center of a good sized wood ball and then holds the string vertical. At his command the ball slides up the string, down the string, or else remains stationary. The *obedient ball* can be easily made at practically no cost. Divide a crochet ball in half by the use of a very fine saw. Carve out enough of the insides so as to have enough room for two small silk spools to revolve freely, see figure (1) A. The spools are glued together and fastened to the inside of the crochet ball by a dowel rod used as an axle. String is wound around each of the spools and the ends led out thru holes at the end of a diameter of the ball, perpendicular to the axle. The ball is glued together, sandpapered, stained and shellacked, and if a good job is made of it no one will suspect that the ball has been cut open.



Altho Not Filled with Spirits, This Obedient Bottle Will Lie Down and Stay Down Only for Its Master—the Magician. How Does It Work? Read on!

Figure (1) B explains why the ball will rise, fall or stand perfectly still. If the string is held loosely, the ball will fall, due to the pull of *gravity* on it. As force is applied to the ends of the string, gradually a point will be reached where the force of gravity is just overcome by the advantage gained by pulling the upper string (since the diameter of the spool to which the upper string is attached is larger than the diameter of the spool to which the lower string is attached). Greater force will cause the ball to move upward. It should be noticed that as one spool winds the other unwinds in each of the cases where the ball rises or falls. Hence the total length of the string in view changes according to the difference in the diameters of the spools. It remains for the performer to detract the attention of his audience away from this fact. The illusion is one of pure physics, more particularly mechanics. The equation for the motion may be written as follows:

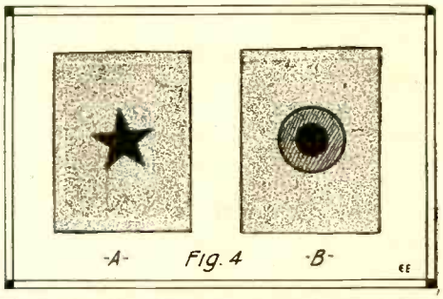
Let g represent the force of gravity, f the force applied to the string by the performer, and D and d, respectively, the diameters of the spools. $Df - d(g + f)$ causes the motion. When f is zero (when the performer holds the string loosely) the tendency to move upward (Df) is zero and tendency to move downward is dg, and the ball moves downward. When f is such that $Df = d(g + f)$, the tendency to move upward equals that to move downward,



If Two Cards Are Drawn to Resemble Figures A and B, Placed Back to Back on a Cord and Then Spun Rapidly, Two Birds Will Appear in the Cage, as at C.

and the ball remains stationary. When f is large enough so that Df is greater than $d(g + f)$, the tendency to move upward is greater than that to move downward, and the ball moves upward.

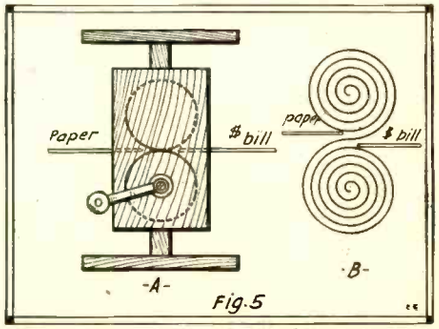
Speaking of the *obedient ball,* the event of July 1st (last) leads us naturally to the *obedient bottle.* A small wood bottle (empty since July 1st) of the shape indicated in figure (2) A, is placed on the table and told to "lie down—and stay down," and the bottle does so. (Nothing remarkable.) The performer then picks up the bottle and passes it around, defying anyone else to cause it to "lie down—and stay down"! No one is able to do so. The performer then takes the bottle again, coaxes it and causes it to lie down as before. This is another case of pure physics, more particularly mechanics. The bottle is weighted with lead as shown in figure (2) A, so that its center of gravity C is very low. It is seen from figure B, that placing the bottle on its side causes the center of gravity to be raised to the position c'. It is well known in mechanics that a body is in stable equilibrium (will return to the same position when displaced) when its center of gravity is at its lowest. Hence it follows that the bottle will always return to its stable equilibrium position (standing up). How, then, does the performer cause it to lie down. He keeps concealed up his sleeve or "palmed" a long narrow weight which he slips into the neck of the bottle whenever he wishes it to lie down. The addition of this long narrow weight causes the center of gravity for the upright position of the bottle to be high, so that placing the bottle on its side causes the center of gravity to be lowered; hence this will now be the position of stable equilibrium. In picking up the bottle before passing it to the audience for examination, the performer allows the weight to drop back into his hand again.



An Interesting Illusion Experiment Based on the Persistence of Vision. A Black Star Drawn on a Blank Card, When Spun Rapidly, Will Change Into Two Circles—One Gray and One Black.

In order not to disappoint those accustomed to "seeing double," the following is inserted for trial any time after July 1st. Draw a bird in a cage on one side of a blank card. On the *reverse* side draw another bird. Attach a piece of thread to the top and bottom of the card and twirl the card about this thread as an axis. TWO *birds will be seen in the cage.* Many variations of this illusion can be tried. The cage alone on one side and the bird on the other; a glass of "Bevo" on one side and an open mouth on the other, etc., etc. The result obtained is due to physiological rather than physical reasons. The phenomenon is known as *persistence of vision.* The retina of the eye retains any image thrown upon it for a moment after the object has been removed. Hence when

(*Continued on page* 479)



Making Money by Magic. A One-Dollar Bill Run in One Side of the Machine Comes Out a Ten-Dollar Bill, or a Piece of Paper Changes Into "Real Money." Ain't It Wonderful? Yes, It Is—NOT!

Practical Chemical Experiments

By ALBERT W. WILSDON

Cleaning and Washing Agents
Part II

WATER and a few other solvents are commonly used to remove dirt, sometimes called "matter out of place." Some of these substances readily dissolve in water; others like the fats, will dissolve in ether



Fig. 1

Showing the Simple Apparatus Required to Perform Experiment No. 1. A Bunsen Burner, a Beaker, Tripod, Gauze and Heating Dish.

or gasoline; and still others, for instance the resins, will dissolve in alcohol. Some form of alkali, such as wood ashes, was formerly used with the water, to assist in removing the dirt. This, it was discovered, possest a very destructive action upon the goods, so a *saponified* fat, the product produced by the action of an alkali on a fat, or what we now call *soap,* came into universal use. This, as is well known, when made of good materials will not injure the goods. Soap was used instead of lye from the lixiviation of ashes, long before the chemistry of the process became known. It was not until 1813 that Chevreul publisht his scientific researches on the composition of fats and the processes of soap-making.

Manufacture of Soaps.

The raw materials used in the manufacture of soap are an alkali known as *caustic alkali,* which may be either sodium or potassium hydroxid. The sodium hydroxid will produce a hard soap, while the potassium hydroxid produces a soft soap. These are made by boiling the carbonat with slaked lime, following out the equation

Sodium Carbonat + Calcium Hydroxid = Calcium Carbonat + Sodium Hydroxid.

From this mixture the calcium carbonat settles out, and the solution of the caustic alkali is boiled down to a solid, and is put upon the market under the name of *concentrated lye,* or the concentrated solution is used directly by the soap-maker.

Recently the caustic soda has been made directly by the electrolysis of sodium chlorid. The sodium deposited at one pole is dissolved in water, and the chlorin is used for making bleaching powder.

The second ingredient of a soap is either a vegetable or animal fat or oil, or a resin. Such oils as that of the palm nut, cocoanut,

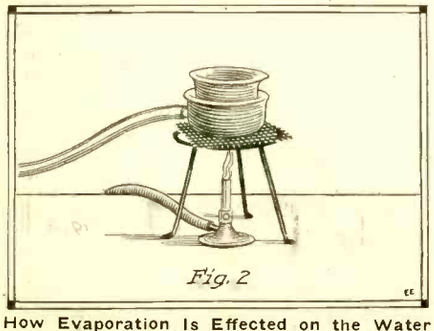


Fig. 2

How Evaporation Is Effected on the Water Bath of the Solution Obtained from Experiment No. 1. Apparatus Shown Is Used in Experiment No. 2.

olive, hemp seed, linseed, cotton seed, fish or lard may be used, and fats like beef tallow, mutton tallow, lard, or house grease.

The process of *saponification* may be occasioned either by the action of water or steam at high temperatures and pressure (especially in the presence of a dilute mineral acid), by the action of caustic alkalies, or sometimes by the use of lime. The fats may be briefly described as consisting of ethers of the triatomic alcohol-radical, containing *glycyl.* By treatment with alkalies or high-pressure steam, they yield *glycyl alcohol* (glycerin) and stearic or other fatty acid. The name given to the compound of the acid and glycerin is *stearin, palmitin,* or *olein.* In the case of stearin, the equation representing the saponification would be:

$$\underset{\text{Stearin}}{C_3H_5(C_{18}H_{35}O_2)_3} + \underset{\substack{\text{Caustic}\\\text{Potash}}}{3KOH} = \underset{\text{Glycerin}}{C_3H_5(OH)_3} + \underset{\text{Soap}}{3KC_{18}H_{25}O_2}$$

With palmitin or olein, the reaction is similar. If the fat or oil is solid, it contains a preponderance of stearin or palmitin, but if liquid, there is an excess of olein.

In making soap on a large scale, a kettle, provided with both a closed and open steam coil, so that the soap may be boiled either by the heat or the free steam, is used. A

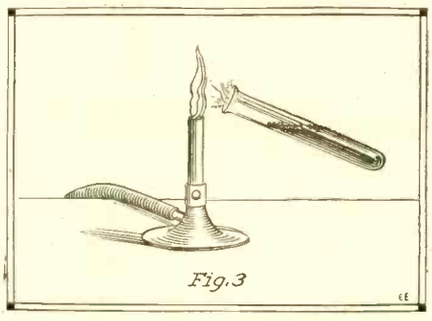


Fig. 3

Applying the "Sodium Test" in the Flame of a Bunsen Burner. Experiment No. 4.

kettle that will hold 100,000 pounds of soap is 15 feet in diameter and 21 feet high, and is made of ⅜ inch boiler plate. The melted fat and lye are run into the kettle and mixed by the aid of free steam and boiled for some time, or until the soap has a dry, firm feel between the fingers; it is then *salted out* by adding common salt. In boiling, the saponification represented in the above equation has taken place, and when the salt is added this causes the soap to separate from the caustic lye and glycerin. After boiling, to mix thoroly, the mass is permitted to stand in the kettle till the soap rises to the top, and then the lye may be drawn off at the bottom of the kettle. Some more strong lye is then added, and the boiling is continued till the material is fully saponified, which the experienced soap boiler knows by sight. feel, and taste, and then the content of the kettle is again allowed to stand for a while, and the additional lye is drawn off. The soap is then boiled with some water, and is permitted to settle again, to allow the separation of more alkali, dirt and impurities, called *nigre.* After standing several days, the soap is pumped into the *crutcher* which consists of a broad, vertical screw working within a cylinder, which is placed in a larger tank. Here it is thoroly mixed, and any perfume or scouring material may be added. The soap is then drawn off into rectangular *frames,* holding about 1000 pounds where it is allowed to solidify. The sides of these frames are removed and the

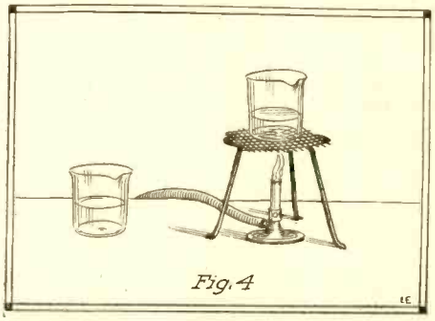


Fig. 4

Simple Apparatus Used in the Preparation of "Prussian Blue," as Described in Experiment No. 5.

soap is cut, by means of wire, into slabs and then into bars. If put on the market in the form of cakes, the bars are prest into the desired shape.

For making white soaps, tallow, palm oil, and cocoanut oil are used. Castile soap, if genuine, is made from olive oil, sometimes with the addition of cocoanut or rape seed oil. It is useless to attempt to make a good soap out of an inferior material. In making lower grades of soaps, cheaper fats are used, and frequently those that have a rancid odor. This is sometimes *corrected* by the addition of a strong perfume, like oil of *mirbane,*—nitrobenzine, made from coal tar. Yellow soaps almost always contain considerable rosin; that is they are made by the usual process, except that quite a large proportion of rosin replaces the fat. This has valuable soap-making qualities, and would not be classified as an adulterant of soap. Cocoanut oil saponifies without boiling, so it is used in making the *cold process* soap. This material also admits of the use of a larger quantity of water, so that the soap will be hard and still contain as much as 70 per cent of water. Soap is mottled by stirring into it, while warm, some coloring substance, such as copperas, ultramarin, or an anilin color.

Sand soap, pumice stone, and compounds of a similar character are made by incorporating sand or powdered pumice, with the ground soap, and this ought to lessen the price of the soap very materially. These substances can act only mechanically; that is they *sandpaper off the dirt.* A silicated soap is made by mixing with the ordinary soap some silicat of soda or

(*Continued on page* 475)

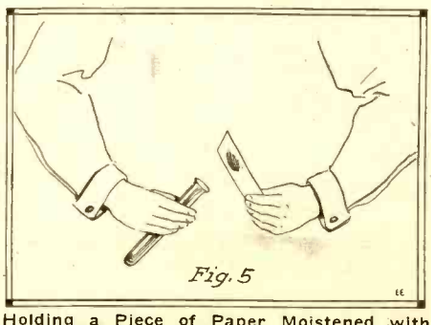


Fig. 5

Holding a Piece of Paper Moistened with Lead Acetate and Permitting the Gases to Act Upon It, Showing the Presence of Hydrogen Sulfid. Experiment No. 7.

THE CONSTRUCTOR

Thermo-Electricity Experiments

By THOMAS W. BENSON

IT was first noted by Seebeck, of Berlin, that when a juncture of dissimilar metals was heated a current of electricity would flow. This phenomena was studied by Cumming, Sturgeon, Pellaci and many others, for it gave promise of providing a means for *developing electricity direct from heat, without the use of steam engines and generators.*

Altho no practical application has been made of the discovery, beyond its application to *pyrometry* for heat measurements, several interesting devices can be easily constructed to demonstrate the phenomena.

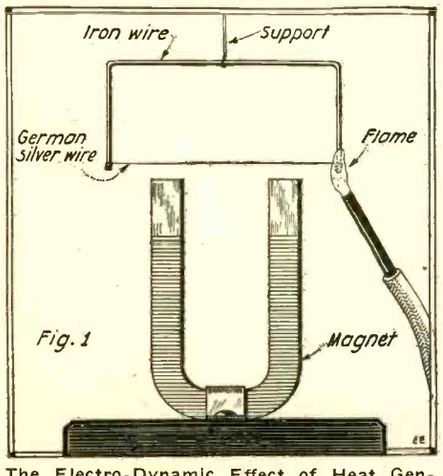
The most powerful currents are generated by heating junctures of the more crystalline metals, such as antimony and bismuth, the other metals lying between these in regard to the strength of the current generated with a given rise in temperature. The following list gives the thermo-electric order of the more common metals:

+Bismuth	Tin	Zinc
Platinum	Gold	Iron
Mercury	Silver	—Antimony
Lead	Copper	

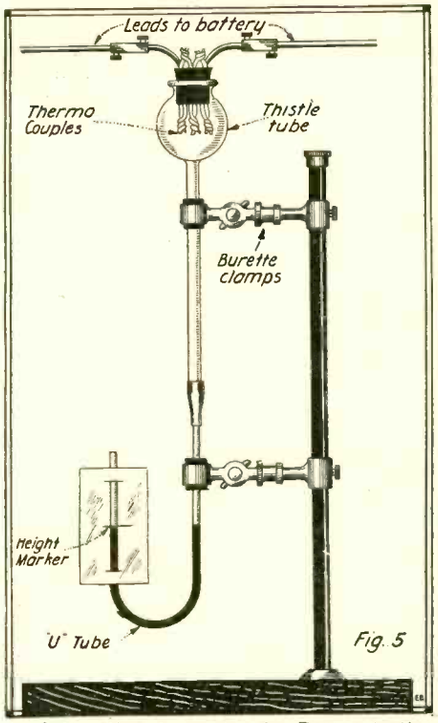
Any two of these metals when joined together and the junction heated results in a current flowing thru the exterior circuit from the metal highest on the list to that lower. The *reverse* is true should the junction be cooled. The further apart the metals are in the table the greater will be the electromotive force.

It is seen that bismuth and antimony will give a so-called "couple" having the highest E.M.F. These are rather difficult to obtain and handle, so for experimental purposes we will substitute iron and German-silver wire. These two metals are employed in the construction of thermo-couples for electric pyrometers, and will serve our purpose admirably.

The electro-dynamic effect of *heat generated* currents can be shown by a device similar to that illustrated in Fig. 1. Three sides of the wire rectangle are composed



The Electro-Dynamic Effect of Heat Generated Currents Can Be Shown by the Simple Device Here Illustrated. An Iron and German Silver Wire Rectangle Is Suspended Above a Magnet. The Loop Turns When Heated.



An Interesting Apparatus for Demonstrating the "Peltier Effect," or the Production of "Cold" by Electricity.

of iron, the fourth of German-silver. The frame is suspended over a permanent magnet and heat applied to one corner as shown. The frame will turn thru an angle of 90° due to the currents flowing in the loop.

A large number of turns of wire could be made to form a *heat compass.* The details of such a device are shown in Fig. 2. A small bundle of soft iron wire is bound with paper glued into place. Take a number of lengths of iron and German-silver wire and wrap them in the same direction on the core, in alternate coils as shown. Twist the ends of the wire together so that every other joint is on top. The ends of the more distant coils being connected together by a loop of wire, thus forming a sling to support the compass.

When this apparatus is suspended over a hot copper or brass plate, the currents flowing around the windings will cause it to act as a *compass* and the core will place its axis in a line with the natural magnetic field of the earth.

A form of *thermo-electric motor* can be constructed as shown in Fig. 3, to demonstrate electro-magnetic rotation. Here we have a ring of iron wire attached to which are a number of vertical German-silver wires, bent over at the top and joined at the center to a pivot. The latter rests in a tiny depression in the pole of a horseshoe magnet, allowing the cage to turn freely.

By applying a small flame to the frame at the juncture of the G.S. and iron wires between the legs of the magnet a current will flow thru the vertical wires and rotation will result from *magnetic repulsion.* The device will attain quite a high speed if carefully constructed.

A thermo-battery can be cheaply made that will deliver a fairly heavy current in the following manner: Take a 1" pine board 6" square and drill with small holes at the intersection of lines drawn in both directions ¼" apart. The board is then impregnated by placing in melted paraffin. Alternate 2" lengths of iron and G.S. wire are pushed into the holes and their ends tightly twisted together on both sides of the board, the end wires being led to binding posts.

When the battery is stood with one side in the sun, the other being shaded, an appreciable E.M.F. will be generated. **If laid on a block of ice in the sun it will ring a vibrating bell!**

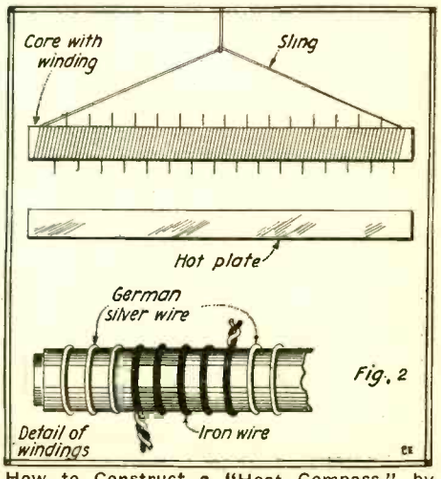
A somewhat similar form of *thermo-pile,* comprising antimony and bismuth bars, in the hands of Forbes and Milloni led to the beautiful discovery of the polarization of heat.

Andrews noted that a current was generated when platinum wires are inserted in a bead of fused borax, potassium chlorid, chlorids of potassium and strontium, iodid of potassium, sulfate of soda, and even when boracic acid is used. These results, however, are due to a *thermo-chemical* action and formed the basis for the work of Edison and others on the *heat cells.* The action differs from the *true* thermic action of dissimilar metals.

Conversely we have electro-thermic effects whereby heat and cold result from an electric current passing between dissimilar metals. The production of cold by this means is rather startling and is known as the *Peltier* effect.

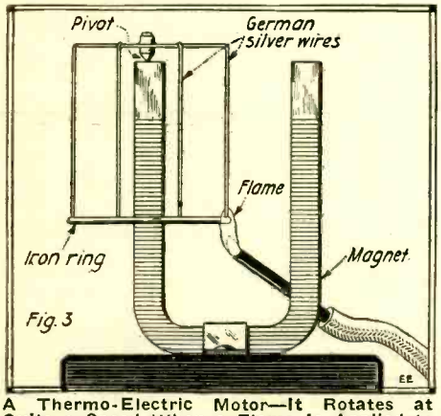
Apparatus to demonstrate the latter effect can be assembled as shown in Fig. 5. A large thistle tube has connected to its lower end a U-tube with a small bore, by means of a length of rubber tubing. The U-tube is partly filled with colored water.

A cork that fits the mouth of the thistle tube has six holes bored thru it into which



How to Construct a "Heat Compass," by Winding Turns of Iron and German Silver Wire About an Iron Wire Core. In Use It Is Suspended Above a Hot Brass Plate.

are inserted short lengths of iron and G.S. wire, about five strands of wire being put in each hole. These are twisted together to form thermo-couples and the cork inserted in the mouth of the thistle tube. A little paraffin wax melted over the cork will seal the whole effectively.



A Thermo-Electric Motor—It Rotates at Quite a Speed When a Flame Is Applied to the Armature, Made Up of Iron and German Silver Wires. A Most Interesting and Little Known Device.

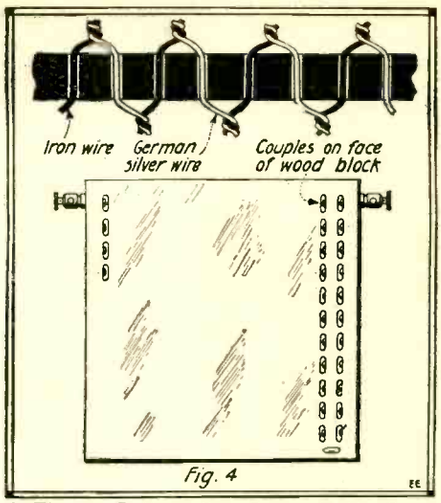
When the positive and negative poles of a battery (gravity type preferred) are connected to the iron and G.S. wire respectively, the junctures inside the tube will drop in temperature and the air contracting will cause the water in the open leg of the U-tube to drop. For best results the current should be regulated by a rheostat so that it is not sufficient to heat the wire used in the couples.

A current having a fairly high E.M.F. and low amperage gives the best results.

The exact cause of the current generated in a thermo-couple is still an unsolved problem. It is not due to any oxidization or chemical effect for it has been found that a bar of the same metal with different temperature of its opposite ends will give a slight current, the cold portions becoming *negative*, the hot parts *positive*. A thoro understanding of the phenomena demands more complete knowledge of matter structure and the inter-atomic forces.

A fuller realization of the forces in action may revolutionize present methods of current generation and perhaps refrigeration.

Thus there is a very fine field open for experimentation by the industrious student. By experiment we learn many things heretofore undreamt of.



A Thermo-Battery Can Be Made U. Quite Cheaply by Mounting Iron-German Silver Wire Couples on a Board as Shown. Laid on a Block of Ice in the Sun, It Will Ring a Bell.

A "Selective" Electrolier Switch

By Albert H. Beiler

The writer recently tried to make an electrolier switch which could control from one to five lamps. The lamps were on a chandelier and it was undesirable to turn each lamp on or off at its socket. They were placed on the chandelier as shown in Fig. 1. Owing to the fact that it was desired to make the lamps light in a symmetrical arrangement, it was not necessary to control each lamp singly, but merely to get a switch which could light one. two, three, four or five in a *symmetrical order*.

Number of Lamps	Number of Each Lamp	Control Circuit
1	3	B
2	1, 5	A
	2, 4	C
3	1, 3, 5	A, B
	2, 3, 4	B, C
4	1, 2, 4, 5	A, C
5	1, 2, 3, 4, 5	A, B, C

For example, if two were desired, it would not look well to light one and four, or two and three, but a combination like one and five, or two and four would do nicely. Accordingly, the wiring to the lamps was arranged as shown in Fig. 2. With this wiring the circuits would have to be controlled as summarized in the table above.

There is thus a common wire going directly from one main to one terminal of each lamp and three control wires which go to the *selector switch*. This switch is constructed as described below.

Secure a piece of hard wood 5 x 5 x ⅞ inches. Lay out a hexagon of 3 inches diameter, as shown in Fig. 4. Drill ⅜-inch holes at the eight points indicated about ¼ inch deep. The seven numbered holes should have small holes go clear thru the wood and just large enough to permit a No. 14 wire to pass thru (No. 50 drill). The unnumbered hole is a blank whose purpose will become apparent later. Twist some bare No. 14 wire into little spirals, as shown at 3A, and put one in each of the seven numbered holes so that the end passes out thru the bottom. Then stop up the small holes where the wires protrude with sealing wax, so that each ⅜-inch hole is a sort of liquid-tight cup with a conductor lying along its bottom. The wiring is shown in Fig. 3 running to four binding posts, which had best be labeled as indicated in India ink to avoid confusion later. The base may now be chamfered and stained to make it look well. The holes should then be connected by the lines shown and the triangle so formed should be labeled as indicated in Fig. 4.

The bridging arms should now be made. These are two triangular pieces of ⅜-inch fiber or hard rubber, the triangles measuring 2 inches on a side (Fig. 5). The holes are drilled ¼ inch from each vertex, and are tapt to receive 8-32 machine screws. A ⅞-inch machine screw is put into each hole at a vertex. These three screws are then connected to each other by No. 16 wire twisted around each and neatly forced into grooves, scratched into the fiber for the purpose by a sharp awl or scriber. A small porcelain knob is fastened to each triangle by a washer and screw fitting into the center hole.

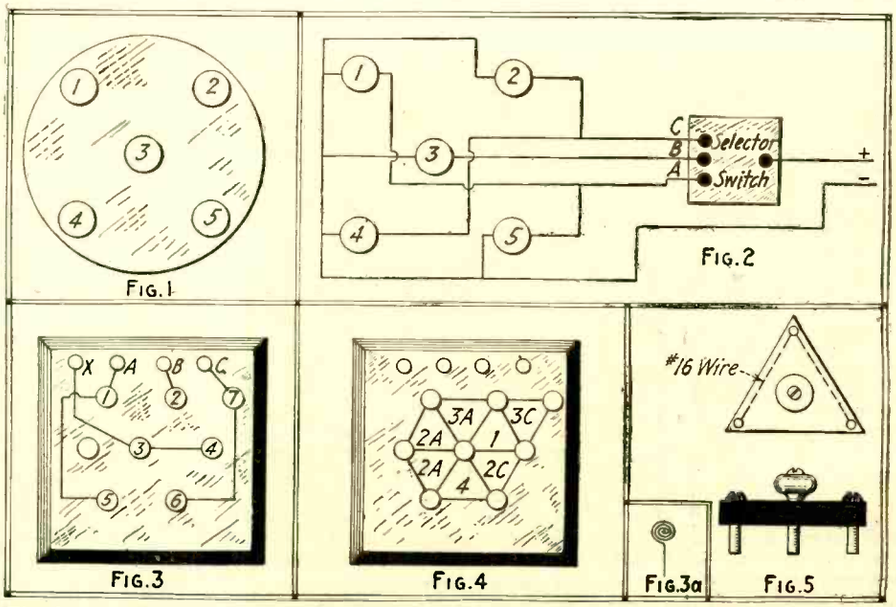
If the triangles are constructed properly each will fit into any three holes at the vertices of an equilateral triangle in the baseboard. The numbered holes should then be filled with mercury to about 3/16 inch from the top. Binding posts A, B and C are connected to control wires A, B and C, and the common wires goes to the other side of the main (Fig. 2).

It is obvious then that any combination noted in the table may be obtained by covering the triangle whose number indicates the number of lights to be lit. For example, to light *four* lamps, one of the triangles is placed in holes 3, 5, 6, so as to cover triangle No. 4, etc. Up to and including four lamps, only one triangle need be used, but for five a combination like 2A and 3C or 4 and 3C is needed, requiring two triangles.

The arc formed when a triangle is lifted out is inappreciable, being broken simultaneously at two places. Should it be desired, however, to break a circuit carrying more than about 5 amperes, it will be better to construct a base of fiber.

This switch may be made at a cost of about 25c, whereas an electrolier switch of commercial manufacture to satisfy this wiring costs upwards of $4.00.

Many modifications of this novel switch can be worked out with a little ingenuity on the part of the builder. This switch lends itself well to many laboratory circuit requirements.



The Construction of a Selective Chandelier Switch for Turning on or off Various Combinations of Lamps, Is Here Described by Mr. Beiler. Special Arrangements for Larger Groups of Lamps Can Be Worked Out Easily.

Making a Machine for Telegraphing Pictures

Part I

By LE ROY J. LEISHMAN

Expert In Telephotography

IT is a very simple matter to *telegraph pictures.* A crude machine for this purpose was suggested seventy years ago. The idea is therefore not entirely new to students of electricity, but the science has been so neglected that it is still nebulous to the average person.

How little the general public knows of *telephotography* is shown by the fact that when two of my machines were exhibited on the Orpheum and Pantage's vaudeville circuits two years ago, the demonstration was fascinating, baffling and uncanny to the audiences everywhere. Even most of the newspapers had never heard of such a thing before.

A person with an electric picture transmission machine may therefore entertain and baffle his friends and townspeople, besides conducting a great deal of experimenting which will be instructive and highly beneficial to himself.

By the time this article appears, popular interest in telephotography will be heightened by the use of telegraphed pictures by many of America's leading newspapers. Several papers have already publisht "news pictures" periodically, *and pictures have been telegraphed across the continent at regular intervals and displayed on bulletins.* The practicability of the scheme is shown by the fact that excellent pictures have been transmitted 4,856 miles! Many newspapers have recently subscribed for a service that will supply one hundred and fifty news pictures a year, *making it possible for them to publish a picture of an event the day it happens, regardless of geographical location or distance!*

So the person with the necessary apparatus to telegraph pictures will find himself the center of interest everywhere.

It has often seemed puzzling to me why more electrical students have not experimented with telephotography. Many letters which I have received lead me to believe it may be due to a popular misconception that such experiments are too costly. I therefore recently designed some *Picture Telegraphing Instruments* which are low-priced enough to suit every experimenter who may be interested. To further interest the readers of this magazine in this fascinating and instructive field, I am explaining in this article how a simple telephotographic set can easily be made. However, the chief fascination and instruction is in the operation of the finished machines and in the various experiments that can be made with them.

No exact dimensions will be given for any of the various parts, as the material at one's disposal sometimes makes it advisable to change some of them; and then the others must be altered accordingly.

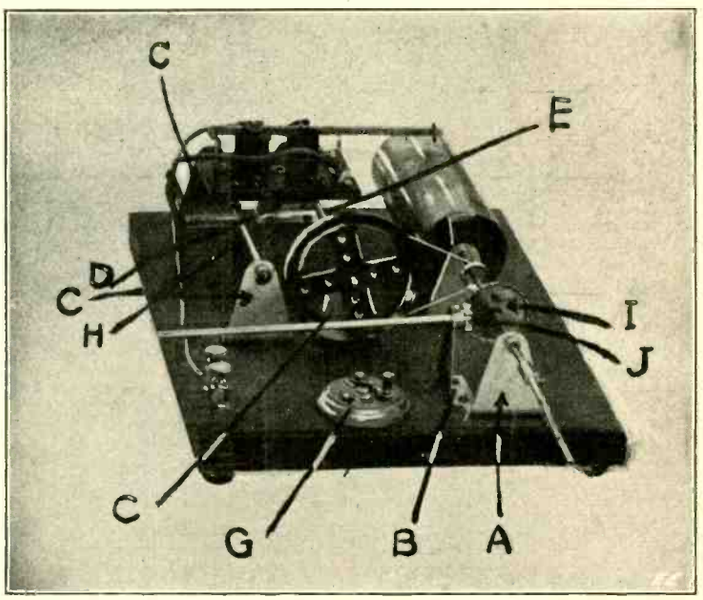
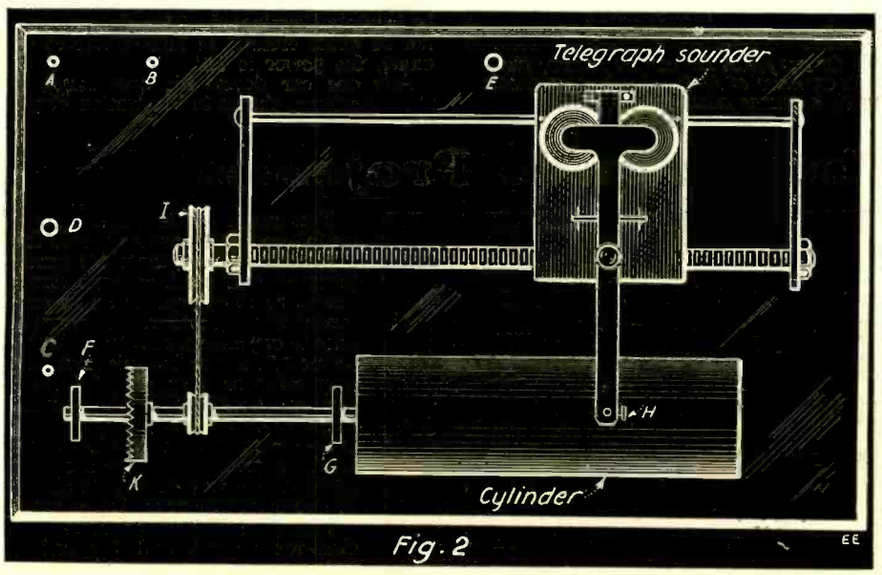


Fig. 1.—The Telephotographic Machine Here Described. It Opens up a New Era in Scientific Experiments for the Electro-mechanical Student and Provides a Stepping Stone to this Newest Branch of Applied Science.

GENERAL DESIGN FEATURES OF APPARATUS

Let us first get an idea of the general appearance of the device we are going to make. A glance at figures 1 and 2 will show that the machine resembles very much an old style cylinder phonograph. The cylinder of the picture transmitting machine holds the pictures to be telegraphed in the same manner that the phonograph cylinder holds the record to be played. The sending and receiving carriage corresponds with the phonograph reproducer, and it passes slowly from one end of the cylinder to the other on a threaded shaft as the cylinder revolves. In this manner the carriage needle finally touches every part of the picture. The threaded shaft on which the carriage travels *must* be absolutely parallel to the cylinder. The reproducer on a cylinder phonograph has a half nut that rests against the threaded shaft, so that the reproducer may be lifted up and moved to the other end of the cylinder. This necessitates another shaft, parallel to the threaded one, on which the reproducer pivots. A picture transmitting machine is similarly equipt.



Top View of Telephotographic Machine Here Described in Detail. The Parts Required in Building It Are Few and Simple, But Should Be Made with as Great an Accuracy as Possible.

The size of the complete apparatus depends upon the dimensions of the pictures to be telegraphed, as this determines the size of the cylinder; and the shafts and base must be proportioned accordingly. A convenient size for the picture is about 5 by 6 inches. As plenty of margin must be allowed, this necessitates a cylinder about 2 inches in diameter and 5½ inches or 6 inches long. Electrical contact must be made with the rolled copper plate which is slipt on the cylinder, so it is most convenient to make the cylinder from metal tubing. Ordinary pipe will not do, as the cylinder must be very true and perfectly uniform thruout. Brass or nickel-plated fixture tubing is excellent. A metal bar or disc must be soldered in each end, and holes *accurately drilled* in the *exact centers* to fit the shaft. As the cylinder is light and supports no great weight, the shaft may have a small diameter, so a rod can be selected for this purpose which will fit the gears available. Erector, Meccano or other rods are satisfactory, and can easily be fitted with gears which are obtainable in the regular sets or at any hardware store. The cylinder rod should be 3 or 4 inches longer than the cylinder and must be *perfectly straight.* Place it thru the holes in the cylinder ends and solder it so that one end is flush with one end of the cylinder.

After the cylinders have been made, the length of the base can be decided upon, as this dimension should exceed that from one end of the cylinder to the other end

(*Continued on page 446*)

Home-Made Compound Microscope

By Carl F. Muckenhoupt

A COMPOUND miscroscope is beyond the reach of many experimenters because of its prohibitive price. Since such an instrument is very useful, and desired by many experimenters, I describe below the theory of the microscope, and the method of building one cheaply.

Fig. 1 shows how the tiny object OP is enlarged by the objective at O'P', which image in turn is re-magnified by the eye-piece, and seen as at O"P". To avoid complexity, only the rays from the head of the little arrow are shown, but rays from the other end would pass symmetrically oppo-

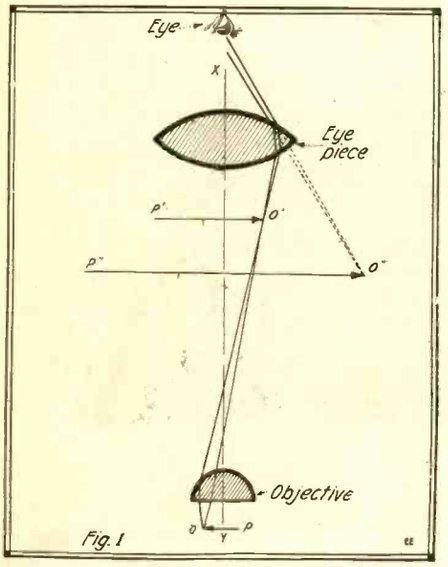


Fig. 1. This Diagram Shows the Path of the Focal Rays Thru the Optical or Lens System of the Home-Made Compound Microscope Here Described and Illustrated. The Eye-Piece Lens Shown Is a Double Convex One, While the Objective Lens Is of the Plane-Convex Type. Most Good Microscopes Have Two Lenses in the Eye-Piece.

site the main axis XY, and come to final focus at P", just as those shown focus at O". We see that by placing the object just outside the focus of the short-focus lens, an enlarged image is cast at some distance, which in turn is magnified by the eye lens. A good microscope has two lenses in the eye-piece, instead of one, to make a field free from chromatic and spherical aberration.

A good microscope is shown at Fig. 2. The tubes are preferably of thin sheet metal, rolled over a stick to the proper diameter, and then soldered. They may, however, be made of pasteboard. The main

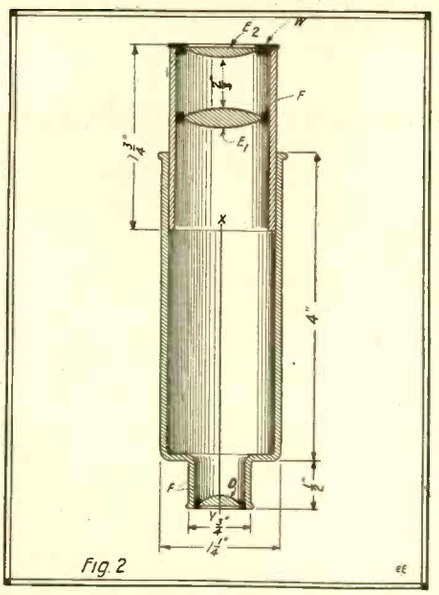


Fig. 2. This Sectional View of the Microscope Shows How the Metal Tubes of Brass, Copper, or Other Covering Are Arranged to Slide Within One Another; the Objective Lens Being Placed at O, and the Two Image-Magnifying Eye-Piece Lenses at E-1 and E-2.

tube is 4 inches long by 1¼ inches in diameter. A ring is soldered to its bottom end, with a ¾ inch hole in it. In this, in turn, the little objective tube, ½ inch long by ¾ inch diameter, is soldered. Make sure everything is well soldered, and then paint the inside of the whole affair a dull black, *not* shiny black. For the eye-piece, make a tube 1¾ inches long, and of a diameter to fit the main barrel snugly. This may take some time, for it must not work too tightly, or be too loose. Paint this black inside as well.

Power	Focal length of E_1 and E_2	Distance between E_1 and E_2	Distance between O and E_1
50	$2\frac{2}{3}$ inches	$1\frac{7}{3}$ inches	$6\frac{1}{3}$ inches
75	$1\frac{2}{3}$ inches	$1\frac{1}{3}$ inches	$5\frac{1}{3}$ inches
100	$1\frac{1}{4}$ inches	$\frac{5}{6}$ inch	$5\frac{1}{8}$ inches
130	$\frac{8}{3}$ inch	$\frac{9}{16}$ inch	$4\frac{7}{8}$ inches
		Note: For low powers the eye piece tube is very long	

Data for eye pieces for various powers; the letters are those of fig. 2. E_1 is always double, and E_2 is always plano convex.

The lenses naturally come next. O, the objective, is a ½ inch focal length, *plano-convex* lens. These can be secured from your optician. E_1 is a 1-inch focus, double convex lens. E_2 is a 1-inch focus, plano-convex lens. Take care to have these last two of the same kind of glass. O is mounted by making a ring to fit the bottom of the objective tube, and with a hole slightly smaller than the ½ inch focus lens. Center the lens over the aperture as shown, and glue a ring of felt F, with a hole smaller (slightly) than the lens, to the metal ring. When fast, clean the lens thoroly, and solder carefully to the little objective tube as shown by Fig. 2.

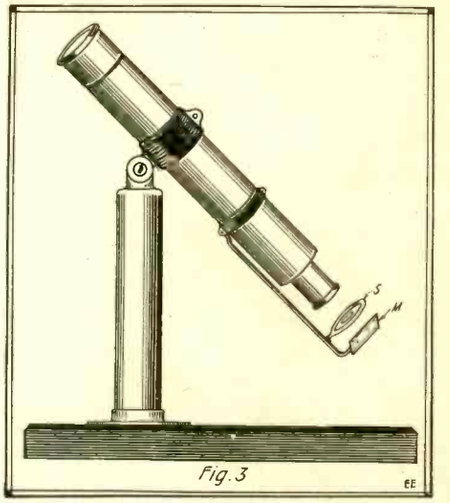


Fig. 3. A Simple Arrangement for the Home-Made Microscope Which May Be Modified and Improved by the Ingenuity of the Constructor, by Adding a Rack and Pinion or Other Precision Focusing Gear.

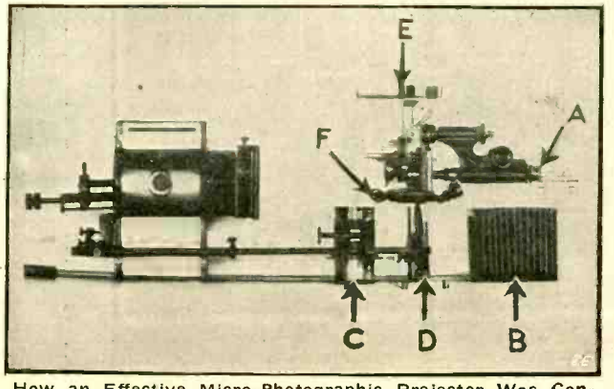
In one end of the eye-piece tube, fasten a ring of wood W, with a hole smaller than the plano 1 inch focus. Cut out the wood until the lens fits well, then screw a cap on the end with an aperture of about ½ inch. Mount E_1 2/3 of an inch from E_2, by forcing a ring in the tube, at right angles to it, and gluing felt around the lens. Push the eye-piece in until E_1 is about 4⅝ inches from O. This need not be exact unless you want to know the power exactly. The objective should be about 9/64 inch from object, which must be brightly illuminated. This distance need not be exact either. If both distances are exact, the power is 112.

Any one can devise his own stand, or use the scheme shown in illustration Fig. 3.

A Micro-Photographic Projector

The ease with which this apparatus is constructed is its main feature, provided, of course, one has the microscope and an ordinary projection lantern. I will proceed to the explanation of the letters in the picture.

Remove the entire front combination of lenses C, and the bellows, B. Bend the tube of the microscope, on the hinge provided, until it is at right angles to the foot E. Turn upside down and fasten to the front support D by two ordinary small wood clamps. Remove the eye-piece A, and you have a most excellent projector. It is much more satisfactory if one has a sub-stage condenser as shown in the photograph.



How an Effective Micro-Photographic Projector Was Constructed from a Stereopticon and a Microscope.

This unique arrangement of physical laboratory apparatus should find a great many uses, especially among lecturers and teachers, who find it necessary to enlarge or throw on a screen micro-photographic views of minute organisms, et cetera. Either an electric arc or incandescent lamp may serve as a source of light or else an acetylene light. Careful focusing of the complete apparatus is necessary to obtain a clear image on the screen. Drawings are often made in this way of minute objects by projecting them on white paper.

I have used this apparatus for class-room work and for making pictures of microscopic objects with fine satisfaction.

Contributed by E. K. GIFFEN.

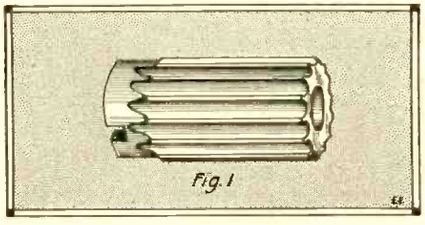
Experimental Mechanics

By SAMUEL D. COHEN

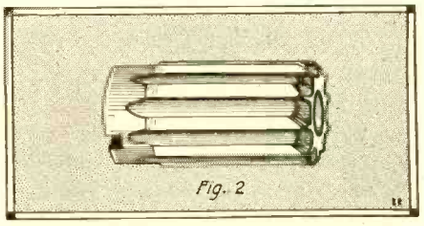
LESSON XIV

REAMERS CONTINUED.

IN order to save the material which would be used for the shank, the shell reamer having a hole thru its center by means of which it is mounted on the arbor, is largely used. By making the reamer in this manner *one* arbor can be utilized for a number of sizes. The general appearance of a shell reamer is illustrated in Fig. 1. This type is known as a *fluted shell* reamer. In Fig. 2 a *rose shell* reamer is shown. The cutting edges, fluting, and back taper of this latter type are the same as those of the rose reamers. However, in all other particulars, the tool is the same as an ordinary fluted shell reamer.

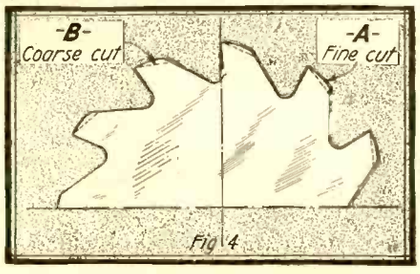


The Shell Reamer—This Form Is Widely Used in All Machine Shop Work. It Is Used on an Arbor.



A Typical Rose Shell Reamer. This Tool Has a Cutting Edge Provided on the End of Each Tooth as Shown.

The arbor used with the shell reamer is shown in Fig. 3, the shell reamer being provided with a keyway, which freely fits the key B. The reamer, when at work, is rotated by means of this key and keyway. The hole thru the reamer tapers, the taper being ⅛ inch per foot. Manufacturers of reamers have adopted certain standard sizes of arbors, and each arbor corresponds to a certain number of sizes of reamers; thus several sizes of reamers are provided with the same size hole, and can be used with the same arbor. The arbor as well as the hole in the reamer must be ground after hardening to insure the true running of the reamer. The outside of the reamer is provided with flutes and cutting edges for the greater part of the length. The short length at the end provided with a keyway, is turned down below the diameter of the cutting edges. This is done to prevent any burr which may be set up by the driving key on the arbor from interfering with the hole being reamed or disfiguring the cutting edges of the reamer.



Showing Two Ways of Grinding Reamer Teeth.

The fluted shell reamer type as shown in Fig. 1, is provided with a greater number of flutes for the same size than are ordinary fluted chucking reamers, because the flutes must be shallow on account of the hole thru the reamer. The flutes are cut, however, with the same kind of fluting cutters as are used for reamers generally. The corners at the end of the fluted shell reamer are slightly rounded.

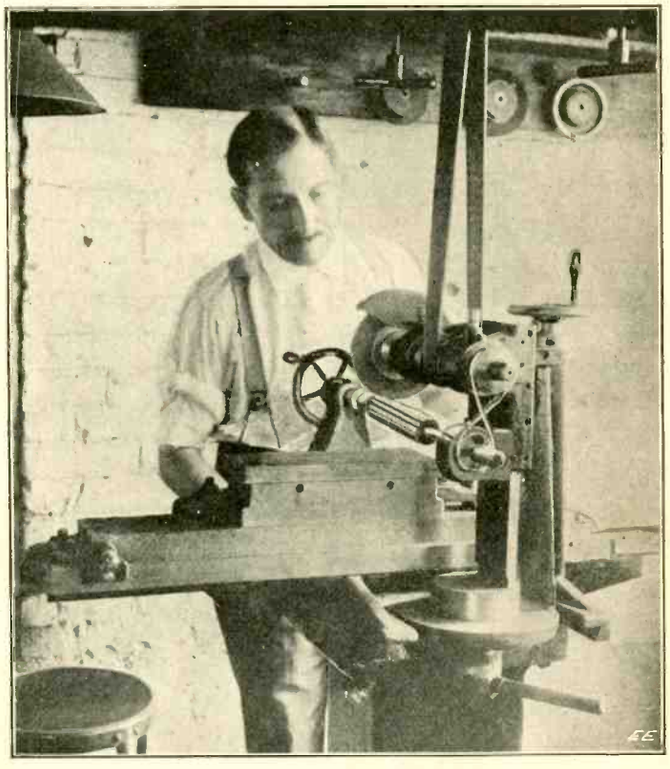


Fig. 5. Reamers Are Usually Ground to Final Size on a Precision Grinding Machine of the Type Here Shown. With Such a Machine the Reamer Can be Ground to Any Taper Desired with an Accuracy of One-Ten Thousandth of an Inch.

The arbor used for driving shell reamers consists of a stem or arbor proper C, as illustrated in Fig. 3, provided with a collar D, fastened to the arbor by means of a taper pin. A tongue B is milled at the end of this collar, which constitutes the key fitting the keyway in the reamer. Precaution should be taken during the "milling process" to ascertain the exact centering of the tongue in the collar. Care should also be exercised in milling the keyway in the reamer. When grinding the outside of the reamer to size, this work should be done on an arbor similar to that on which it is to be used. The arbor as well as the driving collar should preferably be made from tool steel and the collars should be hardened. The arbor as generally manufactured, is made in fourteen sizes, the diameter of each being measured at E, half-way between the end of the key and the solid part of the body of the collar, D. The arbor has a flat milled on the shank for the set screw by which it is clamped and held in position in the machine where it is used.

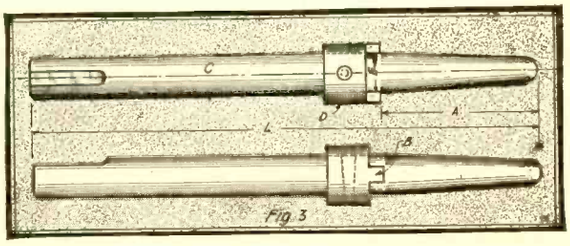
Too great or too little clearance on the teeth of a reamer will tend to produce unsatisfactory results, the first invariably causing the reamer to wear to a greater extent, as the shavings get in between the cutting edges and the work to be reamed, thus slowly grinding away the cutting edges. Also there is a tendency to bind the reamer in the hole, consequently injuring the hole as well as the reamer, and causing more exertion in performing the reaming operation.

The Steel Arbor Used for "Driving" Shell Reamers Consists of a Stem C, Provided with a Collar D, Fastened to the Arbor by Means of a Taper Pin. A Key or Tongue B Is Milled on the Collar to Hold the Reamer.

The *flat relief* or *clearance*, altho mostly used, is not the most desirable, because the cutting edge is not properly supported. Best results are obtained by a clearance, as shown in Fig. 4. The difference between this clearance or relief and the flat is obvious from the illustration, where the relief is shown by dotted lines "B." It is usually termed the *eccentric relief*, and its use is strongly recommended, as it adds greatly to the capacity of the reamer for producing a smooth hole. The relief is produced by placing the reamer in a grinding machine as usual, not on centers in line with the spindle, but on auxiliary centers provided with adjustable side ways, so as to enable them to be set at different positions for different relief required on various sizes and kinds of reamers. The reamer is thus held eccentrically. A rocking motion is then imparted to the spindles holding the auxiliary centers, and in this manner, the grinding wheel traveling back and forth along the reamer, will produce an eccentric relief.

The eccentric relief, however, is not in

(*Continued on page* 438)



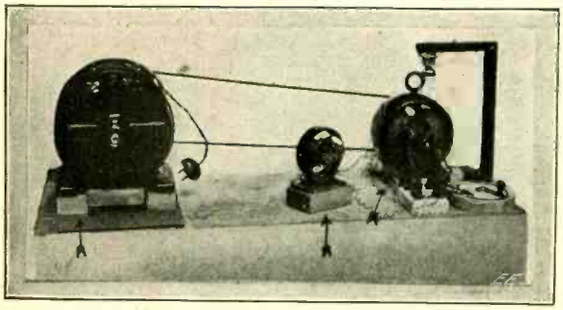
HOW-TO-MAKE-IT

This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 is awarded; for the second best idea a $2.00 prize, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

FIRST PRIZE, $3.00

MOTOR AND GENERATOR SILENCER.

In carrying on experiments in electricity and having only 110 volts alternating current at my disposal, I recently added a motor-generator set to my equipment. As my experiments were necessarily performed at night, due to work in the daytime and having due consideration not to annoy the people on the opposite side of the house at late hours with the humming of a motor and dynamo, the selection of a quiet running piece of apparatus became of prime importance.



Do You Have Trouble With Noisy Motors? Eliminate It! Mount the Offending Machine on Sponge Rubber As Indicated by the Arrows.

A high grade, 6 volt, 6 ampere dynamo was obtained which proved reasonably quiet, but when firmly secured to a 1½-inch board with a one-eighth horsepower motor likewise mounted, driving it, the noise was quite offensive. Most small motors of the alternating current type are very quiet when well bolted onto a concrete or iron foundation, but when mounted on a wooden plank 1½x12x30 inches it is another story. The first motor of 1,750 R.P.M. type was very good, but a little too noisy, and by obtaining a similar machine running at but 1,140 R.P.M., the noise was cut down fully two-thirds.

Of course, these results were encouraging, but my progress was still retarded by the noise made which I knew was not good to put "kids" to sleep by.

It finally occurred to me to use some soft silencer such as cork or rubber, and after numerous experiments with everything I could think of, I was finally successful. For the ⅛ H.P. 1,140 R.P.M. motor I secured three pieces of regular *art gum* from a 10 cent store. These blocks of soft "rubber" measured exactly 1x2x3 inches. They were mounted with LePage's glue to both the base of the motor and dynamo, and when placed on the board, the two machines could be operated with an exceedingly tight belt tension with no "walking" of the apparatus, even after hours of operation.

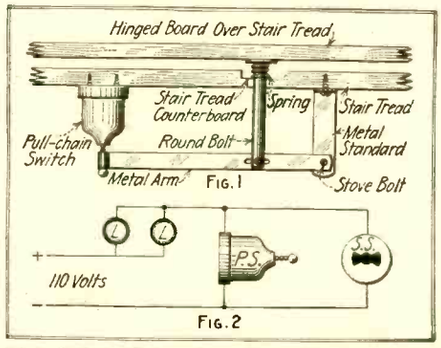
Contributed by C. V. TURNER.

[*Editorial Note—Those having noisy phonograph motors will find it efficacious to mount the feet of the motor on art gum or "sponge rubber." Tests have shown excellent results.*]

SECOND PRIZE, $2.00

CONTROLLING THE CELLAR LIGHTS.

The arrangement with which this is accomplished is shown in Fig. 1. A pull-chain switch of proper size to handle the lamps on the circuit is mounted on the *under surface* of the uppermost stair tread. The chain is shortened to an inch or so, and is attached to a metal arm pivoted on a metal standard which is screwed to the tread a short distance from the switch. At a point near the standard the metal arm is slotted to take a small stove bolt which fastens the slotted round bolt movably to it. This bolt passes thru a hole in the tread which is also counterbored to allow the bolt head to lie flush when the coiled spring under it is fully deprest. A board cut to the same size as the tread should be hinged to the riser above it so that the board will lie flat against the top of tread when stept upon. Coiled springs should be placed between the two at each end, to keep the front edge of the board separated about half inch or so from top of tread. This is all that is necessary as the small movement of bolt is increased by the leverage of the metal arm. The action of the device is obvious. As the top board is trod upon, it is deprest, moving the bolt downward against its spring, which movement is amplified and communicated to the pull-chain of switch by the metal arm, thus turning the switch "on." When weight is released, the board and other parts return to their original positions. When the board is again trod upon, the action is repeated, this time turning the switch "off." No dimensions are given as the sizes of the various parts will vary according to the size of switch and other conditions. As it is sometimes desired to leave the lights (LL) "on" while repeatedly passing up and down the steps it will be well to install a snap switch (SS) in the usual position and connect it in multiple with the pull-chain switch (PS) as depicted in diagram Fig. 2.



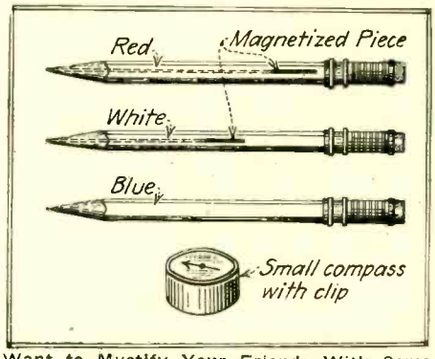
The Cellar Lights Are Turned on and off Automatically by This Stair-Tread Switch Wrinkle. The Moving Tread is Attached as Shown to a Pull-Chain Socket.

Contributed by J. A. WEVER.

THIRD PRIZE, $1.00

THREE MAGIC PENCILS—A MAGNETIC HOAX.

EFFECT: Three colored lead pencils are given out for examination, red, white and blue, for example. The performer leaving the roon. tells anyone to choose any color pencil they wish. while he is out of the room, and to wrap it up in any color piece of paper or cloth, and to hand it to him securely wrapt when he returns to the room. Upon receipt of same the performer passes hand over pencil and tells exact color.

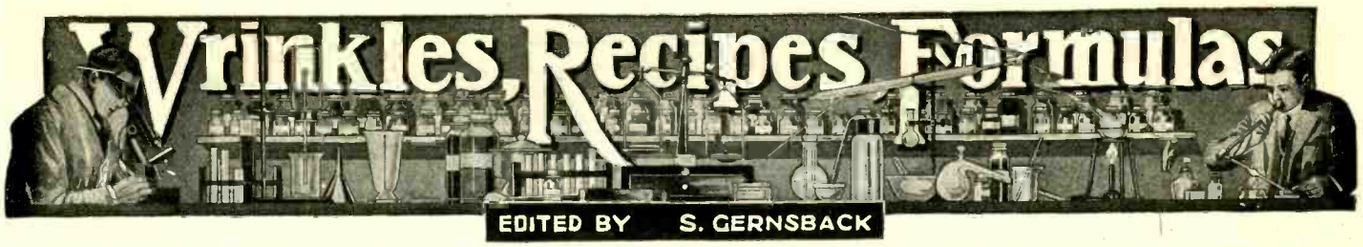


Want to Mystify Your Friends With Some Hindu Pencils? Here's How: With a Magnet Placed at Different Positions in Two or More Pencils, Conceal a Small Compass in Your Cuff. The Rest Is Easy—You Can Tell at Once Which Colored Pencil Is Inside an Envelope, Even Tho It Was Wrapt up While You Were Absent from the Room.

SECRET: Two of the pencils are "faked" in this manner. One of them is drilled with a 1/16 inch drill in the rubber end about 1 inch, and the other one is drilled half-way down or in the middle. Two pieces of Stubb's drill rod, ½ inch long by 1/16 inch diameter, are hardened, magnetized and inserted in the drilled holes and a piece of lead is inserted after the magnetized pieces and are made flush with top of wood in rubber end of pencil, the rubber is placed on top and the trick is ready; the third pencil contains no fake whatever. In leaving the room the performer attaches to his shirt cuff, inside, a small compass (some of these compasses can be obtained as small as a dime, or even of less diameter), which aids him in detecting what pencil is wrapped up or concealed in the cloth or paper in this way: He slowly passes pencil in front of compass and watches needle until it quivers, which it will do when that part of pencil containing the magnetized steel passes needle. If the needle moves when the *end* of pencil is near it, the performer knows it is the *red* one. If it moves when near the *middle* of pencil, he knows it is the *white* one; if needle does not move, it must of course be the blue one. As the back of hand faces audience, the compass is invisible.

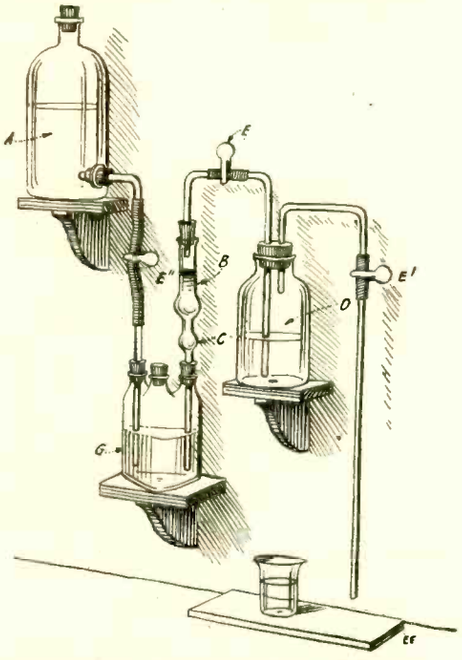
Many variations of this magnetic trick will suggest themselves to the wide-awake experimenter. Such as the magnetic "brass" ball—the inside of the ball is filled with iron filings and the small filling hole stopt up with brass.

Contributed by R. S. MYERS.



A NEW FORM OF HYDROGEN SULFID GENERATOR.

From time to time, in various issues of your splendid magazine, I have noticed *hydrogen sulfid generators* of numerous



This Highly Efficient Hydrogen Sulfid Generator Can Be Made Up from Glassware Found About Every Amateur Chemist's Laboratory.

types and styles described, but I have come to the conclusion that none of them work as easily or are constructed so simply as the one I now have in use in my chemical laboratory. I give herewith a drawing of the same, and will try to render a coherent explanation of its manipulation.

I will first make a notation of the apparatus used:

1 Aspirator bottle.*
1 Woulff bottle (three neck).
1 Calcium chloride drying tube.
1 Large bottle.
Glass tubing.
Rubber tubing.

I will now give a list of the apparatus and liquids denoted by the letters in the drawing:

"A"—Hydrochloric acid.
"B"—Iron sulfid.
"C"—Mineral wool or asbestos.
"D"—Water.
E, E', E"—Pinchcocks.
"G"—Hydrochloric acid.

I don't think it will be necessary to go into detail in reference to the construction of the apparatus, as I believe the sketch fully covers that, but give here a few points on the manipulation:

Open the pinchcock E" and allow the HCl to flow into the Woulff bottle; this will compress the air in the Woulff bottle. When the HCl stops flowing from the aspirator bottle, owing to the compression of the air, close the pinchcock E". Now open the pinchcock E and the HCl (G) will rise in the calcium chloride drying tube, thereby covering iron sulfid (B). (If the compression of air is not sufficient in the Woulff bottle to do this, again open pinchcock E" until the HCl rises in the drying tube sufficient to cover iron sulfid (B). Open pinchcock E and the gas generated will pass over into the large bottle containing the water (D). In this bottle the gas will be washed, and will also form a supply of the gas above the level of the water. Open the pinchcock E' and the gas will flow in a steady stream.

When one is thru with the gas all that is necessary is to close pinchcock E' and then close pinchcock E. Gas will continue to generate and will, owing to no outlet being open, force the HCl, covering the iron sulfid, back again into the Woulff bottle.

When the strength of the HCl, "G," becomes exhausted it can be removed from the Woulff bottle and, owing to the filtration caused by the mineral wool "C," is ready for evaporation for the recovery of the ferric chlorid. Another feature is that one has at all times hydrogen sulfid water on hand owing to the washing of the gas in the large bottle thru the water D. The reason for using a three-neck Woulff bottle is this: that when the pressure in the Woulff bottle, caused by the compression of the air, and also the gas liberated when pinchcock E, is closed immediately after use, will sometimes become too great for the strength of the glass, and so as a "safety first" measure, the three neck bottle is used so that the cork in the center, not in use, will act to liberate the surplus pressure.

Contributed by
WILLIAM N. NUSHAWG.

* An Aspirator bottle is not necessary, as the liquid (A) can be syphoned out of any ordinary bottle.

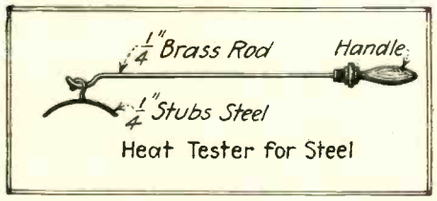
MAGNET TEST FOR HEAT OF STEEL.

One of the best and little-known methods of determining the correct heat at which to quench a piece of steel to obtain the best results, without the use of a pyrometer, is the following:

Take a piece of ¼" Stubb's steel about 2" long, tap a small hole in the center for a small screw eye, then harden and magnetize after bending to the shape shown in illustration. Place in screw eye and hang on the end of a brass rod bent to the shape shown in sketch.

The principle of the method is based on the fact that a piece of steel will not attract a magnet after a certain temperature is reached (about 750° Fahr.).

The little magnet is held over the heated steel every few minutes until the heated steel no longer attracts it, when it is then quenched and the degree of hardness it attains will be perfect.



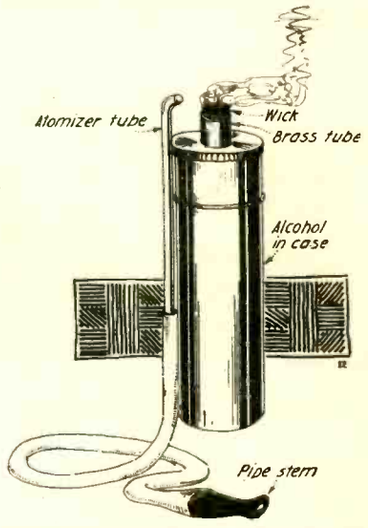
The Principle of This Steel Heating Tester Is That Above a Certain Temperature Steel or Iron Will not Attract a Magnet. Hence: When Is a Magnet not a Magnet? Answer. When It Is Red Hot.

Of course, the steel is to be drawn again to the required color. The above method is known to a very few mechanics.

Contributed by T. W. BENJAMIN.

AN ALCOHOL BLOW-TORCH FROM JUNK.

Want a nice little blow-torch? Below are given the details of an easily made blow-torch that will give as good results for soldering, etc., as the regular torch. It is constructed from a nickel-plated shav-



Who Wants an Alcohol Blow-Torch? Every Electrical Man, and Here's How to Make One from a Shaving Stick Case for Nothing. If You Are a Religious Prohibitionist You Can Burn Gin or Whiskey In Your Torch.

ing-stick case. The top of this case has a hole about three-quarters of an inch cut into it, and a piece of brass tubing inserted and soldered. Thru this runs the cotton lamp wick, dipping into the alcohol, contained in the case. Cotton wicking can be purchased in any hardware store. A piece of an atomizer tube, bent as shown in the illustration, is soldered or otherwise secured to the side of the case, connecting with a rubber tube. At the end of this a mouthpiece from "Pop's" old pipe stem is fastened. This makes a good, neat torch, welcome in any work shop or "lab."

Contributed by GEORGE H. TRUITT.

MAKING CHLOROPHYL.

Chlorophyl is the green coloring matter common to growing plants. Take a handful of parsley and triturate in a mortar with enough alcohol (95%) to cover the mass. Decant the green liquid and allow it to evaporate spontaneously. The chlorophyl remains as an intensely green substance. This may be used to color candies and as cake icings.

Dye from Onion Skins: Take the outer skins from half a dozen onions (medium-sized) and boil in water until the color is extracted. This is a very suitable yellow dye.

Test for the Purity of Olive Oil: Shake equal volumes of the oil and nitric acid. Pure oil should turn from pale to dark green in a few minutes. If it changes to brown, red, or orange, the addition of a foreign oil is indicated.

Heat for five minutes in a water bath at 100°C. It should become pale yellow to orange yellow. On standing it will, if pure, become a yellow solid.

Contributed by FRITZ ZILLESSEN.

RADIO DEPARTMENT

The "Fog Warning" Radio Telephone

THE accompanying illustrations show the interior mechanism used in the wireless telephone "fog warning" signal installed at the Point Judith Light near Narragansett Pier, R. I. This is one of the most treacherous sections on the Atlantic coast for ships to negotiate. For some time the DeForest "Radiophore" has been in use at this lighthouse station. It comprises an old type cylinder phonograph fitted with a record and repeating mechanism, which operates an Oscillion vacuum bulb, in such a way that the following warning is sent out by wireless telephone waves from an antenna, to ships as follows: "Point Judith Light," which is repeated three times. Then the skipper on the boat, or his wireless operator, hears, "You are getting closer, keep off," at about ⅕ volume of the first warning. Until the vessel approaches the danger limit, it does not hear the necessary final warning, but simply the first "location" warning.

The energy used in operating this warning signal is one-fourth kilowatt. The Oscillion vacuum tube generator of the radio frequency oscillations, is a 3¾-inch bulb. Heretofore the wave length was varied automatically for the different signals by a motor-driven variometer, but owing to the difficulty experienced by the ship radio operators in trying to pick up the constantly changing wave length signal and to hold it, the warning is now sent out on a fixt wave length of 600 meters, whereas with the constantly changing wave length previously used, the final message, "You are getting closer, keep off," was liable to be mist.

The first real test of this apparatus has been taking place at Point Judith Light (near Narragansett Pier), and the apparatus is arranged on a very compact scale so that it can be attended to by the regular lighthouse keeper and assistant. A regulation gasoline engine connected with a 36-volt direct-current generator and storage batteries is used to supply the energy, to which is coupled a motor-generator set which operates the transmitting apparatus.

This apparatus is entirely enclosed in a compact cabinet measuring about 18x18x18 inches. On the front of the cabinet is the Oscillion bulb and necessary switches for regulating it; also connection posts for aërial and ground wires. On the side of the cabinet is a small door which gives access to the mechanism inside.

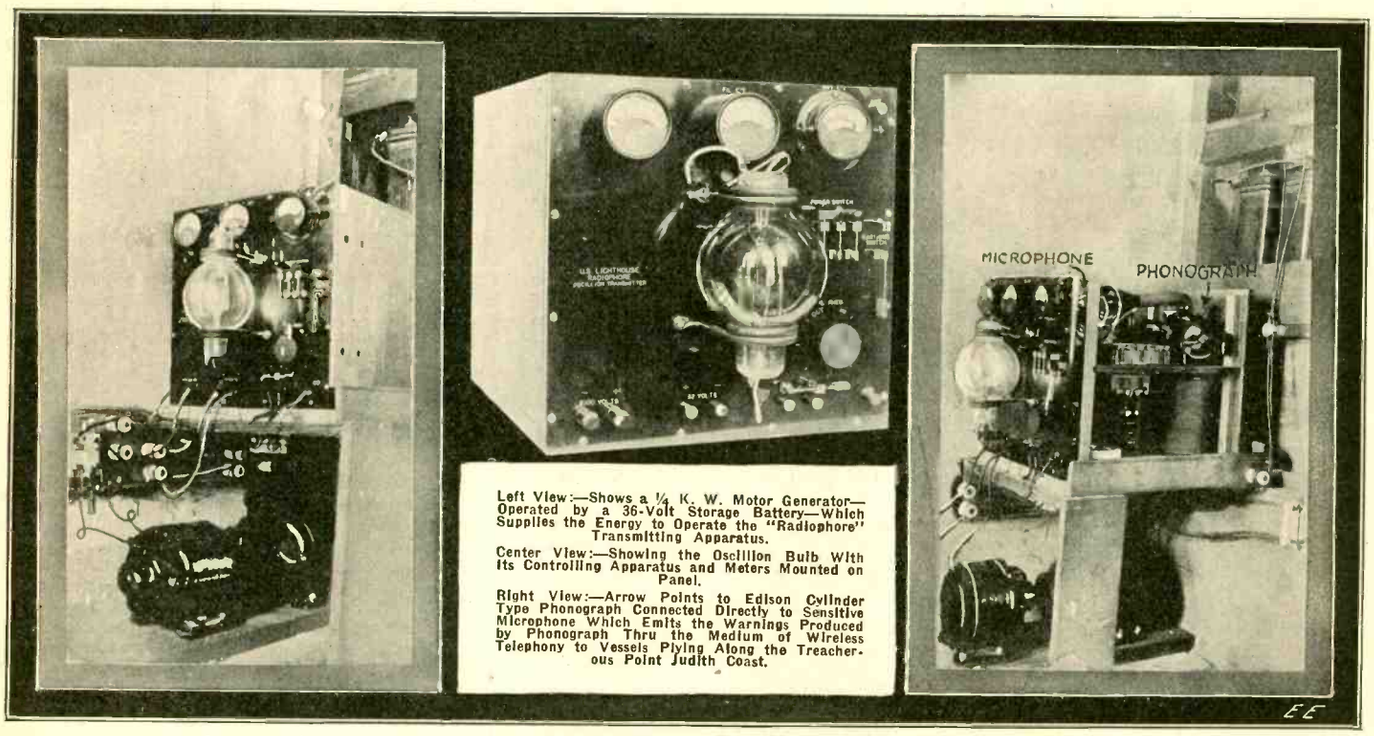
All the working parts are mounted inside the cabinet, including a motor-driven phonograph (see photographs herewith), speaking directly into a microphone. The arrangement of the cylindrical records is such that they repeat automatically, the saffire needle being set back to the beginning each time after it has traveled the length of the record. Each record has an average life of about 60,000 repetitions.

In the circuit diagram may be seen the relative layout of the various horns, microphones, and the Oscillion bulb generator of the radio frequency oscillations used to propagate the vocal message.

Several other modifications of the underlying principles may also be utilized as described in Dr. de Forest's patent. The transmitting apparatus is so arranged that speech can be sent out from the large fog horns, as also musical notes, bell signals, et cetera; on the same prearranged schedule as the radio signals. In this scheme the phonograph with records containing speech, is coupled to a microphonic arrangement and the speech is intensified by means of audion amplifiers and the sound waves sent out thru the fog horns, thereby enabling the captain or other officer to hear the same by ear, *without* the aid of wireless apparatus.

The one big feature of the Point Judith Light equipment is that when a ship is within a range of eight miles of the lighthouse, it will hear the following words flashed by wireless every five seconds: "Point Judith Light;" and after every

(*Continued on page* 462)



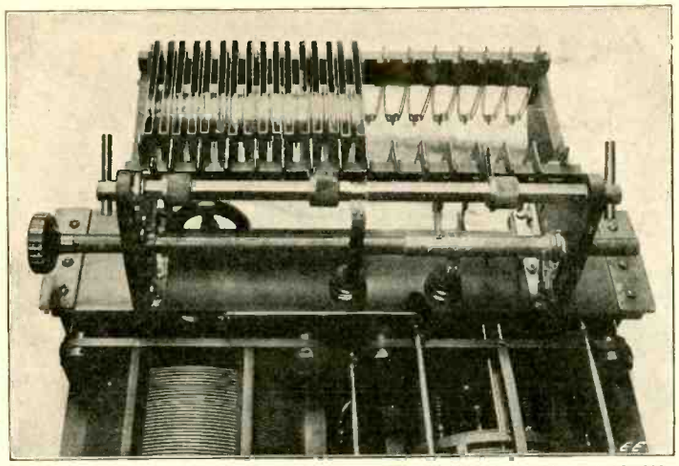
Left View:—Shows a ¼ K. W. Motor Generator—Operated by a 36-Volt Storage Battery—Which Supplies the Energy to Operate the "Radiophore" Transmitting Apparatus.

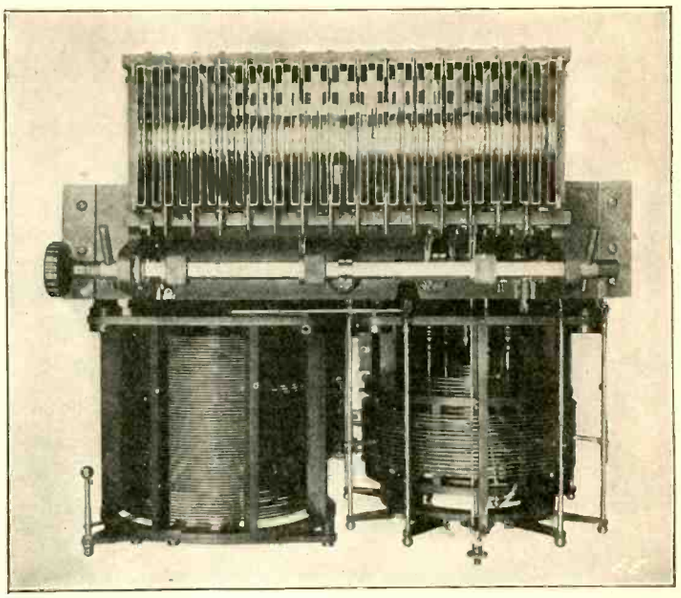
Center View:—Showing the Oscillion Bulb With its Controlling Apparatus and Meters Mounted on Panel.

Right View:—Arrow Points to Edison Cylinder Type Phonograph Connected Directly to Sensitive Microphone Which Emits the Warnings Produced by Phonograph Thru the Medium of Wireless Telephony to Vessels Plying Along the Treacherous Point Judith Coast.

In September "Radio Amateur News"

Grand Opera by Wireless. By H. Gernsback.
Guarding the Ether During the War. By P. H. Boucheron.
Construction of an Audion "B" Storage Battery. By Herbert Webb.
Static Eliminator of Considerable Merit. By Edgar Terrain Johnstone.
Wireless Telegraphy with the Canadians at the Front. By J. W. Caucors
The Doubie Deck Receiver.
A. B. C. of Wireless Reception. By H. K. Dunn.
The Latest Design Antenna Switch. By E. T. Jones
The Lure of Radio. By Eugene Dynner.
A Pocket Size Receiver. By J. E. Aiken.
Value of the Radio Compass. By L. A. Pollock.
Junior Radio Course—Lesson 1. By E. T. Jones.





Two Views of the Navy Type Quenched Gap Used on New 1 K. W. Panel Radio Transmitter. The view at the Left Shows the Quenched Gap With Several of the Units Removed While the View at the Right Shows a Top View of the Panel and Quenched Gap, With All of the Gap Units in Place. The Long Rod Placed at the Side of the Gap and Provided With a Large Insulated Knob at One End, Controls a Power-changing Switch, Which Switches In or Out of Circuit More or Less of the Gaps, as Required for Various Transmitting Powers.

New 1 K.W. Quenched Gap Transmitter

By Lester F. Ryan

THE 1 K. W. panel radio set as is described in the following article, is identically the same in principle and operation to the one described in the July issue of the ELECTRICAL EXPERIMENTER, except for the spark gap. The panel consists of two bakelite-dilecto pieces, the upper panel having the hot wire ammeter, wave changing device and the spark gap mounted upon it. The lower has the volt and ammeter control switches and automatic starter mounted upon it. The voltmeter is of the double scale type. The motor-generator is of the Crocker-Wheeler type, and is driven counter clockwise from the motor end by direct current at 120 volts. It is rated at 2 1/10 horsepower and 1.25 K. V. A. or 1000 watts, at 80 per cent power factor. It is a 500 cycle machine and has 15 field poles. The motor field is controlled by a Ward Leonard 18 point rheostat. This varies the frequency between wide limits. The automatic starter consists of five parts, two solenoids, and two contact discs and plunger, also a common resistance box.

The transformer used with this set is of the closed core dry-type and is rated at 1000 watts, 500 cycles and 150 volts at the primary winding terminals. The ratio of transformation is 38 to 1. It is insulated to stand electric stresses of 30,000 volts and will stand a 50 per cent overload.

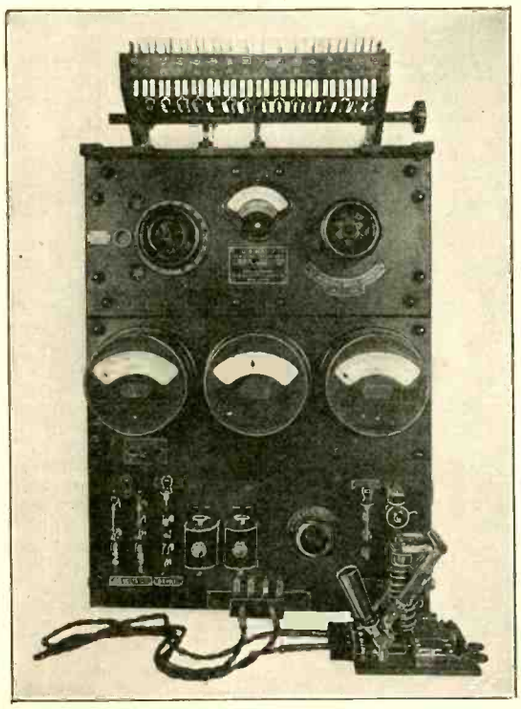
The condensers used are of the Dubilier type of .004 microfarad capacity each, connected in parallel. They are made of selected mica and tested for 100 per cent overload which is more than is ever used.

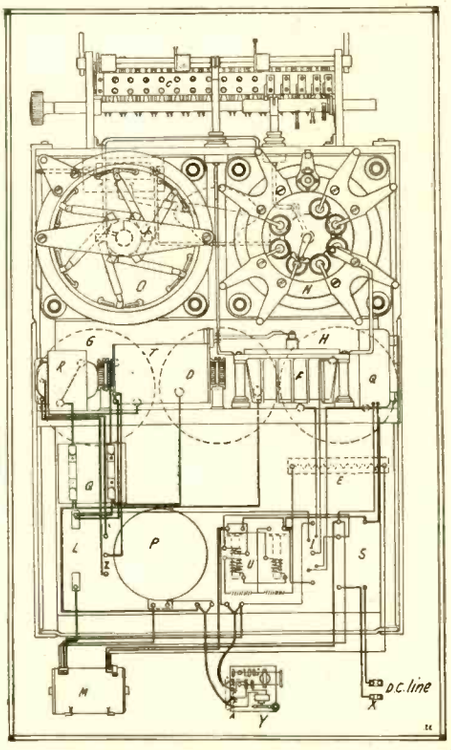
The spark gap which is used with this set is mounted on the top of the panel as shown in figure. The gap consists of a *gap holder* and *power changer*. The gap is horizontal and has a row of fifteen pockets; each pocket accommodates a gap unit as shown in photos. When a gap unit is inserted in a pocket it separates two leaf springs. The pressure of these springs against the gap insures perfect contact. The springs come together as a gap is removed and in so doing bridge the break in the gap holder circuit.

A switching mechanism is also associated with this holder. It consists of two shafts, one above the other and parallel to the row of gap pockets. Each shaft is provided with switch jaws which engage knife blades fitted to the gap holding pockets as shown in figure. The top switch shaft is used for the changing of power. Each movement of its handle inserts or removes gap units in groups. The switch jaws slide over this shaft so that the operator may vary the number of the gaps in a group at will. The three positions of this switch are *Low, Intermediate and High.*

The second and lower switch shaft allows five gaps to be inserted one at a time. The switch engages knife blades projecting from the rear of the first five gap pockets as will be seen. This

(*Continued on page* 471)





Front and Rear Views of 1 Kilowatt Quenched Gap, Panel Radio Transmitter. This Set Has Been Extensively Adapted by the United States Navy and Has Given Excellent Satisfaction. The Quenched Gap Units Are Easily Replaced at a Moment's Notice and Can Be Quickly Repaired When Necessary. The Gap Plates Are Separated by Thin Fish Paper Gaskets. The Set is Noiseless in Operation.

Valves

By PROF. A. U. DION, G.R.I.D., D.C., A.C., H.F.C., T.S.F., etc., and MR. LETIT LEAK, E.M.F., O.T., etc. (Local Plumber)

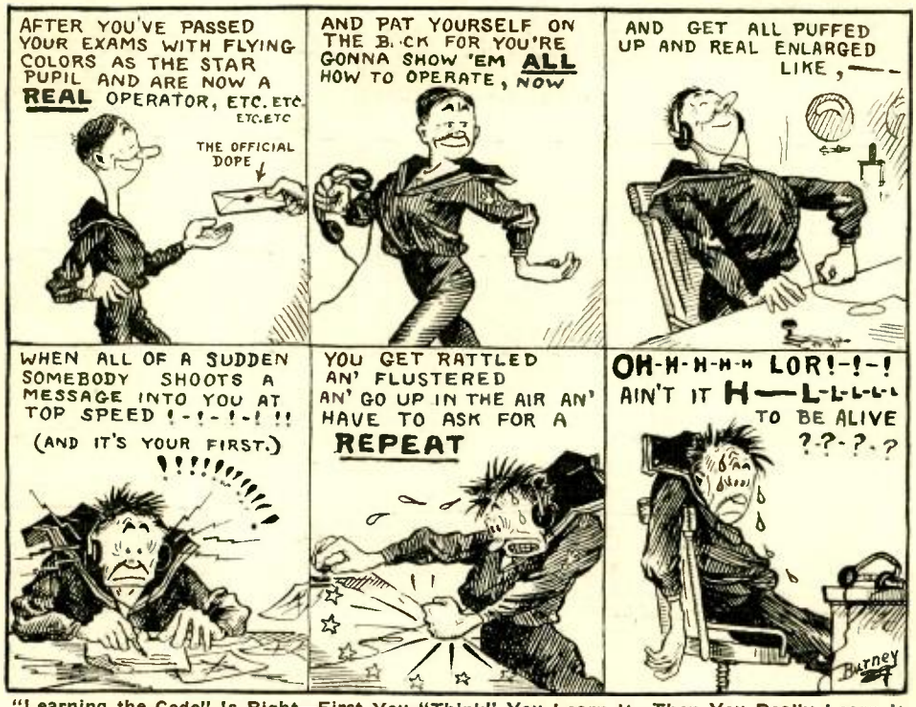
Introduction

In this little article I have tried to set down a few facts and fancies regarding the valve as used in the practice of wireless telegraphy.

They are the direct result of information collected whilst acting in the capacity of W/T operator in one of Britain's aërial dreadnoughts, although much of the advanced technical matter is the result of Mr. Letit Leak's untiring research, and to this gentleman I publicly extend my heartfelt thanks for his invaluable assistance in compiling this treatise.

Author's Note

Thru long association I had come to look upon the W/T valve as the only valve in the wide, wide world, so vividly were its advantages and merits imprest upon me at Cramwell College. I am assured by Mr. Letit Leak, however, that this is quite a fallacy. He tells me that there are H.P. and L.P. steam valves, gas valves, ball valves, and bi-valves, not to mention innumerable others, besides the common or garden dot-and-dash variety.



"Learning the Code" Is Right—First You "Think" You Learn It—Then You Really Learn It All Over Again, As Mr. H. B. Burney Here Illustrates In His Own High Frequency Style.

Valves W/T may be placed in four categories:

(1) The Round Valve (deriving its name from the inventor, not from its shape).

(2) The Hard Valve (has slightly longer life than the soft valve when exposed to the tender mercies of the new operator thirsting for knowledge).

(3) The Soft Valve (so called because it is satisfied with fewer volts than the foregoing instance, and therefore does not require so many ration books).

(4) The "Q" Valve (better known as the "Hush, Hush" valve). By simple proportion it will readily be seen that 31,967 such valves would receive signals from the planet Jupiter.

All four types are much of a muchness in general principle, differing only in detail.

Taking them collectively, a valve consists of a chunk of vacuum surrounded by a layer of glass. A most essential part is the small tip generally found on top of the vacuum. Its precise use has yet to be determined, but Mr. Letit Leak assures me it is a most important *point*. I do not intend to trouble my readers with smaller details, but, in passing, it is imperative to direct attention to a fundamental necessity, which valve manufacturers dare not overlook—viz., the necessity for placing some small parts within the vacuum. These are:

(1) *The Filament.*—A very fragile piece of tungsten made up of 10^{55} negative electrons. Its function is to illuminate the vacuum in order that the student may see how the other parts work.

(2) *The Grid.*—Consists of a number of holes joined together by small pieces of metal. Acts as a shade over filament to protect student's eyes.

(3) *The Sheath.*—A sheet of metal enclosing both the filament and the grid. Prevents small pieces of vacuum, dust or dirt from falling on the filament and affecting its lighting capabilities.

At the bottom of the valve are a number of tags, generally four, although a few more or less should not worry the student. I was under the impression that these were to form a convenient method of holding the valve without making the glass dirty, but Mr. Letit Leak emphatically insists that these tags exist for the sole purpose of ensuring connection with the internal economy of the valve.

To Test Valves.—Carefully examine, and any cracks in glass bulb should be caulked with shellac to prevent the vacuum getting out.

To Test Filament.—Grasping the valve by the tags previously referred to, bang the valve several times in rapid succession against the edge of a bench (unless an anvil is handier), when it should give forth a clear, bell-like note. Should the filament fail to glow after this test, don't waste more time with it, but get another from the stores.

To Test H.T. Circuit.—Connect up to several thousand volts and forget the exact amount. A faint bluish glow will indicate that the H.T. has successfully run the gauntlet of the vacuum and is looping the loop between the filament and sheath, a process known technically as *oscillation*. Should no blue glow be detected and the valve and student still survive, throw the valve away—it is a dud.

To Test Vacuum.—Knock off small tip mentioned previously, and if vacuum is good a faint hissing noise is heard. When the hissing ceases, it denotes that Nature, which abhors a vacuum, has discovered the escape. It is not advisable to apply this test except as a last resource, owing to the extreme difficulty of re-packing the vacuum thru the small hole thus made in the glass.

From the foregoing remarks the student must draw his own conclusions as to the advantages of valves. Our W/T officer says that their tendency to disappear completely and mysteriously is not so marked as that of the carborundum crystal. He attributes this to the post-war amateur not being possest of sufficient filthy lucre to purchase enough high tension to operate the valve, while the current price of volts is so excessive.

Finally. — Mr. Letit Leak informs me that, owing to the super-sensitive qualities of the valve as a detector, it is probable that Scotland Yard will shortly assume the entire control of the valve industry, and every detective will be fitted with seven valves. Police constables, on the other hand, will only be provided with amplifiers.—*Wireless World.*

DE FOREST DEFENDS HIS 3-ELEMENT AUDION

In the interest of fair play and scientific fact Dr. Lee de Forest, acknowledged among scientists as the inventor of the 3-electrode audion or vacuum tube which has made possible the present development of the radio telephone, has made public an open letter to the Editor of the *London Morning Post,* England, protesting against the reported unfair statement of Dr. J. A. Fleming, British scientist, in connection with his series of Cantor lectures in the theatre of the Royal Society of Arts.

The letter written by Dr. de Forest is based upon an article publisht in the *London Morning Post* of February 25th entitled "The Future Telephone—Imperial Conferences by Wireless" in which the perfection of the three-electrode audion is credited to Marconi. The article reads as follows:

"Dr. J. A. Fleming yesterday concluded his series of Cantor lectures in the theatre of the Royal Society of Arts with an account of the thermonic and crystal detectors, which, as he said, have taken an important part in the war. He described how the radiant point from which wireless messages are sent, could be determined by angles taken from two receiving stations, so that the exact position of ships and Zeppelins could be ascertained, and that means whereby electric oscillations could be detected thru the telephone in an airplane above the sound of the engines. Thermionic detection has been enormously developed, and the audience was interested to hear how these instruments, which are the basis of wireless telephony, arose from the discovery by the lecturer himself of a method of utilizing the curious fact that an ordinary filament lamp when incandescent

(*Continued on page* 460)

Vacuum Valve Construction

By R. H. Shaw

By reading this article carefully any Amateur should be able to construct a vacuum detector which will give excellent results. The completed valves are shown in Figs. 1 and 2 as well as connections for them. Several other connections may be used, but those shown have been found best.

In the construction of the valves an incandescent filament is used to produce the electron flow. For this purpose a miniature incandescent lamp with a carbon filament using about three volts should be used.

Having obtained such a bulb place a very thin strip of copper around it, as shown in Fig. 3. Fasten this plate by means of the nut and bolt (B). The plate connection is also made to this bolt.

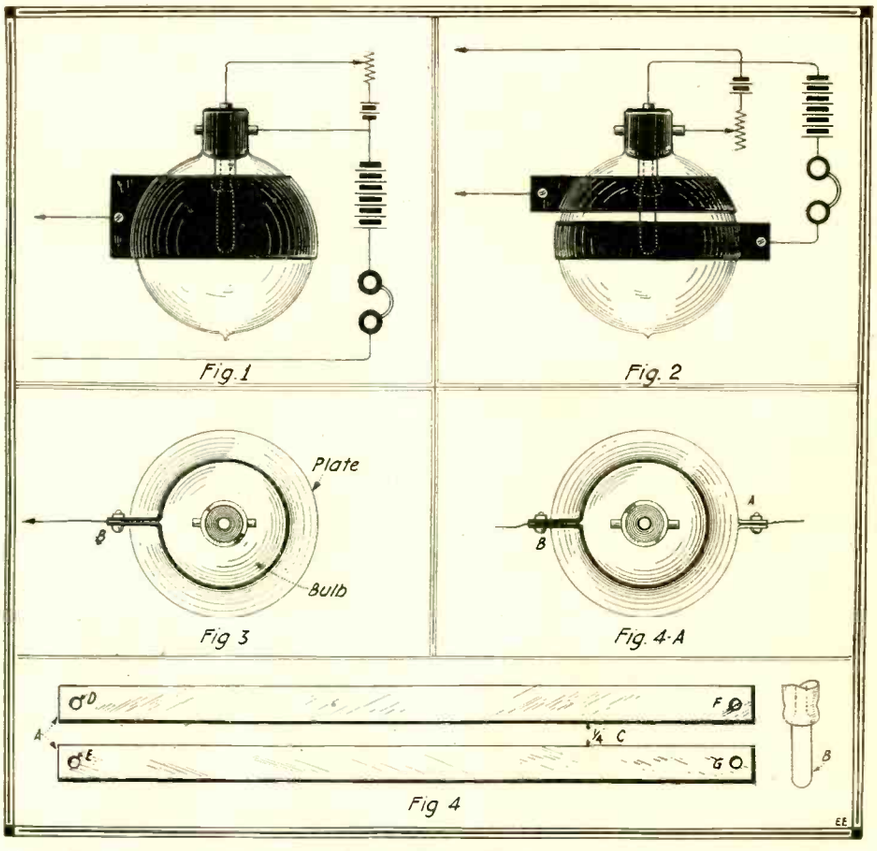
The valve is now ready for use and is connected up as shown in Fig. 1. Adjust the filament to a very high brilliancy, being careful not to burn it out. Do not touch the filament adjustment having once adjusted it, but use the "B" battery potential until the incoming signal is heard loudest in the 'phones.

In Fig. 2 is shown a second type of detector. This differs from the one just described in that its plate is divided. A lamp of the same kind used in the above detector is used for this one.

The construction of the plate for this valve is shown in Fig. 4. A thin strip of copper long enough to go completely around the bulb as shown is first cut (A). This plate should be a little wider than the filament (B). Having cut the strip to the right dimensions a piece one-quarter of an inch wide is cut out (C), Fig. 4. The holes D, E, F, G are next drilled. The two plates are then fastened around the lamp and secured to the bolts (A and B), Fig. 4-A. The plate connections are also made to these bolts.

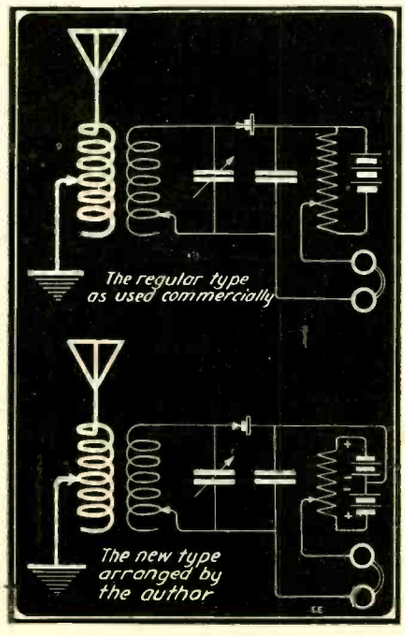
The valve is now completed and is connected as shown in Fig. 2. This valve is adjusted the same as the other one. An "A" battery of six volts and a "B" battery of fifty volts should be used with these valves.

The theory of operation of these valves is: As the glass becomes heated it allows the electrons being discharged from the filament to flow thru it and make connection with the plate on the outside of the lamp. The circuit from the filament to the plate is thus completed. It is therefore advisable to use a lamp containing a carbon filament as it produces more heat than a tungsten filament. The valves described herein are fully protected with patents and must not be manufactured for sale.



Home-Made Audion Designs for Two and Three Electrode Units. Made from Ordinary Single Filament Auto Head Lamps, Purchasable in Any Auto Supply Shop.

The Potentiometer—How to Use It



Above—the Old Way, and Below—the Improved Hook-Up for Obtaining + or — Current from a Potentiometer Circuit Without Switches

There has been very little said in print in regard to the use of this very important and effective instrument as a regulator of battery current which aids some types of crystals decidedly in their functioning.

In the majority of cases upon visiting the ordinary and even the advanced class of Amateur or Experimental stations, I have found that probably one in a hundred made use of this very necessary piece of apparatus. Once used, no one will do without it, owing to the following facts:

1. There is absolutely no carborundum which is not greatly increased in sensitiveness by its aid.

2. I have found upon investigation that there is not a piece of silicon which does not function better, to a greater or lesser degree, according to the kind used, by the aid of minute battery current and a potentiometer for regulation.

Even tho some experimenters do make use of a potentiometer they do not in all cases thoroly understand its operation and correct use in order to derive best results.

As a general rule potentiometers with a critical point of adjustment should be employed. Such a potentiometer would be one wound with fine wire and an over-all high resistance. This affords greater life to the battery shunted across it and allows one to hold point of adjustment at a greater length of time due to the fact that with large wire the battery dies out more rapidly and then it is necessary to readjust the potentiometer to allow the same amount of battery current to flow thru the detector.

A sliding contact potentiometer, if well constructed, should be used instead of the switch contact point arrangement, owing to the fact that it is impossible to arrive at an exact or critical point of adjustment with the latter.

Another point of great interest in connection with this apparatus is that the right polarity must be maintained, and in order to do this with the commercial form of potentiometer, it is necessary to first connect the detector or battery and "adjust"; if no increase in signal strength is found, it is then necessary to transpose either the battery or detector leads. To overcome such annoying procedures as just mentioned the author has arranged the following circuit for the potentiometer, which makes it unnecessary to change the leads of the battery or detector.

The instrument is termed a "duplex polarity potentiometer," and works in the following way: As will be seen from the diagram, the potentiometer is shunted by two batteries opposing each other; therefore no current will flow when the potentiometer slider is in the exact center of the instrument or windings of the same. If it is moved above center one set of polarities is had, and if moved below another set is obtained.

Contributed by E. T. JONES.

Eccentric Antennae

By EUGENE DYNNER

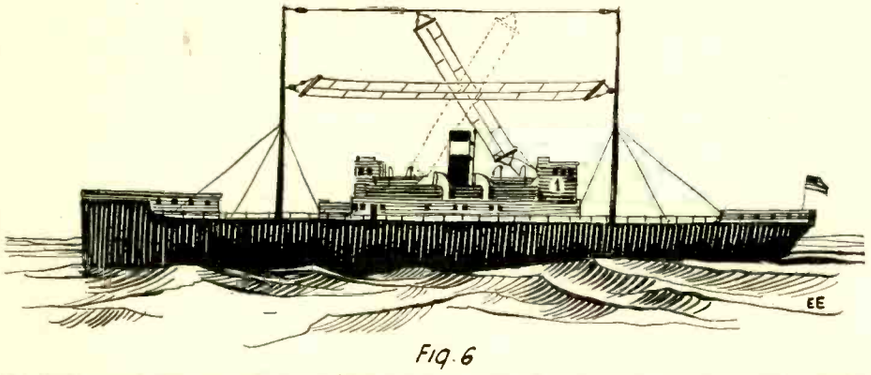


Fig. 6

Novel Form of Eccentric Antenna Tried Out on Ship-Board by the Writer. This Aerial, as May Be Seen, Is of the Cross-Connected Type. With This Form of Antenna, There Was Approximately 50 Per Cent Increase in Strength of Signals Over a 1,500 Mile Range.

SOME time ago experiments were made to develop an antenna which should give the maximum efficiency in reception of radiotelegraphic signals without necessitating the use of expensive apparatus. The first distinctive aërial developed was the one depicted in Fig. 1. This antenna consists of three wires which are connected together at intervals in length twice the width of the spaces between the wires, and measured in such fashion that one of the rectangles formed ends at the center of the adjacent one.

The receiving transformer used was of a special design, consisting of one stationary and three movable coils (Fig. 5). Coil 1 is a primary into which secondary No. 3 may be moved. Coils 2 and 3 also form a primary and secondary which may be brought closer to primary No. 1 or drawn further away. No taps are taken off, there being a double variometer action. A plain galena detector gave excellent results. The entire apparatus was connected as per Fig. 4. Condensers 5 and 6 are of .001 mfd., and condenser No. 7 may be a smaller one.

Using antenna No. 1 with this hook-up, there was an increase in efficiency of about 40 per cent. With coil 2 eliminated and 4 slid inside of 3, a decrease in wavelength resulted and the efficiency was increased about 5 per cent. when an audion was substituted for galena. Efficiency is calculated from results obtained by the use of an ordinary well-built loose-coupler with possibilities for variations by single turns. To test efficiency a device described several years ago in the ELECTRICAL EXPERIMENTER was employed.

With the loose-coupler in circuit and antenna No. 1, it was found that somewhat sharper tuning was accomplisht and signals were louder than those received with the ordinary type antenna.

Antenna No. 2 was found to cause a waste of energy, until the distance between wires 1 and 2, 2 and 3, etc., were separated at least 15 feet. This cage-like contrivance was 150 feet long. Even when this proportion was establisht the increase of efficiency over antenna No. 1 was less than 5 per cent., working under the same conditions.

A composite antenna and "ground" was built, No. 3, which gave excellent results. This arrangement, however, was found most efficient where the capacity of the two bodies was different. Putting the ground above the antenna gave a slight decrease in loudness of signals with broader tuning.

With the antenna depicted in Fig. 6, there was approximately 50 per cent. increase in strength of signals over 1,500 miles away—in direction opposite upper end of vertical antenna—was obtained. Addition of another section of antenna built in direction opposite to first one, gave the same strength in both directions.

In all cases the leads as indicated on diagrams were found most satisfactory. Substitution of single wires for three wire antennae gave practically the same results where the sections were over 300 feet in length, and reception was from stations using wavelengths of over 2,000 meters. For shorter waves the three-wire arrangement was found best.

The United States Navy is using extensively a type of aërial that has been developed in England, and which is used on all her battleships and destroyers. It is termed the "Barrel" type on account of its shape, which is cylindrical. On American battleships, it is anywhere from 75 to 150 feet long. On the smaller type of boat, the aërial must necessarily be much smaller. It consists of six wires arranged in barrel formation and supported every eight feet by three pieces of light bamboo, crost in the shape of a six pointed star. These pieces of bamboo may be of any length, thereby giving the aërial any diameter desired. The diameter is usually determined by the length. On our battleships the diameter of the barrel is anywhere from one to two feet. It may, however, be decreased to six inches for a very small antenna.

For the wire composing the aërial, the United States uses its standard phosphor bronze wire. This wire has been found to be the most efficient in every way. It does not corrode, neither does it rust nor deteriorate in other ways, as the usual kinds of wire do. One big trouble heretofore has been corrosion of the wire in the aërial, due to the action on it of the gases from the smoke stack directly below.

The English government, with whom this type of antenna originated, uses an entirely different kind of wire. They use ordinary copper wire of about No. 12 or 14 B. and S. gage. The bare copper wire is treated with a coat of black enamel, which is made from a specially prepared formula.

The enamel coat does not detract from

(*Continued on page* 470)

This Flat-Type Cross-Connected Aerial Showed an Increase of 40 Per Cent in Efficiency When Used With the Receiving Coupler Described

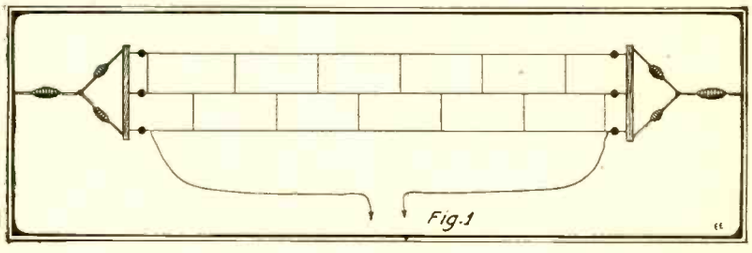


Fig. 1

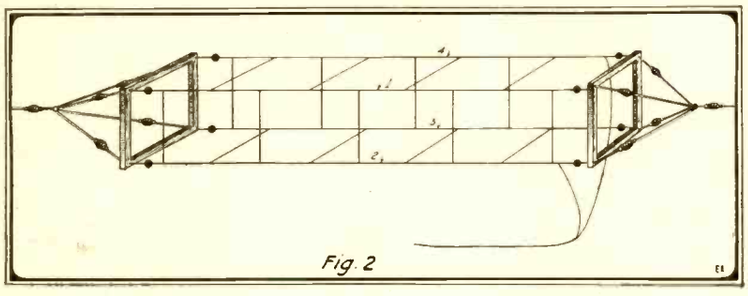


Fig. 2

One Form of Cross-Connected Antenna Tried Out by the Writer With Gratifying Results. The Individual Wires Are of Course Carefully Insulated as Shown.

Novel Composite Antenna and "Ground"—This Design Gave Excellent Results, Says the Author. Placing the "Ground" Above the Antenna Gave Slightly Lower Efficiency.

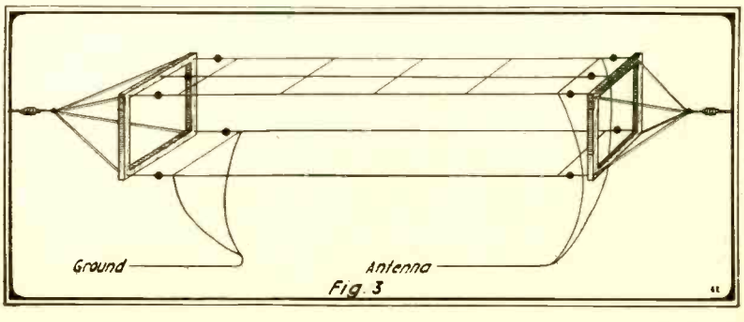
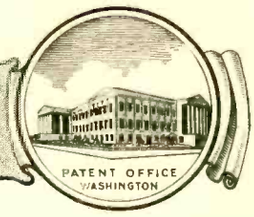


Fig. 3



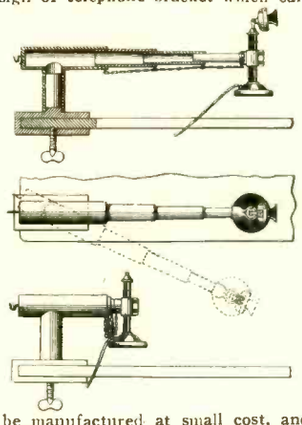
LATEST PATENTS



Telephone Bracket.

(No. 1,288,611, issued to Edward T. Jones.)

This represents a very simple design of telephone bracket which can

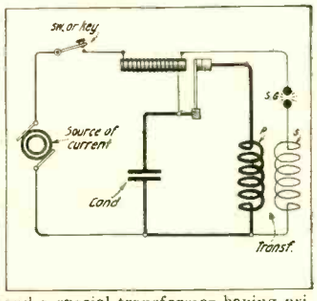


be manufactured at small cost, and still operate with the same efficiency as some of the more expensive and elaborate telephone devices of this character now on the market. The device comprises a series of telescoping metal tubes, which slide into one another when the bracket is to be collapsed, in the manner apparent. A chain is fastened to the successive telescoping sections so that they cannot be put out of alignment or beyond their limit.

Electric Igniter.

(No. 1,307,854, issued to William and Philip Dubilier.)

An electromagnet interrupter is used in conjunction with a condenser

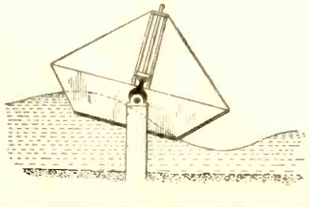


and a special transformer having primary and secondary windings, the primary of which is connected with the interrupter and condenser in such a way that this circuit becomes a tuned oscillator whenever the vibrator is in action. This circuit, in conjunction with a magnetic interrupter, is used to throw a spark across the gap shown, the line current maintaining an arc across the gap.

Wave Motor.

(No. 1,307,095, issued to William Gregersen.)

A surf or wave motor in which the float or body shown is made in the form of a boat pivotally supported, so as to rock with the rise and fall of the wave, and thereby operate a mechanism arranged to rotate a shaft in a continuous circulatory fashion. It is understood that two or more of these wave motor members may be used of course at one location, so as to give a much steadier rotative

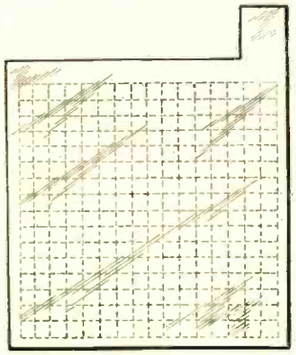


power to the main power shaft, and also to increase the amount of power developed in any instance. The rising and falling float is provided with suitable arms, connected with a set of pawl wheels and ratchets.

Storage Battery.

(No. 1,306,214, issued to Richard J. Crowley.)

A clever scheme providing for a new departure in the manufacture of storage battery plates or grids, having an active agent consisting of lead oxid and aluminum sulfate, and a method of producing a battery plate or grid paste of this compound. One object is to provide a battery element which will permit charging and discharging at a rapid rate without injury to the plates; providing a higher voltage at a heavy discharge and having a greater capacity in ampere-hours than other

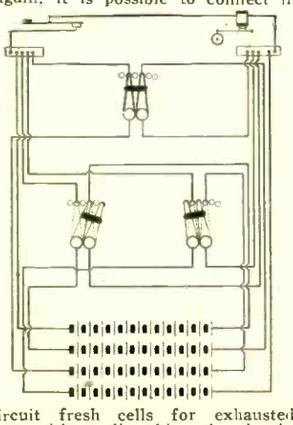


lead cells. Positive elements so made are said not to disintegrate as rapidly as peroxid of lead positives. The electrolyte used may be composed of sulfuric acid and water, but better still it is formed with an acid sulfate of aluminum. This is adaptable for transportation as a solid and only requires the addition of distilled water to form an electrolyte.

Battery Switch.

(No. 1,306,147, issued to Simon B. Hess.)

One of the principal objects of this invention is to provide a battery switching system by means of which large ampere-hour capacity may be obtained for using dry cells. Further, by the switching scheme here provided, it is possible to change the voltage of the battery system at any time without changing the original battery installation in any way. Again, it is possible to connect in

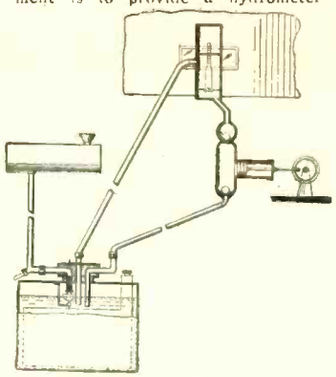


circuit fresh cells for exhausted ones without disturbing the circuit. When the battery system gives out entirely, and becomes no longer possible of manipulation adequate to increase the voltage, anyone not acquainted with the art will be enabled to readily replace old with the necessary new battery cells, and again make the system operative, owing to the simplified connection scheme shown.

Sight Storage Battery Tester.

(No. 1,308,223, issued to Ernest Camp.)

One of the objects of this improvement is to provide a hydrometer

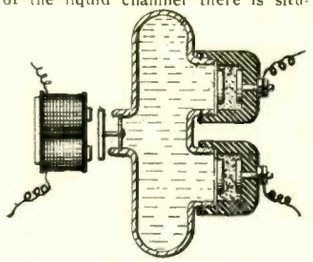


chamber having a connection to the storage battery cell, providing a means whereby the liquid electrolyte may be drawn into the hydrometer chamber, so that the electrolyte may be tested. The testing chamber may be placed upon the dash panel of the car so that the condition of the battery may be examined at any time. A further idea provides a means whereby distilled water may be supplied in small amounts from time to time.

Water Telephone Relay.

(No. 1,306,248, issued to Edward E. Clement.)

At one side of the liquid chamber shown there is placed a diafram actuated by a telephone receiver electromagnet system. At the other side of the liquid chamber there is situ-

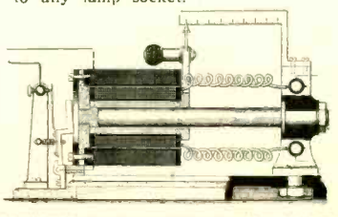


ated one or more microphones. When an incoming sound current passes thru the receiver, it actuates the diafram and corresponding vibrations are transmitted thru the liquid, which may be water.

Induction Coil.

(No. 1,307,093, issued to Benjamin Fulton Gardner.)

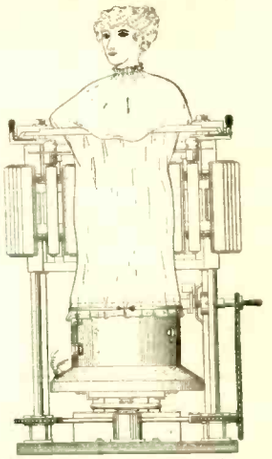
A reversible transformer for the purpose of stepping down or up either alternating current or direct current. There are two coils wound about an iron core and fitted with a vibrator. The outer coil is wound with fine wire and the inner coil is wound with coarse wire, the inner coil being movable along the iron core. A scale is provided so that the strength of the current may be watched as the regulating coil is moved along the core. The device can be connected to any lamp socket.



Electrical Reduction Apparatus.

(No. 1,305,439, issued to William E. Brennan.)

Those having a corpulent form, whether male or female, will be interested in this reducing apparatus invented by Mr. Brennan. One of the principal features of this apparatus lies in the use of an electric heating cell at the base of the structure, in order to give the person

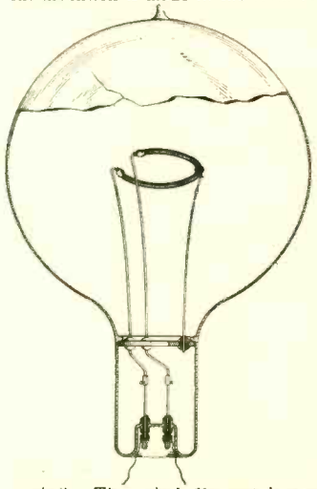


under treatment a considerable rise in temperature while applying the massaging action by means of rotating wooden bars, shown in the illustration. As the inventor points out, any treatment of this nature for reducing the size or weight of a person is much more effective, and the results are more quickly and easily obtained, where the body is heated as well as massaged.

Improved Tungsten Lamp.

(No. 1,306,259, issued to Frederick G. Keyes.)

An improved design for tungsten lamps of high candlepower and suitable for operation on low voltage and high ampereage, in contradistinction to the usual form of high-voltage lamp. One of the features of this lamp resides in the mode of securing proper sealing of the lead wires and the anchors supporting the tungsten filament, which in the present invention is made in the form of



a spiral. The spiral filament is attached at its end to two lead wires made of copper sheathed with iron, the copper being utilized for its good conducting qualities, and the iron being employed for its rigidity, to prevent bending or distortion of the copper wire under the influence of the high temperature developed within the globe.



WITH the AMATEURS



Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light-toned ones. We pay $5.00 each month for the best photo or photos and $2.00 to each "Honorable Mention." Address the Editor, "With the Amateurs" Dept.

The Editors desire to call to the attention of all owners of "Electrical and Chemical Laboratories" the fact that hereafter the MONTHLY PRIZE WILL BE $5.00 CASH, instead of $3.00. ALSO $2.00 CASH WILL BE PAID TO EACH "HONORABLE MENTION" ENTRY PUBLISHT. We have not received any "Laboratory Photographs" of late. So "go to it" and send us your photo, together with that of your laboratory. If they are particularly good we may list some new and bigger prizes. So get busy, Boys!!! It's up to you. Here's a way to earn some greatly wanted laboratory apparatus at no cost whatever. Don't be afraid to send in too many photos, Boys.

"Amateur Electrical Laboratory" Contest

THIS MONTH'S $5.00 PRIZE WINNER— STANLEY C. REED

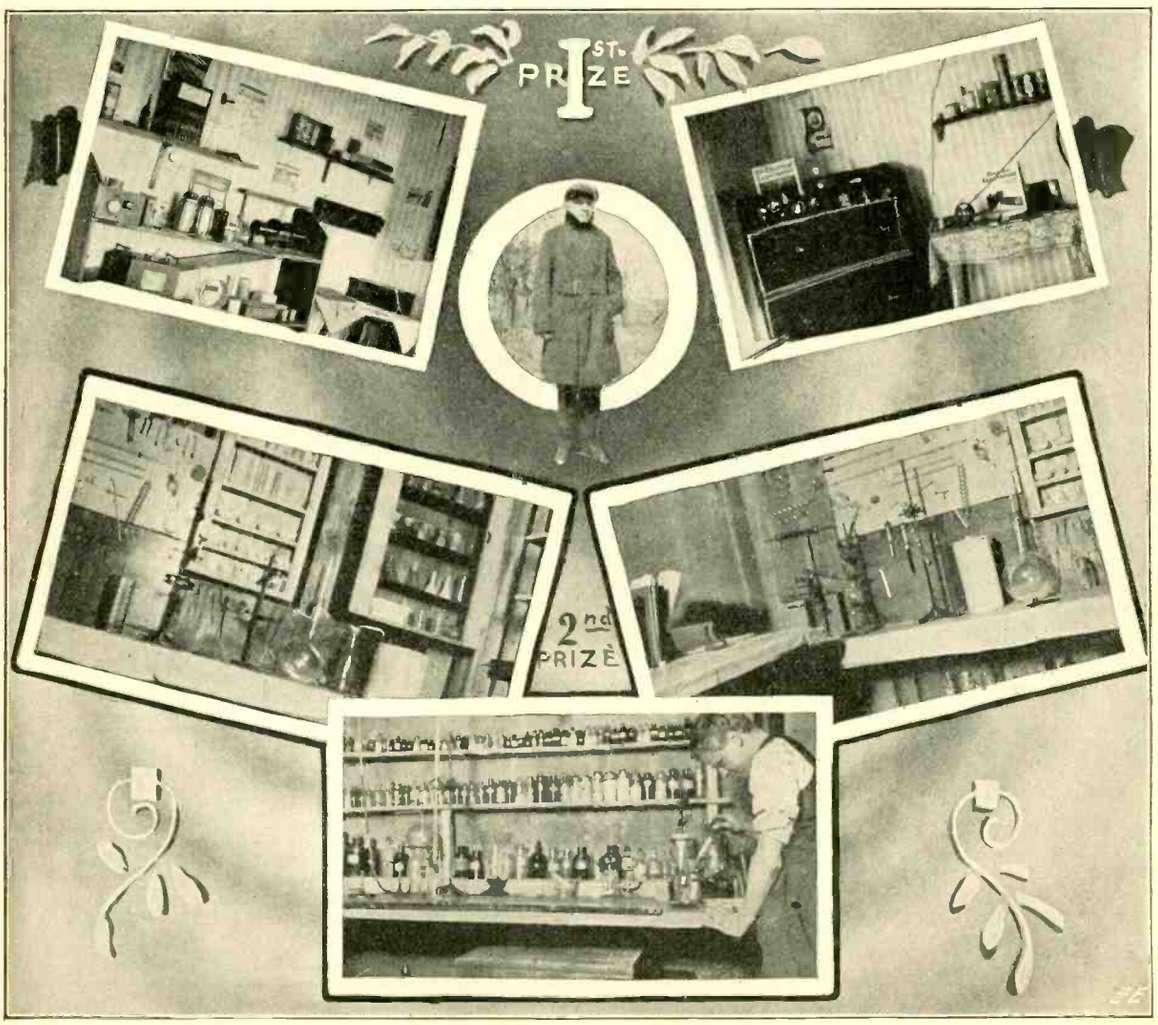
HEREWITH are three photographs of my electrical laboratory. I am sixteen years of age and have had my laboratory two years. I have a 6-volt storage battery, two Tesla coils, spark coils, a dynamo and a number of small motors.

I have a fairly complete wireless "Demonstrating Set" with seven-foot aërials, about ten feet apart. The receiving set consists of a coherer outfit and a detector set with a 75 ohm receiver.

I find the study of magnetism very interesting. I have made many magnets, compasses, galvanoscopes, galvanometers and similar instruments. Also my laboratory contains a chemical department in which I test soils, water, and perform other interesting experiments. In my experimental work I am guided by a library of thirty-five scientific books and the ELECTRICAL EXPERIMENTER.—Stanley C. Reed, Lennon, Mich.

HONORABLE MENTION—THEODORE FREDRICK $2.00 PRIZE PAID EACH "HONORABLE MENTION"

HEREWITH I present four pictures of my chemical laboratory, which is very complete, containing all apparatus used in general chemistry. I spend a great deal of my time in qualitative analysis including analysis of foodstuffs, and most everything else. My laboratory contains an electrical rectifier which I have constructed from an article publisht in the ELECTRICAL EXPERIMENTER. I use this in working experiments in electrolysis, such as making potassium chlorat, sodium hydroxid, etc. I have constructed an electric furnace with which I perform experiments in making alloys and castings. My chemicals number about two hundred and fifty, including salts of most of the metals, and I have about one hundred and seventy-five pieces of apparatus. I have also constructed a large Oudin coil, the top of which can be seen under one of the tables. I have performed a great many interesting experiments in high frequency such as described in this magazine.—Theodore Fredrick, 924 Chicago Avenue, Evanston, Ill.



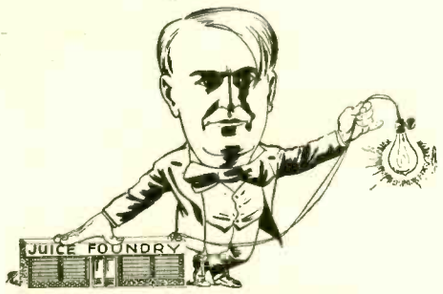
Science in Slang

By EMERSON EASTERLING

"I'M sure glad that station is up and going," remarked Stokes as we motored in from the power plant site.

"I saw a bunch of stuff in the cement houses," put in Punk, "but I'll be flopped if I can make it all out."

"It's more or less a long story," returned Jazz Stokes, "but I'll make it short as possible and still get you birds out of the dark on the subject.



We All Know that Tommy Edison Lost a Lot of Sleep Fiddling Around Over a New Kind of Illumination—the Electric Light. We Used Direct Current then But Nick Tesla Stept in and Gave us "Altering"—Excuse us —Alternating Current.

"We all know that Tommy Edison lost a lot of sleep fiddling around over a new kind of illumination—the electric light—back some years ago. Well, the next thing to do was to make it possible for the neighbors to have the product of his perspiration and inspiration, so he sticks up the primitive central station in the Knickerbocker Burg. The result is that one thing leads to another and now we have 'em all over the sphere.

"Back in the old days they used direct current. Then it was that Nick Tesla steps in and gets disgusted with the layout, kicks out the old stuff and pulls a new one on us. The stunt takes the form of *alternating current*. Nick gets his visionation working and pictures to himself—O, well, anyway he constructs a generator that fools the polarity indicator, and makes it possible for the generator to be farther away from the consumer and yet not have to strain itself to get the juice to the destination."

"How is all this?" asked Bender.

"It's this way," said Stokes, "this alternating current stuff was a new one on the public. The armature in the generator passes thru consecutively opposite magnetic fields and the current therefore goes shooting one way, croaks, and goes flopping back the other way. The speed and number of poles has to do with the frequency of the current.

"Here we put Mike Faraday's induction stuff to some real use. Mike found that if a current be made to pass thru (or over, which way he had it) a wire and another wire be placed parallel, a sort of sympathetic flow will present itself in the second wire; in the other direction. By winding many layers of wire around an iron core—for the iron core makes an easier path for the magnetic flux; the inductive flow is resultant from the induced magnetic field set up by the primary current—of both wires the result is found to be better than to lay the wires stretched out straight. It can be easily seen that the more concentrated flux would act more efficiently than the sparse flux that would course around the extended wires.

"It was found also that if the secondary be wound with smaller wire—more wire being used to make up the mass—that the voltage would be higher in the secondary. If the secondary be wound with larger wire the effect was found to be opposite. All this stuff worked out mathematically to a jot."

The Altering of the Alternating Current

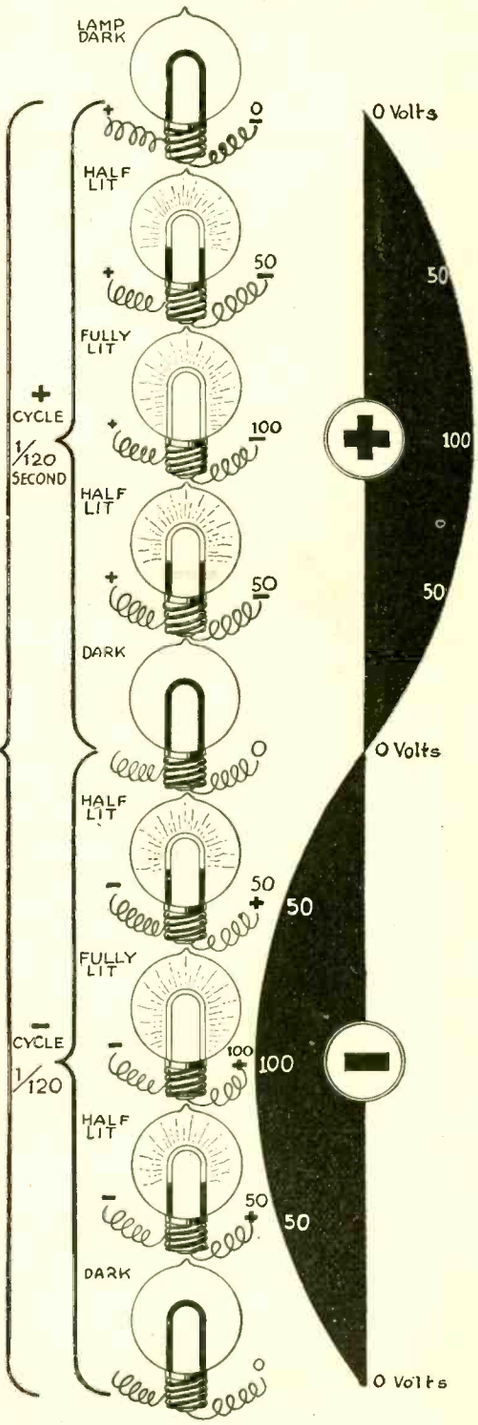
"That all sounds like real spiel," sang out Bender. "But how is it that if the alternating current flops back and forth from positive to negative so many times a second, as you say it does, that we do not perceive any flicker in the incandescent gas bottles, better known as incandescent lamps?"

"Well, as I was going to say," continued Stokes, "several important things happen in producing radiant light from an incandescent lamp after the manner of Tommy Edison's invention. Probably the best way to understand just what happens in the incandescent lamp and why you do not see the flicker when the current pulsation does a one-step, and changes from positive to negative in the twinkling of an eye, is best shown by a drawing." Stokes then took a pencil and pad from his pocket and continued: "Here on the right we have an undulating line known as a *sine wave curve,* and which represents the rise and fall of a single phase alternating current thru two alternations, *or one cycle.* The current at a given instant starts from zero and rises to 50 volts, then 100 volts or 110, whatever it may be, maximum positive value; immediately afterward the positive current impulse starts down hill toward zero again, doing it very smoothly, yet with great speed. The juice makes a complete rise and fall thru *one alternation* or one-half cycle, in 1/120th of a second. Then it passes thru the *dead* or no-current point, also called the zero point, and starts to increase in strength, but in the *negative* (opposite) direction. These negative current pulses, running thru 1/120th second, pass thru the successive rise and fall potentials as you will see, reaching the end once more—this is called *one* cycle by electricians. A cycle comprises two alternations, or a complete reversal from positive to negative. By drawing the various degrees of illumination in the incandescent lamp at different stages thru the cycle, you will at once see how the filament rises from a *dark* condition at the start of a given cycle, increases in temperature and luminosity as the voltage increases thru the *positive* alternation, and finally becomes *dark* again as the current passes thru the first zero point. As the *negative* alternation starts to increase in potential in the next 1/120th second, the filament temperature again rises to a maximum with a consequent full luminosity, and then falls thru successive stages of brilliance until it becomes *dark* once more, as the current passes thru the second zero point at the end of a cycle. This action keeps up repeatedly."

"Yes, that is all very fine," interrupted Bender, "but I don't understand yet, why it is that we do not see the lamp passing thru the dark periods in the cycles. One one-hundred twentieth second is not very fast, and the human eye is supposed to be one of the most wonderful high speed mechanisms in all Nature."

"I was coming to that," bawled Stokes, "if you would have allowed me another minute to catch my breath. Apparently you have forgotten some of your physics, Bender, and on second thought you undoubtedly will agree with me, if you will stop to remember that due to the *retention* of the 'image' on the rod and cone layer of the light sensitive portion of the eye, there is a peculiar action which takes place, causing the image thrown on this element of the eye to be retained for a short but quite appreciable period. Thus it is that

(*Continued on page 444*)



How an Incandescent Lamp Lights Up and Passes Thru the Half Cycle "Dark" Periods When Supplied with "Alternating Current." The "Dark" Periods Are so Short in Time "Duration" that the Eye Does Not Notice Any Flicker.



THE ORACLE

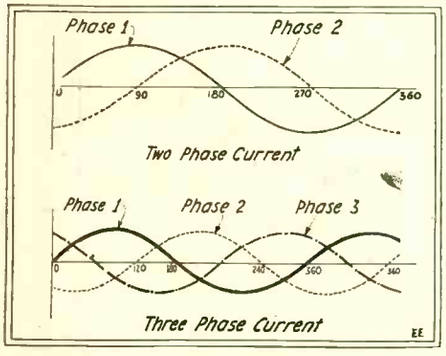
The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be publisht. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions address to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

WHAT IS A POLYPHASE CURRENT?

(1020) Paul W. Meradith, Delavan, Ill., asks:—

Q. 1. What is a polyphase current?



Graphic Curves Showing Difference Between Two and Three Phase Currents. A Polyphase Current is One Comprising three or More Alternating Currents, Spaced Apart on the Time Axis in a Regular and Definite Ratio, Such as Here Illustrated.

A. 1. We must say that this is a very broad subject. You will do very well to consult your library and look up some good works on A.C. current. A very simple explanation, and one which you can readily understand is given in the book entitled, "Alternating Currents—Theory, Practice and Diagrams," by Horstmann & Tousley; also another very excellent work is that entitled "Alternating Currents," by Branch.

We give you herewith illustration showing the relation of the three distinct currents making up a three-phase polyphase system. The three-phase current may be transmitted by six wires or three wires, this system being the usual one in everyday practise. A polyphase current is one composed of two or more distinct, single-phase currents co-acting in a circuit in a certain particular relation to each other. In a two-phase system there are two alternating currents generated in two distinct windings in the alternating-current dynamo; one of these currents is 90 degrees ahead of the other. In a three-phase system there are, as the graph herewith shows, three separate alternating currents generated in three distinct windings on the rotor or stator, as the case may be, of the alternator, and each of these currents is 120 degrees ahead of the other. When one of these polyphase currents enters the windings of an A.C. motor, it sets up a rotating magnetic field of constantly changing polarity, as may readily be imagined, and this drags around the rotor, due to the fact that north and south magnet poles are induced in the iron poles of the rotor, which are repelled and attracted by the suddenly changing north and south magnetic poles of the stator in exactly the same manner as in a direct-current motor.

Your understanding on the subject of D.C. motors most probably makes clear the fact that if it were not for the commutator and brushes connected with the armature or rotor circuit of the D.C. motor, that it could never rotate, and the sole function of the commutator and brushes on such a machine is to suddenly change the polarity of the magnetic poles or fields surrounding the armature, as these poles approach the respective north and south poles of the stationary field.

WANTED!!!

"ODD PHOTOS" AT $1.00 EACH.

Here's what we want! What have you got?

ELECTRICAL PHOTOS—
New photos of Lightning; new and unusual Electrical Apparatus and Machinery; Electric Signs; Electric Autos; Electric Clocks.

SCIENTIFIC PHOTOS—
New Scientific Apparatus; Results; Effects; Motion Pictures; Stunts.

OPTICAL PHOTOS—
Peculiar stunts obtained with various lens arrangements; odd film effects caused by unusual conditions; novel micro-photographic subjects.

ASTRONOMICAL PHOTOS—
New eclipse photos; star and moon effects caught by the camera; comets; shooting stars; progressive moon studies; moon and star photos.

FREAK PHOTOS—
Odd double and triple exposure effects; novel and striking effects due to unusual exposures.

MECHANICAL PHOTOS—
Electrical and Mechanical apparatus of unusual news interest.

RADIO PHOTOS—
New stations, both commercial, government, and private. Owners of private or amateur stations will find a special contest for these photos on another page of this issue. And don't send us plate or film "negatives"; send unmounted or mounted "prints", preferably a light and dark one. Enclose stamps if photos are to be returned and place a piece of cardboard in the envelope with them to prevent mutilation.

Address photos to—Editor "Odd Photos", Electrical Experimenter, 233 Fulton Street, New York City.

ONE-INCH SPARK COIL.

(1021) D—— Brothers, East Lynn, Mass., writes:—

Q. 1. Asking for data on spark coil and underground antennae.

A. 1. Regarding data which you request on underground wireless, we would refer you to the June 1919 issue of the ELECTRICAL EXPERIMENTER wherein you will find a special article by H. W. Secor.

For size of coil which you wish to use with four cells of dry battery, we recommend the following:—

Core about 8 inches long, 1 inch in diameter, properly insulated with a fibre tube having about two to three layers of No. 14 D.C.C. magnet wire wound on same. Over these two or three layers of empire cloth and another insulating tube on top of this, wind about No. 38 S.C.C. magnet wire so as to make the coil about 4 inches in diameter when complete. The coil when operated will give about 1 inch spark.

For information on the construction of spark coils, we would recommend a very excellent book, namely: "Design and Construction of Induction Coils," by Collins, $3.25 prepaid.

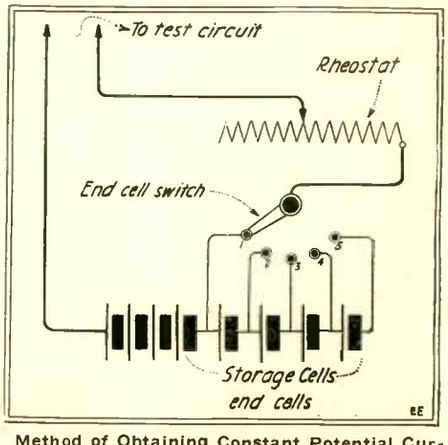
CONSTANT POTENTIAL TESTING CURRENT

(1022)) Oliver V. Austin, Ellisville, Miss., wants to know:—

Q. 1. How can I obtain an absolutely constant testing current from a storage battery?

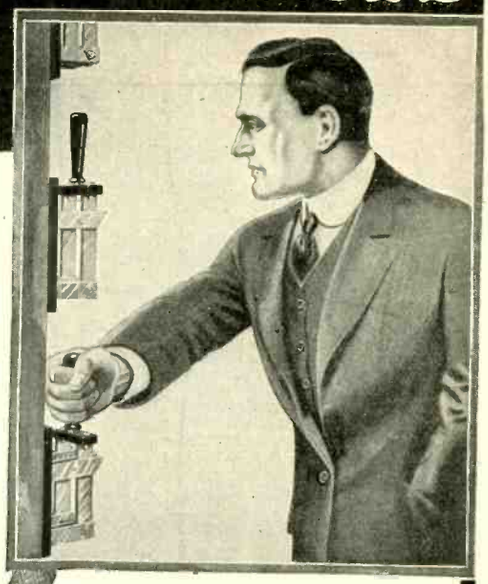
A. 1. Would say that there is no ordinary method available, to our best knowledge, for maintaining a constant potential from such a source, except by means of a rheostat in the circuit, and also by the provision of a so-called *end-cell switch.*

An end-cell switch is a multi-point switch, connected at the end of the series of cells, and so arranged that as the voltage falls from the battery that other cells one by one can be switched in the circuit, and then the final graduations of potential are compensated for by means of a finely adjustable rheostat connected in series with the battery, as here illustrated.



Method of Obtaining Constant Potential Current from a Storage Battery by Means of an End Cell Switch.

Why Electrical Workers Are Needed.



Consider for a moment what part electricity plays in every-day life, in the comfort, convenience, pleasure and even health of the whole civilized world.

Think of having to ride in horse cars again—

of writing a letter every time you now phone—

of waiting days for what the telegraph does in a few minutes—

of no automobiles or moving picture shows—

Electricity takes millions to and from work. Without it the automobile and airplane would be impossible—the telephone and telegraph would be useless. All the civilized world relies on it for light, heat, transportation and communication. In a thousand ways electricity is used in factories, offices and in the homes.

Electricity is almost as essential as the air we breathe. Business would be almost at a standstill if deprived of its energy.

To say that electricity is still in its infancy is no exaggeration. Every day brings into practical use some new method of controlling it, some new device or appliance for using it. In industrial work there are still scores of operations where electricity will be utilized sooner or later. The day is coming when the railroads will entirely replace steam with electricity. Doctors, dentists and scientists are only beginning to realize the possibilities af electrical energy.

These facts merely touch the high spots, yet they prove beyond a doubt that electricity plays a vital part in business, in our individual lives, and that there is unlimited scope for those who make electricity their life work.

The electrical worker provides other men light to work by, the telephone and telegraph to convey their orders, the power to run their machines and transport their goods. He supplies power in the homes to operate washing machines, vacuum cleaners; for ironing, heating and ventilating. In short, it is the electrical worker who makes it possible for the world to live more comfortably, to enjoy more pleasures and to do a bigger, more profitable business.

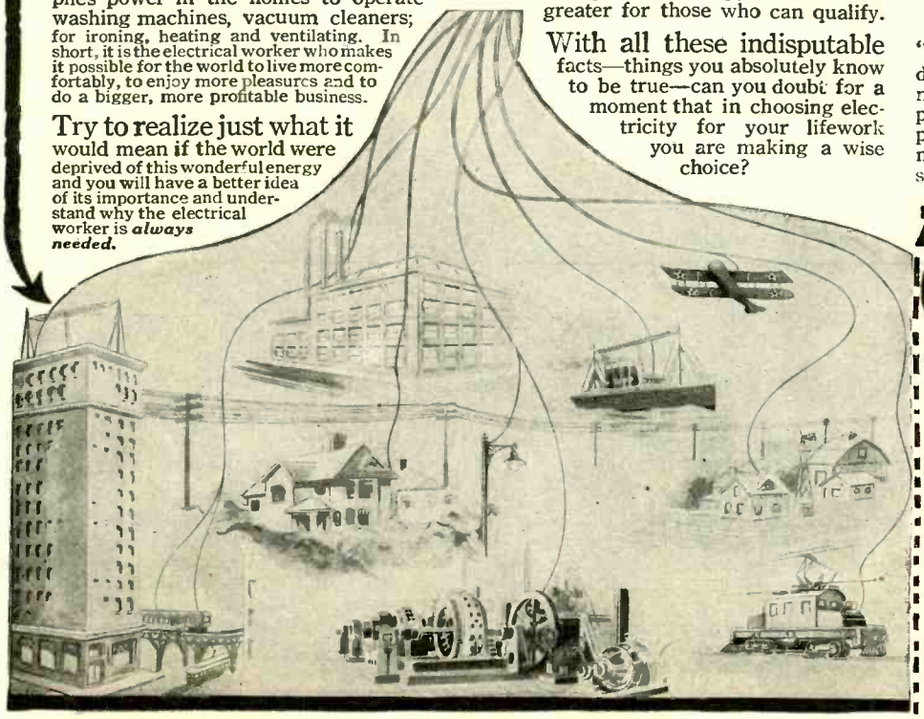
Try to realize just what it would mean if the world were deprived of this wonderful energy and you will have a better idea of its importance and understand why the electrical worker is *always needed.*

What Electricity Offers You

Once you have mastered the A-B-C of electricity you are confronted with unlimited opportunities for advancement. You can specialize in extending and perfecting the wonders already accomplished in the field. You may take up those branches of electrical and mechanical work which cover the design and manufacture of electrical apparatus or start in to qualify for a well-paid position in the designing, construction, operating or consulting branches of the electrical engineering profession, and to fit yourself eventually for a position as Distribution, Operating, Testing, Erecting or Designing Engineer.

In the automobile, airplane, telephone and telegraph lines there is also great scope for the trained electrician. Many wonders of electricity have yet to be unfolded—its uses multiplied—and opportunities still greater for those who can qualify.

With all these indisputable facts—things you absolutely know to be true—can you doubt for a moment that in choosing electricity for your lifework you are making a wise choice?



How You Can Qualify

You don't have to interfere with your present work while qualifying for a good electrical position. The American School can give you just the training you need in your SPARE TIME. Our electrical courses have been specially prepared for home study—are written so you can understand everything quickly—and from your first lesson until you get your Diploma expert instructors coach you. Our training will enable you to get into the game RIGHT.

Read This Guarantee —Then Act

"We guarantee at any time during the first year of your enrollment to refund the entire amount paid if, immediately upon the completion of ten examinations, you notify the School that you are not satisfied with your course."

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. G 266 CHICAGO

TRAINING—THE KEY TO SUCCESS

Please send me booklet and tell me how I can fit myself for the position marked X

. . Electrical Engineer	. . Automobile Repairman
. . Electric Light and Power Superintendent	. . Airplane Mechanic
	. . High School Course
. . Hydroelectric Engineer	. . Architect
. . Wireless Operator	. . Building Contractor
. . Mechanical Engineer	. . Lawyer
. . Heating and Ventilating Engineer	. . Business Manager
	. . Certified Pub. Acc'nt.
. . Sanitary Engineer	. . Accountant and Auditor
. . Master Plumber	. . Bookkeeper
. . Civil Engineer	. . Gen'l Education Course
. . Structural Engineer	. . Com. School Branches
. . Western Union Course	. . Fire Insurance Adjuster
. . Telephone Engineer	. . Shop Superintendent
. . Draftsman and Designer	. . Steam Engineer
. . Automobile Engineer	. . Stenographer

Name. . . . . .

Address. . . . . .

. . . . . .

Diamonds Watches Jewelry

Ten Months' Credit

SEND NO MONEY

According to our simple, easy payment plan, we will send you any Diamond for your examination, express prepaid. If satisfied, pay 1/5 of the purchase price and keep it; balance divided into 10 equal monthly payments.



SWEET Diamonds are superior in quality, distinctive in beauty, perfect in cut—gorgeous bursts of radiant splendor. Can be exchanged at a yearly increased value of 7½%. Ask us about this Profit-Sharing Exchange Plan and for YOUR catalog, No. 579P—IT'S FREE.

THE HOUSE OF QUALITY

L. W. SWEET & CO. INC.

2-4 MAIDEN LANE, NEW YORK



$1362 BUYS THE MATERIAL TO BUILD THIS HOME

Improved Sensibly. Cut-to-Fit. Approved by Carpenters. When You Build "THE HARRIS WAY" you build to stay. Exclusive cutting and bundling features—special advantages for the careful Home Builder. It is the best, safest and most sensible way to build your ideal home right, without the waste of a single penny.

LOW PRICE STILL IN FORCE

If you are needing a house, either for investment or for a home, write us.

$10,000 FREE Plan Book

Write today for our beautiful $10,000 HARRIS HOME PLAN BOOK now ready. 100 Designs, with floor plans, prices, etc.; explains how we save 25 to 33 1-3% on finished cost.

Get our FREE Blue Print Plan offer

Your protection—Every sale iron clad guaranteed

Write Today

HARRIS BROS. CO. Dept. CX-412 Chicago



SLIGHTLY USED STANDARD MAKE TIRES

Size	New Tube	Price	Size	New Tube	Price
30x3	$1.85	$ 4.50	35x4½	$3.00	$10.25
30x3½	2.00	5.00	36x4½	3.50	10.50
31x3½		5.50	35x5	3.75	11.00
32x3½	2.25	6.00	36x5		11.50
31x4	2.75	6.50	37x5	4.00	12.00
32x4	2.40	7.50			
34x4	2.70	8.50	Special—Brand New		
34x4½	2.85	10.00	32x3½, Cord		$12.25

Order now. Shipment made the same day. $1 deposit required with each tire order, balance C. O. D., subject to your examination. Specify whether you desire to have clincher or straight side tire.

Special cash discount of 5 per cent if full amount accompanies order.

CENTRAL TIRE & VULCANIZING CO.,
2309 S. STATE ST., Dept. E. E. CHICAGO

Experimental Mechanics

By Samuel D. Cohen

(Continued from page 423)

favor with all users of reamers. The eccentrically relieved reamer is purely a finishing reamer, and cannot be used with advantage to remove any considerable amount of metal. When hand reamers are used merely for the purpose of removing stock, or simply for enlarging holes, the flat relief will undoubtedly prove to be superior to the eccentric. The primary use of straight hand reamers, however, is for producing holes true to size and smoothly finished, removing meanwhile but a small amount of stock. For this purpose nothing excels the eccentric relief. That there are a number of different classes of reliefs required, according to the use to be made of the reamer, is best proved by the fact that while some manufacturers of tools relieve their reamers eccentrically, intending them to be used as finishing reamers, some of their customers place them in a grinding machine and replace the eccentric relief with a flat one, because they find this relief better for their purpose, viz., simply enlarging holes irrespective of the highest requirements of accuracy and smoothness.

A regular cutter and reamer grinder is often used for grinding reamer teeth. See Fig. 5. Another method is to utilize an electric grinder held in the tool post of a lathe, while the reamer is held between the lathe centers. The most economical and best results are obtained when using a grinding machine, made for this purpose. The sharpening or backing off of reamers in a lathe is unsatisfactory and should never be resorted to unless no other means are at hand. Sometimes it happens that a large reamer must be sharpened, the diameter of which is either too long or too short for the capacity of a grinder. In such a case the electric grinder used in a lathe will prove satisfactory. Of course, from the experimenter's point of view, the only means at hand for him to grind his reamers will be the lathe and electric grinder.

The amount of clearance that a reamer tooth should have depends largely upon the class of reamer and its size. A suitable clearance for reamer teeth, exprest in degrees (the face of the tooth being radial), is not a fixt number, but varies for different diameters, and the smaller the reamer the greater the angle of clearance should be. Hence, if the cutter and reamer grinder are set to grind the right amount of clearance on a large reamer, a smaller reamer would not have a suitable clearance at that setting.

(To be continued)

How the R-34 Crost the Atlantic

(Continued from page 404)

fying audion and sending outfit he has been able to send and receive a distance of 1,200 miles by actual test, he being off the coast of the Azores at the time, communicating with the British Air Ministry at London. The auxiliary outfit is capable of sending 800 miles. In addition to this there is an ordinary spark coil outfit, utilizing but a small amount of current, which has covered a range of 300 miles. This seems rather unique, inasmuch as it is seldom that small spark coil outfits ever cover such a great distance. But according to Lieut. Durrant, it is a fact, and is recorded in the ship's "log." In addition to these outfits there is a "Wireless Telephone" instrument device, which can be connected to the auxiliary wireless outfit, and when so connected, forms a part of this auxiliary outfit, by means of which wireless telephonic communications have been sent and received while in flight.

In back of the Radio Room is the engine room of the forward gondola. This, like the other gondolas, contains a high-powered gasoline engine, which, however, is greatly geared down, the power of each motor being about 275 H.P. An oiler and a mechanic are in charge of these engines constantly, both day and night. Amidships are two gondolas, each of them containing an engine and its respective propeller. The rear gondola has two such engines geared to a single propeller so that either one or both may be operated at the same time. Energy for electric lights is derived by special dynamos each connected to an engine; these dynamos furnish the light for the respective gondolas, and are connected in such a way as to allow any one of them to furnish the electric current thruout the entire ship if necessary. The energy for the wireless station is derived from the main engine. From each gondola there is an aluminum ladder enclosed in a fabric, which leads up into the interior of the blimp. These ladders connect into a passageway so that men aboard the airship may pass from one gondola into another. In the center of the airship there is a large room 20 feet long by 8 feet wide, in which the crew eat, their meals being cooked over the exhaust pipe of the engines. Strange as it may seem the men had bacon and eggs for breakfast on the first day out, cooked as above mentioned on the exhaust pipes of the engine. This shows the terrific amount of heat that these engines, because of their combustion, furnish. Hence each engine has connected with it a very elaborate system of radiators in order to cool it. These radiators are placed above the gondolas as shown in the illustrations.

In the center of the ship there is a runway covered with linoleum, as already mentioned, stretching almost thru the entire length of the keel, i. e., about 600 feet long, and only 9 or 10 inches wide, which the crew use for exercising and for passing from one gondola to another. Should one member attempt to pass the other, either one of them must lean against the aluminum frame-work of the dirigible, so as to allow the other to pass. Should they fail to do this, a drop of about 8,000 feet into the briny deep would result. There is plenty of room to walk upright, the roofs of the gas bags above being about 12 feet from the runway. The gas bags are divided into eighteen separate envelopes, which are inflated with hydrogen, nine of these being equipt with automatic valves so that expanding gases due to changes in temperature may escape. All the bags are incidentally equipt with gages, which register the pressure of gas and are inspected hourly. The hydrogen bags are made of calves' intestines (goldbeater's skin). There are sixteen gasoline tanks attached to the frame-work on either side of the runway, each with a capacity of about 70 gallons, forming a total weight when filled of about 500 lbs. There are forty-nine of these tanks aboard the gondolas and thirty-two in the ship, making a total of eighty-one, more than half of which can be thrown overboard to lighten the craft in case of emergency, which is absolutely necessary inasmuch as there is no way of refilling the

(Continued on page 440)



Be a Draftsman
Raise Your Income

Get into this paying profession and have positions opened to you by manufacturers, architects, railroads, contractors—by every kind of a corporation where mechanical design and construction are carried out. Draftsmanship puts you in the class of specialists, raises you above the crowd of job hunters, makes you a man whose services are needed.

You have the same opportunity to get the training that other men had who took the Chicago "Tech" Course in Draftsmanship and are now drawing large salaries and holding important, responsible positions. You also can learn how to earn

$25 to $100 a Week

Not enough really skilled draftsmen are available to fill the places open now. All you need is training to be prepared to answer the call that will mean more money for you. Begin your training without delay. Don't waste time waiting. The Chicago "Tech" experts are ready today to give you the thorough, practical instruction which will enable you to step into the drafting room of some big organization prepared to do the kind of work that earns high salaries and leads to advancement. At least write. Mail the coupon below or a letter stating which branch specially interests you.

Drawing Outfit
(No Extra Charge)

Every student of the Chicago "Tech" Home Study Course in Draftsmanship receives this drawing outfit—set of instruments in case, drawing board, T square, triangles, scale, curve, drawing paper, pencils, etc. or a cash credit in case he already has an outfit. These instruments are of the same make and sizes as used by high salaried experts in drafting rooms of factories, shops, railroads, etc. You use them while learning — then take them right into your practical work.



Come to Chicago "Tech" OR TRAIN AT HOME

Chicago "Tech" has its students everywhere. If you can't come to Chicago, take the Home Study course. The same professors who direct the resident courses will teach you by mail. You will have their personal direction, you will learn the most modern methods—all this while holding your present job. We train hundreds of ambitious men—and see them quickly rise to success. You therefore need not be denied this technical education. Sign and mail the coupon.

Get Practical Training from Practical Men
NO TIME PUT IN ON NEEDLESS STUDIES

Enrollment with Chicago "Tech" means getting direct personal instruction from men who for years have planned and directed big architectural and engineering work in leading cities. They have weeded out useless theories and needless studies and will give you the kind of instruction which will enable you to work beside the most experienced men.

That is one reason why you can get a complete, thorough technical training here in such a short time. Also the reason why Chicago "Tech" men are in such great demand. They go into work prepared to give the kind of service wanted.

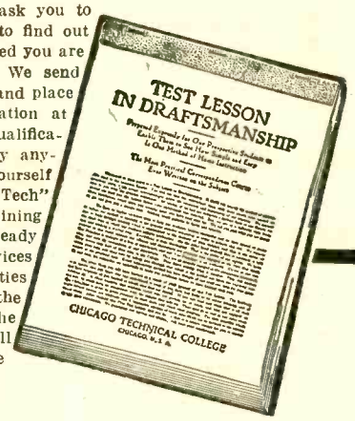
This is the training you are offered either at the college or by mail. And this is the time to enroll when there is such a pressing need for highly trained draftsmen. Use your spare hours to fit yourself for a bigger salary—a more important position. Chicago "Tech" offers you the opportunity. WRITE.

EASY PAYMENTS

Low tuition fees and easy terms of payment. Pay as you go along. Get training which will soon repay in extra earnings all the cost of the course. You know the salaries received by skilled technical men today. Get information on the opportunities which you opened wide to you by Chicago "Tech". We will give you all this information about fees, terms, etc., and send testimonials from Chicago "Tech" graduates on how they have profited from our instruction, if you will send the coupon.

FREE TEST LESSON

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything. And see for yourself just what Chicago "Tech" offers you in training which will bring a ready market for your services and open opportunities which are closed to the untrained man. The coupon will bring all the facts about the course, the small fee, and the easy terms.



Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Learn all about Principles of the Automobile, all about Gas Engines, Power Plants, Transmissions, Lubrication, Cooling, Batteries, Starting and Lighting Systems, etc.

KNOW HOW TO FIX TROUBLES

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men.

Aeronautics

Complete, practical instruction in Aeronautic Engineering. Every principle made clear. Construction of every type of machine fully explained. This course equips you for expert work. Get the catalog and information. Send coupon.

WRITE

Below we list our principal courses in Drafting and several others. Just mark X in the [ ] to show which course interests you and we will send catalog and information about that particular subject. If in doubt about yourself, tell us your ambitions and we will advise you. Sending this coupon may mark a turning point in your career. May lead to a larger measure of success than you have expected. We can train you as we have trained others. Send the coupon today.

CHICAGO TECHNICAL COLLEGE
945 Chicago "Tech" Building, Chicago

CHICAGO TECHNICAL COLLEGE
945 Chicago "Tech" Building, Chicago

Without obligation upon me, send your Catalog on subject indicated below. Also FREE Lesson if inquiry is on Drafting or Plan Reading.

Mark X opposite work in which you are especially interested.

[ ] Architectural Drafting
[ ] Machine Drafting
[ ] Electrical Drafting
[ ] Structural Drafting
[ ] Sheet Metal Drafting
[ ] Builders' Course
[ ] Plan-Reading—Buildings
[ ] Plan-Reading—Shop Men
[ ] Estimating.
[ ] Surveying
[ ] Autos and Gas Engines
[ ] Aeronautics

Name.....

Address.....

City.....State.....

College or Home Study? State which.....

Book of Styles and Cloth Samples Sent FREE

We Pay Shipping Charges



AMAZING SUIT OFFER!

$17.50

Tailored to Your Measure

Yes—a real $27.50 suit cut and made TO YOUR INDIVIDUAL MEASURE—tailored with all the skill and style that only the best custom tailors can give. Price only $17.50. Finished with highest grade trimmings and linings—the kind that wear and give satisfaction. A special proposition to introduce to the readers of this magazine the wonderful values offered by our system of tailoring. Nothing else like it—no values to equal it.

Our Plan Saves You $10

We have no agents, no dealers, no traveling salesmen. Our catalog is our only representative. Our plan saves $10 or more on every suit and gives you real individuality in your dress. A wonderful selection of fancy wool worsteds, cassimeres and all-wool BLUE SERGES, AT UNHEARD-OF LOW PRICES.

Send only $3.00 and your measurements, with cloth selection made from our catalog. We will make the suit to your measurements and you pay balance on arrival. We take all the risk, you none, for this is our guarantee: Complete satisfaction or all money refunded.

FREE Book of Styles and Cloth Samples

Our big, new Fall and Winter Book is ready for you—contains samples of latest woolens; also lowest prices on men's hats, shoes and furnishings. It is your guide to correct and economical clothes buying. Write, mentioning this publication so we can identify this special offer.

Bernard-Hewitt & Company
424 South Green Street, Desk 349, Chicago, Ill.

$SALARY EASILY DOUBLED

STENOGRAPHERS!

Typewrite the New Way—80 to 100 words per minute guaranteed. Earn $25 to $40 weekly. Totally new system. Gives speed and accuracy. Learn at home.

If you want more money in your Pay Envelope write for book, explaining the system. Tells how hundreds of NEW WAY graduates increased their salaries $300, $500, $1000 yearly. SEND POSTAL TO-DAY FOR FREE COPY.

THE TULLOSS SCHOOL
3529 College Hill, Springfield, O.

THE NEW WAY IN TYPEWRITING

READ THE CLASSIFIED ADS. ON PAGES 484-486

How the R-34 Crost the Atlantic

(*Continued from page* 438)

bags with hydrogen while at sea. There are three immense drinking water tanks and several water ballast tanks which may be opened to lighten the airship. Everything inside the ship is balanced to perfection, tank for tank, hammock for hammock, and parachutes and life belts for parachutes and life belts on either side. The men eat and sleep in shifts. They sleep in hammocks made of Italian hemp, which are strung from one aluminum strut to another; there are ropes to tie oneself in with. There are ten of these hammocks, three forward, three aft, and two on each side amidships. Two aluminum ladders are connected with the forward and rear gondolas leading between the hydrogen balloonets to the top of the dirigible, where a cockpit opens to the external atmosphere by means of which the observer, taking care not to attempt to stand on the roof while the ship is in motion, takes a "shot" at the sun.

No leather shoes are worn by any of the men around the vessel in order to avoid jarring. Nor are matches allowed inside the envelope at all, everyone using flashlights equipt with miniature electric storage batteries. Inside the ship are found some of the comforts of home, the crew having brought two phonographs to America with them and returning with a third, presented by Mr. Thomas A. Edison. By jabbing a needle into Caruso, they heard him yell all night. In other words, these phonographs were kept going constantly. Lieutenant Durrant asked us not to forget to mention the mascot, a small maltese cat named "Jazz," which he is sure brought them luck on both the journey to America and back home again.

THE AIRSHIP IN MOTION.

The ship is 672 feet long and 150 feet beam at its maximum diameter. The ladders leading to the top are approximately 80 feet high. In order to start the vessel, its moorings are loosened, after which the ship swiftly drifts upward to about 8,000 or 9,000 feet. At this level an equilibrium is establisht and the engines are then started, when the ship proceeds on its course. The speed of the vessel is approximately 49 knots per hour when under full swing with no unfavorable winds, and the men on duty remain at their posts for about four hours, after which they are relieved by another section. For every thousand feet that the dirigible ascends, it loses 1/30th of its volume of gas, and in very heavy foggy weather naturally its normal position would be much nearer to the earth's surface, due to the fact that with a heavier atmosphere it would not be as buoyant.

The ocean viewed from this wonderful craft appears to be a vast blue stretch of prairie, beautifully streaked with green, which is visible thru the rifts in the clouds; every now and then a long white streak forms and rolls along rapidly. Wave motion is not visible at all, but the foam turned up by the wave as it breaks is distinctly noted as the white line of which we have just spoken. On preparing to land, the hydrogen is not allowed to escape, as so many think. The blimp's propellers are kept in constant motion and its rudder is tilted so as to make a nose dive at about a 45 degree angle. Sweeping around the field several times and preparing for a landing place, the vessel comes nearer and nearer to the ground. When all is ready a heavy cable is thrown out from the forward gondola which willing hands immediately grasp, and in addition to this some water ballast is thrown out, giving the landing crew a nice ducking.

While at Mineola, Long Island, the airship was anchored to huge concrete blocks, but because of the terrific resistance such a large body offers to a gust of wind, it broke loose from its moorings, a large hole being torn in its outside envelope. This was repaired in short order, and after that the balloon was held under control by a number of United States soldiers who swung the balloon like a weather vane, so that it continually presented a streamline effect and never broadside to the wind. In this way it was handled for the rest of its stay with no mishap.

An American army portable electric generating station furnished electric current for the searchlights scattered thruout the field, and current for operating the electric gasoline pumps to fill the tanks in the R-34. This outfit represents the latest army type of portable generator, giving about 110 volts and 125 amperes direct current.

Sir William Crookes' Psychical Researches

By Hereward Carrington, Ph. D.

(*Continued from page* 407)

with electricity, and of such a height that it would just fit under the table (see illustrations). Writing of these experiments, Sir William says:

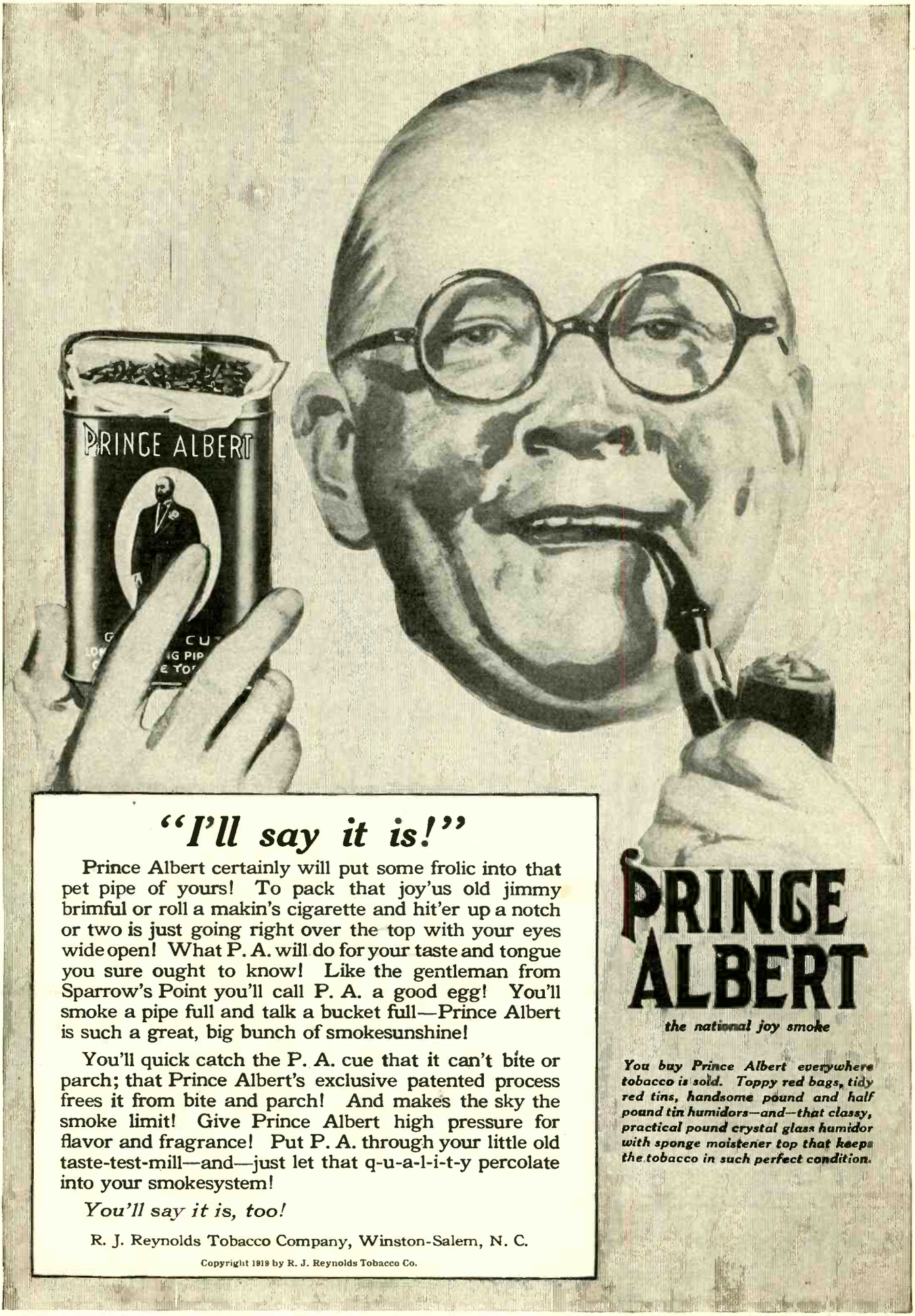
"Mr. Home took the accordion between the thumb and middle finger on one hand at the opposite end to the keys. . . . Having previously opened the brass key myself, and the cage being drawn out from under the table so as just to allow the accordion to be pushed in with its keys downwards, it was pushed back as close as Mr. Home's arm would permit, but without hiding his hand from those next to him. Very soon the accordion was seen by those on each side to be waving about in a somewhat curious manner: then sounds came from it, and finally several notes were played in succession. Whilst this was going on, my assistant looked under the table, and reported that the accordion was expanding and contracting, and at the same time it was seen that the hand of Mr. Home, by which it was held, was quite still—his other hand resting on the table.

"Presently the accordion was seen by those on either side of Mr. Home to move about, oscillating and going round and round the cage, and playing at the same time. Dr. A. B. now looked under the table, and said that Mr. Home's hand appeared quite still, whilst the accordion was moving about, emitting distinct sounds. . . . But the sequel was still more surprising, for the medium then removed his hand altogether from the accordion, taking it quite out of the cage, and placed it in the hand of the person next to him. The instrument then continued to play, no person touching it and no hand being near it."

When Home had hold of one end of the accordion, Sir William Crookes took hold of one of the medium's wrists, and found that *he was not moving a muscle.*

The next experiments were those with a "spring balance." A mahogany board, 36 inches long, was suspended at one end to a balance, supported by a firm tripod stand. See illustration herewith. Any downward pressure upon the board was therefore registered by the spring balance. The other end of the board rested upon a knife-edge fulcrum on a solid table, and directly over the center of the fulcrum was placed a large glass bowl filled with water. Over this, in

(*Continued on page* 442)



"I'll say it is!"

Prince Albert certainly will put some frolic into that pet pipe of yours! To pack that joy'us old jimmy brimful or roll a makin's cigarette and hit'er up a notch or two is just going right over the top with your eyes wide open! What P. A. will do for your taste and tongue you sure ought to know! Like the gentleman from Sparrow's Point you'll call P. A. a good egg! You'll smoke a pipe full and talk a bucket full—Prince Albert is such a great, big bunch of smokesunshine!

You'll quick catch the P. A. cue that it can't bite or parch; that Prince Albert's exclusive patented process frees it from bite and parch! And makes the sky the smoke limit! Give Prince Albert high pressure for flavor and fragrance! Put P. A. through your little old taste-test-mill—and—just let that q-u-a-l-i-t-y percolate into your smokesystem!

You'll say it is, too!

R. J. Reynolds Tobacco Company, Winston-Salem, N. C.

Copyright 1919 by R. J. Reynolds Tobacco Co.

PRINCE ALBERT

the national joy smoke

You buy Prince Albert everywhere tobacco is sold. Toppy red bags, tidy red tins, handsome pound and half pound tin humidors—and—that classy, practical pound crystal glass humidor with sponge moistener top that keeps the tobacco in such perfect condition.

Be a Real Man!

LOOK LIKE ONE AND FEEL LIKE ONE!

BROADEN YOUR SHOULDERS, DEEPEN YOUR CHEST, ENLARGE YOUR ARMS, AND GET A DEVELOPMENT THAT WILL ATTRACT ATTENTION. FILL YOURSELF FULL OF ENERGY AND BE POWERFUL

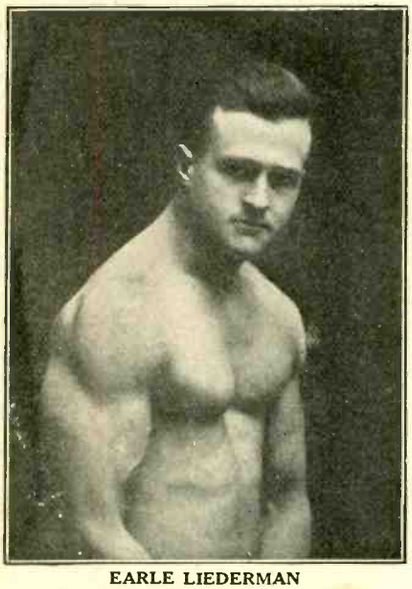
What's the use of merely existing, when you can improve yourself to such an extent that life will become a pleasure.

You don't know what life is unless you are an athlete.

If you are weak, run down, mentally and physically, if you lack ambition or feel discouraged, if you have suffered from youthful errors, or dissipations of later years, if you are bothered with indigestion, constipation, worry, kidney trouble, or any like ailment, *brace up*, and **START IN ANEW, AND MAKE THE MOST OF YOURSELF.**

I can do for you what others cannot attempt to begin to do, because my methods are original with me.

I BEGIN WHERE OTHERS LEAVE OFF.



EARLE LIEDERMAN
The Acme of Physical Perfection

I have trained some of the world's strongest men. If you will let me train you, I can give you a *wonderful muscular development* and great strength as all my pupils have.

I PRACTICE WHAT I PREACH. By my own original methods I developed myself. I keep myself fit.

To make others fit, an instructor should first be fit himself. If an instructor cannot keep himself fit, what good are his methods of training?

HAVE YOU RECEIVED A COPY OF MY NEW BOOK "MUSCULAR DEVELOPMENT"? If you have not as yet read this interesting book, by all means send for a copy. It is handsomely illustrated with 20 full page photographs of myself and some of the finest developed athletes whom I have trained. This book describes my system and you will find it intensely interesting. Send me 10c, stamps or coin, and I will mail you a copy promptly. Simply tear off the coupon below and mail to me with 10c. Do this right now, at once, before you forget it.

EARLE E. LIEDERMAN
Dept. 212, 203 Broadway, N. Y. City

EARLE E. LIEDERMAN,
203 Broadway, New York City.

Dear Sir:—I enclose herewith 10c for which you are to send me, without any obligation on my part whatever, a copy of your latest book "Muscular Development." (Please write plainly.)

Name .....

Street .....

City .....State .....

E. E., Sept., 1919.

Sir William Crookes' Psychical Researches

By Hereward Carrington, Ph. D.

(*Continued from page* 440)

turn, but quite detached from it, being separately supported, was a metal cup, perforated, so as to allow the entrance of the water. The board, thus suspended, weighed six pounds.

It will be observed that by placing the fingers in the metal bowl no added weight was imparted to the board, since this would serve only to displace a small amount of water, which would be registered equally on both sides of the fulcrum.

Mr. Home was asked to place his fingers in the metal bowl, in the water, without touching anything, and requested to *will* the emission from his fingers of the "psychic force," in order to register a depression of the opposite end of the board near the spring balance. He did so, his hands and feet being carefuly guarded (all these experiments being in good light). *A pull of about* 5,000 *grains was registered!* In a number of subsequent experiments, even stronger pressures were measured, which results were permanently recorded by means of a needle, making a graphic tracing of the various depressions and oscillations of the board. The manifestation of some kind of "psychic force" thus seemed to be establisht.

These, however, were but the simple, initial experiments undertaken by Sir William Crookes, which proved to him the reality of "psychic phenomena." His subsequent researches were most striking, including such manifestations as the *levitation or floating in space of the medium's body; the elongation of his body; the movements of objects without contact; playing upon musical instruments without any human hand being near him; the handling of red-hot coals without injury to the medium, and finally (with the medium Florence Cook) full-form materializations, which were seen and photographed by Sir William Crookes, and proved by him to be independent beings, separate from the body of the medium.* Sir William thus enumerates the phenomena witnest by himself:

The movement of heavy objects without contact; raps; the alteration of weight of bodies; movements of heavy substances at a distance from the medium; levitations of tables and chairs, without contact; the levitation of human beings; luminous appearances (lights); the appearance of hands; direct writing; phantom forms and faces; various phenomena indicating intelligence other than that of the medium.

Regarding, for instance, *levitation,* Sir William Crookes says:

"On one occasion I witnest a chair, with a lady sitting on it, rise several inches from the ground. On another occasion, to avoid the suspicion of this being in some way performed by herself, the lady knelt on the chair in such manner that its four feet were visible to us. It then rose about three inches, remained suspended for about ten seconds, and then slowly descended. . . . The most striking cases of levitation which I have witnest have been with Mr. Home. On three separate occasions have I seen him raised completely from the floor of the room. Once sitting in an easy chair, once kneeling on his chair, and once standing up. On each occasion I had full opportunity of watching the occurrence as it was taking place. . . . There are at least a hundred recorded instances of Mr. Home's rising from the ground, in the presence of as many separate persons, and I have heard from the lips of the three witnesses to the most striking occurrence of this kind—the Earl of Dunraven, Lord Lindsay and Captain C. Wynne—their own most minute accounts of what took place. To reject the recorded evidence on this subject is to reject all human testimony whatever, for no fact in sacred or profane history is supported by a stronger array of proofs.

"The accumulated testimony establishing Mr. Home's levitations is overwhelming. It is greatly to be desired that some person, whose evidence would be accepted as conclusive by the scientific world—if, indeed, there lives a person whose testimony *in favor* of such phenomena would be unequivocally taken—would seriously and patiently examine these alleged facts. Most of the eye-witnesses to these levitations are now living (at that time), and would, doubtless, be willing to give their evidence. But in a few years such direct evidence will be difficult, if not impossible, to be obtained. . . ."

Other phenomena recorded by Sir William Crookes regarding the mediumship of Home are still more wonderful. For instance, on a number of occasions, *Home took live coals from the fire, held them in his bare hands, and blew on them until the flames licked between his fingers, and the coal could be seen burning with a fierce heat in his hands.* On several occasions Home asked one of his sitters to touch the coal to assure himself it was hot; he did so, with the result that a large blister was at once raised on the hand. On other occasions, however, Home would apparently communicate his "preternatural incombustibility" to one of the sitters. He would say, "*Now,* touch the coal!" and they would be enabled to do so with the same impunity as Home himself. These phenomena—incredible as they may appear—were vouched for by many witnesses, including Sir William himself, and seem to be among the best-attested of Home's phenomena. The only analogy we have is the so-called "fire walking ceremony" performed in India, Japan, the Fiji Islands, etc.—if we leave out of consideration the historic case of Shadrach, Meshach and Abednego!

Doubtless the most striking tests undertaken by Sir William Crookes, however, were those made with the medium, Florence Cook. These manifestations took place in Sir William's own home—usually in his laboratory—and were of the order of *full form materialization.* Florence Cook, the medium, would enter the cabinet, and apparently go into a state of deep trance. The room being in complete darkness, a white-robed spirit form, claiming the name of "Katie King," would emerge from the cabinet and be seen by the sitters—at times carrying on a conversation with them. Naturally, the question at once comes into the mind: Was fraud possible in this case? Was a confederate employed, or could the medium herself have played the part of the materialized spirit?

It may be taken as certain that no confederate was employed. The tests were conducted, as stated, in Sir William Crookes' own laboratory, and the doors were securely locked before the séance began. No; if any fraud was possible at these times, the medium herself was responsible for it. Could the medium have played the part of "Katie King"?

Writing of this, Sir William says:

". . . Katie is half a head taller than Miss Cook, and looks a big woman in comparison with her. In the breadth of her face she differs essentially in size from her medium, and the photographs show several other points of difference. . . .

"I have the most absolute certainty that

(*Continued on page* 444)



Which Job Do You Want?

NOT one of these jobs is beyond your reach. You can have any one you want. The big pay that goes with it is yours, too. A little ambition and some training that you give yourself at home is all you need. You don't have to serve an apprenticeship. You don't have to go to school. American Technical Society Home Study Books and a little spare time will quickly fit you to hold any kind of job. If you haven't the necessary "know how" to put you in the big pay class, make up your mind to get it right now. Pick out the job you want and send the coupon for the books that will fit you to hold it.

Some of the greatest experts in the world prepared these books just for you—to help you get ahead. They are written in plain, everyday, good old U. S. language, just like you and I talk. No big technical terms—no trouble to understand them. Hundreds of pictures and diagrams in each set help to make difficult things as simple as A. B. C.

Examine Any Books Free

Carpentry and Contracting, 5 volumes, 2138 pages, 1000 pictures. Was $25.00. Now...$17.80
Civil Engineering, 9 volumes, 3900 pages, 3000 pictures. Was $45.00. Now..... 29.80
Fire Prevention and Insurance, 4 volumes, 1500 pages, 600 pictures. Was $20.00. Now 15.80
Electrical Engineering, 8 volumes, 3800 pages, 2600 pictures. Was $40.00. Now..... 24.80
Automobile Engineering, 6 volumes, 2600 pages, 2000 pictures. Was $30.00. Now..... 19.80
Machine Shop Practice, 6 volumes, 2300 pages, 2000 pictures. Was $30.00. Now 19.80
Steam and Gas Engineering, 7 volumes, 3300 pages, 2500 pictures. Was $35.00. Now...$21.80
Law and Practice (with reading course) 13 vols, 6000 pages, illustrated. Was $72.00. Now 39.80
Telephony and Telegraphy, 4 volumes, 1728 pages, 2000 pictures. Was $20.00. Now... 12.80
Sanitation, Heating and Ventilating, 4 volumes, 1454 pages, 1400 pictures. Was $20.00. Now 13.80
Practical Accounting, 4 volumes, 1840 pages, 800 pictures, etc. Was 20.00. Now..... 12.80
Drawing, 4 volumes, 1578 pages, 1000 pictures, blueprints, etc. Was $20.00. Now..... 14.80

Don't Send Money The coupon alone, properly filled out brings any books you select by express collect. No money to pay in advance and no obligation to buy. **Only 50c a Week**

Use the books as you please for a week and send them back at our expense if you want to. If you decide to keep the books to help you make more money like thousands of other men have done, send us only $2.00 each month. This is only 50 cents a week.

Extra Special FREE OFFER Those who send the coupon promptly will be enrolled as a consulting member of our Society for one year. This gives you the privilege of consulting our engineers and experts on any problem connected with your work—**Free of any charge.**

Go after one of these big jobs now. This is the time. Trained men were never more needed than they are today. This coupon is your start on the road to real success. **MAIL IT NOW.**

American Technical Society
Department X-256 Chicago

REDUCED PRICE COUPON

American Technical Society, Dept. X-256, Chicago

Please send me set of ..... for 7 days examination, shipping charges collect. I will examine the books thoroughly and if satisfied, will send $2 within 7 days and $2 each month until I have paid the special price of ..... If I decide not to keep the books, I will return them by express at your expense. Title not to pass to me until the set is fully paid for.

Name .....
Address .....
Reference .....

½ SAVED
GET OUR
BIG BOOK

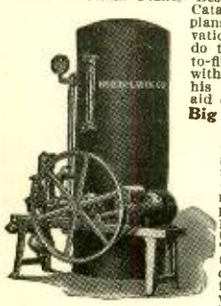
DO Your Own PLUMBING AND HEATING at low cost

Send for our big instructive 256 page well-bound Handy-Man Book Catalog. Every Home Owner, Contractor, Electrician, Farmer, Factory Manager, etc., needs it. Shows over 10,000 Fixtures and Supplies in plumbing and heating at wholesale. Shows how to save skilled labor, hard work and unnecessary material by



OUR NEW
Cut-to-fit-Method

This wonderful book helps you select and install the proper Plumbing, Water Supply System, Hot Air, Water or Steam Plant. Besides being our Wholesale Catalog it has many practical plans, diagrams, sketches, elevations, etc., showing how to do the work this newer, cut-to-fit way. Any handy man with a few tools can easily do his own installing with the aid of this



Big Handy-Man Book

We have spared no effort and have gone to a great expense to compile this valuable book. With economy still a national necessity, it would be unpatriotic to send this expensive book broadcast to non-interested parties. Therefore, we request a temporary deposit for each copy of 25c which we refund on first order, or we send our Bargain Bulletin Free. Address Today

HARDIN-LAVIN COMPANY
40 Years At
4510-20 Cottage Grove Ave., Chicago
$500,000 plants behind our guarantee

Become a
Doctor of Chiropractic
SUCCESS
Implies Health, Wealth, Happiness

All of these desirable and necessary conditions to a life of success can be attained thru CHIROPRACTIC.

However, to attain success in any important profession requires thorough preparation thru RESIDENTIAL INSTRUCTION. Chiropractic is rapidly gaining recognition in every state and only graduates of Standard Schools and Colleges are allowed examinations. Correspondence courses are inadequate to meet the requirements, therefore, the road to success in Chiropractic leads thru residence courses only.

Length of course, tuition cost are yet moderate.

Write for full particulars & booklet 59

N. Y. College of Chiropractic
1416 Broadway, New York City
Tel. 6956-7 Bryant

Write Secret Letters With Invisible Ink

Pour seemingly plain water into three glasses and have it turn red in one, white in another and blue in the third! Make your own magic writing paper, and blue ink or ink powder. Write with plain water and have the writing turn blue. You can surprise and puzzle your friends with these and more mysterious and amusing Chemical tricks, if you have "CHEMCRAFT" Junior—the boys' miniature chemical outfit. Send 25c for your outfit right now, it's the greatest fun-maker you ever had. Send at once and get a Free copy of "The Chemcraft Chemist," an interesting magazine for boys.

Amateur Chemist's Catalogue and Hand Book containing much valuable information for Boy Chemists and listing many useful chemicals and apparatus, sent complete for 10c. None free. Regular "CHEMCRAFT" Chemical Outfit, $1.50, $3.00 and $5.00.

THE PORTER CHEMICAL CO.
Hagerstown, Maryland

CHEMCRAFT JUNIOR
25¢
POSTPAID

INSYDE TYRES Inner Armor
for Auto Tires. Double mileage, prevent blowouts and punctures. Easily applied in any tire. Thousands sold. Details free. Agents wanted.
Amer. Accessories Co., Dept. 53, Cincinnati

Sir William Crookes' Psychical Researches

By Hereward Carrington, Ph. D.

(*Continued from page* 442)

Miss Cook and Katie are two separate individuals, so far as their bodies are concerned. Several little marks on Miss Cook's face are absent on Katie's. Miss Cook's hair is so dark a brown as almost to appear black; a lock of Katie's, which is now before me, and which she allowed me to cut from her luxuriant tresses, having first traced it up to the scalp and satisfied myself that it actually grew there, is a rich golden auburn. . . .

"One evening I timed Katie's pulse. It beat steadily at 75, whilst Miss Cook's pulse a little time after was going at its usual rate of 90. On applying my ear to Katie's chest, I could hear a heart beating rhythmically inside, and pulsating even more steadily than did Miss Cook's heart when she allowed me to try a similar experiment after the séance. Tested in the same way, Katie's lungs were found to be sounder than the medium's, for at the time I tried my experiment Miss Cook was under medical treatment for a severe cough. . . . ."

Sir William Crookes also took a number of flashlight photographs of Katie—one showing her standing beside him, and one showing Miss Cook, entranced, in the cabinet, with Katie, the materialized spirit, beside her. These phenomena, incredible as they may appear, were nevertheless seen and testified to by a large number of responsible people, and were observed by Crookes himself for many weeks consecutively, and tested in every way possible. These phenomena are among the most extraordinary in the whole history of spiritualism—the most incredible, *and the best attested!* What are we to think of them? That is the question which has been asked for the past half century, and which still remains unanswered! They are the most startling manifestations which Sir William Crookes reported, and will remain forever associated with his name.

In the next issue, "Apparatus Used in Exposing Fake Spiritualists." Another interesting discussion by Dr. Carrington.

Science in Slang

By Emerson Easterling

(*Continued from page* 435)

the eye tends to retain an impression of the filament at full or nearly full luminosity, while the current passes thru zero and the temperature of the filament proper decreases rapidly toward zero. Hence, before the image of the illuminated filament thrown on the eye is lost, insofar as its effect on the optic nerve is concerned, the current and filament temperature has past safely thru the zero point of the style, and started to rise again on the reversed current pulse of the cycle, as I showed you previously.

"As high voltage currents transmit with more efficiency and low voltage currents are more conducive to longevity when placed within reach of the uninitiated consumer, it was found that alternating current would have to neither be partial to the transmission nor the consumer, so the juice peddlers stick in the A. C. generators and hang pots (transformers) to step up the juice for better transmission, and then step her down for the consumers' better health, disregarding the undertakers' scowls."

"That is a pot," Bender said, pointing to a cast iron object on an electric light pole, and looking over at Jazz to see if he was going to censure the statement.

"Yes," replied Punk, "I have noticed them on a number of telegraph poles."

"There is a funny thing," laughed Stokes, "to the general public a pole is a pole—whether telephone, telegraph, light, or power. There is as much difference as there is in nigger, chink, white, or Eskimo. One of the most apparent differences would be found out if you should happen to try to tap in on a high tension transmission line to get the Tia Juana results."

"How is the stuff worked?" asked "Bonehead" Florey. "How is the juice sent from the station where the stuff is manufactured to the kitchen range or cigar lighter?"

"The stuff is first stept up, as I said, then it is stept down somewhat by a substation, generally in the outskirts of the village that the juice is being pumped into. The idea is that 4,000 volts is less likely to cause a massacre if the lines blow down than 66,000, 33,000, 20,000, or the like; so they step it down. Four thousand will transmit the distances from most substations with more efficiency than would the higher voltages—they figure that the line loss is more desirable than the life loss. Some companies step the voltage down to 2,300 again, or direct from the sub-station. Laws, ideas, and convenience have to do with the voltage.

"Then again, the *three phase* effect that the A. C. made possible has put that form of service over the direct current way in practically all power work. The three phase motors have first place in efficiency, you know."

"What is three phase?" asked Bender.

"In alternating currents we have *single phase* currents. The working of the current is generally described on paper by drawing a straight horizontal line representing zero—no current. All above the line is current in one direction, say positive. All below the line negative. The vertical distance from the line represents the height of the voltage. The voltage in a single phase current under ideal conditions would describe a continuous reversed curve, a semi-circle above the line and a semi-circle below the line. It will be seen then that the potential raises from zero to the maximum and to zero, thence to maximum in the other direction. You see the effective voltage is not the maximum voltage, for part of the time there is no flow in the circuit, and part of the time there is more than is recorded on the voltmeter. I guess that explains the single phase.

"Then in actual practise we have *two* and ***three phase*** alternating currents. In the two phase when one circuit is dead, the other is making an impression on the line. In the three phase each wave comes up just as the other is dying and keeps up the 'racket' in a much better manner than is possible for the intermittent single phase, or the two phase."

"And a volt is the pressure on the circuit. An ampere is the rate of flow. The volts times the amperes equals the watts. One thousand watts equals one kilowatt," rambled on Punk. Then turning to Stokes, "Isn't that right?"

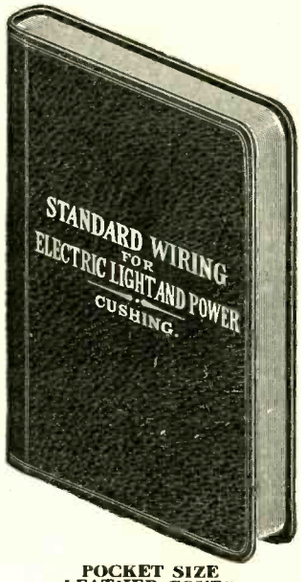
"Right," responded Jazz, "and the juice peddlers stick you up so much per kilowatt——"

"Yes," interrupted Bender, "too much."

All You Need to Know About Wiring

Is In This Latest Edition of "STANDARD WIRING"

It Will Make You An Expert Wireman



POCKET SIZE
LEATHER COVER

GENERATORS—How to install them, care for them and operate them; all their troubles and how to prevent and cure them; all diagrams showing connections for compound, series and shunt wound machines. How to operate them in parallel or in series. How to protect them and wire them in accordance with the underwriters' requirements.

MOTORS—How to install them, how to protect and operate them. The required amperes, volts or horse power when any two factors are known. How to take care of hot boxes, sparking commutators and other troubles. How to change the direction of rotation when desired. How to start and stop any kind of motor in any class of service. All diagrams of motor wiring. How to find the proper size of wire for any motor for direct current or for A. C. single, two or three-phase.

OUTSIDE WIRING—Pole line construction, line wires, service wires, roof structures, poles and their dimensions and weights, and how to erect and protect them and wires they carry. Insulators, guard arms, guy anchors. Tree wiring, splicing, service and entrance wiring. How to install Lightning arresters. Transformers with diagrams and instructions.

INSIDE WIRING—when and where to use rubber covered, slow burning and weatherproof wire. How to find the proper size of wire to use for lamps, motors or heating devices for any current, voltage and drop, either by formula or by the many tables that are given in this section of the book. How to wire for two-wire or three-wire systems. Direct current, two-phase and three-phase with formulae and tables, with examples worked out for each system and in a simple manner that anyone can understand and use. How to run wires on walls, ceilings, floors, through partitions and walls and in concealed places, damp places and where dangerous surroundings exist. When and where to install Switches, Cut-outs and Circuit Breakers and just how to do it. How to wire for high and low voltage systems and the precautions to be taken. The proper way to install Knife and Snap Switches, Cabinets and Cut-out Boxes, Outlet, Junction and Switch Boxes, Panel Boards, Wooden and Metal Raceways. How to install complete interior conduit jobs either for rigid metal, flexible metal or flexible non-metallic conduit. Concealed knob and tube work or armored cable. How and where to install and wire electric and combination lighting fixtures. How and where to use flexible cord and where not to use it. How to install arc lamps and gas filled lamps and the fixtures and rules required.

LIGHT AND ILLUMINATION—What is meant by proper and efficient illumination, the latest data on Mazda and gas filled lamps of every candle power and wattage. Direct, indirect and semi-indirect illumination and where each should be used. Illumination required for various classes of service from show window lighting to public halls and from factories to small residences.

TABLES—Fifty-two tables giving every dimension, carrying capacity, resistance, weight and strength of every size of wire and cable of copper, steel and iron.

All the necessary dimensions, capacities, weights, and other data on conduits, fuses, insulators, lamps, sockets, motor efficiencies, current per horse power of motors. Electrical units and their equivalents. Proper size of wire for all classes of power, light and heating installations. The proper symbols to use to indicate on plans just what is wanted from a motor to a small snap switch with all necessary diagrams.

APPARATUS AND SUPPLIES—A classified list of the leading manufacturers of officially approved wires and wiring devices. Engines, generators, motors, appliances, fixtures, and all supplies necessary for any complete installation from a Central Station to a small cottage.

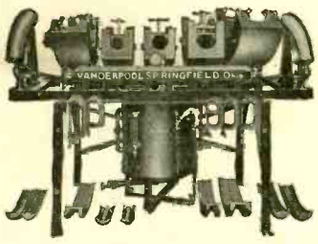
The most complete and accurate Book on Wiring and Construction published

350 PAGES - LEATHER COVER - POCKET SIZE, $1.50

Sent Postpaid to Any Address on Receipt of Price by

H. C. CUSHING, Jr., 10 West 40th St., New York

Every Electrical Inspector in the United States will approve your work if done in accordance with the simple rules given in "Standard Wiring"



Big Money and Independence for Life

Here is the most profitable business on earth — TIRE REPAIRING. Open a Tire Repairing Shop—business pours in. We are the pioneer manufacturers of the Dry Cure Vulcanizer—the only vulcanizing that guarantees absolutely PERFECT work. Write at once for FREE TIRE REPAIRING MANUAL and full particulars.

In answering address Dept. U-14.

Wm. Vanderpool Co. Springfield, O.



Bewitching Pictures!

Exact reproductions from original Photographs, already for mounting and framing. If you are a lover of the beautiful in art, here is just what you have long wanted. For a short time we make a special introductory offer, as follows: **Send 25c and we will send you eight selected beauties** and our beautifully illustrated catalog. After seeing the samples you will want more.

PARIS NOVELTY COMPANY
Dept. P. 1, 26 E. Adams St. Chicago



Big Band Catalog sent free

Whatever you need—from a drumstick to the highest priced cornet, in the world. Used by the Army and Navy. Send for big catalog; liberally illustrated, fully descriptive. Mention what instrument interests you. Free trial. Easy payments. Sold by leading music stores everywhere.

LYON & HEALY
57-69 Jackson Boulevard, Chicago

ONLY 35c



Cut Your Own Hair WITH THIS SAFETY HAIR CUTTER

If you can COMB your hair you can cut your own hair with this marvelous invention. Cuts the hair any desired length, short or long. Does the job as nicely as any barber in quarter the time, before your own mirror. You can cut the children's hair at home in a jiffy. Can be used as an ordinary razor to shave the face or finish around temple or neck. Sharpened like any razor. Lasts a lifetime. Saves its cost first time used. **PRICE ONLY 35c, postpaid. Extra Blades 5c each.**

Taylor, Barnard & Co., Dept. H. I. 24 E. Adams St., Chicago, Ill.

READY MONEY

when you want it and as much as you wish to earn. Cover your territory for us. Spend only a few hours a day or devote all your time, whichever you prefer. Send for our plan at once.
Experimenter Pub. Co., 233 Fulton St., N. Y.



ZIP-ZIP Patented Sept. 3rd. 1918

The Greatest 50 Ct. Article on the Market. Shipped right from the factory the same day we receive your order. The Prong is made of beautiful metal; never break or wear out; scientifically made and best workmanship. The rubbers are elastic and lasting, with plenty of pep and force. Zip-Zip, complete, only 50c prepaid. Be sure the name Zip-Zip and our address appear on the article you buy. Order from us or any Sporting Goods Store in your city. Send Stamps, Coin or Money Order.

AUTOMATIC RUBBER CO.
COLUMBIA, S. C.



POPULARITY FOLLOWS THE

UKULELE

If you play quaint, dreamy Hawaiian music or latest songs on the Ukulele you will be wanted everywhere. We teach by mail 20 simple lessons; give you free a genuine Hawaiian Ukulele, music, everything—no extras. Ask us to send the story of Hawaiian music. You will love it. No obligation—absolutely free.

The Hawaiian Institute of Music
1400 Broadway, Dept. 61, New York

Speeding Up the Airship

(*Continued from page 397*)

equally light gas, which we do not know of as yet.

On its first visit to the United States, the R-34 proved beyond controversy that the natural element of the dirigible is the air. As long as an airship remains from 300 to 500 feet above the surface of the earth it is comparatively safe, and at this level it will be possible for it to ride out any storm. The airship in this instance is not any different from the steamship, which can ride out any storm, as long as it is in the open ocean. What the steamship fears is the proximity of land or reefs, which usually spell its doom.

The future airship will not land its passengers by coming down to earth, any more than the steamship lands its passengers by climbing upon dry land. The airship will be fastened to earth by means of long thin steel cables from 200 to 500 feet long, and only one or two of these cables are needed; they will probably be attached to either the center or the nose of the airship. The passengers will then be landed by means of a landing passenger and freight elevator built into the airship, as described in our article in the July issue. This idea is also depicted in the above illustration, which shows the portable elevator built into the airship.

Making a Machine for Telegraphing Pictures

By Leroy J. Leishman

(*Continued from page 421*)

of its shaft by about 4 inches. The width of the base should be 8 or 9 inches. It is inadvisable to make these bases from metal, as short-circuits are too liable to occur. Wood is good enough.

Five holes are to be bored in each base as indicated in Fig. 2. A and B are for binding posts. C should be a small hole to accommodate a piece of annunciator or magnet wire. D and E should be large enough for two flexible cords such as that used for light drops. Do not bore E until the machine is practically completed for reason that will be apparent later.

The uprights A (Fig. 1) that support the cylinders must be made of metal. They can be triangular shaped, and should have half an inch of the lower edge turned up to a right angle for affixing to the base (see B, Fig. 1). From this angle to the hole which is to be bored at the top for the cylinder shaft the distance must be at least a half inch more than the radius of the cylinder. The holes in these *must be bored exactly the same distance from the bottom, so that the cylinder will be supported absolutely level.*

The cylinder should be mounted close to the opposite edge of the base to that near which the holes were bored for the binding posts. The binding posts are at the back of the machine, and the cylinder at the front. Mount the cylinder and shaft so that the cylinder comes about 3 inches from the end of the base, leaving about 1 inch between the end of the rod and the other end of the base. One support should be placed against the cylinder and the other about 1 inch from the end of the shaft (see F and G, Fig. 2). Screw the supports in place so that the cylinder is parallel to the edges of the base, and then place the cylinder rod thru the holes provided for the purpose. If Meccano or Erector material is used, collars can be obtained for keeping the cylinder and other parts in place.

Now get a cold-rolled steel rod about 3 inches longer than the cylinder and about ¼ inch in diameter. Have this threaded within a half inch of one end and an inch of the other. No particular pitch is essential, as the progress of the carriage can be governed by other means. The unthreaded ends must now be turned down to the same size as the cylinder rod, so that the same make of gears or pulleys will fit. Then secure a rod about a half inch shorter than the threaded shaft. This rod can be of the same diameter and material as the cylinder shaft.

The height of the supports for these will vary with the material at your disposal for the carriages, which can be made from ordinary telegraph sounders by soldering an extra piece on the end of the arm where the spring is attached. This piece can be the same width and thickness as the original arm of the sounder, but must be at least 3/16 inch square. The length will be dependent upon the diameter of your cylinder and the way the sounder is mounted on its own base. Hold the sounder level and at the same height as the cylinder rod, keeping the end of the sounder with which we are concerned toward the cylinder and the base of the sounder at least ½ inch behind the cylinder. The addition to the arm must be long enough to extend about ⅛ inch beyond an imaginary line perpendicular to the base of the whole machine and extending thru the center of the cylinder when the carriage is held in this position. The phonograph needle, to be placed in the end of this extension arm, will then touch the cylinder right at the top. Drill a hole the size of a steel graphophone needle down thru this extension arm about ¼ inch from the end, when measured from the top, and slightly less than 3/16 when measured from the bottom, so that the needle will set at an angle of thirty or forty degrees. As the needles must be changed, a thumb screw (H, Fig. 2) should be placed in the right side of this arm to hold the needle in place. A Victor or Columbia graphophone thumb screw is satisfactory, and most phonograph repair shops have taps to thread holes to fit.

If you do not have two sounders—one for each machine—the essentials for making the carriage are merely the needle arm, the fulcrum, a pair of electro-magnets, a bar for the magnets to attract, a coiled spring, and a stop to prevent the arm from moving too far up or down.

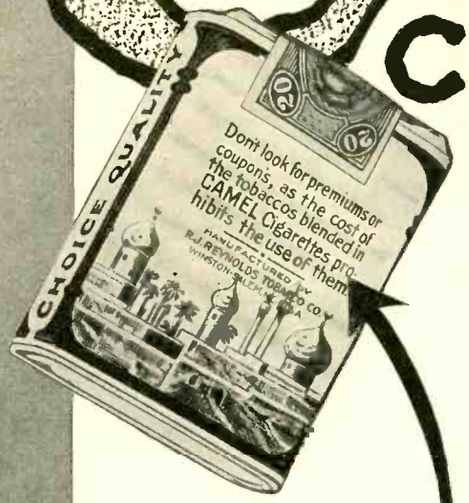
Under the front of the carriage, near each side, some sort of threaded half-nut arrangement must be provided. It is satisfactory to use a couple of pieces of tin with the edges turned down and slotted approximately to fit the screw or threaded shaft. Place one at each side. Under the back of the carriage two screw eyes can be used for the guide rod to pass thru.

The height of the uprights or supports C (Fig. 1) for the guide rod D and threaded shaft E can now be determined. They should hold these rods at a height which will support the carriage so that the end of the phonograph needle in the end of the arm will touch the cylinder when the arm is in its downward position. These supports can be made of metal, like those for the cylinders, or else from wood. Separate supports can be made for the screw and rod, or else double supports with two holes. *The screw and rod must be absolutely parallel, otherwise the carriage will catch or bind.* They must also be parallel to the cylinder, but not necessarily in the same plane. This means that great care must be taken in boring the holes in the uprights so that the screw and rod will be not only the proper distance from each other, but absolutely the same distance from the base thruout. Be sure, therefore,

(*Continued on page 448*)

Camel CIGARETTES

18 cents a package



Smokers realize that the value is in the cigarettes and do not expect premiums or coupons!

Camels supply cigarette contentment beyond anything you ever experienced! You never tasted such full-bodied mellow-mildness; such refreshing, appetizing flavor and coolness. The more Camels you smoke the greater becomes your delight—*Camels are such a cigarette revelation!*

Everything about Camels you find so fascinating is due to their quality—to the expert blend of choice Turkish and choice Domestic tobaccos. You will prefer this blend to either kind of tobacco smoked straight.

You'll say Camels are in a class by themselves —they seem *made to meet your own personal taste* in so many ways!

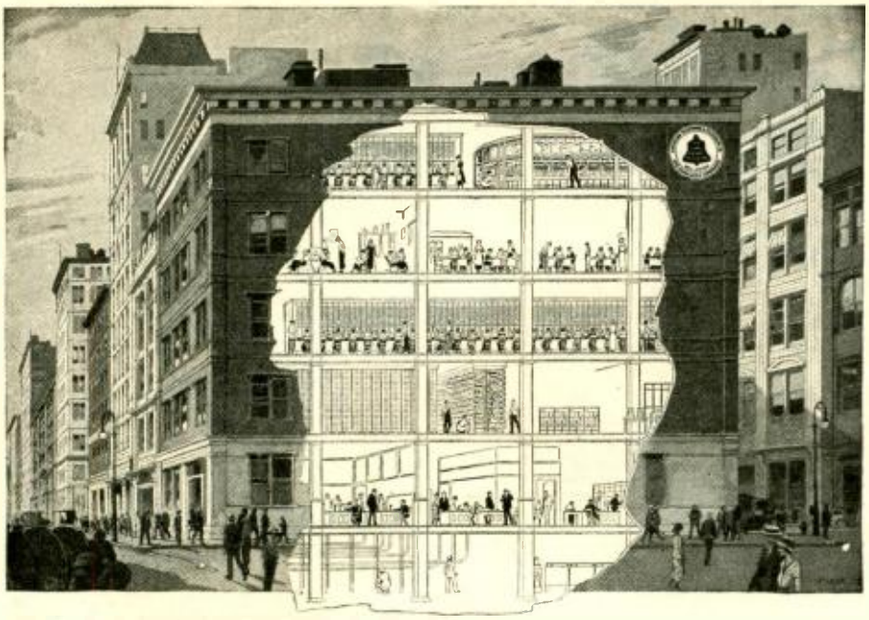
Freedom from any unpleasant cigaretty after-taste or unpleasant cigaretty odor makes Camels particularly desirable to the most fastidious smokers. And, you smoke Camels as liberally as meets your own wishes, for they never tire your taste! You are always keen for the cigarette satisfaction that makes Camels so attractive.

Compare Camels with any cigarette in the world at any price!

R. J. REYNOLDS TOBACCO COMPANY, Winston-Salem, N. C.

Camels are sold everywhere in scientifically sealed packages of 20 cigarettes or ten packages (200 cigarettes) in a glassine-paper-covered carton. We strongly recommend this carton for the home or office supply or when you travel.





The Great Task of Construction

With the coming of peace the Bell System faced an enormous construction program. Conditions arising from war resulted in the wiping out of the reserve equipment normally maintained, and necessary to give prompt connection to new subscribers. The release of industry and accumulated growth of population now makes telephone demands almost overwhelming.

Telephone construction, including buildings, switchboards, conduits, cables and toll lines, must, from its inherent nature, be undertaken in large units. A metropolitan switchboard, with its tens of thousands of parts, may require from two to three years to construct and install.

Only great extension can meet the present excess burden of traffic and provide for future requirements. Extension which cares for immediate demand, only, is uneconomical and calls for continuous work of such a character as to be frequently detrimental to the service.

During the war the Bell System devoted all its margin to the needs of the Government. The great task of getting back to normal pre-war excellence of operation requires the reestablishment of an economic operating margin capable of taking care of a larger growth than has ever before confronted the Bell System.

Construction is being pushed to the limit of men and materials; while every effort is being made to provide the best, present service.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy *One System* *Universal Service*

CARNOTITE

(Radium Mineral.) The American Pitchblende found in Colorado, from which *Radium* is extracted.

A generous piece, enough to conduct experiments, such as affecting photographic plates thru opaque material (similar to X-Ray pictures), first made by Sir W. Crookes and Mme. Curie, is furnished in neat, wooden box.

URANIUM ORE (*Radio-Active*)

Containing about 35% of pure Uranium; also Radium and Vanadium. One of the most rare and interesting minerals. Twenty milligrams are furnished in glass vial protected by lead cover.

One box of *Carnotite* and one vial of *Uranium Ore* as described above 50c sent prepaid.

FORMULAS

Luminous Paint—Silver Plating Powder—Liquid Court Plaster—Soap Bubble Liquid—Straw Hat Bleach—Collapsible Tube Tooth Paste—Resilvering Mirror Liquid—Polish for Tan Shoes—Dressing for Tan Shoes—Paint to make Oil Cloth.

These Ten Recipes in sealed envelope for 50c. Sent prepaid.

SIDNEY SPECIALTY CO., 233 Fulton Street New York City

Making a Machine for Telegraphing Pictures

By Leroy J. Leishman

(*Continued from page 446*)

that the rod and threaded shaft are straight. Mount these so that the rods extend the same distance beyond each end of the cylinder, and so that the front of the mounted carriage comes about ¼ inch behind the cylinder with the needle at the top of the cylinder directly above its center.

The only place in the whole set of machines where pulleys can be used instead of gears is in connecting the threaded shaft and the cylinder. The pulley I (Fig. 2) for the screw must be larger than the one on the cylinder rod, the exact size depending on the pitch of the threads and how dark or light you may desire the telegraphed pictures to be. The cylinder should make from 60 to 120 turns while the carriage travels 1 inch. After the pulleys are placed on the rods and lined up, put on a cord, elastic band or spiral spring for a belt.

It is essential that the cylinders of both machines turn as true as possible. If they do not do this, bend the rods till they are as perfect as you can make them.

Hole E (Fig. 2) should now be bored about a half inch behind the guide rod D (Fig. 1) and J (Fig. 2), and midway between its two ends.

After both machines are this far completed, they may be wired. Get a piece of flexible fixture cord and cut two pieces about 2 feet long. Peel the ends and scrape the strands of wire till they shine. Inasmuch as it is difficult to tell which one of the wires you want after they are drawn thru the base, it is best to twist both ends of one of the wires in such a way that it will be recognized from the other. Put a pair of these wires thru hole E in the base of one machine, and use the other pair in like manner for the other instrument. Attach one wire to the terminal of the magnet windings on the carriage, and also ground it so that it is electrically connected to the metal arm bearing the phonograph needle. Connect the other end of the same wire to one of the binding posts. The other wire should be connected to the other side of the carriage magnet windings, so that a current in both wires will energize the magnets and lift up the needle. The remaining unconnected end of these wires should be drawn thru hole D (Fig. 2), where it is to be connected to the right side of a two-way battery switch G (Fig. 1). The slack in this wire should be pulled above the base to give the carriage plenty of play. A piece of magnet or annunciator wire should lead from the left contact of this switch thru hole C, and be grounded to the support of the cylinder rod. The main terminal of the battery switch must be connected to the other binding post at the back of the base. Both machines must be connected the same way.

Now suppose we examine these circuits. First turn the battery switch to the contact at the left—the position used when "sending." The current now comes from the binding post to the switch, thru the right contact to the upright and thru the rod to the cylinder, thence thru the needle down one of the flexible wires to the other binding post. When the switch is thrown to the right or "receiving" position, the current passes to the carriage magnets.

Excepting for the gear connections, the machines themselves are now completed, but as no picture can be transmitted unless the cylinders run in *synchronism*, I shall presently explain three ways to synchronize them before showing how to prepare and transmit a picture.

(*Part II will appear in the October issue*)

Popular Astronomy

By Isabel M. Lewis

(*Continued from page 400.*)

his weight would be zero. Continuing from the center to the surface thru the same shaft the weight would increase progressively until the surface value of 150 lbs. was restored.

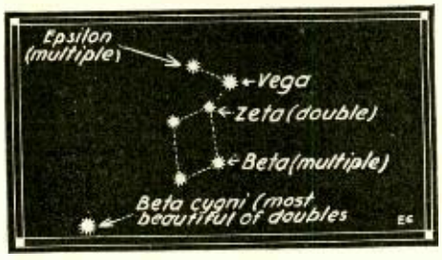
WEIGHT ABOVE SURFACE OF EARTH.

If, on the other hand, it were possible for a man to ascend above the earth's atmosphere he would still be subject to the attraction of the earth (see diagram IV), but the force would *decrease* inversely as the square of his distance from the earth's center, so at a distance of two radii, or 8,000 miles from the earth's center, a man weighing 150 lbs. at the surface would weigh only one-fourth as much as at the surface of the earth, or 37½ lbs. At a distance of six radii, or 24,000 miles, from the earth's center, he would weigh 4⅙ lbs., and at a distance of about 12¼ radii, or 50,000 miles, his weight would be only one pound. If the distance should be increased to four times this amount, or 200,000 miles, his weight would be decreased to one-sixteenth of his weight (at 50,000 miles)—or one ounce.

ASTRONOMICAL QUESTIONS AND ANSWERS.

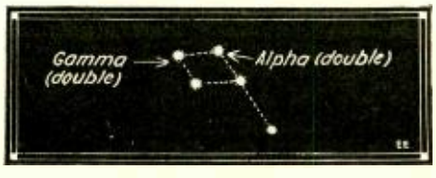
Question 1. What is the sidereal system and sidereal time?

Answer 1. (a) The terms sidereal system, stellar system, and sidereal universe, are all synonymous and refer to the organized system of the stars in which our solar system is a single unit. The stars do not move in a haphazard manner but are governed by some definite law and purpose



and organized into some great system. To this system belongs the Milky Way as well as practically all the stars, both visual and telescopic, the great irregular gaseous nebulae, the globular star clusters and loosely formed moving star clusters, such as the Hyades and Pleiades groups. It is not yet known whether the spiral nebulae are subordinate units in the sidereal system to which our sun and his satellites belong, or whether they are external systems or external universes independent of our own sidereal system and units along with it in some vaster system.

Answer 1. (b) Sidereal time is "star" time as distinguished from solar time or "sun" time. A sidereal day is the interval between two successive passages of the meridian across the same star. The sidereal time of any place on the earth is zero when the meridian of that place crosses the vernal equinox (point of intersection of the celestial equator and the ecliptic), which is chosen instead of a star as the point of reference for sidereal time. A "solar" day is the interval between two successive passages of the same meridian across the center



Why Not Earn $35.00 to $100 A Week As A Mechanical Draftsman?

"Get into the profession of big pay and Rapid Advancement with the help of the school that has started hundreds on the Road to Success. I am ready to help you." Roy C. Claflin, President, Columbia School of Drafting.



Learn At Home In Spare Time

You don't have to stop work or leave home in order to become a trained Draftsman. Through our practical home study Training we will teach you Right in Your Own Home so that you will soon be able to qualify for a good position at Big Pay. We will continue to instruct and help you until we know you have the knowledge necessary to succeed.

No Previous Training Necessary

Right now—TODAY—there are openings for thousands of Draftsmen in the Government Departments, industrial concerns, and the big engineering offices. One department alone recently called for 1,800 draftsmen. With this tremendous demand has come a big increase in salaries.

Draftsmen Are Getting $35 to $100 a Week

with big chances for even better pay as the demand grows. By enrolling NOW for our practical Home Study Course in Drafting you can quickly qualify for a position as Draftsman and by properly applying the principles we teach.

You Have a Chance to Become a Chief Draftsman

and get to the very top in this fascinating profession. Our course will give you just the knowledge you need to make good as chief draftsman when your chance comes.

Peace Calls For More Draftsmen

With the problems of reconstruction facing the nation the demand for draftsmen is even Greater Than During the War. All big engineering, construction and manufacturing projects must first go through the drafting room before the workmen can commence. You can help in the work of reconstruction and secure a Big Salary with excellent opportunities for advancement. Prepare now and be ready when the demand reaches its height.

We Will Help You Secure a Position

as soon as you complete our course. We have already placed hundreds of our graduates in good paying positions and are constantly in touch with vacancies for which Draftsmen are Urgently Needed. Government Departments and Private Concerns are continually calling upon us for our graduates because they know that our instruction produces draftsmen of the caliber they need.

Thousands of Men Wanted Right Now

Drawing Outfit FREE As soon as you enroll you will be sent our special drawing outfit FREE so that you will be sure to have it to work with while taking the course. This set will be yours to keep. You are not asked to return it after completing the course.

Illustrated Book of Particulars Sent Free

Fill in the coupon below—send it to us and we will send you FREE a copy of our illustrated book telling all about our practical Home Study Course and how you may secure our instruction at once on Easy Terms so as to quickly qualify for one of the Big Positions Now Open.

Mail This Coupon To-day

Columbia School of Drafting
Dept. 1053, 14th and T Sts., N. W.
Washington, D. C.

Without obligation to me, please send me your illustrated book telling how I can secure your complete Home Study Course, the FREE DRAWING OUTFIT, and your help in securing a position as Draftsman.

Name .....

Address .....

City .....State .....

DIAMONDS WATCHES ON CREDIT

SEND FOR FREE CATALOG

There are over 2000 illustrations of Diamonds, Watches, Jewelry, etc. Whatever you select will be sent, all shipping charges prepaid.

You see and examine the article right in your own hands.

If satisfied, pay one-fifth of purchase price and keep it; balance divided into eight equal amounts, payable monthly.

LIBERTY BONDS ACCEPTED



Watches

Our Catalog illustrates and describes all standard world-renowned Watches—solid gold and gold filled cases. Splendid bargains in 25-year guaranteed Watches on credit terms as low as

$2.50 a Month

Diamond Rings

Beautiful Genuine Diamond Rings, any style 14-K solid gold mounting, wonderful values at $25, $50, $75, $100 and up. EASY CREDIT TERMS

Special Bargains

Diamond La Vallieres - - - - $10 up
Loftis 7-Diamond Solitaire Cluster Scarf Pins $75 up
Diamond-Set Birth Month Rings - - 3 up
Diamond Brooches - 7 up
Diamond Ear Screws 25 up
Diamond Studs - - 10 up
Diamond Cuff Links 5 up
Wrist Watches - - 20 up
Watches, Gold Filled 15 up

WE HAVE BEEN IN BUSINESS OVER 60 YEARS

LOFTIS BROS & CO. ESTD 1858 — The National Credit Jewelers — Dept. D 22 — 108 N. State St. — CHICAGO, ILL. — STORES IN LEADING CITIES



Build and Fly a Model of the N C - 4.

This new "IDEAL" Model Aeroplane is a dandy—the celebrated Naval-Curtiss Seaplane, first to cross the Atlantic Ocean—a strictly American 'plane every American boy will want to build. 4½ feet across the planes and a true, scale-model duplicate of the real NC-4. Guaranteed to rise from the water and make a perfect flight under its own power. Get a set of "IDEAL" Accurate Scale Plans, including Building and Flying Instructions, and build this wonderful Model Aeroplane right away.

Plans and Instructions for Building a 4½ foot Model NC-4 50c

Other Plans and Instructions at following prices, all sent postpaid:

DE HAVILLAND BATTLE PLANE..35c
Curtiss Military Tractor 25c
Bleriot Monoplane 25c
Nieuport Monoplane 25c
Taube Monoplane 25c
Cecil Peole Racer 25c

"IDEAL" Model Aeroplane Construction Outfits, containing all parts and materials needed to build these Model Aeroplanes, are sold by Leading Toy, Sporting Goods and Department Stores.

Ask for them at your store.

"IDEAL" Model Aeroplane Catalog, 48 pages, 5c postpaid.

IDEAL AIRPLANE & SUPPLY COMPANY
Established in 1911
159-161 Wooster St., New York City

PROFITS for YOU { Charging Batteries / Making Electric Lights

With the HB Lighting and Battery Charging Set you can make your own electric lights for as low as 2c per KW, and make a profit from $100 to $150 per month on battery charging. Anyone can easily operate without experience. Sturdy, dependable, economical to operate from line-shaft or your engine.

Small Payments Put This Money-Maker In Your Shop

Balance on easy terms. Profits pay for outfit. Absolute Money-Back Guarantee. Ask our Service Department about proper size for your needs. Pin this ad to your letterhead and write TODAY for information.



HOBART BROTHERS COMPANY
Box 92E, Troy, Ohio
Successful Manufacturers Since 1893

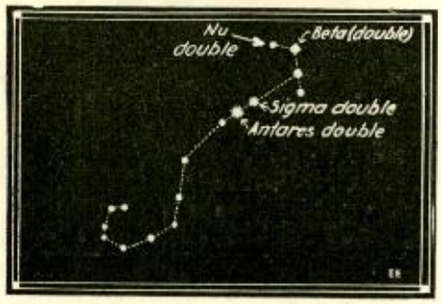


FREE BOOK ON AVIATION

Learn of the great opportunities in this new $1,000,000,000 industry. Thousands of men needed. Learn by mail—free book tells how. Write at once.
Nat. Aero Inst., Dept. 744Z, 916 S. Mich. Av., Chic.

of the sun. As the sun appears to move eastward among the stars about one degree a day the solar day is longer than the sidereal day by about four minutes, the time that is required for the meridian of the place to turn thru an angle of one degree and "overtake" the sun. Since the sidereal day is four minutes shorter than the solar day the stars appear to rise four minutes earlier and to come to the meridian four minutes earlier each successive evening.

Question 2. Please name and locate a few double and multiple stars.



Answer 2. An interesting multiple star is Epsilon Lyrae, now visible in the constellation Lyra about 2° N. E. of Vega (on the meridian 9 p. m. Aug. 30). The two wider components are 207 seconds of arc apart and can be distinguished as separate objects by persons with exceptionally fine eyesight. Each of these components is itself a double star and can be separated with a three-inch telescope. Beta Lyrae, about 6° S. E. of Vega, is not only an interesting multiple star but also a remarkable variable with a period of nearly thirteen days and a range of one magnitude.

There are several interesting doubles in addition in this constellation, which is a fine field for a three-inch telescope.

Beta Cygni, about fifteen degrees to the southeast at bottom of Northern Cross is a most beautiful double.

In the constellation Delphinus, known as Job's Coffin, are two fine doubles, Gamma and Alpha. This constellation is a small diamond-shaped group of stars about 30° to the southeast of Lyra.

In the constellation Scorpio (in southern skies in August west of meridian in the early evening) are three interesting doubles, Sigma, Beta and Nu. Sigma is the star just north of Antares, the brilliant red star in this constellation. Antares also has a greenish companion, but it takes a four-inch telescope to separate it. Nu and Beta are about ten degrees northwest of Antares.

200,000 Horse-power in One Hour

(Continued from page 409)

will go out of its way or take a round-about course. However, it notifies the system operator; subsequently these warnings either discontinue, or the rapidity of the signals increases as the storm approaches or dies out. With this storm, however, it was different; it approached with hurricane velocity, and when about one-half to one hour away the bell strikes every minute.

This now became a positive signal that the storm was about to break, and that within a very short time. The fires in the boiler room, which have been banked up to the present time, are now let loose and coaled up. Within a short time "steam is up" in the boilers. The system operator now, by means of telephone or other forms of annunciators, directs the starting of the gigantic reserve generators, so that everything will be in readiness should the storm break. Now the auxiliaries are started. The system operator is warned by the bell ringing continuously, and the device, which



Adventures of the Auto-Wheel Coaster Club

The Circus Parade

Jim, the Club Captain, is a great one for new ideas. When the circus hit town last week, he said the Auto-Wheel Coaster Club "ought to march in that parade."

So we all took our Auto-Wheels down to the show-lot, and when the march started we joined in. We hitched on to the biggest elephant in the show and followed along.

We didn't have to decorate those Auto-Wheels. They're good-looking to begin with. And they ran along just as smooth as autos. You should have heard the crowd cheer when we passed. "Biggest Hit in the Whole Parade," the folks said. And after it was over five fellows came up and wanted to know where they could get Auto-Wheels. Jim sent them to the local dealer, and they are going to join the Club. Jim has sent to The Buffalo Sled Co., for FREE Club Caps for them, like ours.



BOYS!—DO YOU WANT WAGONS LIKE THESE?

The Auto-Wheel Coaster is a wonder—smooth-running, strong, speedy. The Auto-Wheel Convertible Roadster is two wagons in one—can be changed from a Coaster to Roadster in a second.

Send us three dealers' names, telling which one handles the Auto-Wheel. We'll send you Free Felt Pennant and Booklet.

The Buffalo Sled Co.,
163 Schenck Street,
N. TONAWANDA, N. Y.
(In Canada: Preston, Ont.)

NORMA TALMADGE says:

"It is one of my favorite magazines. I enjoy reading it every month."



"JUST to get acquainted" send a dollar and receive the next four numbers of

The PHOTO-PLAY WORLD

Contributions by leading authors
Beautifully illustrated, handsomely printed
By the year $3.50—35 cents a copy

Trial Offer: 4 numbers for $1
(Foreign postage 50 cents extra)

THE DOWNS PUB. CO., Bulletin Bldg., Phila., Pa.

FUN $5.00



Noiseless Target Practice

Fit your .22 with a Maxim Silencer and get no end of fun this summer practicing in your back yard and on your vacation.

MAXIM SILENCER MAKES YOU A BETTER MARKSMAN

It eliminates recoil and all noise of the report, and steadies your aim. Direct from Dealer or Factory $5.00. Write for Free Book of Stories.

FREE BOOK

MAXIM SILENCER CO.
89 Homestead Ave., Hartford, Conn.

has finished its overtime work, is now short-circuited. There is no further need of warning. The city becomes enveloped in darkness equal to that of night. Suddenly the storm breaks and together with a downpour of rain comes the click of so many light sockets and the pull of so many chains, and we think no more of it. The "juice" is there and we have light.

We never realize how those fellows up at Waterside station have to work in order to supply this demand. There is the crashing of many huge switches, as extra feeders are put into operation, and finally as a last resort powerful storage batteries are thrown into the circuit so as to supply the city with its increasing demand for electricity—and this has been done with no inconvenience and without bravado. Thanks to the Edison service, New Yorkers were able to work at their offices as late as desired, while the house and theater lights blazed forth by the hundred thousand.

Electric Cookery—A Snap!

By Grace T. Hadley

(*Continued from page* 412)

oven switches on *High* for fifteen minutes in advance. Bake paste fifteen or twenty minutes on *High* heat.

Quick Coffee Cake.—Turn oven switches to *High* before preparing cake. Sift together twice one pint of flour with one-third cup of sugar, three heaping teaspoons of baking powder, one-half teaspoon each of salt and cinnamon. Mix to a soft dough with one cup of milk stirred into a well-beaten egg. Add four tablespoons of melted butter and spread in a buttered shallow pan. Sprinkle over with granulated sugar mixed with cinnamon. Bake on lower grate from twenty to twenty-five minutes, turning switches to *Medium* for last ten minutes of baking.

Date Muffins.—Cream three tablespoons of butter with three of sugar and add two well-beaten yolks of eggs, then three-fourths of a cup of milk and two cups of pastry flour sifted with three scant teaspoons of baking powder. Beat well and add the stiffly beaten whites of the eggs and a cup of dates cut into small pieces. Turn oven switches to *High* twenty minutes in advance and muffins should bake in from twelve to fifteen minutes with switches left on *High*.

Advantages of Electric Ranges.

The modern electric range is really a triumph in beauty of design and workmanship. Clear white enamel walls and oven door panel, bright nickel trimmings make this type of range a source of pride and joy to the particular housewife. There is so much labor saved. There are no black bottomed pans and pots to be washed, hence there is a great saving in the matter of cleaning up after the cookery process. The easy control and perfect regulation of the heat establishes dependable temperature conditions. Best of all is the satisfaction of doing good cookery in the most modern way.

"I would not be without my electric range for anything," is the verdict of Mrs. Modern Housewife.

A Dinner Prepared in Automatic Electric Range.

Chicken, 3 lb.; pudding, 1 quart; baked potatoes, six. Place in upper oven; current on thirty-five minutes. Wattage should be 875.



Scenes from the Universal Film "Heads Win!"

"Heads Win!"

Traffic jammed at the rush hour! Crowds thronging station platforms! A mile of stalled trains! The swing-bridge would not close and all because down in the power house something had gone wrong and nobody knew what—until Jim came to the rescue.

Each night thousands are seeing unfolded on the screen the thrilling story of Jim Godfrey, who, in the hours after supper, with the help of the International Correspondence Schools, had put a trained head on his shoulders—a head that knew what to do in an emergency.

There are thousands of Jims in real life. You will find them in offices, shops, stores, factories, in mines and on railroads. For in every city and town and in every line of industry there are men who have gained in spare moments, with I. C. S. help, special training in the work of their choice.

There are men like Jesse G. Vincent, who rose from a toolmaker's apprentice to inventor of the Liberty Motor; men like Joseph G. Tynan, the laborer who became the world's greatest ship builder; men like Robert E. Ramsay, the clerk who became editor of Advertising and Selling. There are carpenters' helpers who became architects, bookkeepers who became general managers, men and boys who rose from nothing at all to responsible positions at splendid salaries.

It's simply a question of training. Your hands can't earn the money you need, but your head *can* if you'll give it the chance. "Heads win" every time!

More than two million men and women in the last 28 years have let the I. C. S. help them win better jobs, make more money, enjoy happier homes. Over one hundred thousand right now are turning their spare moments to profit. Hundreds are starting every day.

Can you still go on, putting in your days at the same grind, getting the same pay envelope with the same insufficient sum, keeping up the constant fight against a soaring cost of living, when a little grit on your part could be the means of changing your whole life?

It is easily possible for you to have the position you want in the work you like best, to have a salary that will give you and your family the kind of a home, the comforts, the little luxuries, the enjoyments that you would like them to have. No matter what your age, your occupation, your education or your means—you can do it!

All we ask is the chance to prove it. That's fair, isn't it? Then mark and mail this coupon. There's no obligation, and not a penny of cost. But it may be the most important step you ever took in your life. Take it *now!*

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6198, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

ELECTRICAL ENGINEER	SALESMANSHIP
Electric Lighting and Rys.	ADVERTISING
Electric Wiring	Window Trimmer
Telegraph Engineer	Show Card Writer
Telephone Work	Sign Painter
MECHANICAL ENGINEER	Railroad Trainmen
Mechanical Draftsman	ILLUSTRATING
Machine Shop Practice	Cartooning
Toolmaker	BOOKKEEPER
Gas Engine Operating	Stenographer and Typist
CIVIL ENGINEER	Cert. Pub. Accountant
Surveying and Mapping	TRAFFIC MANAGER
MINE FOREMAN or ENG'R	Railway Accountant
STATIONARY ENGINEER	Commercial Law
Marine Engineer	GOOD ENGLISH
Ship Draftsman	Teacher
ARCHITECT	Common School Subjects
Contractor and Builder	Mathematics
Architectural Draftsman	CIVIL SERVICE
Concrete Builder	Railway Mail Clerk
Structural Engineer	AUTOMOBILE OPERATING
PLUMBING AND HEATING	Auto Repairing
Sheet Metal Worker	Navigation
Textile Overseer or Supt.	AGRICULTURE
CHEMIST	Poultry Raising

Spanish French Italian

Name_____

Present Occupation_____

Street and No._____

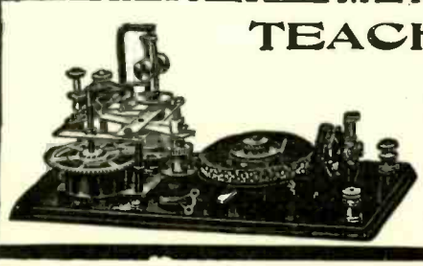
City_____ State_____

Canadians may send this coupon to International Correspondence Schools, Montreal, Canada

"THERE'S MONEY IN IT"

AT HOME LEARN TELEGRAPHY AT HOME

MORSE AND WIRELESS



TEACH YOURSELF

In half the usual time, at trifling cost, with the wonderful Automatic Transmitter. **THE OMNIGRAPH.** Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would.

Adopted by U. S. Gov't. 4 styles. Catalogue free.

OMNIGRAPH MFG. CO.
39L Cortlandt St. New York

ELECTRICAL ENGINEERING IN ONE YEAR

training again open to civilians. Over 3000 men trained for electrical industries in experience of more than a quarter of a century. For men of ambition and limited time. Condensed course in Electrical enables graduates to secure good positions and promotions. Theoretical and Practical Electricity, Mathematics, Steam and Gas Engines, Mechanical Drawing. Students construct dynamos, install wiring and test electrical machinery. Course with diploma, complete.



Thoroughly equipped fireproof dormitories, dining hall, laboratories, shops. Write for catalog. 27th year opens October 1, 1919.

BLISS ELECTRICAL SCHOOL
260 TAKOMA AVENUE, WASHINGTON, D. C.



Says the Master Mechanic. The Greb Automatic Grip Puller is a One-Man Puller—Quick-acting, strong and simple in the extreme. May be locked in any desired position. A combination of two or three arms. Heavy Duty Size capacity 1" to 18"—Junior size capacity 1" to 7". Two sets of jaws furnished with each size.

Ten Days' Trial If your dealer or jobber does not have them we will send you one. Try it ten days. If not satisfactory, return to us and we will refund your money. We also make the GREB RIM TAPOL.
THE GREB CO., 230 State Street, BOSTON

Learn Autos and Tractors



Wonderful opportunities constantly offered trained men; we train you thoroughly to start your own business or make good money as motor expert, driver, shop foreman, etc.

5000 Graduates making good. Catalog Free.

Cleveland Automobile School, 1807 E. 24th St., Cleveland, O.

NO CARBON—MORE POWER—LESS FUEL Price 50c up



On market 5 years. Over 10,000,000 in use. Every set guaranteed. Popular thru service. Don't re-bore cylinders. "NO-LEAK-O" makes good when others fail. Made different. Give results no other ring can. Write for booklet. Order from nearest Jobber, or write direct.
NO-LEAK-O PISTON RING CO., Baltimore, Md.
Beware of Imitations. See that NO-LEAK-O is on EVERY PACKAGE

The Seneca MOTOR CAR Built for the Owner $1085.00



Simple, Sturdy construction. Low cost of up-keep and operation. Cantilever springs in rear. Comfortable E-Z riding

4 cyl. - 27 H. P. 108 in. wheel base

Dealers Wanted Immediate deliveries. Fifth successful year. Increased output. Liberal newspaper advertising in dealers' territory. Wonderful opportunities. Write or Wire NOW.
THE SENECA MOTORCAR CO., 49 Seneca Factory, FOSTORIA, OHIO

ENINGER WILL SAVE YOU $40



BIG MONEY SAVINGS FOR YOU
Used and rebuilt motorcycles, single and twins, $25 to $100. Used bicycles, $5.00; tandems, $10. All machines guaranteed in good working order. New bicycles and motorcycles at Factory prices. You save dealers' profits. Motorcycle and automobile tires too, $3.00. Complete line of parts and supplies.
Send for catalog
Deninger Cycle Co., Rochester, N.Y.
YOU 25 TO 50 DOLLARS

FREE! Sonora



These phonograph needles replace steel needles, play 50 to 100 times and are used on ALL MAKES of steel needle records. Economical, convenient, improve tone, and preserve records. 30c per card of 5, 40c in Canada. Write today for FREE sample.

Semi-Permanent Silvered NEEDLES

Sonora Phonograph Sales Company, Inc.
GEORGE E. BRIGHTSON, President
279 Broadway, Dept. G, New York Toronto: Ryrie Bldg.



BUILD A $100 PHONOGRAPH
Assemble your own Phonograph
Do it yourself easily. Have the finest machine. Astounding saving. We give you the phonograph secrets. Complete instructions 10 cents.

ELECTRO MECHANICAL PARTS CO.
160 N. Wells St. CHICAGO

Want to Make Money? Send for our big July and August Sale By Mail. You'll save many dollars on your summer purchases of Cameras, Jewelry, Auto Supplies and Traveling Goods.
DAVID STERN COMPANY
1027K Madison St., CHICAGO, U. S. A.

STAMPS

50 diff. Belgium (large bi-color), China, Jamaica, Portugal, Venezuela, etc., 10c; 100 diff., nice packet, 20c; 1,000 well mixed, 40c; 100 var. U. S., 50c; 1,000 hinges, 10c; Agts. wanted. 50%. List free. I buy stamps. L. B. Dover, Overland, Mo.

Carrots, spinach, turnips, in three-cluster utensil. Current on fifteen minutes. Wattage 213.

Food cooks in both ovens one and a half hours.

Make coffee in electric percolator, four cups; 167 watts.

Princess Pudding.—Two-third cup butter, one cup sugar, one large cup flour, three eggs, one-half teaspoon baking powder, small glass cider. Rub to smooth cream butter and sugar, add eggs one at a time, beating few minutes after each addition; add flour sifted with baking powder and cider; put into mold well buttered, set in sauce pan in some boiling water; steam thus one and a half hours; turn out on dish carefully; serve with lemon sauce.

Tapioca and Cocoanut Pudding.—One cup tapioca soaked overnight, one quart milk, yolks four eggs, whites of two, one cup sugar, two tablespoons grated cocoanut; bake one-half hour. Make frosting of whites of two eggs, three tablespoons sugar, two tablespoons grated cocoanut; spread over pudding when baked. Set in oven until light brown.

DINNER
Asparagus Soup
Pseudo Roast Chicken
Carrots Espagnole
Baked Tomatoes or Potatoes
Salad
Fruit Tarts Whipt Cream
Demitasse

Pseudo Roast Chicken.—To avoid cold storage chicken and yet have it tender, try the "pseudo roast." Take the cleaned fowl, place it in kettle of water already heated to boiling. Simmer gently in boiler oven, current low, until chicken meat becomes tender; twenty minutes before mealtime baste chicken with butter and place in oven, current on *High* until golden brown.

Carrots Espagnole.—Boil and mash thru a colander two or three bunches of carrots; beat into them melted butter, pepper, salt and cayenne or paprika; add two eggs well beaten and grated cheese to taste; bake in mold and serve turned out on a hot dish; garnish with parsley. It should be as light as a souffle. Cook carrots in boiler oven. Bake tarts, tomatoes or potatoes, chicken and carrots espagnole in large oven.

Electric luncheon to Northwestern Electric Equipment Co. by Edison Electric Appliance Co., Hotpoint Division, January 10, 1919. Menu for forty-five guests:

Celery Olives
Chicken Soup Wafers
Roast Beef, Meat Sauce
Potatoes and Peas in Cream
Sweet Corn in Ramekins
Raisin Bread Sweet Rolls
Head Lettuce Salad
Plum Pudding, Hard Sauce
Coffee Cheese Straws
Van Dyke Cigars

Prepared on electric range by Miss Bell, of the Minn. Gen. Elec. Co.

10 cans soup	469	watts
18 lbs. roast beef	2,325	"
1½ pks. potatoes	1,188	"
2 cans peas, 5 cans corn	300	"
6 loaves bread	1,000	"
5 doz. rolls	700	"
50 portions pudding	1,275	"
70 cups coffee	525	"

At 4 cents per kilowatt-hour, this generous repast was prepared entirely at a cost of 31 cents per person. The operation was in charge of Miss Bell, of the Minn. Gen. Elec. Co., with one assistant, and not only were they on the job only ninety minutes, but the task found them just as sweet and clean as tho they had never seen a kitchen.

Total wattage was 7,782, or 172.9 per person. How was it done? By utilization of one great essential in successful range operation—stored oven heat. Of four surface burners only three were used to a current consumption of 2,682 watts.



$2 Get Details



"THERAPHONE"
REFINED PHONE SERVICE
High Power Scientific Receiver Earpiece is tuned to the ear. It can't confuse nor fatigue. Absorbs shocks, improves the Hearing and conserves time. For Busy, Deaf, Nervous, Privacy and Noises. Guaranteed to suit. (Check or C. O. D.—Export $2.20). No Agents.
Evolution Phone Company
48 Greenwich Ave., New York City

SECURE A MOTOR-CYCLE AT LOW COST



by putting a RELIABLE STEFFEY MOTOR on your wheel. Easy to attach. Costs less to run than an expensive motorcycle. Write at once and secure low factory prices.
STEFFEY MFG. CO.
Dept. E, 5025 Brown St., Philadelphia, Pa.

SAVE ½ ON AERIAL WIRE



Special sale of No. 12 or No. 14 Copper Wire at the remarkably low price of
30c per 100 foot roll
50c per 200 foot roll
Add 7c for postage charges.
Send 5c for our big illustrated catalogue showing scores of other bargains for electrical experimenters.
ELECTRICAL SPECIALTY COMPANY
Dept. E—48 So. Front St., Columbus, O.
Dept. E—128 So. 11th St., Phila., Pa.

MARKO
STORAGE BATTERIES
ARE GOOD—TRY ONE
Paul M. Marko & Co., Inc.
1402-1412 Atlantic Ave.
Brooklyn, N. Y.

WE BUY STAMPS

158 Genuine Foreign Stamps—Mexican War Issues, Venezuela, Salvador and India Service, Guatemala, China, etc., only **10c.** 60 all diff., fine, 15c; 200 all diff., 25c. FINEST APPROVAL SHEETS 60% to 80%. AGENTS WANTED. Big 72-page Lists FREE! We Buy Stamps. Est. 25 years. **O. E. HUSSMAN STAMP CO. Dept. 67 ST. LOUIS, MO.**

BE A C.P.A.
ACCOUNTANCY
The Highest Paid Profession taught thoroughly in a few months of home study by new system.
FREE BOOK International Accountants Society Dept. 39J, 2626 S. Mich. Ave., Chicago

Learn Watchwork, Jewelrywork and Engraving A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL Department, Bradley Institute, Peoria, Ill., for our latest catalog.



TYPEWRITERS
$10 AND UP. ALL MAKES. SAVE $25 TO $50 on rebuilt at the factory by the well-known "Young Process." Sold for low cash—installment or rented. Rental applies on purchase price. Write for full details and guarantee. Free trial. **YOUNG TYPEWRITER CO., Dept. 822, Chicago**

$200,000 RADIUM INSTITUTE TO TREAT CANCER.

The establishing of a splendid Radium Institute for Cancer Treatment is being built at Los Angeles, Calif., by King C. Gillette, of safety razor fame. The institute is being established for the study and treatment of neoplastic (tumor and cancer growth) diseases. It will be the only one of its kind in the West, and will employ upwards of $150,000 worth of radium. Mr. Gillette is to be president of the institution, and Dr. Rex Duncan will act as medical director.

In his announcement recently Dr. Duncan, who has just returned from the East, where he studied the use of radium at Johns Hopkins, Harvard and Cornell cancer research institutes, stated that the Los Angeles institute will use more radium and radium therapathic equipment than can be found in all the other territory west of the Atlantic Coast. The building "L" will cover an area 65x38 and 50x36 feet. In addition to its offices and elaborately-equipt laboratories, it will have a large number of beds for patients who find it necessary to remain at the institute for a time.

"The purpose of this institution," said Dr. Duncan, "is to provide unexcelled facilities for radium therapy, and the study and treatment of neoplastic disease. The benefits to be derived will be available to all requiring such treatment, and a fee consistent with the financial condition of the patient will be charged. Any profits earned above those required for the proper maintenance and equipment of the institution will be devoted to scientific and research work."

WORLD'S BIGGEST TURBINE DYNAMO—100,000 H. P.

(*Continued from page* 401)

chine is combined with the flexibility and reliability of three regular independent units.

The entire control of this turbine, together with all the others in the power house, is centered at an electric switchboard located in a room in the upper part of the power house. Here, by merely operating a few dozen small keys, resembling telegraph keys, the operator starts and stops the turbines in accordance with the demands of the transportation system, directs the current into various circuits as required, makes special connections to meet emergencies, and in other ways keeps New York constantly on the move. The responsibilities connected with this work can hardly be over-estimated, since a single error might tie up half of the city's elevated, subway, and surface lines.

In addition to this human control, a system of governors has been devised for the large turbine that automatically takes care of almost every possible contingency. In consequence, the machine practically runs itself and one of the things that strikes a visitor is the fact that workmen are rarely seen on the power house floor.

For the technical reader the following details will be of interest. Superheated steam enters the *high pressure* element at 205 lbs. pressure and dividing into two portions is exhausted into the *low pressure* elements at 15 lbs. pressure. From the low pressure elements it goes into the *condensers* in which a 29-inch vacuum is maintained; 826,000 lbs. of steam are used per hour for the maximum load, and the water rate is below 11 pounds of steam per kilowatt-hour. The generators are each rated at 20,000 KW continuously and 23,500 KW for two hours. Three-phase, 25-cycle current at 11,000 volts is delivered to the substations. The floor space occupied by the entire turbine is only 52x50 feet and its height is about 20 feet.

Photos Courtesy Westinghouse Elec. & Mfg. Co.

Oh! you Misfit!



LIONEL STRONGFORT

"Dr. Sargent, of Harvard, declared that Strongfort is unquestionably the finest specimen of physical development ever seen."

SAILING under the name of man. You know the truth if no one else does—you know what you lack—what you need. You may hide it from others in a way, but you can't hide it from yourself. Are you a victim of any pernicious habit that you want to get rid of? Have you a spark of ambition left to be the man you once were, to be the man you ought to be? Are you an easy victim of every little ailment that comes along, going around without snap or ginger, losing ground when you ought to gain it? Then wake up and be a man, not a misfit. Deserve the name of man; be vigorous, virile. It makes no difference if you are a physical wreck, if you join hands with me, I'll make you the kind of man that's wanted, the kind of man needed, the kind of man looked for, sought for, bid for all the time, and it will be done without drugs, or tonics or stimulants.

You will gain in vim, and vigor; your muscular power will increase in flexibility and strength, your nervous system fortified to renew its energy, not bolstered up for the time being, to fall back below the level it was, as it does when you resort to drugs or medicine.

You married men come across to yourself—get the pep and ginger and tingle of life into you. You are not living for yourself alone; you need dash, spirit, the enterprise you used to have. Regain and maintain your vigor; I'll show you how.

You business men—overworked, did you say? You are not doing half as much as you ought with your experience. Never mind, there is a way to get back your aggressiveness, to be right in the fight and enjoy it. You can double your percentage of real worth as a man, and enjoy life as you ought to be able to do.

You young man—think of your future—how about it—are you fit for marriage—are you qualified—do you feel it in your soul—are others sliding by you doing more—getting more than you are? I know what is dragging you down, what is keeping you down, and it is time, high time, that you **Stop.** No one can abuse nature and succeed; others tried it and failed miserably. Do you want to be a failure, or even worse than a failure? Then come to me; I have helped thousands; physically, mentally, morally. I will help you; I will make you the kind of young man that is a credit to any community— will make you so that your progress in any undertaking will be easier. Just be frank and above board—tell me your troubles. I will guide, direct and point the way; the natural way for you to achieve what I have said—Nature's way. You can stop the drain on your system, you can be free from bad habit, gain muscular tissue, be strong, virile, erect in carriage, courageous and likeable to all you meet. Let me be your guide, your teacher. I have pupils all over the world, learning a system of Health, Strength, moral courage building, known as

Strongfortism

Under my methodical system and the plan of practicing Strongfortism, you men can build your body up in symmetrical proportions as nature intended you to be. You will gain greater confidence in yourself, and compel others to have more confidence in you—it, best of all, brings you success—that you can call success, capped with the glow of health and the supreme joy of living. You can keep your youth with you, no matter what mistakes you have made, or what your present physical condition is, or what ailment or disorder you have—youthful errors, vital losses, devitalizing habits, poor memory, constipation, rheumatism, no matter what your present physical condition is. See that coupon, check what interests you, mail and I will send you helpful personal information. It will not cost you anything and it will surely help you to broader, bigger, better things and a great deal more happiness.

To know what Strongfortism can do for you, send for a copy of my book, "PROMOTION AND CONSERVATION OF HEALTH, STRENGTH AND MENTAL ENERGY." IT IS FREE—Just enclose three 2c stamps to cover mailing expenses to get a copy. SEND AT ONCE.

LIONEL STRONGFORT

Physical and Health Specialist

1033 Strongfort Institute NEWARK, N. J.

FREE CONSULTATION COUPON

Mr. Lionel Strongfort, Newark, N. J.—Please send me your book, **"PROMOTION AND CONSERVATION OF HEALTH, STRENGTH AND MENTAL ENERGY,"** for postage of which I enclose three 2-cent stamps. I have marked (X) before the subject in which I am interested. (1033)

..Colds	..Insomnia	..Youthful Errors
..Catarrh	..Short Wind	..Impotency
..Asthma	..Flat Feet	..Gastritis
..Obesity	..Stomach Disorders	..Heartweakness
..Headache	..Constipation	..Poor Circulation
..Thinness	..Biliousness	..Skin Disorders
..Rupture	..Torpid Liver	..Despondency
..Lumbago	..Indigestion	..Round Shoulders
..Neuritis	..Nervousness	..Lung Troubles
..Neuralgia	..Poor Memory	..Increased Height
..Flat Chest	..Rheumatism	..Stoop Shoulders
..Deformity (describe)	..Vital Losses	..Muscular Development

Name.....

Age.....Occupation.....

Street.....

City.....State.....



FLIES 500 FEET

Lightning Racer Experimental Model. This is not a toy. It is a practical, scientific flying model, guaranteed to fly hundreds of feet; designed and built from the finest selected materials, by Model Experts. This machine and our famous "Montauk Flyer" are the only Complete Model Aeroplanes guaranteed to fly 500 ft. selling for less than $5.00. The model, shipped with monoplanes detached, ready and guaranteed to fly, $3.75 prepaid. Send stamps for circular describing this wonderful model.

Blueprints of the following models 1-2 actual size 50 cents postpaid in U. S.

Bierlot Racer, flies 600 ft. Manhattan Racer, flies 2000 ft. "Montauk Flyer, flies 500 ft. 3 ft. Curtiss or De Haviland Biplane, 75 cents each, postpaid.

HEC Flying Boat guaranteed to rise from the water and fly 500 ft. Two sheets blueprint $1.00 postpaid U. S.

HEC AEROPLANE CO., 300 E. 49th St., N. Y. C.

Send Only 12c

(Stamps Coin)

And I will send you a copy of my valuable booklet.

"Hints to Music Loving Owners of Talking Machines"

Tells you how to take care of your machine and records, preserve the life of both, and gives many pointers to improve the tone of your instrument and increase your enjoyment of it. Instructs on the care of the motor, cleaning, speed adjusment, care of the needles—in fact every thing you should know. Send 12c today and the booklet will come by return mail.

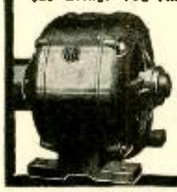
J. H. ELLIS, Box 882, Milwaukee, Wis.

Patentee & Manufacturer, Ellis Harmonious Reproducer

USE HB BALL BEARING ELECTRIC MOTORS

SAVE ON POWER BILLS—GET BETTER POWER. HB Ball-Bearing Motors supply better power than gas engine or steam engine, and cost less to operate. Amply designed for hard service, trouble proof, absolutely reliable. Ideal for factory, garage or machine shop. Best service at lowest cost.

$20 Brings You Any HB Motor. Balance on Easy Terms. Sizes ½ to 15 h.p. Choose to Suit Your Needs.



In planning your installation, write our service department. Get their advice—FREE. Simply state what machinery will be run and type of current available. Let us plan your power system for best results at least cost. Pin this ad to your letterhead and mail TODAY for full information. Ask also about HB Battery Chargers, Generators, etc.

HOBART BROTHERS COMPANY
Box 93E Troy, Ohio
Successful Manufacturers Since 1893

FACTORY-TO-RIDER
SAVES YOU MONEY



Buy direct and save $10 to $20 on a bicycle. **RANGER BICYCLES** now come in 44 styles, colors and sizes. Greatly improved; prices reduced. Other reliable models $16.75 up. **WE DELIVER FREE** to you *on approval* and *30 days trial* and riding test.

Our **big FREE catalog** shows everything new in bicycles and sundries. Write for it.

TIRES, lamps, wheels, parts and supplies at *half usual prices.*

Do not buy a bicycle, tires, or sundries until you get our *wonderful new offers,* low prices and liberal terms. A postal brings everything.

Ranger Electric Lighted Motorbike

MEAD CYCLE COMPANY Dept. G107 Chicago

35 Miles per hour Is Record of this Car



Boys, Build This Car. This nifty little car driven by gasoline motor, can be built by any boy. Parts are furnished by us and are very cheap. Send 26c for building plans and price list of parts showing how to build this lad's car.

SYPHER MFG. CO.
158 Warren Street
TOLEDO, OHIO.



HERE BOYS

ALL THE PARTS & PLANS
50 CENTS PREPAID.
Don't Send Stamps

Made in a JIFFY, flies around your yard, Maiden very NIFTY, a toy you wont discard.

NIFTY NOVELTY & TOY CO., Newark, N. J.

Under-Water Surveying by Reflected Sound Waves

By H. Winfield Secor

(*Continued from page* 405)

to the greater sound conducting properties here presented, the velocity of sound wave propagation thru water being about 4,700 feet per second, or somewhat over four times the velocity of sound traveling thru air. Otherwise the sound waves in water behave much the same as they do in air, giving all the echo, reflection and diffraction effects and other well-known phenomena with which we are all familiar.

AUDIBLE AND INAUDIBLE SOUND WAVES.

Mr. Ries has spent a great deal of time on research in the physics of sound wave propagation and reception, and one of his startling statements was the fact that in time of war or for certain other reasons (where multiplex or selective communication might be required in a constricted body of water), it then becomes possible to apply his sound surveying and detecting system by means of *inaudible* sound waves, i.e., sound waves pitched either above or below the normal register of the human ear. The human ear normally does not detect the presence of sound waves at below eight vibrations per second nor higher than sixteen to seventeen thousand per second, altho among radio operators it is common to "hear" at a higher limit of audibility—30,000 vibrations per second. The buzz of the beetle's wings is in the neighborhood of 16,000 to 17,000 vibrations per second, and this is about as high a sound as the average ear will note, unless specially trained. This particular detail is unusually interesting to us, for if audible sound waves have to be relied on to detect an enemy submarine for instance in war time, then the enemy might hear the sound waves.

By means of specially sensitive apparatus well known to engineers and physicists, it is possible by several distinct means to thus utilize for the purpose of solving the location of a distant object under water, by sound wave triangulation *sounds above the audibility of the ordinary ear.* Mr. Ries has devised apparatus which will not only detect such sound waves at two points on the base of a triangle, but also record them.

As Mr. Ries pointed out, it is a simple yet not commonly known fact of everyday physics that a sound that is inaudible to one person may be audible to another person, all depending upon the structure of the outer ear and the thinness and elasticity of the diafram in every case. It has been proven by scientists that there are a perfect multitude of sounds surrounding us all the time of which we have no cognizance, simply because our ears do not ordinarily respond to these abnormal frequency sounds. For example, there are certain insects which make sounds inaudible to ordinary persons, and thus it is believed that they carry on communication between one another. Furthermore, simply because we do not hear a sound, such as produced by Mr. Ries's 20,000 to 30,000 cycle surveyors, while listening at the receiver connected to a submerged microphone, is not a reason why our ears would not under proper conditions pick up and interpret that sound to the brain. If the form of the outer ear, i.e., the shell of the ear, were properly formed with regard to its length and angle, quite possibly the diaframs of our ears would respond. Therefore, it becomes apparent that to hear a certain sound is certainly a case of ultra-mechanics, or building a sufficiently sensitive apparatus to hear a certain sound or range of sounds.

(*Continued on page* 457)



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle massage. Can be used with or without electric current.

All users of the Lek-Tro-Shav speak well of it

A barber says—"Have shaved for years and have never used any shaving device near its equal."

A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."

No. 1 Made for use from Light Socket.
No. 2 Made for use from Dry Battery.

Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.

VIBRATING ELECTRIC RAZOR CO.
Dept. 122. Omaha, Nebr.

INSTRUCTION ON THE ELECTRICAL SLIDE RULE

On account of a number of men who have applied for instruction on the use and application of the *electrical slide rule,* we have selected the best rule for the purpose and prepared lessons which enables one to thoroughly understand how to handle it. We furnish a high grade rule in a leather case with the course of instruction. *The charge is small.* If interested write us.

BURGESS ELECTRICAL SCHOOL
745 E. 42nd Street, Chicago, Illinois

Send To-day for the
"Electrical Worker's Friend"

An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting A.C. motors. **Special at $3.50**

Or write for full particulars of this valuable book.

SMITH & SMITH PUBLISHING CO.
1524 LOWRIE ST., N.S., PITTSBURGH, PA.

Telegraph Pictures
BY ELECTRICITY



Complete sets of two machines of this marvelous equipment at ridiculously low prices. Instructive, mystifying and useful. This picture of President Wilson was telegraphed by these machines. Will transmit pictures, maps, drawings and hand writing. Picture telegraphing is the coming science. Write today.

J. LEISHMAN CO., Dept. T Ogden, Utah

Electricians

Get up-to-date in HOUSE WIRING! Save TIME, MONEY, LABOR and MATERIAL by using our 98 GENUINE BLUE PRINT DRAWINGS, containing all the latest diagrams and connections known in house wiring—every diagram and connection up-to-the-minute as used by first class electricians for wiring BELLS, BURGLAR ALARMS, LIGHTS, ANNUNCIATORS, FIRE ALARMS and ELECTRIC GAS LIGHTING. These drawings are bound in the form of a flexible book (9 x 12) for convenience in using on the job. Send for them, and if they don't make you more efficient as a wireman and save you many times their cost as a contractor, return them and money will be refunded—you can't afford to be without them. ONE DOLLAR postpaid. Send for circulars on other sets of drawings.

PATENT SPECIALTY COMPANY
P. O. Box No. 583 San Francisco, Cal.

EXPERIMENTS

In—Science, Electricity and Invention
256 Pp., by P. Edelman, $1.50 Ppd.
Here is the big illustrated

how to make and do it book you want. Full of stunts, home laboratory wonders, models, etc.

Edelman Publishers, 1802 Hague Ave., St. Paul, Minn.

STAMMERER

Send 10 cents for my remarkable book, "How To Stop Stammering." Kill the fear of stammering. Re education the key.

The Hatfield Institute, 109 N. Dearborn St., Chicago, Ill.



In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries address to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are publisht here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

Developing an Idea*

By Nelson Hall

NEARLY every one at some time gets an idea that he would like to develop if he knew it was worth while. That is if the field is not already covered or paralleled. It is always a burning question with inventors to know what has or is being done along the line of his idea. In these days when improvements are being made so fast that the patent office issues over a hundred patents a day, it is not uncommon to find, much to the inventor's distress, that some one has covered his cherished idea with a patent or come near enough to be an interference. Realizing the time and money spent in developing, the litigation involved in interference or overlapping of claims, and the disappointment that comes from an invention which has little or no market value, the following information is being offered to those who are developing ideas.

When an idea occurs give it some time and attention. Lay it out in the mind as much as possible, make rough sketches until a clear mental picture is formed. Building models or samples is always very instructive and aids much in producing a working article. At any rate think it out so it can be drawn or some one can be directed to draw it or build it if it is a construction, or go thru the sequence of operations if it is compounding or manipulating drugs or chemicals.

When the conception is developed sufficiently that it can be seen thru all the operations and the parts are in fair proportions, make a complete assembly drawing showing very clearly the new parts, improvements and the novelty. Also write a brief concise but lucid description to accompany the drawing, and take these before a notary public and have one or more of your friends who understand the drawing and description sufficiently to identify them sign as witnesses. If a model has been made photographs of it should accompany the drawing and description. This is much stronger evidence, because it shows that work has actually been done in developing. By these papers and the date affixed by the notary public a record is made that will be taken in court should it ever be needed. Very often the date of conception is of the utmost importance in establishing the priority of claims.

Do not conclude that such documents make it unnecessary to take out a patent, for such is not the case. Should any one secure a patent on the same idea, tho your conception antedated his, it would cost a lawsuit to establish your claims. If too much time had elapsed from the time of the witnessing *the court would consider yours an abandoned idea* unless you could produce evidence of your developing. One should not delay taking out a patent. He should file his application as soon as he knows the idea will work, can be manufactured and marketed. But before one decides how well his idea will work, how suitable it will be for manufacturing and how well the buying public will receive it, some very careful thinking technically and painstaking sounding among manufacturers, prospective users, and salesmen are required.

Every one meets people in several walks of life during each twenty-four hours of the day, and some of these may have just the information desired. By a little artful juggling of words the conversation can usually be shifted to the desired topic and run something like this if, let us say, a tire iron is the idea under consideration:

"I just saw (in mind or the mental picture which was worked out in getting the idea into a working form) a man repairing a tire with a very unique tool. The way he rolled that four and a quarter over the rim beat anything I ever saw, and when it came to replacing it was just as easy."

"What kind of tool was it? I have seen several and have a very good one with my car."

"It was about eighteen inches long with a peculiar shaped hook at one end that slipt under the tire and hooked on the rim, giving an unusual amount of leverage. I understand that it is new and is going to be put on the market soon."

By carrying the conversation further an opinion can be formed whether or not this man who is a user of a car and a prospec-

* Owing to the fact that this special article by Mr. Hall is running this month, the usual "Patent Advice" Questions and Answers will appear next month.

U.S. PATENTS



Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

LANCASTER & ALLWINE

255 OURAY BLDG.,
WASHINGTON, D. C.

PATENTS COPYRIGHTS TRADE MARKS DESIGNS

U.S. PATENTS

Our facilities for securing patents enable us to give prompt and reliable service at reasonable rates. Inventors are invited to write to us regarding questions appertaining to securing patent protection. All matters receive prompt attention. Send sketch for preliminary examination.

Books free on request

A. M. BUCK & CO.

Patent Attorneys

205 Second National Bank Bldg.,
Washington, D. C.

PROTECT YOUR RIGHTS TO INVENTION

Write today for "Record of Invention," which contains forms to establish evidence of conception. Prompt personal service. Preliminary advice without charge.

J. REANEY KELLY
732-P Woodward Bldg. Washington, D. C.

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE ON CONCEPTION." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention we will give our opinion as to its patentable nature.

Our illustrated Guide Book, "HOW TO OBTAIN A PATENT," sent Free on request.

Electrical Cases a Specialty Highest References Prompt Attention Reasonable Terms

FREE COUPON VICTOR J. EVANS & CO., Patent Attorneys

New York Offices: 1001 to 1007 Woolworth Bldg. Pittsburgh Offices: 514 Empire Bldg. Philadelphia Offices: 135 S. Broad St.
Main Offices: 779 Ninth Street, N. W., Washington, D. C.

Name..... *Address*.....

PATENTS

TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
164 Owen Building, Washington, D. C.
2276-8 Woolworth Bldg., New York City

PATENTS

LACEY & LACEY

Attorneys-at-Law—Patent Practice Exclusively
Solicitors of
U. S. and Foreign Patents
Trade-Marks, Copyrights
659 F St., N. W., Washington, D. C.
Write Us for Our Free Inventors' Book
PATENT-SENSE
Established 1869

Competent Patent Service
By a Former Examining Official of the U. S. Patent Office
NORMAN T. WHITAKER
Lawyer and Engineer
480 Whitaker Bldg. Washington, D. C.
Branch Office, 87 Nassau St., New York City.
INQUIRIES INVITED

PATENTS
Inventors Invited to Write for Information and Particulars
Highest References. Best Results.
Promptness Assured.
WATSON E. COLEMAN
Patent Lawyer
624 F Street N. W. Washington, D. C.

PATENTS
Hand Books on Patents, Trade Marks, etc., sent free. Our 70 years of experience, efficient service, and fair dealing, assure fullest value and protection to the applicant. The Scientific American should be read by all inventors.
MUNN & CO., 622 Woolworth Bldg., N. Y.
Washington Office, 622 F St., Washington, D. C.

PATENTS C. L. PARKER
Formerly Member Examining Corps. U. S. Patent Office.
PATENT LAWYER
McGill Bldg.
Washington, D. C.
Patents, Trade Marks, Copyrights, Patent Litigation
Handbook for Inventors, "Protecting, Exploiting and Selling Inventions," sent upon request.

tive buyer feels the need of a new tire iron. Sounding out several such men gives a fair idea of how keenly the public feel the want. This is very essential, from a financial point of view. It is possible for an invention to work perfectly, be a good manufacturing proposition and still not be received favorably by the public.

Often the original patents have expired before the public realized the merits of the invention. This was the case with the typewriter. Offices needed the typewriter, but there were no operators, and it was only after a long and tedious delay of developing operators, educating the public, and perfecting the machines that they became universally adopted in practice. Many of the original experimenters were dead before typewriters found their way from the inventor's shop.

Parallel with this is the modern steam turbine. Mr. Parsons' original patents expired before the turbine was considered seriously as a prime mover by the engineering profession. Mr. Parsons received his returns not from his patents but from his advanced knowledge gleaned from the experimental work which became a priceless asset in his later engineering practice. All this goes to show how important it is for the inventor to realize the condition of the public's wants. Many an inventor has been obliged to abandon an improvement because he could not stay in the game until the public realized its merits. Financial backers are liable to lose interest and withdraw their support if they have "come in" expecting a quick turnover, and it takes several seasons instead. Inventors are prone to be too optimistic about the public's receptivity of their invention and to paint such glowing pictures of success that their organization is sorely disappointed with the volume of business and the financial headway made in a given time.

If one meets a salesman he can adjust the conversation to get an idea of the selling capacity of the article. Will the article be *bought* or *sold?* It has been said there are no life insurance policies bought—they are all sold, and sold by personal solicitation of salesmen. One can describe the article and the plan he has for selling as if he were considering taking an agency himself and ask the salesman for his opinion. "Knights of the Grip" are always ready to pass an opinion, pick up a side line, or while the time away in conversation, so he will tell of any similar article that he may have seen and how it was marketed. If he is favorably imprest, remember him for the future selling force. He may cite to you several ways of marketing this from cases that have come under his observation. It is a very good plan for the inventor to have a feasible selling plan worked out before trying to interest capital.

From a manufacturer one can get some idea of the probable cost of production, necessary equipment, etc. The cost of manufacture is always more or less a stumbling block, but it is one of the three great questions that investors always ask. These are: What does it cost to manufacture, what does it sell for, and how long will it take to get it going? One can, if he likes, submit the whole article to a manufacturer and have him bid on it. But it is preferable to see what the cost of standard parts will be from a trade catalog, get bids on the other parts from screw machine works, stamping concerns, or others specializing in making parts. They will bid on the part in any quantity named from a blue print.

There is a type of man that one is bound to find in his travels, namely, the man with a lot of ideas. He will quickly commence: "I'll tell you what I would like to see and what I would buy if I could find it. I believe it can be done. It's a wonder to me some one has not done it already."

Such a man is often wide awake—he sees

(*Continued on page 473*)

PATENTS

INVENTORS: Send us sketches or a model of your invention and a description of the device for advice in regard to the best way of obtaining patent protection. Our practical experience covers a period of twenty years. Our hand-book on patents is sent free on request. All communications strictly confidential. Write us today.

TALBERT & TALBERT
Patent Lawyers
4287 Talbert Bldg. Washington, D. C.

PATENTS

If you have an invention and desire to secure a patent, send for our Free Guide Book. HOW TO GET YOUR PATENT. Tells our Terms, Methods, etc. Send model or sketch and description for our opinion of its patentable nature.

RANDOLPH & CO.
Dept. 172 Washington, D. C.

Patents Promptly Procured
Send sketch or model for actual search of U. S. Patents. Highest references. Personal service. Moderate fees. Write for Free Patent Book.
GEORGE P. KIMMEL, Patent Lawyer
99-X Loan & Trust Bldg. Washington, D. C.

AMATEURS — INVENTORS
ELECTRICAL APPARATUS MADE TO ORDER
COSTS NO MORE THAN READY MADE
and allows you to
WORK UP YOUR OWN IDEAS
KAUFMAN MACHINE COMPANY
1357 Odell St. New York City
Engineers Expert Instrument-Makers Designers

INVENTORS HAVEN'T YOU SOME IDEA that you can't just work out? Give us the idea—we will develop it for you. Mechanical and electrical ideas developed. Experts in model and experimental work and in perfecting inventions. Designing and building labor-saving machinery a specialty. Get in touch with us—we can save you money.
ELK MFG. CO.
1926 Broadway, New York



SPECIAL KON-VER-TER SLIDE RULE
The Hamilton KON-VER-TER slide rule has over 8000 graduations and over 1800 characters on it, will handle anything in Arithmetic, Algebra, Geometry or Trig. This slide rule is in use in all parts of the world and is much simpler to operate than others of similar lines. Does not require a wizard to use it.
Eventually you will get this rule, get it now and save the extra bother and expense. Utility rules $1.00. Special De Luxe, white ivory celluloid $2.50, instructions free. Leatherette case 50c extra.
J. C. HAMILTON & CO.,
Dept. B 7 Water St., Boston, U.S.A.

DOLLAR ADDING MACHINE $1



Adds and multiplies with speed of expensive machines. Seven columns capacity. Remarkably simple in construction. Nothing to get out of order. Weight one ounce. Made of metal and celluloid. The ideal pocket, desk or home machine. Order today. The best way not to forget is to do it now.
L. J. LEISHMAN CO., Dept. 142, Ogden, Utah



SAVE 25% to 60%
on slightly used
GRAFLEX-KODAKS
Cameras and Lenses of every description. Equal to new. Save money. Write now for Free Bargain Book and Catalog listing hundreds of money-saving bargains in slightly used and new cameras and supplies. All goods sold on 10 days' Free Trial. Money back if not satisfied. You take no chances dealing with us. We have been in the photographic business over 16 years. Write now.
CENTRAL CAMERA CO., Dept. 179 124 S. Wabash Ave., Chicago

FOR HEADACHE AND NEURALGIA
ANTI-KAMNIA
AK TABLETS
10c & 25c PACKAGES
ASK FOR A-K TABLETS

Under-Water Surveying by Reflected Sound Waves

By H. Winfield Secor

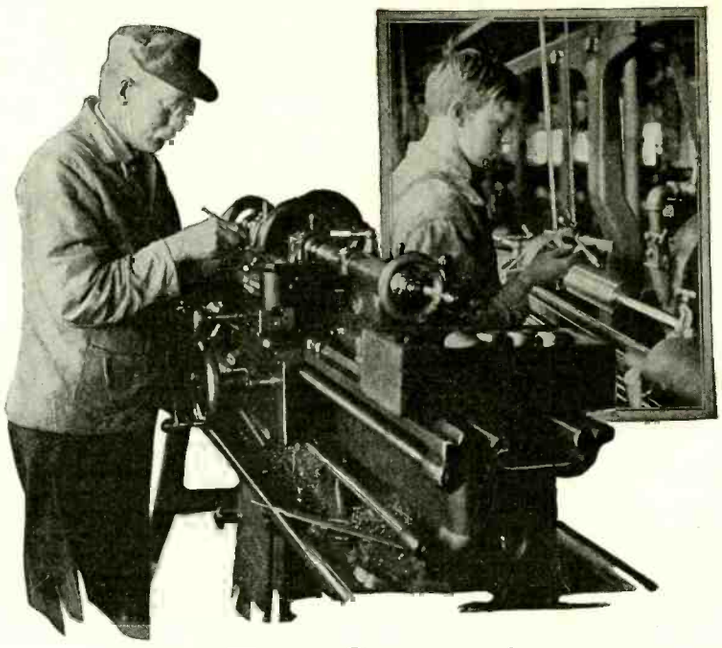
(*Continued from page* 454)

We remember one scientific investigator who could hear sounds as high as 38,000 cycles per second.

As Mr. Ries demonstrated, it is very remarkable how accurately a sound can be located, such as a blast from a whistle, if two short curved horns about one and one-half or two feet long are held tightly against the two ears, as shown in one of the accompanying illustrations. Should someone sound a whistle quite a distance away and you then swing your head from side to side, you will quickly ascertain that there is one certain position which will be found to be at right angles to the direction from which the sound emanated, in which a *maximum response* will be heard. It is possible that this method could be used to make a simple *range-finder* for military or other requirements. A very beautiful principle of pure physics was further mentioned at this juncture, and one that probably not one person in ten thousand ever thinks about. It deals with *sight* instead of sound, and the principle of triangulation is clearly illustrated thereby. Mr. Ries said: "Show me a good artist or draftsman and I will show you *the man who possesses abnormally separated eye-balls.*" This does not mean the eye-balls are divergent or convergent as in stigmatism, but that two normally straight eyeballs, having the most accurate observation possibilities, of extreme importance in all perspective drawing and painting, was here enhanced by the fact that the possessor of such a pair of eyes had a *longer base* for his triangulation of sight on a given object than the average man, or one whose eye-balls were spaced abnormally close. This fact is brought out pointedly by referring to the accompanying illustrations. If you are familiar with the laws of simple geometry and trigonometry, or else with the operation of the range finders now in use by the Army and Navy gunners, you will see that the reasoning is correct, and of momentous import indeed.

Mr. Ries's Under-Water Sound Detector.

There are two general methods by which Mr. Ries's highly perfected system of surveying may be carried out by means of sound waves. In the first method it may be applied in charting or surveying a given body of water and ascertaining the formation and character of bottom. In this case it is only necessary to provide at the receiving or measuring station a beam of known length on the extreme ends of which are placed two of the improved sub-aqueous microphones with balanced diaframs, perfected by the inventor. A sound projecting horn is sounded at pre-arranged intervals, and readings are taken as the apparatus is moved from point to point. In order to measure the range quickly, the two pivoted microphones are connected by means of gearing or rods with a calibrated dial placed in the center of the beam supporting the microphone sound detector. This dial moves proportionately to the movement of the microphone, and always gives the appropriate reading for identical angular positions of the microphones. The diaframs of Mr. Ries's subsea microphones are accurately balanced against the water pressure by comprest air, the pressure of which is automatically varied to a nicety in proportion to the pressure of the water, which, of course, increases as the depth of submergence is increased. The horns fitted on to the front of the microphones may also be attuned to a certain frequency.



For Two Generations

Inspectors, Toolmakers, Machinists and Apprentices have pinned their faith to the accuracy of

Starrett Tools

In the lathe room, at the bench, throughout the shop, wherever metal work requires precision measurement, you'll find men using Starrett Tools from preference.

Catalog No. 21LE sent free on request.

The L. S. Starrett Co.

The World's Greatest Toolmakers.
Manufacturers of Hack Saws Unexcelled.

Athol, Mass. 42-941

Attention Schools and Colleges

A WONDERFUL BARGAIN

The undersigned will sell at a very low cost, either in whole or part, the following:—

"Two 2-K.W. Marconi, 240 cycle sets of the old style with synchronous enclosed spark gap, complete with 110 volt generator, starter, field rheostat for the 240 cycle alternator aerial switch condenser, oscillation transformer, De Forest Commercial Type Audion Receiver, Marconi 2,000 ohm phones, Marconi 4,000 meter couplers."

These are two complete outfits which will be sold to the highest bidder and will make an ideal outfit for any school or university.

All of the appartus is in first class condition.

For further information, write to Mr. W. J. Gordon, International Milling Company, New Prague, Minn.

BOYS



Learn Drafting

Employers everywhere are looking for skilled draftsmen. They are offering good salaries to start with splendid chances for advancement.

Drafting offers exceptional opportunities to a young man because drafting itself not only commands good pay, but it is the first step toward success in Mechanical or Structural Engineering or Architecture. And drafting is just the kind of work a boy likes to do. There is an easy delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving boys just the training they need for success in Drafting and more than 200 other subjects. Thousands of boys have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon, then mark and mail it. This doesn't obligate you in the least and will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6200, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ MECHANICAL DRAFTING
- ☐ STRUCTURAL DRAFTING
- ☐ SHIP DRAFTING
- ☐ ELECTRICAL DRAFTING
- ☐ ARCHITECTURAL DRAFTING
- ☐ SHEET METAL DRAFTING
- ☐ BOILERMAKER DRAFTING
- ☐ BRIDGE DRAFTING
- ☐ MACHINE DESIGN
- ☐ ELECTRICAL ENGINEER
- ☐ Electric Lighting and Railways
- ☐ Electric Wiring
- ☐ Telegraph Engineer
- ☐ Telephone Work
- ☐ MECHANICAL ENGINEER
- ☐ Machine Shop Practice
- ☐ Gas Engine Operating
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ STATIONARY ENGINEER
- ☐ Marine Engineer
- ☐ ARCHITECT
- ☐ Contractor and Builder
- ☐ Concrete Builder
- ☐ Structural Engineer
- ☐ SALESMANSHIP
- ☐ ADVERTISING
- ☐ Show Card Writer
- ☐ Sign Painter
- ☐ ILLUSTRATING
- ☐ Cartooning
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Public Accountant
- ☐ TRAFFIC MANAGER
- ☐ Railway Accountant
- ☐ GOOD ENGLISH
- ☐ Teacher
- ☐ Common School Subjects
- ☐ Mathematics
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ AUTOMOBILE OPERAT'G
- ☐ Auto Repairing
- ☐ PLUMBING AND HEATING
- ☐ Textile Overseer or Supt.
- ☐ CHEMIST
- ☐ Navigation
- ☐ AGRICULTURE
- ☐ Poultry Raising
- ☐ Spanish
- ☐ French
- ☐ Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____



Don't Grope for Words

We are all trying to SELL something—it may be brains, or automobiles, or soap—but words are the universal medium of exchange. LEARN TO USE THEM CORRECTLY—PROFITABLY. Get a command of English! Spend a few minutes daily with Grenville Kleiser's Mail Course in Practical English and Mental Efficiency. It will surely teach you how to

Use Good English — *and Win*

Enlarge your Stock of Words—Use the Right Word in the Right Place—Write Compelling Business Correspondence, Stories, Advertisements, Speeches—Become an Engaging Conversationalist — Enter Good Society, etc.

Ask for free particulars *today*.
We send them by mail. No agent will call.
FUNK & WAGNALLS COMPANY, Dept. 313, NEW YORK, N. Y.

Where it is not possible to utilize a distant direct source of sound, as in measuring the distance of an iceberg, etc., then *reflected sound signals are used*. As afore-mentioned, a powerful siren or bell is now placed midway between the two microphones, and this is operated in the following manner: By means of an automatic *double contact switch* when the siren or submarine bell is sounded, to send out the *originating* sound signal, the circuits of the receiving microphones are automatically disconnected so that the powerful sounds being transmitted are not picked up, which would prove confusing, if for no other reason. After the signal has been sent out for a few seconds, the switch is thrown to "receiving," and the microphone circuits are re-connected. By this time the sound has died away at the transmitting station, and is being propagated toward the distant point from which the reflection is sought. After a few seconds, and during which time the pivoted beam supporting the two microphones is swung back and forth continually, a sound will be heard which is the echo, if there has been a reflection of the sound, and of course, if there is no reflection or echo, then no sound will be heard. The distance which the echo has traveled can be checked by a stop watch or other chronometer, dividing the time elapsed in seconds before the echo is heard, by two, and then multiplying this value by 4,700, which gives the range in feet. This is not necessary, however, as the automatic range reading scale connected to the two pivoted microphones is calibrated to give both the distance and position directly, once the beam has been swung so as to be at right angles to the point of the original sound, or in the present case the point from which the echo was reflected.

One of the accompanying views shows a diagram of Mr. Ries's *differential sound receiver* for this purpose, and its operation is very ingenious indeed. A differentially wound telephone receiver is used, provided with two windings or coils, one of the receiver coils connecting thru an induction coil as shown to one microphone, while the second receiver connects thru another induction coil and shunt circuit to the second microphone. What happens when a sound is received, is interesting. No sound is heard at all in the receiver, for the following reason:—When the microphones have been properly focust and the sounds localized and picked up in each microphone unit are equal in strength, then the currents passing thru the induction coil circuit to the two differential windings in the telephone receiver are arranged so that they neutralize one another, and as a consequence no sound is given forth by the receiver diafram.

An exceedingly important and timely application of Mr. Ries' invention is that brought about by the World War that is now happily ended, namely, the location and recovery of many of the numerous and costly warships and merchant vessels sunk by submarines, mines, etc., amounting, according to recent estimates,* to more than 18,000,000 tons out of a total world tonnage in 1914 of 42,000,000 tons. Among the original purposes which Mr. Ries had in view in devising his apparatus was the location and salvage of vessels and the preliminary study and charting of their position and condition, *from the surface*, by means of the reflected sound waves which were brought to a focus upon and caused to travel in exploration along the entire exposed part of the vessel, and also over the ground on which she lay. In this manner not only the exact depth and position of the ship is ascertained without the use of a diver, but every part of the ship is plotted as the survey proceeds. A three-funneled steamship, for example, with the widely separated sound receiver horns brought to *a spot focus* upon it, will give

* See article in "Sci. Amer.", July 19, 1919.

Young's Elements OF Astronomy (Revised)



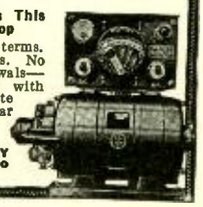
Brought strictly down to date. A general exposition of the subject and at the same time a valuable work for the reader or student who desires a reference book for constant use. It recognizes the new methods. It includes the new results. Amply illustrated, $2.00.

GINN AND COMPANY
70 Fifth Avenue New York

HB BATTERY CHARGING PAYS BIG PROFITS

$100 to $200 CLEAR EXTRA PROFIT Each Month
New Lower Price On This HB 500 Watt Charger
Recharges 1 to 7 6-volt batteries at once for 10c to 15c each. Owner pays 75c to $1.50. Figure those profits! You can build a big, profitable business in battery charging. No mechanical knowledge required. Small investment—long, easy terms—BIG PROFITS.

Small Cash Payment Puts This HB Outfit In Your Shop



Balance on easy monthly terms. Profits easily carry payments. No burnouts, no expensive renewals—steady, dependable service with BIG PROFITS. Absolute Money-Back Guarantee. Tear out this ad and mail TODAY for information.

HOBART BROTHERS COMPANY
Box 91E Troy, Ohio
Successful Mfrs. Since 1893



THE MIDGET SLIDE RULE will solve any problem in addition, subtraction, multiplication, division and proportion. A Log-Log Scale gives any root or power of any quantity. Gives Logarithms, Sines, Tangents, Cosines, Cotangents and the decimal equivalents of fractions to six figures. It is grease and water proof and will give years of service. This rule is not to be compared with the paper utility rules which sell for $1.00 and are put together with paper fasteners. It is accurate, simple to operate and comparison shows that it is undoubtedly the fastest and most complete rule made. Our refund guarantee protects you from loss or disappointment. An instruction book 16 pages, 12 illustrations, is sent with each rule. Made in two models: Metal (white coated steel), **$1.00**; White Celluloid, **$1.25**. Leather Case **50c** extra. Send for catalogue of Slide Rules. Your money back if you are not satisfied.
Gilson Slide Rule Co., Niles, Mich.

Build Your Own PHONOGRAPH,

It's Easy With Our Help

A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fine profit building phonographs for your friends.
Write Today for Our Free Blue Print Offer. Agents wanted for our ready built Choraleons.

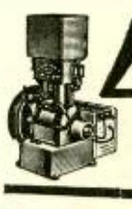


SAVE OVER HALF

Choraleon Phonograph Co.
709 Menger Bldg., Elkhart, Ind.

NATIONAL TRADE DENTAL SCHOOL

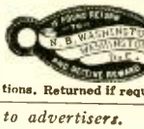
506 S. Wabash Ave., Chicago, Ill.
LEARN MECHANICAL DENTISTRY—DEMAND UNLIMITED
A paying professional trade: You will be a trained dental mechanic and receive our diploma when competent. Students given advantage of thoroughly up to date laboratory and services of graduate Dental Surgeons on practical cases. No effort spared to place graduates advantageously. No age limit. Day or Evening. Individual instruction. No educational requirements. No book or home study. Easy terms. Highest references. Especially attractive proposition to those who write at once for catalog H.



SMALL ENGINES

Perfected Gasoline Engines—½, 1 and 1½ h. p.—for Farm and Shop use. Price, $27.50 and up. Also
WASHING MACHINES
We ship on trial. Send for Booklet and Special Offer.
SIEVERKROPP ENGINE CO.
1401—19th St., Racine, Wis.

STARTER for FORD CARS



EARN MONEY

Stamping Names on Key Tags. $50
Either sex. Spare time. Some make
Send 25c for Tag with your name on and instructions. Returned if required. **Exp. Key Tag Co., Cohoes, N.Y.**

three characteristic echoes as the pivoted exploring arm is moved.

Ries Balanced-Flame Sound Detector.

In this case two manometric flames, as shown in the accompanying illustration, are separated by an opaque partition inside of a ventilated glass bell or other cover. The two flames are adjusted to burn with equal brilliancy, and pneumatic comprest air tubes provided with appropriate needle tips are placed at the side of either flame. These two pneumatic tube systems, which are used to cause either of the flames to vary or quiver, are suitably connected to the two receiving microphone-telephones. While the microphones in this case are being focust, there will be a fluctuation of the flames until the beam is accurately focust and the sounds of the telephones are of equal strength, when the flames will become balanced, and each will burn with equal brilliancy and shape.

An interesting experiment, which the reader may like to conduct, is that of causing a focust sound wave to be propagated across a room, and then listening for the focust ray. This will demonstrate one of the principles on which Mr. Ries's invention works. To perform this experiment, all you need is a common garden variety of watch, such as a dollar Ingersoll, which gives a good healthy tick, and this may be placed in a parabolic or other reflector, or even a china oatmeal bowl.

Experimental Under-Water Signaling System.

All that is required for making this experiment is a water-tight tin box, in which is mounted a small buzzer. This buzzer may be soldered to the inside of the metal box, which may be a cocoa tin. The two wires carrying battery current to the buzzer are carried out thru the top of the container thru a piece of small rubber tubing. Where the rubber tube enters the box the joint may be tightly sealed by the liberal application of hot sealing wax. The lid of the box may be sealed tight by thoroly waxing with paraffin.

The receiver is of the microphone type, and any electrical experimenter will be able to make this device very easily with a little ingenuity. There are several ways in which it may be done. The first requisite is a sensitive carbon microphone. A Skinderviken microphone button, which is complete in itself, may be used, attaching it firmly to a ferrotype (iron) diafram about 2¾ inches in diameter. It is best to place solder over the nut on the water side of the diafram to keep the inner chamber of the receptor thoroly water-tight. The receptor may be mounted on a piece of pipe or a metal rod, so as to be suspended over the stern of a rowboat or launch, and provided with a handle so that the microphone and its attached metal horn can be swung in different directions. One side of the circuit may be completed thru the metal suspension of the microphone apparatus, and the other side of the circuit thru an insulated wire leading up above the water thru a rubber tube. All joints around the microphone should, of course, be made water-tight, but this is not very much trouble where a simple experimental apparatus is under consideration. The microphone diafram should be fitted with substantial rubber gaskets on front and back, and then the base of the horn and the rear casing of the microphone thoroly bolted together to form a compact whole by means of a number of small stove bolts or machine screws and nuts placed around the perifery of the chamber, as shown in the drawing. This is due to Christian Berger.

An ordinary 75-ohm telephone receiver, or a pair of them, are connected up with a dry cell or two in circuit with the microphone at the receiving station. All is then ready to try out the transmission of sound signals thru water.

DETROIT
The Auto Center is the Logical Place To
LEARN AUTO AND TRACTOR BUSINESS
Training for Head and Hand
Trained men are needed everywhere to test, repair and give expert advice on care and handling of automobiles, trucks and tractors. Big money for M. S. A. S.-Detroit trained men. Good jobs or independent businesses await our graduates. Opportunities unlimited.
Earn $100 to $400 Monthly
Our Course will teach you how in a few short weeks. Most complete, comprehensive and up-to-date Course known. Wholly practical. No job too hard for our graduates. Every phase of work covered. Actual experience given on dozens of different cars. Entire equipment best obtainable. Instruction includes complete Tractor Course. Brazing, Welding and Tire Repairing taught separately.
Learn in Detroit — Start Any Time — Our Graduates in Demand
Here you get the benefit of finest co-operation of biggest factories. They know the thoroughness of our Course and gladly help our students in every way possible. Almost daily we have calls for graduates to fill responsible positions. School open all year. Enter classes any time. No need to waste or lose a moment.
Money-Back Guarantee
We guarantee to qualify you for a position as chauffeur, repair man, tester, demonstrator, auto electrician, garage man, automobile dealer, or tractor mechanic and operator, paying from $100 to $400 monthly, or refund your money.
Big Factories Endorse Our School
They know what we do--how we teach, and the type of graduates we turn out and give our students unusual assistance. Every instructor an experienced man--one who knows and is able to teach others.
MAXWELL MOTOR COMPANY
DETROIT, MICH.
Mr. James Williams, 20 Lincoln St., Gloversville, N. Y.
Dear Sir:--Your letter of February 2d, making inquiry regarding the Michigan State Auto School received.
Wish to say that this is one of the best schools in the country, and would not hesitate to recommend it to anyone. It is a recognized institution among the Automobile factories of this city. We have a great many graduates from this school in our employ and every one has given entire satisfaction.
Very truly yours,
MAXWELL MOTOR COMPANY, Inc.
CHALMERS PLANT.
H. H. Lee, Supervisor Welfare and Labor.
Get Free Catalog
Tells all about "The Old Reliable School" located in "the Heart of the Auto Industry." Or, better still, jump on the train and come to Detroit as hundreds do. Your fare refunded if everything not as represented.
MICHIGAN STATE AUTO SCHOOL
A. G. ZELLER, Pres.
669 Auto Bldg., Woodward Ave.
DETROIT, MICH., U. S. A.
DETROIT THE HEART OF THE AUTO INDUSTRY
STATE AUTO SCHOOL
140 ACCESSORY FACTORIES
44 AUTOMOBILE FACTORIES

YOUR OPPORTUNITY
Canceled Government Contracts
We have secured a large quantity of Small Motors, Generators and Charging Outfits. This material is new, still in original cases and carries the full factory guarantee.
This is Your Opportunity to buy new, guaranteed Electrical Apparatus of Standard Manufacture
1/2 H.P. INDUCTION MOTOR 110 or 220 volts, A. C. 60 cycle, single phase, 1750 R. P. M. $32.50
ALL MOTORS COMPLETE AS CUT
Battery Charging Outfits
For use on 110 volt, A. C., 60 cycle, single phase current only.
80 watts, 8 volts, 10 amperes . $48.50
150 watts, 30 volts, 5 amperes . $68.50
150 watts, 15 volts, 10 amperes . $68.50
300 watts, 30 volts, 10 amperes . $94.50
All outfits complete with switchboard as cut shown.
Mail $5.00 cash or Money Order. We will send C. O. D. subject to full examination.
MONEY BACK GUARANTEE
1/4 H.P. 110 volts A. C., 60 cycle, single phase 1750 R. P. M.
WASHING MACHINE MOTOR
Suitable for operating Small Compressors, Coffee Grinders, Bottle Washers, Lathes Drill Presses, etc. $18.50
WRITE FOR CATALOGUE. BARGAINS IN MOTORS AND GENERATORS. SPECIAL QUANTITY PRICES
220 volts POLYPHASE MOTORS 1750 R.P.M. 60 cycle, 2 or 3 phase. Complete, pulley and base
1 H. P. $59.50 3 H. P. $ 84.50
2 H. P. $72.50 5 H. P. $102.50
NEW MOTORS
110-220 volts REPULSION MOTORS 1800 R.P.M. 60 cycle, single phase. Complete with pulley.
1/2 Hp. $44.50 1 Hp. $67.50
MANUFACTURERS' DISTRIBUTER
CHAS. H. JOHNSTON - West End - PITTSBURGH, PA.

What 15c will bring You from the Nation's Capital
Washington, the home of the Pathfinder, is the nerve center of civilization; history is being made at this world capital. The Pathfinder's illustrated weekly review gives you a clear, impartial and correct diagnosis of public affairs during these strenuous, epoch-making days.
The little matter of 15c in stamps or coin will bring you the Pathfinder 13 weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation: a paper that prints all the news of the world and tells the truth and only the truth; now in its 26th year. This paper fills the bill without emptying the purse: it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you would appreciate a paper which puts everything clearly, fairly, briefly—here it is. Send 15c to show that you might like such a paper, and we will send the Pathfinder on probation 13 weeks. The 15c does not repay us, but we are glad to invest in new friends. The Pathfinder, Box 76 Washington, D.C.

MODEL AIRPLANE SUPPLIES
Build and fly Model Airplanes
Send 5¢ for catalog of complete and knocked-down scale models of new machines, parts, fittings, and supplies.
Wading River Mfg. Co. 672 Broadway, Brooklyn, N.Y.

MURDOCK No. 55

2000 OHM DOUBLE SET **3000 OHM DOUBLE SET**

$4.00 **$5.00**



Your Decision

is good enough for us. If, after trying a set of MURDOCK No. 55 'phones, you decide that they do not suit your requirements, send them back and get your money. We are certain that you will say that these 'phones are the best value in the world.

Guaranteed to be as sensitive as you require, more reliable than most, and as serviceable as any. They compare very favorably with sets costing from two to three times as much.

ORDER YOURS NOW

BULLETIN 19A describes these 'phones and a complete line of thoroughly good experimental apparatus. Send for a copy.

WM. J. MURDOCK CO.

55 Carter Street
CHELSEA, MASS.
221 Second St., San Francisco

CORE WIRE

We have been fortunate in securing thru auction several tons of guaranteed pure, double annealed **Norway Iron Core Wire** and are selling this wire to "Experimenter" readers

At Pre-war Prices, 20cts. lb.

This wire is just the thing for spark coils, transformers, etc., and it is, of course, a very much more superior product than the usual iron wire.

We have only one size left:
24 INCHES LONG.
Thickness about No. 21 B and S

If this size should be too long we advise cutting the wire down yourself by means of shears.

As long as the supply lasts we offer this wire as described above to our customers at the very low price of 20c a pound.. Add postage or we will ship express collect. Order at once.

Electro Importing Co., 231 Fulton St., N.Y.C.

"Audions on A. C." Correction

In the article entitled "Operate Your Audions on A. C.," by Elliott A. White, published in the July issue of the ELECTRICAL EXPERIMENTER, page 234, an error occurred in the statement of the formula in the center column of page 234. The multiplying factor in the numerator of the equation should have read 6.25 instead of .625. Also the second line at the top of column three should have read 1 ampere instead of 0.5 ampere.

We are pleased to add the following information contributed by Mr. White since the publication of the original article, and which we believe our Radio friends will be very glad to procure, especially in view of the high technical standing of the author, who was formerly Radio instructor at the *Carnegie Institute of Technology*. The additional information follows:

"If the tubes of the rectifier are of the high internal impedance type, they must pass at least as much current as is required by the plate circuit of the receiving tubes; and if the tubes of the rectifier are of the low internal impedance type (such as the G. E. Co.'s *Tungar* tube), a current-limiting resistance should be inserted in the lead from the middle of the transformer windings T3 T4, to protect the tubes. As the filaments of these tubes require only 2 volts, but a correspondingly heavy current, the transformer windings T5 T6 would have to be wound for 2 volts with heavy wire. There is another simple way of connecting the rectifier to the transformer, whereby all the windings are in series and the plates in parallel, but to avoid confusion this method is not given. Any connection or design adopted by the experimenter is satisfactory, so long as it is adapted to the kind of tubes used, whether they are transmitter tubes, receiver tubes, commercial tubes, or home-made ones."

TRENCH USE OF TELEPHONE WIRE.

Telephone wire is the *sine qua non* of the trenches. It is used to hang pictures on the walls of the dugouts, to mend cots and to make them. Men who have been "over there" have said that frequently soldiers have stopt in their pursuit of the Hun to gather bits of telephone wire lying along the blood-soaked fields of No Man's Land.

De Forest Defends His Three-Electrode Audion

(*Continued from page* 428)

gave off torrents of negative electricity. This discovery was made before anything was known of electrons, but Dr. Fleming had persisted in his efforts, directed towards rectifying alternating high frequency currents, and eventually by an exceedingly pretty contrivance, was able so to control and study the current as to suppress all the oscillations in one direction by the Fleming valve. This was improved on later by Mr. Marconi, and the present three-electrode valve, with its contrivances for audio-magnification, three times repeated, was finally evolved. Two currents being coupled and exalting each other made an exceedingly sensitive detector, and the lecturer remarked that this might be tested by placing the receiver and the transmitter of a telephone together, when all the little noises in the room were picked up and a whistling sound produced. Thus, with the modulation of the waves to the human voice, the problem of radio-telephony was solved, and great developments were to be expected.

"Conversation with ships would be practicable, as man to man in the same room, and also Trans-Atlantic telephony. The Premiers of the Dominions would, he anticipated, be able to take part in a cabinet meeting in London by vocal intercourse, tho their bodies were thousands of miles away."

The protest of Dr. de Forest is contained in the following letter:

Editor of *Morning Post*,
London, England.

Sir:

I have just read the paragraph in your issue of February 25th entitled "The Future Telephone," a resume of a Cantor lecture by Prof. Fleming. Prof. Fleming's lectures have usually been so clear and instructive that I am astonished to see him now quoted as having made statements widely at variance with well known facts. In the recent testimony before Mr. Justice Spencer in the unsuccessful attempt before his court by the Marconi Company experts to prolong the "Fleming valve" patent it was admitted by the Marconi experts (Prof. Fleming himself being present at the trial) that the Fleming valve did not amplify, that it only rectified the weak currents received in wireless signalling.

As a matter of fact, well known to radio engineers, the true Fleming valve has itself been of exceedingly small value in the modern wireless art. And Fleming did not improve it. It is a three-electrode vacuum tube, called by myself, shortly after its invention, the "Audion," which, if I may say it in all modesty, has brought about all those wonderful advances in radio signalling.

The Audion and not the Valve made possible the trancontinental wire telephony —the Audion and not the Fleming Valve, used as an oscillator at the transmitter, and as detector, and then amplifier at the receiver stations made possible transoceanic radio telephone in 1915, and again this year between New Brunswick, N. J., and the S. S. *"George Washington"* in Brest Harbor.

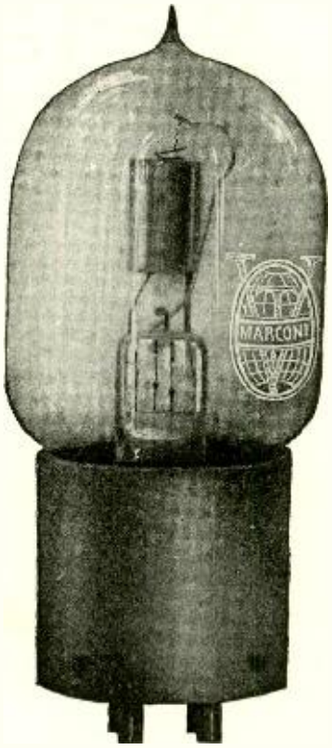
I cannot believe that a scientist of Prof. Fleming's standing would knowingly lend his name to any deliberate attempt to mislead the public in stating, or artfully inferring that Marconi improved the Fleming valve and produced the three-electrode device. Neither do I believe that a paper of the standing of the *London Morning Post* would knowingly lend its columns to any unfairness or pettiness in withholding the credit due an American inventor, altho there always has been and there still is plenty of evidence to show such an unfair and petty attitude on the part of certain British interests, especially in the United States. Marconi had no more to do with inventing a three-electrode device or Audion than the Kaiser, altho both have made good use of it, since an American produced it and demonstrated its limitless possibilities.

In the interest of fair play and scientific fact, I ask you to publish this communication. (Signed) LEE DE FOREST.

CORRECTION NOTICE.

Courtesy for the photographs used in illustrating article entitled "Airplane Antenna Reels" on page 324 of the August issue, should have been given to Emil J. Simon, Inc.

THE HEART OF THE WIRELESS ON THE NC 'PLANES



Fleming Pat. No. 803684
De Forest Pat. Nos. 841387-879532

Also used on the Vickers Vimy
Trans-Atlantic Flight

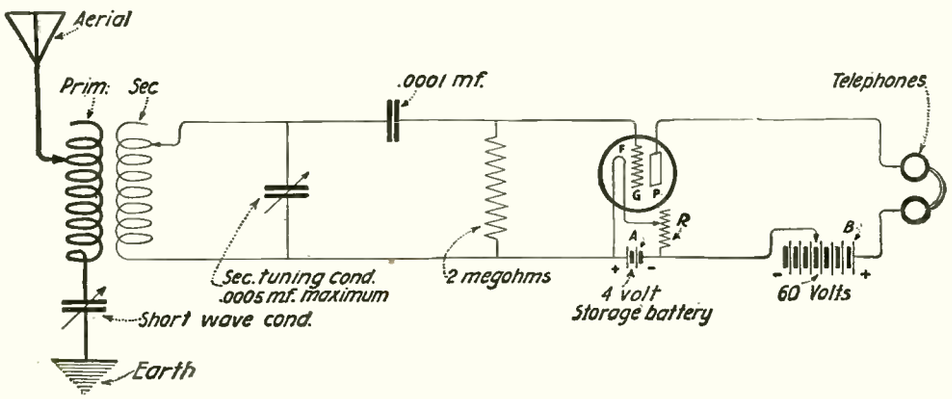
MARCONI V. T.

$7.00 each

Standardized Socket - - - - - -- - $1.50 additional

Agreements recently effected have made vacuum tubes available for experimental use. The Marconi V. T. is the only vacuum tube, or audion, which may be sold to amateurs, laboratories, schools of instruction and experimenters.

A highly developed, all-around tube for use as a detector and amplifier in wireless communication. It has practically the same electrical constants as the tube used by the Allied armies and navies throughout the war in continuous wave transmission and reception.



The preferred detection circuit for the Marconi V. T.

The Approximate operating life of the MARCONI V. T. is 1,500 hours.

Class I—Designed for use as a detector; operates with plate potential of 20 to 60 volts.
Class II—Designed for use as an amplifier; plate potentials from 60 to 110 volts may be applied.
Tubes in either class may be used for detection or amplification, but those of Class I are best as detectors, and Class II tubes are superior as amplifiers.

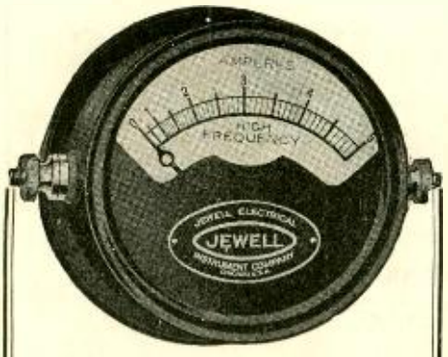
Send all remittances with order to

COMMERCIAL DEPARTMENT

Marconi Wireless Telegraph Company of America

Sole distributors for De Forest Radio Telephone & Telegraph Co.

Woolworth Building, 235 Broadway, New York



RADIO FREQUENCY AMMETER

4 inch Face

0 to 3, 0 to 5 or 0 to 10 Amperes. Specify Reading Required.

$11.00 Net

The Jewell Electrical Instrument Co. is prepared to fill the instrument needs of the amateur experimenter in radio and general electrical work, as well as those who desire more precise and accurate measurements of electrical quantities.

We show above our high frequency ammeter, of the thermo couple type, especially desirable for medium sized installations.

For receiving panels, we are supplying small D. C. instruments for plate voltage and filament current, at a very reasonable price.

Write for our special radio instrument bulletin.

JEWELL ELECTRICAL INSTRUMENT CO.
1640 Walnut St. Chicago



WIRELESS!

KNOB AND SWITCH LEVER—Mounted on brass bearing and shaft, threaded 6-32, two inches long. Lever securely fastened to knob. Each 40 cents, postage 4 cents.



KNOBS as illustrated above as used on Switch 1¼x¾ with hole for mounting, each 20c postpaid.

CONTACT POINTS 7/32x7/32 Brass with screw for mounting. Postpaid 25c per doz.

Bakelite-Dilecto panels, about

9½ x 19 x ¼	Black XX	$4.00
19 x 19 x ¼	Black XX	8.00
9½ x 19 x 3/16	Black XX	3.00
19 x 19 x 3/16	Black XX	6.00

A. H. CORWIN & CO.
924 Kinney Building Newark, N. J.

Get Our Prices

on the Wireless Apparatus you need, before buying.

We handle new and second hand instruments on which we can save you money.

All Second Hand Instruments guaranteed to be in perfect working order.

WHAT DO U NEED?

Send us your list now

Radio Equipment Co.
630X Washington St. Boston, Mass.

The "Fog Warning" Radio Telephone

(*Continued from page* 426)

third repetition the warning, "You are getting closer, keep off!" is sent out with a limit of range of about two miles. These signals are sent out during fog, mist, rain, and falling snow.

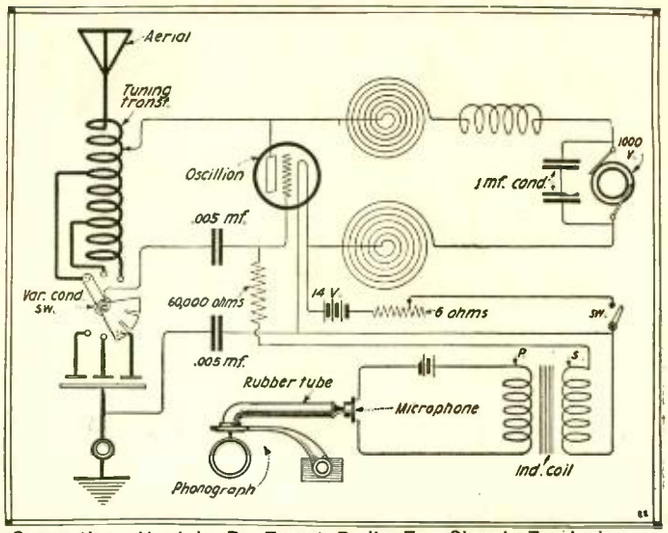
When sent out by *radio* the signals can be heard with any suitable or well-known wireless telegraphic telephonic receiving apparatus which may be employed to receive, detect, or reproduce the emitted or radiated signals. Crystal detectors may be used. The signals are sent out now on a first wave length of 600 meters.

If the transmitting and receiving apparatus is equipt for graduated strength musical note signals, these will be received by a ship at sea; for instance, suppose the ship receives the note corresponding to the Middle "C"; then it will be known that the lighthouse is four miles away.

If both the middle "C" and the "E" and "G," are detected at the receiving station, the distance is two miles, and if all four notes are heard, then the distance away is one mile or less, and so on for any other pre-arrangement and adjustment of the sounding apparatus.

This invention is bound to be a great help to all mariners and the system is a direct innovation over any that have heretofore been tried. Doubtless many disasters and wrecks will be avoided and in general to make navigation safer.

Every important lighthouse and lightship on the U. S. coasts will be fitted with this new Radiophone "fog signal."



Connections Used in De Forest Radio Fog Signal, Employing an Oscillion Bulb to Generate the Transmitting Oscillatory Current.

EMIL J. SIMON WINS CANADIAN LAWSUIT.

The Marconi Wireless Telegraph Company of Canada, Limited, the plaintiff in a Canadian radio patent suit, recently released and discharged the American Wireless firm of Emil J. Simon from and against all claims and demands set forth in the Statement of Claims, and further stated in their disclaimer that it will not institute any other proceedings against the defendant, Emil J. Simon, in respect thereof. This notice was dated Montreal, June 7th, 1919.

A competent English authority says that English central station managers realize that lighting is fast becoming the small end of the electric central station's income, and power and appliances are to be the main sources of revenue in the future.

The How & Why of Radio Apparatus

By H. Winfield Secor

(*Continued from page* 431)

comprising a four-wire inverted "L" aërial, the wires being spaced about 2½ feet apart.

However, where long distances are wanted, it becomes necessary to use longer aërials.* The reason for this is that, to gain the highest maximum results in any radio transmitting or receiving circuit, the antennae oscillatory circuit down to earth should be able to vibrate at a frequency approximating its natural period. Hence, it is seen that for this reason, it is necessary to use a long aërial, having in consequence a long wave *natural period* in order to pick up efficiently such wave lengths as 12,000 or 15,000 meters. This is not the whole story, either, for another important factor is that the longer the aërial, the more energy will be picked up from the rapidly moving etheric wave front, as it passes across the antenna wires. This may be compared for analogy to the electromagnetic field. In a dynamo or motor you will recollect that the longer the wire, the more magnetic flux it will intercept in its rotation in the field, with a consequent greater potential produced in the moving conductor. In the case of radio transmission, the conductor is stationary, while the electrostatic field moves and thus cuts the wire, inducing an electric current in the wire. It is this induced current which operates the detector in the receiving set.

*See "Calculation and Measurement of Inductance"—in the September, 1917, issue of this journal.

As a guide to the young radio designer, the accompanying graph chart is given, which shows the natural wave lengths of four-wire antennae of various heights and lengths. These values were computed from data given by Dr. Louis Cohen. A common rule for calculating approximately the wave length in meters of a simple antenna system, without any coils or other apparatus connected with it, is to multiply the length of the flat-top, plus the length of lead-in wire to earth, in meters by 4.5. This rule applies to inverted "L" type aërials. It is also applicable to "T" type antennae, but here the length of wire considered in meters is the lead-in length to earth, plus *one-half the length of the flat-top.* The factor 4.5 varies under different conditions, as, for instance, where metal roofs may change the natural capacity of the antenna. But it serves very well for approximation, and has been very extensively used.

Mathematical Calculation of Antennae Wave Lengths.

In a previous paper the writer had the following to say in regard to the wave length of radio antenna and the value of tuning inductances in the aërial oscillatory circuit.

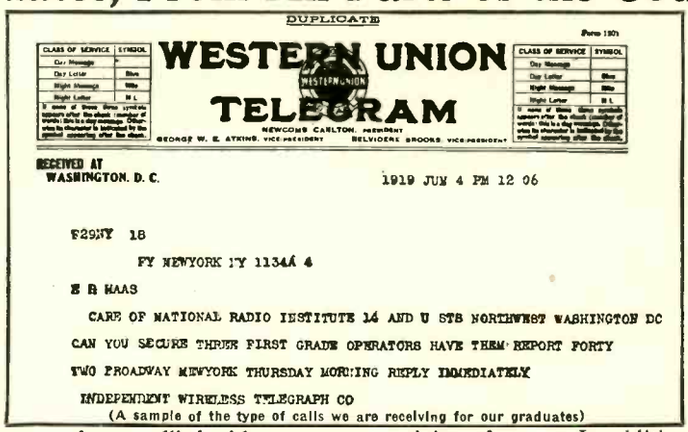
Having theroly discust the methods of both calculating and measuring the inductance of coils, we are now in a position to continue with the design of the most im-

(*Continued on page* 464)

Wireless Operators Wanted—At once

Calls Coming In Steadily, For National Radio Institute Graduates, From All Parts of the Country.

COMMERCIAL Radio has arrived and thousands of positions are now opening up in the Merchant Marine, Aerial Mail and Land Station Service, Railroad Companies, Lake and Ocean Steamship Lines. We are now receiving requests for more National Radio Institute Graduates than we can furnish.



DUPLICATE

WESTERN UNION TELEGRAM

NEWCOMB CARLTON, PRESIDENT
GEORGE W. E. ATKINS, VICE-PRESIDENT BELVIDERE BROOKS, VICE-PRESIDENT

RECEIVED AT WASHINGTON, D. C. 1919 JUN 4 PM 12 06

F29NY 18
FY NEWYORK NY 1134A 4
E R HAAS
CARE OF NATIONAL RADIO INSTITUTE 14 AND U STS NORTHWEST WASHINGTON DC
CAN YOU SECURE THREE FIRST GRADE OPERATORS HAVE THEM REPORT FORTY
TWO BROADWAY NEWYORK THURSDAY MORNING REPLY IMMEDIATELY
INDEPENDENT WIRELESS TELEGRAPH CO

(A sample of the type of calls we are receiving for our graduates)

Salaries Up to $250 A Month

With exceptional opportunity for promotion to Radio Mechanic, Electrician, or Engineer. No previous experience or training is necessary. You can learn Wireless the National Radio Institute way, in Ten Weeks, by mail, right in your own home. With our help you can quickly qualify for a good position at big play. Many of our students secure positions before completing the course, because it is based on actual practice and teaches what is needed to make a big success of Wireless work.

Get Your Instructions from the Nation's Capital

(Our Course is Endorsed by the U.S. Goverment Officials)

The National Radio Institute headed by authorities who have been closely allied with government training of students, was established in 1914 and is the first school in America to successfully teach Wireless by Mail. The work is under the direction of J. E. Smith, E.E., director of the Radio Department Howard University, and E. R. Haas, formerly of the Radio Division of Yale University.

We now have students throughout the world. Our location in the Nation's Capital together with the standing of our officers and their wide acquaintance among government officials connected with Wireless activities place us in position to give our students the best instruction obtainable and to be of the utmost help in assisting them to secure good paying positions.

Travel and See the World

If you want to travel and see the world—go to foreign countries, and increase your knowledge of world affairs Wireless offers you the chance of a lifetime. However, you are not obliged to travel, but may secure a permanent position at one of the big Land Stations, Railroad, Telegraph, or Steamship Companies if preferred.

Pay As You Learn

Our plans of payment bring a wireless education within the reach of anyone who desires to learn. A small payment down on our convenient payment plan, and small following payments, often enables our students to earn the cost of their tuition while actually learning to be a wireless operator.

Free Instruments to Every Student

In addition to 5 text books—35 Special Lessons, and 18 Personal Examinations we send you, while taking our course a Standard Automatic Wireless Transmitting and Receiving Set for sending and receiving messages. These fine instruments are Free only to National Radio Institute Students.

Oldest Wireless School in America

In addition to being the oldest and largest Wireless School in America our location in the Nation's Capital enables our Students Employment Department to keep in close touch with the best openings for our graduates. A Post Graduate Course is given Free to every graduate. Special discounts are allowed to discharged soldiers, sailors, and marines with former wireless experience and to Radio amateurs.

Representatives wanted to help introduce our course to wireless enthusiasts

FREE

Our booklet "Wireless the Opportunity of Today," gives you complete information in regard to our course, the quick and easy methods by which you can master wireless, and other important facts you should know. It is free. Just mail the coupon. No obligation whatever on your part.



NATIONAL RADIO INSTITUTE

ESTABLISHED 1914 WASHINGTON D. C.

Mail This Coupon Today

National Radio Institute
Department 92
Washington, D. C.

Send me free of charge, your booklet, "Wireless the Opportunity of Today," with full particulars regarding your famous 10 weeks Home Study Course, and your Special FREE INSTRUMENT OFFER.

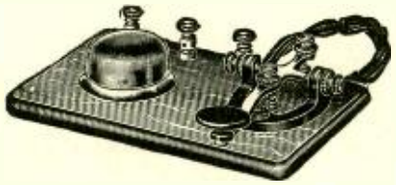
Name .....

Address .....

Town ..... State .....

Wireless Receiving Ban Raised

MESCO WIRELESS PRACTICE SET



The Practice Set comprises a regular telegraph key, without circuit breaker, a special high pitch buzzer, one cell Red Seal Dry Battery, and four feet of green silk covered flexible cord.

The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes.

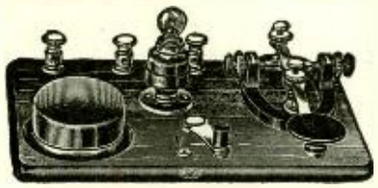
List No. Price

342 Telegraph Practice Set, with Battery and Cord $3.24

Weighs 4 lbs. packed.
Price does not include postage.

MESCO — Combination Practice Set for Learning the Morse and Continental Visual and Audible Codes

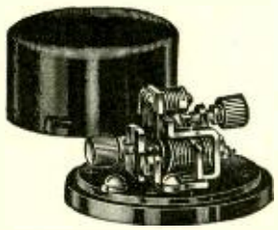
This outfit is the only reliable instrument which will enable students to become proficient operators in the U. S. Naval Service, because it is equipped with a buzzer and miniature lamp enabling the user to master both the visual and audible signals quickly.



List No. 52—Practice Set with Red Seal Battery and Cord $4.05

Weighs 4 lbs. packed. Price does not include postage.

MESCO RADIO BUZZER



This buzzer maintains a constant note and is recommended as an exciter for checking wavemeters where pure note and ample energy are required.

It consists of practically a closed circuit field of low reluctance, having a steel armature to which is riveted a strap supporting a movable contact. The armature tension is adjustable by means of a screw with a milled head large enough to be easily and permanently adjusted with the fingers. The stationary contact is adjusted by means of a similar screw. The magnet coils are connected in series with a total D. C. resistance of 3.9 ohms. Shunted across these coils is a resistance having a D. C. value of 3 ohms. This shunt eliminates all sparking such as occurs at the break on ordinary radio buzzers and the energy saved thereby is transferred into any oscillating circuit connected to it, the result being that this buzzer as constructed radiates five times more energy than any other existing type. All connecting wires liable to be broken are eliminated. Contacts are of genuine platinum, which is essential in order to maintain a constant note. The parts are mounted on a Condensate base to insure constancy in operation.

Diameter 2 in., height 1¼ in. The cap is attached to the base by a bayonet joint.

List No. Price

55 Mesco Radio Buzzer $2.05

We carry a Large and Complete Line of Standard Wireless Material Recognized by Experts as such with Competent Experienced Wireless Attendants in Charge

Send for the New Edition of Our Catalog W28

It is pocket size, contains 264 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Wireless Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

Manhattan Electrical Supply Co., Inc.

17 Park Place, New York, N. Y.

CHICAGO
114 S. Wells St.

ST. LOUIS
1106 Pine St.

SAN FRANCISCO OFFICE: 604 Mission St.

FOUR FAMOUS BOOKS

Wireless Course in 20 Lessons

By S. Gernsback, A. Lescarboura and H. W. Secor. E. E.

A course that tells you everything you can possibly want to know about "Wireless". The mysteries of "Wireless" are unfolded to you by the use of such simple language so skillfully used that of necessity you must understand every word. The subject is not treated superficially, however, for there is a whole lesson devoted to the Theory and Mathematics of this epoch marking subject.

Size of book is 7 x 10¼ in., 160 pages, 350 illustrations, 30 tables.
Flexible cloth cover....per copy $.50
Stiff cloth cover.....per copy 1.00
Postpaid

Experimental Electricity Course in 20 Lessons

By S. Gernsback and H. W. Secor. E. E.

A Course of the theory and practice of Electricity for the Experimenters. This is undoubtedly one of the most complete and comprehensive treatises of this special subject ever published. The book is written by the same authors as the famous "Wireless Course in 20 Lessons".

Every phase of experimental electricity is treated comprehensively in plain English.

The book contains 160 pages and more than 400 illustrations.

Flexible cloth cover...per copy $.50
Stiff cloth cover.....per copy 1.00
Postpaid

No. 1. How to Make Wireless Sending Apparatus
No. 2. How to Make Wireless Receiving Apparatus

By 20 Radio Experts.

Two Remarkable Books

Book No. 1 contains 100 pages, size 7 x 5 in. and 88 illustrations, paper bound.

Book No. 2 contains 100 pages, size 7 x 5 in. and 90 illustrations, paper bound.

These two books have been written and published entirely for the wireless enthusiast who wants to make his own radio apparatus.

Book No. 1—How to make Wireless Sending Apparatus 25c

Book No. 2—How to make Wireless Receiving Apparatus.....25c

Postpaid

THE EXPERIMENTER PUBL. CO. Book Dept. 233 Fulton St., New York

The How & Why of Radio Apparatus

By H. Winfield Secor

(Continued from page 462)

portant type of inductance coils used in radio work. We will confine ourselves to the types of coil which are mostly used, namely—loading inductances, loose couplers, variometers and transmitting oscillation transformers.

Before we delve into the actual design of these coils, however, let us first consider the fundamental facts necessary for the design. Since the inductance is employed in building up the proper oscillating condition of the circuit and consequently the wave length, we can express this relation by the following formulæ:

We have first the formula expressing the wave length, *W.L.*, of the open (antennae) oscillatory circuit, thru the primary, L_o, of a loose coupler, loading or tuning coil.

$$W.L. = A\sqrt{L \times C}\ ; \qquad (1)$$

where:—

A = a variable, ranging from 38.15 to 59.6 for short wave length. (See curves for various values of *"A"* in article cited below in February, 1917, issue.)

L = total inductance in centimeters of aërial, including lead-in and loose coupler, tuning coil or loading coil.

C = capacity in micro-farads of aërial, including lead-in.

Those interested in this subject should refer to the excellent article on "The Design of Large Radio Receiving Transformers," by C. S. Ballantine, in the February, 1917, issue of this journal, page 732. The variable factor, 59.6, appearing in the usual wave length formulæ was there discust at length, with a graph giving the different values of this function for various wave lengths and aërial inductance to localized inductance ratios.

Considering long wave lengths (10,000 meters and higher) and the design of large loose couplers we are safe in using the expression:

$$W.L. = 59.6\ \sqrt{L \times C}\ ;$$

where:—

L = inductance of loose coupler primary and loading coil (if used); the inductance of the antennae being neglected, owing to its small value compared to the inductance of the loose coupler (or loading coil).

C = Capacity of antennæ, including lead-in.

For designing short wave apparatus we shall call L_o the value of the loose coupler (or tuning coil) primary inductance. Then we have:

$$L_o = \frac{\lambda^2}{3552 \times C} - L\ ; \qquad (2)$$

here:—

L_o = inductance of load (loose coupler, tuner, etc.), in centimeters.

λ = maximum wave length to be tuned to.

L = inductance of antenna and lead-in in centimeters.

C = capacity of antenna and lead-in in micro-farads. (See tables herewith for these values.)

For long wave apparatus, let L_o represent the loading coil inductance, plus the inductance of the loose coupler primary (or tuner, if used). Then we have the formula:

$$L_o = \frac{\lambda^2}{3552 \times C}\ ; \qquad (3)$$

with all values the same as in formula No. 2.

The following tables will be found useful in applying the above equations to the design of loose couplers, etc.:

TABLE "A"

Cap. in M.F., Including Lead-in, of 4 Wire Inverted "L" Aerials. Wires Spaced 3 Ft. Apart

Height	Length of Flat-top in Feet			
	60	80	100	120
40....	.00033	.00042	.00051	.00060
50....	.00035	.00043	.00050	.00058
60....	.00036	.00044	.00051	.00059
70....	.00037	.00045	.00052	.00059
80....	.00039	.00046	.00053	.00060
90....	.00040	.00048	.00055	.00061
100....	.00042	.00049	.00056	.00062

TABLE "B"

Inductance in Cms., Including Lead-in, of 4 Wire Inverted "L" Aerials

Height	Length of Flat-top in Feet			
	60	80	100	120
40....	35,000	41,100	47,200	53,310
60....	48,800	55,460	62,090	68,700
80....	62,400	69,320	76,300	83,300
100....	76,260	83,500	90,750	98,020

It is possible to determine approximately the inductance required to produce a desired wave length when the capacity of the total oscillating system is known. When using any of the above formulæ, it should be remembered that they include the *total value* of the unit. Thus, the capacity factor includes the antenna, and condenser capacity, each of which must be determined separately and the capacity of the antenna must be obtained by actual calculation, formula for deriving this quantity having been given on page 732 of the February, 1917, issue of this journal, as well as a table of the capacities of a four wire antennæ of different lengths and heights.

The first step in the design of an inductive tuner (having determined the wave length) is the actual size of the instrument, and from this to find the approximate dimensions of the winding tubes to be used. Having these on hand, and knowing the maximum inductance of the primary by equations (2 or 3), we can immediately determine the number of turns that the primary coil will require to obtain the wave length sought, by solving equation (3) of (Part 1, March, 1917, issue) for *N*.

The inductance of the secondary winding should be such that its wave length should correspond very nearly to the antenna circuit, and that of the primary. If this condition is to be obtained, then we have an ideal condition of maximum efficiency and great care must be exercised in bringing about this ideal condition. The value of the secondary inductance must therefore be in the neighborhood of the primary (unless it is to be shunted by a variable capacity), but in practise it is made somewhat larger than that of the primary. It is customary in coupler design to allow one-half inch difference in size of diameters between the primary and secondary tubes and therefore the diameter of the secondary can readily be determined The number of turns required is deduced from equation given in the September, 1917, issue.

Details of Aërial Construction.

When it comes to discussing details of amateur aërial construction, one could almost write an encyclopedia of several volumes, for in traveling about the country, it is amazing to note the many different ideas followed in building antennæ. This is so for many reasons, not simply because one Radio Amateur wishes to have something different from his fellow Amateur across the street, but in a great majority of cases his pocketbook controls the design. And so it is that instead of using beautifully molded ten-inch Electrose insulators on his aërial, you may perchance bunk into one of the greatest freaks of modern times, a real dyed-in-the-wool Amateur antenna—constructed from about six kinds of wire, including some good old iron hay-baling wire, and a variety of insulators that would win first prize in any freak photo contest, made from miscellaneous odds and ends,

"ASK ANYONE WHO HAS USED IT"

WENT THROUGH CHATEAU-THIERRY, ARGONNE AND MEUSE OFFENSIVES

A soldier who used a Brandes Headset all through the war brought it to us for slight repairs afterward. He *knows* that a Brandes is the best that can possibly be made. You ought to hear him talk. (Name on request.)

BRANDES WIRELESS HEADSETS



CLEAR TONE
LIGHT WEIGHT
DEPENDABLE SERVICE

Score 100% efficiency in actual use. Sharp, Unblurred, Readable Signals assured by

Superior" Set 2000 ohms, $6

"BRANDES MATCHED TONE"—

Exactly matching the tone of both receivers in each set and thus eliminating all confusion due to unmatched harmonics.

TRIAL OFFER *Brandes Wireless Headset sent to you on trial for 10 days. Test it,—compare with others,—for sensitiveness, clearness, distance. Prove for yourself the fine quality, the "matched tone." The two diaphrams, toned exactly alike, strengthen the signals and prevent blurring. Used by many U. S. Gov't experts, and experts abroad; by colleges and technical schools; and by professionals and amateurs everywhere.*

If, for any reason, you are dissatisfied, your money back without a question.

SEND 4c FOR CATALOGUE E.

C. BRANDES, Inc.
Room 814
32 Union Square
New York City, U. S. A.

WIRELESS RECEIVER SPECIALISTS.

Complete Line of Brandes Receivers for those in Canada. Send stamp for Pamphlet "E"
Radio Electrical Supply Co., 43 McGill College Avenue, Montreal, P. Q., Can.



ELECTRICAL ENGINEERING

Bachelor of Science Degree in Three Years. Accomplish your electrical ambition. Three years of intensive conscientious study here will train you to become an Electrical Engineer with a degree of Bachelor of Science. Electrical industry demands technically trained men—engineers. At home or abroad the field is widening by leaps and bounds.

Forty professors, expert in their lines, form our faculty. They are leading hundreds of ambitious young men to sure Success. **Why not you?**

In fully equipped laboratories, shops, drafting rooms and recitation rooms day by day you will become fully prepared to engage in the profession of Electrical Engineering.

Fall Term Opens Oct. 1st

"Earn While You Learn" if you wish. Full provision for securing deficient high school credits.

Clip the coupon now for a "Photo Story" book and bulletin of the College of Electrical Engineering.

SCHOOL OF ENGINEERING OF MILWAUKEE
College of Electrical Engineering
110-373 Broadway Milwaukee, Wis.

CLIP HERE

School of Engineering of Milwaukee
Milwaukee, Wis.

Gentlemen:—Without obligation, send me catalog, Photo-Story book and particulars concerning your 3-Year Electrical Engineering Course with B.S. Degree.

Name .....
Address .....
City ..... State .....
Age ..... Education .....

SCHOOL OF ENGINEERING OF MILWAUKEE
110-373 Broadway Milwaukee, Wis.

HOME BATTERY CHARGING

means vitality and long life to your battery and anyone can do it with the

NEW F-F BANTAM BATTERY BOOSTER

which will fully charge any 6 volt storage battery eF-Ficiently from 100 to 130 volt 60 cycle alternating current lamp socket.

This is a new size of F-F Rectifier and similar to our standard F-F Magnetic Rectifiers which have been on the market for over 3 years. Thousands in use giving satisfactory service. Simple, safe, sure acting. Copper and carbon electrodes rectify the current. Capacity 6 volts 8 amperes. Shipping weight 10 pounds. Price complete with Ammeter and Battery Clips $15. Also F-F Battery Charging Rheostats that operate from Farm Lighting Plants and Direct Current Service.

Send check for prompt shipment via express or if via parcel post add sufficient for postage and insurance. Bulletin 12 on request.



$15

THE FRANCE MANUFACTURING CO., Cleveland, Ohio

WHY PAY

for a course of study in wireless telegraphy when our unique plan of profit sharing with our students guarantees a large saving on tuition and an estimated return of all?

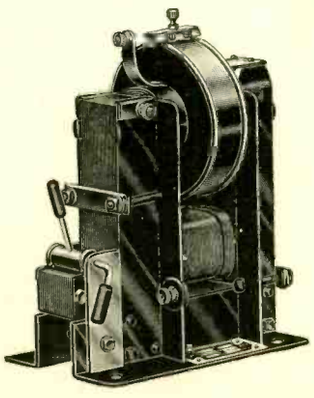
Our Correspondence Course

is most thorough and we are placing all our graduates in good positions without one day's delay. We represent several large steamship companies and are actually paying students to complete our course and obtain their licenses, the demand on us for operators is so great.

We are now the largest and best equipped radio school in the world, although some with less than one-fifth the number of students claim this distinction.

SERVICE RADIO SCHOOL

Dept. E, 900-2 Pa. Ave. Washington, D. C



RADIO AMATEURS

Do you want your radio station listed among the "long distance" amateurs? Our new type "R" 1 K. V. A. 25,000 volt Wireless Transformer will make your station efficient for "long distance" relay work. Write for our catalog 20 T describing complete transmitting apparatus.

Thordarson Electric Mfg. Co.

501 S. Jefferson St. Chicago, Ill.

including beer—excuse us, *near-beer*—bottles, porcelain cleats, waxed wooden rods, pieces of crockery and other choice bits of "backyard junk."

So it is seen that there is a wide latitude in ideas, and good ones, too, in many cases, let it be said, for building an experimental wireless antenna of fair efficiency. Your average Radio Amateur does not care so much about the "looks" of his antenna as he does about the fact as to whether or not he can sit down in his little coop with his apparatus about 10 P. M. and hear "Carnarvon" calling one of his Britannic Majesty's cruisers lying off the Canadian coast! That's the life that cheers.

Figs. 5 and 6 show several practical and approved developments in aërial design, which are not only efficient, but simple as well, in their application. Fig. 5 shows a typical elevated aërial spreader, which may consist of a length of stout bamboo, or a very good spreader is composed of cypress or oak sparring, about two inches square. The best shape for the spar is to make it about four inches broad at the center, so as to give it greater strength against bending. For ordinary work the Amateur usually winds several turns of wire around the spreader, and then fastens his insulators to it. A good construction, however, is afforded at very small cost by having a blacksmith (or else you can make them yourself) bend up a few eye-bolts, as shown in Fig. 5. These may be made from ⅜ inch round, wrought-iron bar, threaded at one end and provided with a washer and a nut or two. The iron and wood work on the aërial should be thoroly painted, of course, before erection, so as to withstand the weather. A heavy red or white lead paint is advised. If the antenna is to be used for "Receiving" only, four insulators are placed at both ends of the flat-top at the spreaders. Where the very highest efficiency is desired, extra insulators may be placed in the suspension ropes holding the spreader, as shown at X. This is the standard of aërial construction, but a much simpler form which has been extensively used in commercial practice, on ship stations particularly, is that shown in Fig. 6. Here no insulators are used in the flat-top part of the aërial proper, but they are placed in the main suspension ropes, as shown at X. This insulating scheme effectually insulates the aërial, of course, and a piece of brass or iron pipe may very well serve as a spreader, connecting the wires of the flat-top to the pipe, by winding the ends of the wires around it. It is the best practice to run a jumper wire across the strands, soldering this thoroly at the joints. This applies to the free end of the antenna; no jumper wire being required at the opposite end, where the lead-in rattails are led off. In any case all joints in the aërial circuit thru which radio frequency energy has to pass, *should be carefully soldered*, or else a very good design of clamp should be used, packing the cleaned wire joint with tin-foil before tightening the clamp. The jumper and rattail connections for inverted "L" and "T" type aërials are clearly shown in Figs. 1 and 2.

Kind of Wire to Use in Aërials.

"What kind of wire should I use for constructing my aërial?" "How many feet long?" and "What altitude?" are questions frequently repeated, and these are not simple ones, either. However, the Radio Experimental fraternity may count itself lucky in the respect that the size of wire for the antenna is pretty well standardized. For Amateur antennæ, it is common to use a wire corresponding in size to No. 14 B. & S. gage solid conductor. Where stranded cable is used, and which possesses a much lower *high frequency* resistance than a solid conductor of equal diameter (owing to its greater surface area, which

is the only part of the conductor traversed by the radio frequency currents), then a seven-strand cable is commonly employed. Seven strands of No. 22 or 24 wire constitute a common size of cable for experimental work, while a heavier cable is used in building commercial and Government stations. There are several kinds of wire in use for aërial construction. Aluminum wire was used previously, but it is very difficult to make a good soldered joint with aluminum wire, and for several other reasons it has not been used very much in latter-day practice. A very good wire for amateur work is a plain solid copper conductor, No. 14 B. & S. gage, or heavier, which may or may not be tinned. A good stranded cable for this work is one comprising seven strands of tinned copper wire. Another standard cable is a seven-strand one composed of phosphor bronze stock, which is of course very strong and suitable for the extra long spans. Still another form of wire in use for experimental aërial construction is copper-clad steel wire, which possesses greater tensile strength than any other equal size electrical conductor. The radio-frequency currents pass thru the outer copper jacket. Plain iron wire alone has been used, but is not very satisfactory.

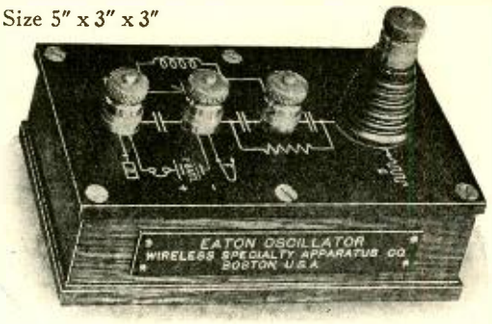
Grounding Connections.

The matter of grounding antennæ, especially of the elevated type, is very important, markedly so in the case of *thunder-storms*. Also the *Fire Underwriters'* rules have to be carefully heeded in this respect, which apply to every building on which *fire insurance* is carried. The safest method to follow in any event, for your own protection, as well as keeping in conformity with the Fire Underwriters' rules, covers the following recommendations for the *grounding of radio antennæ*.

These regulations call for a ground wire connected to a first-class ground plate or pipe running down to damp earth, or to the street side of water mains in cities, this ground wire being composed of No. 4 B. & S. gage solid copper conductor. The ground wire connects to a grounding switch rated at 600 volts and 100 amperes. The regulations do not specify what size of lead-in conductors should be used, but it is apparent and obvious that if you intend to conduct a heavy static surge or induced charge from a thunder-storm down to earth thru this massive switch and ground wire, that you certainly would not make a lead-in of No. 14 gage wire, like so many amateurs have been wont to do in past years. The right way to do this is to construct the lead-in wire of No. 4 B. & S. gage solid copper conductor or its equivalent in cross-sectional area, such as by employing two or more wires of smaller size stranded together. Good Radio Engineering practice calls for rattail leads brought down from each strand of the aërial to be of equal cross-sectional area to the aërial strands proper, and then bunching these rattail leads into the lead-in joint at the bottom of the fan-tail construction. All of these joints, as aforementioned, should be SOLDERED. The rattail leads should be brought into an aërial connector of some kind before being soldered, so as not to depend upon the solder alone for mechanical strength or electrical conduction.

The *Fire Underwriters'* rules further stipulate that this lightning ground and switch should be placed on the exterior of the building in all cases, and furthermore, that this *ground* which has just been described in detail, should be separate from the station ground. It is the usual practice in experimental radio stations to place the aërial grounding switch either on the window-sill or on the side of the window, and, of course, it should be covered with a metal or other box, so as to protect it from rain

Size 5" x 3" x 3"



THE EATON OSCILLATOR
FOR EXPERIMENTERS

Designed to transform receiving circuits to receive arc and other undamped signals. It may be used across circuits whose inductance lies between .05 and 100 M.H. and whose capacity lies between .0003 and .005 m.f.

Requires no adjustments of any kind. Circuits are engraved on top. Only one variable, the tuning condenser, is required.

The simplest and cheapest way of receiving arc, tube and high frequency alternator signals.

PRICE $14.90 IMMEDIATE DELIVERY

THE .004 M.F. FARADON MICA CONDENSER

Comparative tests have proved the W.S.A. mica FARADON to be the best primary transmitting condenser made. FARADONS are built in .002 m.f. and .004 m.f. capacities. The .004 m.f. FARADON is tested for 30 minutes at 21,000 volts and 18 amperes in a circuit of 1000 meters electrical length.

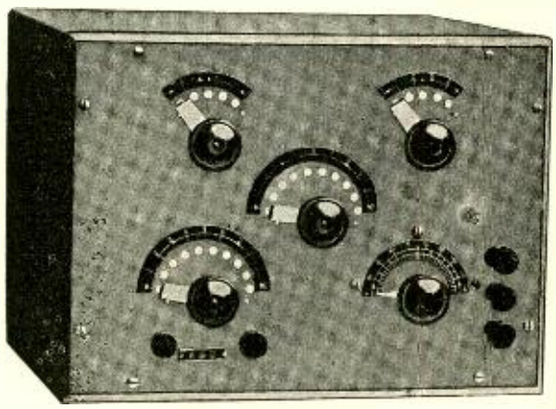


The temperature rise during this period is less than 3.5°C. Every condenser is guaranteed for one year.

.004 m.f. FARADON $28.50 Immediate Delivery

WIRELESS SPECIALTY APPARATUS CO.
ENGINEERS, DESIGNERS, MANUFACTURERS
Boston, Mass., U. S. A.

UNIVERSAL RADIO APPARATUS



Type UL-5 Receiver

It is the policy of this company never to consider a sale completed until the customer is thoroughly satisfied. Incidentally our instruments seldom fail to satisfy, because they are scientifically designed and built on honor. If you are interested in radio apparatus of the highest grade at fair prices, enclose a 2-cent stamp for our catalogue.

Type UL-5 Receiver.

This is a complete receiver for undamped waves up to 17,000 meters. No external coils, couplers or condensers are needed, since it is entirely self-contained. Sizes 8" x 12" x 7" approximately.

We control the patent rights for the Mignon System and can supply these instruments.

UNIVERSAL RADIO MANUFACTURING CORP.
Dept. W Elmira, N. Y.

AMPLIFY YOUR RADIO SIGNALS

With the new DETECTAGRAPH-TRANSMITTER, the amateur can amplify radio signals to such an intensity that he can hear the signals about his station without the need of the telephone head set.

By the addition of a loud talking telephone he is able to hear the messages many feet away from the instrument.

The super-sensitive DETECTAGRAPH-TRANSMITTER herewith shown is two and three-eighths inches in diameter, five-eighths of an inch thick and weighs less than three ounces. It is the most sensitive sound detecting device ever brought before the public.

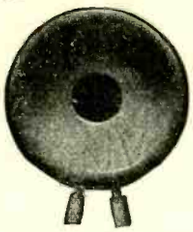
The manner in which the amplifying process is attained is by attaching with tape the DETECTAGRAPH-TRANSMITTER to the regular wireless receiver.

Not only is this instrument applicable for amplifying radio signals, but it can be used with equal satisfaction for magnifying other sounds. Phonograph music can be transmitted from one place to another by means of this instrument, and those who are afflicted with deafness will find enormous benefit by using this transmitter. It is the greatest device for building your own loud talking telephone, detectagraph and other devices. Can be used for any purpose where a sensitive detecting instrument is required.

SUPER-SENSITIVE Detectagraph MICROPHONE DEVICES



Our Super-Sensitive Detectagraph Transmitter. Price, $7.00 Complete



Our Special No. 25 Loud Talking Receiver. Price, $4.00 Complete



Detectagraph Rheostat, especially made for amplifying circuits. Price, $2.00 Complete



Super-Sensitive No. 40 Receivers to be used in connection with Detectagraph-Transmitters, $10.00



The Detectagraph Junior Deaf-Phone $15

Equal to any $35 instrument made. Outfit consists of Super-Sensitive Transmitter with cord connector; Super-Sensitive Ear Piece with small black cord; Black Single Headband; Black Case and Two Batteries.



Model "B" Horn, with Loud Talking Receiver, Cord Plugs and Desk Stand Base. Price, $10.00 Complete



Model "C" Horn, with loud talking Receiver, Cord Plugs and Wall Base. Price, $10.00 Complete



Detectagraph $15 This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord, Receiver, Headband, Case and Battery.

Order direct from ad.

Or write for free descriptive circular.

G. BOISSONNAULT COMPANY

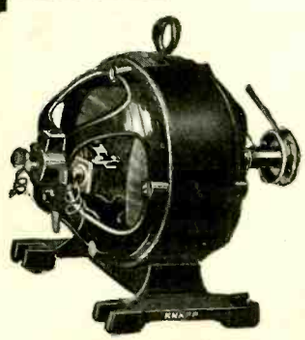
26 CORTLANDT STREET NEW YORK CITY

Makers of Super-Sensitive Microphone Devices

DEPENDABLE KNAPP ELECTRIC-SPECIALTIES

Motors and Electrical Specialties Are Best

Knapp Goods have stood the test for 29 years. No detail in construction has been spared to make them the best that money can buy. The complete Knapp line includes Toy and Power Motors, Generators and Dynamos. Specialties and Novelties that amuse and instruct. Fans, Rheostats, Compasses, etc. And Knapp prices are always lowest. Always insist on Knapp Goods.



KNAPP DYNAMO MOTOR

Will electroplate, charge storage batteries, run lamps, motors, train of cars, induction coils,—in fact, the number of experiments it can be used for is unlimited. Runs on 4 to 6 Volts or can be connected to run on 110 Volts through a transformer.

Price, Complete, $7.00

KNAPP "LEARNELECTRICS"

A complete Electrical Laboratory, including a very valuable instruction book by H. P. Gorman, A.I.E.E. Covers all subjects clearly and concisely.



Price, Complete, $3.50

Order to-day. Or your dealer can secure them for you. DESCRIPTIVE CIRCULAR and CATALOG of celebrated **KNAPP MOTORS** *and Electrical Specialties from 10c up mailed FREE on request.*

KNAPP ELECTRIC & NOVELTY CO., 523 West 51st Street, New York City

VACUUM TUBES
In Wireless Communication

The only book on the subject. Written by E. E. Bucher, author of "Practical Wireless Telegraphy". Price $1.75.

Wireless Press, Inc. 233 B'way, N. Y.

Arnold Loose Couplers

Combination Loose Coupler Parts and accessories.

Send 3c stamp for literature which is sure to interest you.

J. F. ARNOLD 2082 Lexington Av. N.Y. Established 1910

and snow. In running the ground wire down the side of a building, it need not be insulated and bare copper wire is generally employed. Fig. 4 shows one form of efficient ground for lightning protection or for the regular station grounding purposes. This ground is composed of a piece of galvanized chicken wire buried from three to five feet in the earth between two layers of charcoal. The depth to which the ground plate is buried will depend upon how dry the top soil is. *The ground plate must be placed in wet earth*, no matter if it has to be buried twenty feet deep, unless some provision is made to keep the earth in this vicinity moist, such as by daily watering, or else by allowing a waste pipe from some water system to empty over the spot.

Types of Masts.

When it comes to masts or towers for supporting the elevated type of antenna, there are many different styles. One of the latest events in radio is the "Tree Aërial," as devised by Maj.-Gen. George O. Squier, which was described in detail, with special drawings, in the July, 1919, issue of the ELECTRICAL EXPERIMENTER.

This represents one form of natural elevation for supporting aërials or aërial conductors at a considerable altitude, and another one is the balloon or box kite. The average Radio Amateur does not care so much about details on the construction of radio masts, for in practically all cases he will follow his own intuition in making use of whatever material and facilities he may happen to have on hand. For example, some antenna masts used in the past have been of the latticed wood form of construction, while others of the iron pipe type have been erected to considerable heights. We remember one mast of iron pipe construction in the vicinity of New York City which rose to a height of 110 feet. For safety's sake, such a mast should not be constructed with too small a pipe at the base, and for altitudes of 75 to 100 feet, the first and second base sections of the mast should comprise standard heavy wrought iron pipe not less than 3 to 3½ inches in diameter. Needless to say, the iron pipe should be either galvanized or else thoroly painted before erection, and very carefully guyed by stranded steel cables attached ⅓, 2/3 the altitude and at the top. Long guy wires should be split up into sections not exceeding 20 feet, by means of strain insulators.

Aërial Insulators.

Various forms of commercial and home-made aërial insulators are shown in Figs. 7 and 8. Fig. 7 illustrates the commercial, fluted type of molded Electrose insulator, as well as the Electrose ball insulator. Where greater efficiency is desired, several of these insulators are connected in series to give a high resistance. Porcelain cleats are often used in constructing small experimental antennæ, and serve the purpose quite well. Another detail shown in Fig. 7 is an aërial insulator made from a piece of hard rubber, polished or unpolished (Bakelite is best), the two ends of which have threaded screw eyes as indicated. A tin or galvanized iron water shield is made to clamp at one end of this hard rubber insulator in order to ward off rain, and thus keep the insulator in a better working condition during inclement weather. It is absolutely impossible to obtain any long distance results for *transmitting* or *receiving* with rain pouring down on the insulators; for a considerable amount of the energy induced in the aërial conductors will leak to earth thru the water covering the insulators. The commercial radio companies have overcome this difficulty by placing cable shields on the antenna insulators in this fashion in a great many instances, and undoubtedly will use more of them as this fact is better appre-

ciated. Figs. 7 and 8 show novel ideas for constructing antenna insulators from porcelain tubes. Of course, the small tubes are not of much use, generally speaking, but the large size tubes, measuring about 12 inches long by 1½ inches in diameter, are cheaply purchased, and make very good insulators. Of course, the main question here is "How can the screw-eyes be securely anchored?" and several suggestions are given in the drawing herewith. In one case the screw-eyes have their lower ends twisted spirally with the largest diameter at the base, so as to hold firmly in molten sulfur; or the screw-eye may be held by slotted wooden blocks cut so as to expand and wedge against one another inside the tube. Fig. 8 shows a detail drawing for making a pair of brass or iron clamps which will make a very substantial aërial insulator from any stout porcelain tube.

THE HOW AND WHY OF RADIO APPARATUS.

Series to Date.

No. 1. *The Induction Coil, Page* 493, *November,* 1916.

No. 2. *The Transformer, Page* 656, *January,* 1917.

No. 3. *Condensers, Page* 735, *February,* 1917.

No. 4. *Spark Gap, Page* 113, *June,* 1917.

No. 5. *Radio Transmitting Inductances, Page* 537, *December,* 1917.

No. 6. *Radio Receiving Tuners, Page* 685, *February,* 1918.

No. 7. *Radio Receiving Condensers, Page* 766, *March,* 1918.

No. 8. *Detectors, Page* 30, *May,* 1918.

No. 9. *Telephone Receivers, Page* 176, *July,* 1918.

No. 10. *Radio Amplifiers, Page* 472, *November,* 1918.

No. 11. *How to Make and Use a Direct-Reading Wave Meter and Decremeter, Page* 874, *April,* 1919.

Radio men everywhere will undoubtedly like to obtain the complete set of these specially prepared papers on the "How and Why of Radio Apparatus." Also the following three important and timely papers on the "Calculation and Measurement of Inductance," by Mr. Secor and Samuel D. Cohen.

Nos. 1, 2 *and* 3 *"Calculation and Measurement of Inductance," appearing in the March, April and September,* 1917, *issues.*

Those interested in these valuable papers can obtain prices of individual back numbers containing them by writing to the "Circulation Department."

In closing, it may be said that the Amateur Radio man will learn much by close observation and the application of common sense and everyday electrical technique to his antenna structures. Don's use faulty lead-in insulators to bring the aërial current into your radio shack—buy a good one, even tho it costs a few dollars. An excellent one is that made of molded Electrose, with threaded tightening flanges. A hole drilled thru the center of a piece of glass, hard rubber or bakelite sheet, at least one foot square, makes a very excellent lead-in insulator. Don't tie your aërial so tight that in a wind-storm it will break at the first swing; suspend one end by a counterbalance weight, or else by springs, so that the flat-top can expand at least 5 to 10 feet in a 100- to 150-foot span. Watch your aërial's behavior in your first wind-storm and you will learn more than by reading several books on the subjects.



ARE YOU IN THE RACE

FOR POSITION -- POWER -- SUCCESS?

There is no "handicap," All contestants are eligible

ALL YOU NEED IS GRIT—DETERMINATION—

TRAINING!

At the School of Engineering of Milwaukee can be secured the specialized technical training prerequisite, if you would win to success in the great electrical field. *Special One Year Course in Practical Electricity.*

Expert instructors, extensive and perfectly equipped laboratories—careful, scientific combining of theory and essential practice—these and many more desirable features have guided hundreds of ambitious young men to the success for which they have striven.

Are You Less Ambitious Than They?

Resolve to enter the race at once. Right Now! Get in line by clipping the coupon *today.* No matter what your previous education, there's a starting place for you here. Every phase of electrical instruction taught in a way to benefit and aid you to success. R. O. T. C.—Physical Director—Fraternity House with Board and Room at Cost to Students.

Mark and mail the coupon for the new "Photo-Story," bulletins and full particulars concerning the course that interests you.

School of Engineering of Milwaukee

105-373 Broadway, Milwaukee, Wis.

"An Electrical Technician's Institute"

Scissors here

School of Engineering of Milwaukee,
105-373 Broadway, Milwaukee, Wis.

Gentlemen:—Please send me, without obligation, a "Photo-Story" and full information concerning the courses marked.

Electrical Engineering (B.S. Degree 3 Yrs.)
Electrotechnician Course 6-Month Trade Courses
1 Yr. Practical Electricity Home Study Courses
1 Yr. Electrical & Mechanical Drafting

Name.....

Address.....

City.....State.....

Education.....Age.....

Announcing the New Grebe Vacuum Tube Plate Battery





This is the first practical storage battery for supplying the plate current for vacuum tubes and is so far in advance of all other types that it is destined to maintain the leadership.

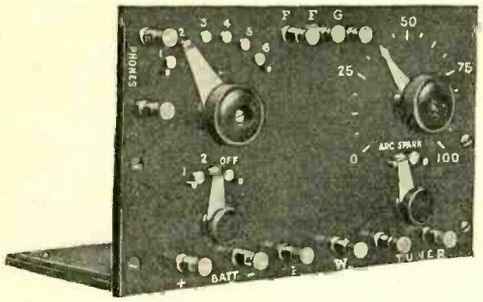
The numerous advantages of the lead cell are fully characterized in this battery. The construction is rugged; the plates are of the best design and workmanship; the individual cell-casings are made of transparent Pyralin and welded together to form a solid unit. Its capacity of 3 ampere hours is sufficient for supplying current to a number of tubes simultaneously while assuring peak voltage operation for long periods of discharge. With this battery, charging from A.C. sources is easily accomplished with any type of "Tungar" rectifier without changing any of the windings.

TYPE ROAA—with liquid electrolyte $17.50
TYPE ROAB—with non-spillable electrolyte 19.50

Send for literature on this and other new Grebe developments.

A. H. GREBE & CO. Richmond Hill, N. Y.

AUDIOTRON
VACUUM TUBE PANELS
PARTS AND ACCESSORIES



Panel full XX Grade Continental Bakelite Dielecto Steel cut and whitened engraving. All metal parts heavily nickeled. Switches for double filament tubes and arc or spark reception. New type Back mounted smooth running rheostat. Panel also furnished in maple with imitation black bakelite finish.

No. 8B.	Full Bakelite panel assembled.....	$15.00
No. 8BP.	Complete set of parts.....	12.00
No. 8W.	Wood panel complete	12.50
No. 8WP.	Complete set of parts.....	10.00

Send for free bulletins on panels, couplers, detectors, parts, etc.

Send cash with order and save all delivery charges. Dealers: write for proposition.

AUDIOTRON SALES CO., 311 Lick Bldg., San Francisco



DUCK'S BIG 300 PP. Wireless & Electrical

Catalog is now as it always has been, the largest and most complete and dependable Wireless Catalog published. Mailed for 12c in stamps or coin which may be deducted on first order of one dollar. Catalog not sent otherwise. This catalog costs us twice the price of other catalogs.

Everything in wireless *worth while* is listed in this catalog. The experienced amateur will tell you to see our catalog before buying. You are thereby insured against an unwise purchase. It is the *Beacon Light* to guide you right in the selection of your wireless apparatus. No bigger or better values are obtainable elsewhere. Send for revised price list. It is yours for the asking.

THE WILLIAM B. DUCK CO., 230-232 Superior St., Toledo, Ohio

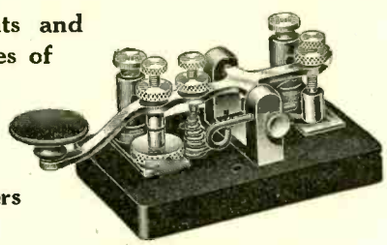
Manufacturers of Reliable Instruments and Distributors of All Prominent Makes of

RADIO APPARATUS

Everything essential to the successful installation of a radio station.

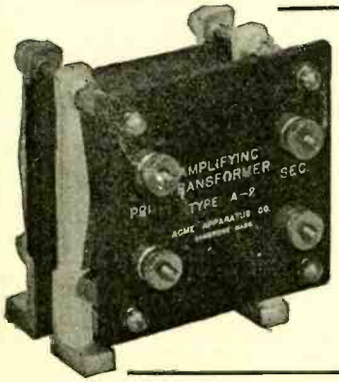
Bunnell Apparatus is Sold by Dealers Everywhere

Catalog 40-E on Request.



A Special Feature, The Straight Line Radio Key.

J. H. BUNNEL & CO. 32 Park Place, New York



Acme Apparatus For Results

THE ACME AMPLIFYING TRANSFORMER
Type A-2

A very compact and efficient transformer especially designed for repeating between tubes in Vacuum Tube Amplifier Circuits.
Two-winding, closed magnetic type. Primary and secondary of No. 40 enamelled wire, wound on one leg, with a turns-ratio proved by exhaustive experimentation to be the best. Supported on aluminum castings, with bakelite panel and nickel-plated binding posts. Shipping weight, 2 lbs.

Type A-2 Ampylifying Transformer, $10.00
Same, unmounted 7.50

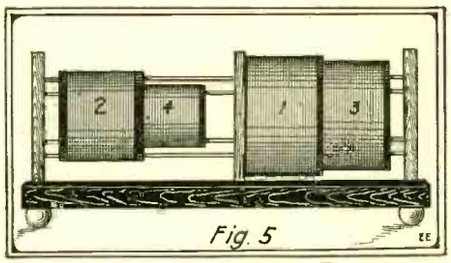
Inquiries solicited from responsible dealers.

ACME APPARATUS COMPANY
23 WINDSOR ST., CAMBRIDGE, MASS.

Eccentric Antennae

(*Continued from page* 432)

the general efficiency of the aërial, but serves to protect it from corrosion. As to the relative merits of the two kinds of wire, there seems to be some doubt. The operaters using each kind declare their own particular kind the best.

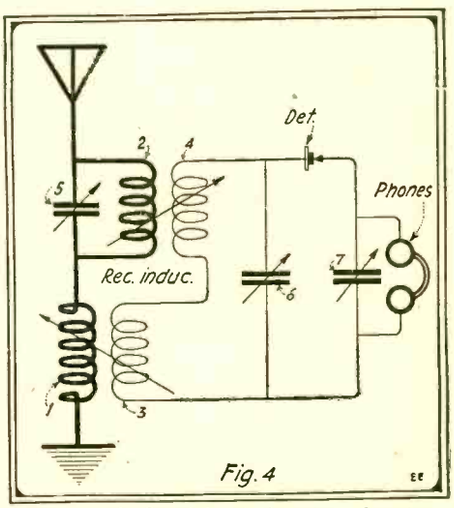


Side View of Special Receiving Transformer Having Four Coils. 1 and 2 Are Primaries, While 3 and 4 Represent Secondaries. This Affords Very Fine Tuning.

There has also been some discussion as to the relative merits of the two forms of aërial—i.e., the *flat-top* and *barrel* types. There is no doubt, however, that the barrel type has far more capacity for the same length than the other. But it also, apparently, would help to increase the static in the phones.

The United States Government has evidently found some very excellent advantages in it tho, for it has adopted the barrel type for use on all its battleships, and has practically abandoned the use of the flat-top aërial on them. It was first tried out by our battleships that were working in conjunction with the Allied fleet in the North Sea.

No doubt the up-to-date Amateur will be glad to give these different antennae a try-out.



Hook-up of Special Variometer Coupler, Provided With Four Coils, Two in the Primary and Two in the Secondary.

NEW HONOR FOR SIR OLIVER J. LODGE.

On June 6th at Clarence House, the Duke of Connaught presented to Sir Oliver Lodge the Albert Medal of the Royal Society of Arts, which was awarded to the famous scientist "in recognition of his work as the pioneer of wireless telegraphy."

BARGAINS IN RADIO MASTS.

What with the great epidemic of underground antennæ now sweeping Amateur Radiodom, we should shortly see radio masts given away for the asking. What?



COMMERCIAL WIRELESS

Splendid opportunities now in the MERCHANT MARINE for Wireless Operators. Salaries now being paid—Junior Operators, $85 per month; Chief Operators, $110; food and quarters included. Equivalent ashore from $35 to $40 per week. Interesting and fascinating work. Our graduates in all parts of the world as operators, instructors, inspectors, etc., etc. Students from all over the country. If you are interested in Commercial Radio let the EASTERN RADIO INSTITUTE train you. Endorsed by Marconi and Government officials.

SUMMER COURSES. Day or evening start any Monday. Send for prospectus.

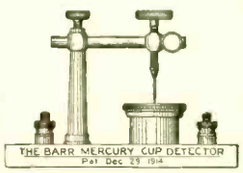
EASTERN RADIO INSTITUTE
899B Boylston St. Boston, Mass.



NEW catalog just off the press. Seventy-six pages of new apparatus for the Radio Experimenter. Send 4c for this complete catalog.

Haller, Cunningham Electric Co.,
478 Market Street, San Francisco, Cal.

THE BARR
MERCURY-CUP WIRELESS DETECTOR



The most efficient Detector on the market. Tested by the United States Government and Marconi Wireless Telegraph Co.

Increases the efficiency of every wireless receiving set by making the signals clear, sharp and distinct.
Instantly adjustable at a constant pressure.
For full information and price—write
THE BARR MERCURY-CUP DETECTOR
169 Columbia Heights Brooklyn, N. Y.

TELEGRAPHY

Both wire and wireless, and Station Agency taught thoroughly and quickly, BIG WAGES NOW PAID, some of our recent graduates procuring $138.00 per month to start. Great opportunities for advancement. Our school the oldest and largest—annual enrollment 600 students. Endorsed by railway, telegraph, wireless and government officials. Expenses low—chance to earn part. Catalog free. Write.
DODGE INSTITUTE, 22nd St., Valparaiso, Ind.

New 1 K. W. Quenched Gap Transmitter

(*Continued from page 427*)

switch has been named a "Tone Clearer" because poorer tone conditions due to changed operation in the gaps may be compensated for by rotating the handle at the left of the holder as shown in Fig. 3. Precaution is urged never to use the power changer or gap changer with the current on, as the shaft and handle are "alive."

Each gap unit consists of two brass discs which are bolted together thru their centers. A silver ring electrode is riveted to one side of each disc. Two fish paper gaskets, one placed underneath the bolt head and the other between the interior face of the discs. Upon close scrutiny these gaskets will be observed in the gap in the photos herewith presented.

Proper cooling of the gap is afforded by the two sheet metal parallel flanges, which are placed integrally with each gap disc. These flanges join each other at two edges only, the other two edges being left open, forming a flue.

The resonance inductance which is furnished with this set is of the iron-clad type. It has two windings, one being for full power operation, the second, which is larger inductance, is for low-power operation. Actual operating tests show that the natural period of the A. C. armature, resonance, inductance and transformer primary is 425 cycles. The operating frequency ranges from 450 to 550 cycles.

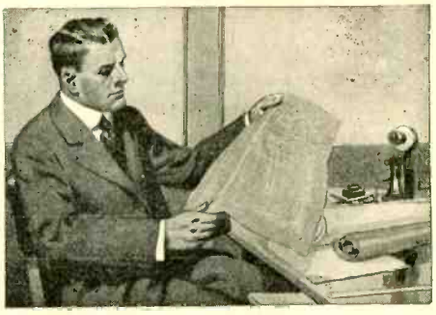
One of the most unique parts of this set is the combination flame-proof Morse key and antenna switch. The key is made with larger contacts for carrying audio-frequency currents at low potential. It is encased in a gas-tight housing of black Japanned sheet brass, this housing making the "live" parts of the key free from all electrical contact with the power circuit. The connection between the key and the panel is made by two lengths of flexible cable, each five feet long. By means of the antenna switch, both the generator armature circuit and also the generator field circuit are broken when the switch is in receiving position.

The thermo ammeter is used in connection with the Weston shunt-block, one end being grounded to the panel frame. It reads from 0 to 15 amperes.

The wave changing device that is used in connection with this set, is built for durability as well as the highest efficiency. It consists of a fixt primary coil and movable secondary coil. They are designed to have corresponding turns as tuning points, and make simultaneous contact with two selector arms. At the left of the upper panel will be seen the handle which varies the wave length. At the left of this handle will be seen three openings, the center one being encircled by a white ring. The correct wave-length of the set is read from this point, the other two openings being for various calculations of wave length. The right-hand handle on the panel is used in connection with the loading inductance. Designated wave lengths of this set when operated on a Navy standard are 600, 752, 952 and 1,905 meters. This set under laboratory tests with a dummy antenna, the same as would be used on a ship, has radiated as high as 18 to 19 amperes antenna current. It has a daylight sending range from actual tests of over 1,000 miles.

This set is at the present time being used by the Navy and is installed on a great many of the merchant vessels, and has proven one of the most efficient sets ever designed.—*Photos courtesy, Emil J. Simon.*

Mechanical Engineering



Learn at Home!

Employers everywhere are looking for men with mechanical ability. Splendid salaries and rapid advancement are offered.

There is an easy, delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving men and women just the training they need for success in mechanical engineering and more than 200 other subjects. Hundreds of thousands have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6199, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

ELECTRICAL ENGINEER	CHEMICAL ENGINEER
Electrician	SALESMANSHIP
Electric Wiring	ADVERTISING MAN
Electric Lighting	Window Trimmer
Electric Car Running	Show Card Writer
Heavy Electric Traction	Outdoor Sign Painter
Electrical Draftsman	RAILROADER
Electric Machine Designer	ILLUSTRATOR
Telegraph Expert	DESIGNER
Practical Telephony	BOOKKEEPER
MECHANICAL ENGINEER	Stenographer and Typist
Mechanical Draftsman	Cert. Pub. Accountant
Ship Draftsman	Traffic Management
Machine Shop Practice	Commercial Law
Toolmaker	GOOD ENGLISH
Gas Engineer	STATIONARY ENGINEER
CIVIL ENGINEER	CIVIL SERVICE
Surveying and Mapping	Railway Mail Clerk
MINE FOREM'N OR ENG'R	Textile Overseer or Supt.
ARCHITECT	AGRICULTURE
Architectural Draftsman	Navigator
PLUMBING AND HEATING	Poultry Raising
Sheet Metal Worker	Automobiles

Spanish
French
Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____

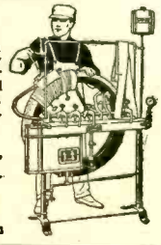
AN EASY WAY TO MAKE MONEY

Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business. One man says "I made $60.00 the first day." Others average $200 to $500 a month. Very little capital needed. Jobs plentiful. Every motorist a possible customer. No experience needed. We teach you.

SHALER Tire Repair Outfit

Improved Wrapped Tread Method Used by Tire Manufacturers

Does as good work as the big high priced vulcanizing outfits. A boy can use it. It's the only vulcanizer that has Automatic Heat Control, and can't undercure or overcure a tire. Requires no watching or regulating.



FREE Book

"How to Open a Tire Repair Shop." It tells how to make big money. Don't delay. Write quick.

C. A. SHALER CO.
2208 Fourth St. Waupun, Wisconsin

BURGESS ENGINEERING COMPANY

Consulting Electrical Engineering

We design and perfect electrical devices and apparatus. Power plants, electric railway maintenance and operation, and railway signals a specialty.

Information supplied on electrical subjects

Write us your needs and permit us to advise you and furnish data. Our service is prompt, reliable and satisfactory, facts which are proven before our bills rendered are payable.

BURGESS BLUE BOOK

Our Mr. Burgess has prepared a pocket-size note book which is especially adapted for use by electrical men and electrical students. It contains over two hundred formulas for calculations and worked out problems, showing how the formulas are used. Also drawings of electrical machinery and devices, particular effort being made in regard to Inside Connections. This book is recommended by electrical men all over the country, is being used in several technical schools, and is being purchased by a number of electrical establishments who furnish them to their employees and customers.

The price of the Burgess Blue Book is $1.00 and we refund the price if the book does not meet with your approval.

BURGESS ENGINEERING CO.
Yorke Burgess, Pres. and Consulting Engineer
750 E. 42nd Street Chicago, Illinois

ELECTRICITY

Taught by a practical man.
Put part of your spare time to a good purpose.
A Home Study course for ambitious men.

This is a course of study for the worker, not the idler, and one who wishes to learn the electrical business, or to make quicker and surer progress in this line, I can help. The work as designed, suits both experienced men and beginners as the instruction is actually handled by me with a view of meeting the particular needs of each student. The principal requirement for success in my work is for the student to be willing and anxious to do his part, I do mine and I naturally expect and do insist that the students do theirs.

I Promise Little But Do Much

I only make one promise and that is to satisfy you if you are in earnest and will do your share. I cannot do it all alone for without some effort on your part, my instructions are useless to you. My course of study is not hard and one with an ordinary education can handle it successfully, as I have made every effort to reduce the subject to the simplest possible terms.

RESULTS

Practical men recommend my course to others. Over 65% of my students are engaged in electrical work. Over 11% of my present enrollment was obtained through satisfied students.

FIFTY-FIFTY

All my dealings are on a 50-50 basis. I look at the proposition from your viewpoint as well as mine, and do not expect you to do anything which I would not want to do myself, if I was in your position. While I naturally expect to make money through my efforts, at the same time, MONEY is not my first thought. No student is permitted to pay cash for his course on starting, the payment being made in monthly installments. Also students have the privilege of discontinuing the work if they find it is not just what they wish, and their payments stop at the same time.

Send for my catalogue which tells the whole story regarding the way in which the instruction work is handled, terms and what I have done for others.

Yorke Burgess, Supt.,

BURGESS ELECTRICAL SCHOOL 745 E. 42nd Street, Chicago, Illinois

AMAZING AUDION DETECTOR VALUES-$9.50 $11.75 $18.85 $22.00

Remarkably efficient and handsome audion control panels within the price limit of **EVERY AMATEUR, BUILT AND DESIGNED FOR THE AUDION, AS ONLY THE MAKERS OF THE AUDION CAN BUILD IT.** IN THE PAST, INSTRUMENTS OF THIS CALIBRE HAVE NEVER BEEN OFFERED AT TWICE THESE PRICES.

GENERAL SPECIFICATIONS, ALL MODELS: **Beautifully engraved and grained genuine bakelite panels; 4 prong heavy nickeled tube receptacles; smooth running, positive acting, adjustable rheostats; impregnated efficient mica stopping condensers;** adjustable or fixed grid leaks with polished nickel covers; bakelite covered binding posts with new slotted positive connecting feature; positive segmentally connected nickel plated switches; 40 volt B battery of two 20 volt type units cast en block with operating life of 6 to 12 months—a remarkable advance in B batteries; handsome quartered oak cabinets, round corners, standard de Forest "Early English" finish; perfect workmanship and expensive design throughout.



TYPE P500—$22.00

Type P-400 Audion Panel—Consists of tube receptacle, grid leak and condenser, rheostat and binding post for connection to tuner, A and B batteries on bakelite panel 7½" x 7½" without cabinet and B batteries.....$9.50
Type P-401 Audion Panel—Same as above with cabinet, $11.75
Type P-402 Audion Panel—Larger panel with 40 volt B battery in cabinet.....$18.85
Type P-500 Audion-Ultraudion Panel—Type P-402, Panel with two switches for audion-ultraudion connection and either 20 or 40 volt B battery in cabinet.....$22.00



TYPE P401—$11.75

NOTE: All de Forest audion apparatus is sold without the tubes. Audion detector oscillator or amplifier tubes, $7.00 each additional. Catalog sent on receipt of 10c in stamps to cover postage.

DE FOREST RADIO TEL. & TEL. CO., 1415 Sedgwick Avenue, New York City

Developing An Idea

By Nelson Hall

(*Continued from page* 456)

much, gathers up a large amount of information in his travels which he is ready to impart to any one who will give him an attentive ear. By pulling him to your line you can get what he knows and all he has heard. In time he will make a good advertising medium if he is given "the dope."

Then one can inquire in stores handling such a line for the article. They will show the nearest thing in stock and tell if they have seen anything like it. Also it is good to write to mail order houses, for they are posted on a large variety of manufactured commodities.

Trade journals and magazines have special articles describing new inventions as they come out and later advertise them. One can find these articles by consulting such as *Pool's Index, Reader's Guide to Periodical Literature* and *The Industrial Arts Index,* which can be found in public libraries. Often librarians will look up references and sort out the articles if you will write or telephone your request in time. But usually it is best for one to go over the references himself, for while the articles may not directly pertain to the subject they may suggest something worth while considering. Strange as it may seem, the best part of some papers is in the advertising section. By taking papers going to the class of people interested in your article you can see what is being offered. It is well to look over several different papers, because advertisers do not confine themselves very closely and often try the dailies as well as trade journals. A good paper for general interest is the *Saturday Evening Post;* for office supplies, *System;* for household supplies, *The Ladies Home Companion;* for agricultural implements, *The Farm Journal* or *The Country Gentleman;* for tools, *Machinery;* for marine supplies, *The Marine Engineer;* for power plant equipment, *The Electrical World,* and the ELECTRICAL EXPERIMENTER, for what the electrical experimenter and "bug" will want. Nearly every public library has all of these and many more along the same lines on its files. But if one desires most of them can be obtained from newsstands.

From the advertisers many circulars, catalogs and leaflets can be had for the asking. In some libraries there is a file of trade catalogs in the industrial department that may be profitably consulted.

Sometimes going to all of this trouble will not bring to light the fact that some one has taken out a patent on this very article and has not put it on the market—yet. Hence it behooves one to make a patent search or have one made. Patent attorneys will make the search from a drawing, model, or description if it is clear to them, for a nominal fee. But it is usually more satisfactory for one to make the search himself; then he can see what has been done and the looking about may suggest something new. The *Patent Office Gazette* is on file in public libraries and in offices of many patent attorneys. One can go thru the indexes of these, get the numbers and read the short description given in the Gazette, and if it interests him send for a copy of the original patent. These can be obtained from the Commissioner of Patents, Washington, D. C., for five cents each in coin or money order (no stamps accepted). If one decides to have the search made, be very certain that the attorney has the idea right, understands how it works, and sees the novelty of it. He should be furnished with an assembly drawing, lettered so it can be described, clearly showing how it works, and laying special stress on the novelty. A copy of the one taken to the notary public is all right.

Some may think this is carrying the research too far, but after an inventor has developed an idea or two with much laborious study and a fair amount of money on experimental work he will then realize the importance of looking ahead and finding out what has been done by other inventors *and not do the same thing over.* Looking ahead will save the inventor much annoyance and his company from financial distress. Many Teslas and Edisons are turned into insignificant positions because they blundered in their first attempt and lost heart.

The Mystery of Atmospheric Electricity

By Rogers D. Rusk, M. A.

(*Continued from page* 416)

particles the water vapor has condensed as a liquid, forming the large ions, while about others it has only condensed as a dense atmosphere, forming the intermediate ions. When the vapor pressure in the air increases, the dense atmosphere on the intermediate ions may change to a liquid, as in Fig. II, and thus the *intermediate* ions become *large* ions in a fraction of time. This theory is not at all conclusive but it fits in with the observed facts better than any other, and is the only one which explains how the intermediate ions may suddenly become larger and more slowly moving. As water vapor only condenses in this peculiar way on rigid surfaces under certain conditions, we must assume that the centers of the intermediate and larger ions are different from the smaller ones usually found in gases and that they contain some small, rigid dust-like particle. This would also explain why they are not found in dust-free gases even tho the small ions are present, and why they are commonly found in the air.

HOW ATMOSPHERIC PARTICLES ARE ELECTRIFIED.

How these particles become *electrified* is another and vital question. There are many possible ways in which the phenomena may be accounted for. The ultra-violet light from the sun is a very powerful ionizing agent, having the power to detach electrons from the molecules of the air, as it passes thru the air. This ultra-violet light is particularly strong in the upper and thinner layers of the atmosphere, and tho the air absorbs a great many of these waves on account of their shortness, still a large number reach the lower levels of the air. Some more visionary theorists claim that ions and electrified particles are actually carried in huge streams from the sun to the earth, and there is some striking evidence that this may be true during periods of the sun's greatest activity. Friction is a great producer of electric charges, as is evidenced by the action of the well known friction *static machine,* and it is highly probable that friction of the air and dust particles in the air may be one of the potent causes of the electrification of the air. Again it may be due in part to radio-active substances in the earth's surface which constantly give off electrified particles into the air.

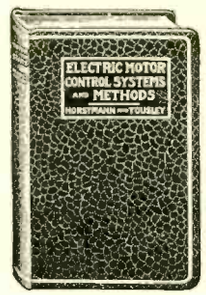
The mystery of the electricity in the air is a double one and if we could discover just how the ions are produced we could more easily ascertain just what they consist of. When these two questions are solved we may be in a position to harness the "electricity of the air" to our own use.

Fit Yourself for the Big Job

Don't hesitate any longer. There is a greater demand for trained men now than ever before — greater opportunities — bigger pay — more rapid advancement. It's training that counts now—accurate knowledge—a complete grasp of your trade.

Drake's Practical Mechanics Books

For Home Study

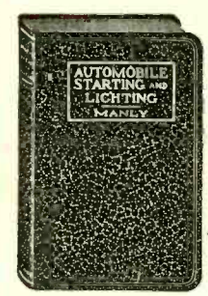


Pave the way to the fat pay envelope. Written in non-technical language that any man can grasp. Send the price of any book listed below. We will send the books postpaid — you keep them five days—if not entirely satisfied return the books and your money will be refunded in full. Order direct from this page. Use the Coupon.

Electrical Books

Electric Motor Control Systems and Methods. Leatherette.....$1.50
Electrical Tables and Engineering Data. Leatherette 1.50
Motion Picture Operation. Leatherette.. 1.50
Alternating Current. Leatherette..... 1.50
Wiring Diagrams and Descriptions. Leatherette 1.50
Armature and Magnet Winding. Leatherette 1.50
Modern Electric Illumination. Leatherette 1.50
Modern Electrical Construction. Leatherette 1.50
Electricians' Operating and Testing Manual. Leatherette..... 1.50
Drake's Electrical Dictionary. Leatherette 1.50
Electric Motors, D and A. Leatherette.. 1.50
Electrical Measurements and Meter Testing. Leatherette..... 1.50
Drake's Telephone Handbook. Leatherette 1.50
Elementary Electricity. Cloth..... 1.25
Electricity Made Simple. Cloth..... 1.00
Easy Electrical Experiments. Cloth..... 1.00
Operators' Wireless Telegraphy and Telephone Handbook. Cloth..... 1.00
Telegraphy Self Taught. Cloth..... 1.00

Automobile Books



Automobile Ignition. Leatherette, $2.00
Brookes' Automobile Handbook. Leatherette ..$2.00
Automobile Starting and Lighting. Leatherette ..$1.50
Ford Motor Car, Truck and Tractor Attachments. Cloth, $1.00
Storage Batteries. Cloth .....$.50
Ford Motor Car, Truck and Tractor Attachments. Leatherette ..$1.50
Automobile Catechism and Repair Manual. Leatherette $1.25
Gas and Oil Engine Handbook. Cloth... 1.00
Gas and Oil Engine Handbook. Leatherette 1.50
The Up-to-Date Electro-Plating Handbook. Cloth $1.00
Sheet Metal Workers' Manual. Leatherette 2.00
Oxy-Acetylene Welding & Cutting. Cloth 1.00
Brookes' 20th Century Machine Shop Practice. Cloth 1.00
Brookes' 20th Century Machine Shop Practice. Leatherette 1.50
Practical Mechanical Drawing & Machine Design. Cloth 2.00

Mail the Coupon NOW

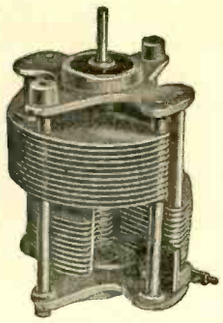
Order on our five day money back plan.

FREDERICK J. DRAKE & CO.,
1009 Michigan Ave., Chicago, Ill.

Enclosed find ($.....), for which please send me prepaid the books checked in this adv. (or list attached). It is agreed that I may return same in 5 days if not entirely satisfied, and money will be refunded in full.

Name .....

Address .....



Type 800

Balanced Variable Cond. Supplied in three sizes. Unmounted or mounted in nickeled brass case for use with oil or other liquid dielectrics

Radio Electrical Apparatus

Our new Bulletin Y offers a distinctive line of Radio and Laboratory apparatus including Transformers, Spark Gaps, Oscillation Transformers, Variometers, Variable Condensers, etc., in fact, the most complete line built by any single manufacturer in America.

Bulletin R describes the Cambridge alternating Current Rectifier for

STORAGE BATTERY CHARGING

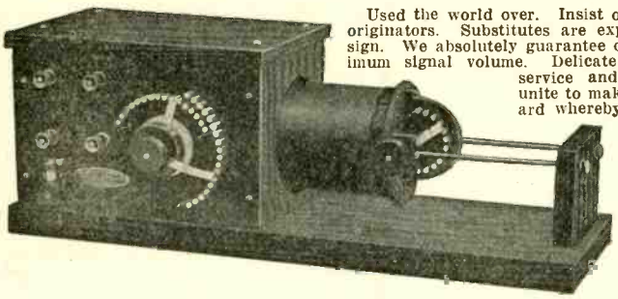
Send 3c stamp for both bulletins

CLAPP-EASTHAM CO.

131 Main Street Cambridge, Mass.

REMLER RADIO MFG. CO.
62 Post Street - San Francisco
Pacific Coast Representatives

TRACO QUALITY
RECEIVING TRANSFORMERS



Used the world over. Insist on the genuine, built by its originators. Substitutes are expensive, irrespective of design. We absolutely guarantee our tuners to give the maximum signal volume. Delicate refinement, uninterrupted service and high class workmanship unite to make TRACO tuners the standard whereby all others are judged. If your Dealer does not handle them, order direct from us.

LIBERTY DETECTOR VALVES. RADIO AMPLIFYING PHONES, type used by the UNITED STATES, BRITISH and FRENCH GOVERNMENTS, now in stock, for sale.

Send stamps for bulletins.

The Famous 5A and 5C Models

THE RADIO APPARATUS CO., Pottstown, Penna., U. S. A.

SPECIAL SALE!





Reduced Photograph of Transmitter showing nickel plated case and Hard Rubber Mouthpiece

$1.00 ONLY

Postage extra.

Ship. Weight, 2 lbs.

Diameter, 3¼ ins.

We have on hand 2,000 Carbon Grain Transmitters as per photograph. They are first-class instruments and may be used for all kind of experiments, especially for wireless telephone sets, where a heavy current is to be passed through. Slightly used, but in perfect working order. Money refunded if not satisfied. A real bargain. Order one or more today.

THE ELECTRO IMPORTING CO., 231 Fulton St., NEW YORK

You Need These Remarkable Books

No. 5. Wireless Construction and Installation for Beginners
Describes in detail with *working drawings* how any handy boy can make his own apparatus at lowest possible cost. Describes simpler and cheaper apparatus than No. 6 Book. 73 pages—67 illustrations.

No. 6. Experimental Wireless Construction
Explains in detail with *working drawings* how to build wireless apparatus, how to erect the aerial, connect and operate. 86 pages—93 illustrations.

No. 3. Lessons in Wireless Telegraphy
Explains in detail the principles and apparatus for wireless from aerials to end losses and Audions.



Price, 25 cents each, Postpaid, Anywhere

COLE & MORGAN, Inc., *Publishers*, P. O. Box 473 C. H. Sta., New York City

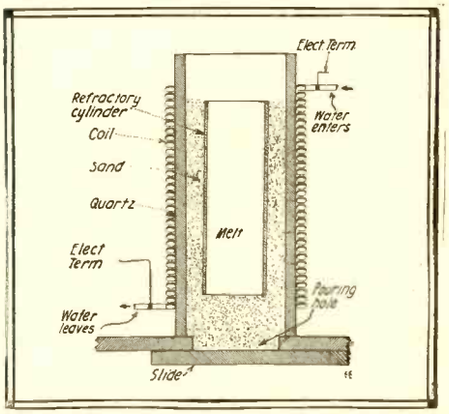
Possibilities of High Frequency Currents

(*Continued from page* 410)

could hardly be called power transmission, for only a very small portion of the original energy eventually reaches its destination in any case.

Very few investigators have given any thought to the utilization of these currents, for great power distribution.

Very new and strange phenomena are apparent when these currents are working. For instance, currents can be induced efficiently in circuits *without iron* as a magnetic medicine. Hysteresis losses are practically eliminated. Without iron in a transformer, it would be lighter for a given power than the present 60 cycle ones. It would be more compact, thereby reducing magnetic leakage. There is no saturation point to consider because of an air core. The reactive effect of a few turns of wire



The Special Type of "High Frequency" Induction Furnace Required for Enabling the "Carbon Free" Melts Is Here Illustrated. The Tremendous Concentration of Energy Produced by Inductive Action in a Comparatively Small Volume Makes It Necessary to Maintain the Inductor Coil Cool by Artificial Means. To Accomplish This Cooling in a Simple and Effective Manner, the Material Used for Winding the Inductor Coil Is a Thin Walled Flattened Copper Tubing. It Is Flattened and Wound Edgewise to Obtain the Maximum Possible Number of Turns to the Inch. A Small Flow of Water Thru This Tubular Coil Maintains It Always at the Temperature of the Tap Water Used. The Melt, Which Is Located Within the Inductor Coil and Which May be Only ½ to 1 Inch Less in Diameter than the Inside diameter of the Coil, May be Raised to a Temperature of 2500° or 2800° C., the Coil Remaining Under 20° C.

is very great; but a small condenser will cause resonance. Therefore the power factor can be easily made unity.

Among the few original engineers in this field of high frequency A. C. power transmission is Prof. Dr. E. F. Northrup, who was assisted by the writer at the Palmer Physical Laboratory, Princeton University, in extensive research along these lines. With these currents, it was possible to get results never before obtained by any other investigator.

Advantages of High Frequency Transformers

With an *air core* transformer, having a resistance load, more efficient results were noticed than could be procured with transformers having iron for a core. The losses were mostly due to the resistance of the conductors; but they were very small, as the circuits were of large cross-section. The hysteresis was negligible, due to the absence of iron. Magnetic leakage was reduced to a minimum because the coupling between primary and secondary was close. The capacity was 10 kilowatts, with three turns primary, insulated for 7,200 volts, and one turn secondary, reducing to 2,400 volts. The circuit was *resonant; therefore the power factor was unity*, or numerically 1.

It remained for Prof. E. F. Northrup to critically study these currents at *low voltage*. He found they could be confined in a mass of metal, thereby producing a terrific heat in a very simple and efficient manner.

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 180 Big Pages, 500 illustrations, 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy." 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 20 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.

WIRELESS

Send 6 cents in stamps or coin for which we will send our latest Cyclopedia Catalog No. 20 as described.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

MICA DIAPHRAGM TELEPHONES

We carry a complete stock of Baldwin Mica Diaphragm Telephones, both the old and new types.

Old type (type C).....$23.00
New type (type E)..... 26.00
(postage on two pounds extra)
High grade galena crystals 20c oz.

Send for circulars and price lists

PACIFIC RADIO APPARATUS COMPANY
1247 Forty-seventh Avenue
San Francisco California

AMATEURS! DO NOT OPEN TRANSMITTING STATIONS
without first learning to send and receive radio MSGS.
WILGO WIRELESS PRACTICE SET



The first need of every amateur. Hightone buzzer and key for learning code. Also for test buzzer and four other purposes. With code, wiring diagrams and instructions.

$1.00 Postage Extra

Our new cat. "E" of electrical and wireless apparatus and code chart sent for 3c stamp.

THE WILCOX LABORATORIES LANSING MICHIGAN

WIRELESS

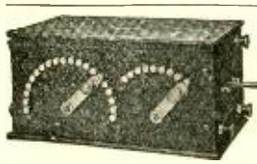
On account of increased demand for Radio Operators, we have concluded to give a correspondence course aside from our regular day and night classes. Full course $20, with FREE learning instruments.
Write for Literature, SOUTHERN WIRELESS INSTITUTE, 22 St. Paul St., Baltimore, Maryland.

WIRELESS apparatus, Raw Materials, Magnet wires, motors, experimenters' needs, novelties listed in our Catalogue C-3. Assure yourself of prompt service and right prices by buying from this world famed, reliable, experimenters' Supply House.

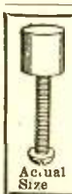
The Newman-Stern Co., Cleveland, O.

RECO QUALITY

SUPERLATIVE RADIO EQUIPMENT
THE BEST KEY IN THE COUNTRY
10 Amp. $7.75—20 Amp. $8.25
A three cent stamp will bring bulletins of this and other higher grade apparatus. Audiotron, double filament detector, amplifier, oscillator, $5.00.
THE RADIO ENGINEERING COMPANY,
22 St. Paul St., Baltimore, Md.



GET ONE!
Make your station more selective and efficient for only $10.50. Send 2-cent stamp for bulletin.
COLBY'S TELEGRAPH SCHOOL, AUBURN, N.Y.



Actual Size

AMERICAN ELECTRO TECHNICAL APPL. CO.
235 Fulton St., N. Y. City Cort. 3153
Batteries,-special type for Audions
Switch Points—Binding Posts. Knobs —Levers—Rods—Sliders. Etc.
All parts for the Amateur to make his own Apparatus.

The present day development in wireless has been to *raise* the voltage and frequency, because under these conditions maximum radiation of energy is brought about.

After several years of careful experimentation, a *high frequency, electric induction furnace* was produced that was applicable for the production of heat in either a *conductor* or *non-conductor*. Its extreme simplicity, owing to the absence of iron and a few turns in the inductor coil, leads one to believe that along these lines lay perfection in electrical mechanics.

At present there is in actual operation under industrial conditions a 20 K.W. furnace of this type. It is used for studying glass at high temperature in *vacuum or under pressure.*

A few years ago applications of this sort were purely imaginary.

There is now under test a 50 K.W. unit. Most all tests were carried on with the damped oscillations of condenser discharges up to 50 K.W., but the undamped oscillations of the high frequently alternator will be used for greater capacity.

With the spark method for producing these currents, a two phase field was used, no doubt for the first time. Altho nothing other than a half revolution of a circular conductor on an axis in this field was noticed, the writer is firmly convinced that, with proper apparatus and research, an induction motor could be made utilizing these currents. *A motor of this sort would be* WITHOUT IRON as a magnetic medium and therefore extremely light. Proper design would undoubtedly make it efficient.

High frequency lighting has already given promise to be eventually the means whereby the much heralded "cold light" may be produced.

The fundamental principles involved in producing these currents has been firmly establisht in "wireless" and with these methods, slightly changed, it is possible to investigate a brand new field of "endless wonders."

In the last decade there has been marvelous advances in electricity; but these have only paved the way for far greater things.—*Photos courtesy Pyrolectric Instrument Co.*

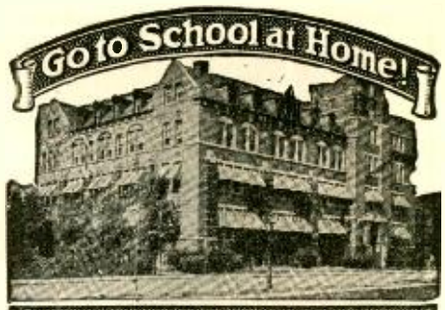
Practical Chemical Experiments

By Albert W. Wilsdon

(*Continued from page* 418)

soluble glass as it is called. Into most laundry soaps both sodium silicat and sodium carbonat are *crutched,* as a filler to soften hard water and to give additional detergent properties.

Toilet soap is made either by melting raw soap, by perfuming an odorless soap, after cutting in fine shavings and drying, or by making the soap directly by the use of pure materials. In either case the mass is colored by metallic oxids or anilin colors, and is perfumed by the use of essential oils, and is then prest into molds while yet fresh. To make a transparent soap it is necessary to dissolve an ordinary soap in alcohol, allow the insoluble residue to settle out, and distill the alcoholic solution to jelly. This may then be prest into molds and dried. Another method quite frequently utilized is to make a cold process soap, with coloring matter and perfume aded, and then to add to the mass more glycerin, or a strong sugar solution, which renders it still more transparent. Soft soap is made directly by the use of potash lye, or by the use of soda lye and considerable water. The glycerin and the excess of lye, if any, remain in the soft soap. This is used in *fulling* or shrinking cloth and in other manufacturing operations, probably on account of the excess of alkali which it contains. The salt lye which is drawn off



HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY HANDICAPPED if you lack High School training. You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE This Course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and *meets all requirements* of a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY

Most people *idle* away *fifty* hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within *two years.* You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

TAKE 10 LESSONS FREE So that you may see for yourself how thorough and complete our training is. We invite you to take *ten lessons* in the High School Course—or any Course of specialized training in the Coupon below—before deciding whether you wish to continue. If you are not then satisfied you are not out one cent. *We absolutely guarantee satisfaction.* On that basis you owe it to yourself to make this test. Check and mail the coupon NOW for full particulars and Free Bulletin.

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. H 266 Chicago, Illinois

TRAINING—THE KEY TO SUCCESS

Please explain how I can qualify for the position marked X

.....High School Graduate	.....Lawyer
.....Electrical Engineer	.....Business Manager
.....Elec. Light & Power Supt.	.....Certified Pub. Accountant
.....Hydroelectric Engineer	.....Accountant and Auditor
.....Telephone Engineer	.....Bookkeeper
.....Telegraph Engineer	.....Stenographer
.....Wireless Operator	.....Fire Insurance Expert
.....Architect	.....Sanitary Engineer
.....Building Contractor	.....Master Plumber
.....Civil Engineer	.....Heating and Vent. Engineer
.....Structural Engineer	.....Automobile Engineer
.....Mechanical Engineer	.....Automobile Repairman
.....Shop Superintendent	.....Airplane Mechanic
.....Steam Engineer	.....General Education Course
.....Draftsman and Designer	.....Common School Branches

Name.....

Address.....



Type L-1 Inductance Units

Pancake wound in Oak Cabinet with Bakelite front. Can be used as Loading Inductances or one can be used as a Primary and a second as a Secondary constituting an excellent long wave tuner, the range depending upon the size units employed. To vary the coupling it is only necessary to change the relative positions of the units. Also can be used with great success as Tickler Coils for Regenerative Reception. Furnished in three sizes.

Maximum wavelength obtainable, 5,000 meters $10.00
Maximum wavelength obtainable, 10,000 meters 11.00
Maximum wavelength obtainable, 15,000 meters 12.00

Shipping Weight 4 pounds.
Send stamps for complete catalog of high grade apparatus.

WESTERN RADIO LABORATORIES
156 Second Street
San Francisco, California.

Q. S. T.

"All men having commercial licenses should report for jobs at once."

Big shortage of operators!

Every student completing the course has qualified himself to fill a position paying $85-$130 per month and keep.

Short, thoro course — excellent laboratory.

Dormitory — swimming pool.

Call or write for illustrated booklet.

Y. M. C. A.

RADIO SCHOOL

NEW YORK CITY

Manhattan Branch: 154 East 86th St. Tel. Lenox 6051
Brooklyn Branch: Marcy Ave. Near B'way Tel. W'msburg 3800

NEW-ORLEANS
WIRELESS SUPPLIES AND MINERALS OF ALL DESCRIPTIONS
L. A. ROSE
4323 MAGNOLIA STREET
NEW ORLEANS, LA.



HERE IT IS

The sign that you have all wanted but could never get. Printed in bright red with big bold letters on stiff cardboard. Don't miss this opportunity to make your den or station look big and dangerous to others. This sign is exceedingly attractive and neat. No electrical bug should be without one. 7¾" x 11½". Price 20c, 3 for 50c. postpaid anywhere.
LEONARD BECK, 102 Meridith Ave., Arverne, N. Y.

from the kettle in which soap is boiled is used for the manufacture of glycerin. In this process the soluble soap and impurities are taken out by chemical treatment, and mineral salts are separated by evaporation and crystallization. The purified crude residue containing about 80 per cent glycerin is distilled with steam under diminished pressure.

It is false economy to use a cheap soap, on account of the excess of alkali which it usually contains, it injures the fabrics washed, by causing the fibers to disintegrate and readily fall apart. There is a great advantage in using a well dried soap, as it does not so readily become soft in the water and therefore does not wash away so quickly. A laundry soap will lose 25 per cent of water if the bars are piled and allowed to remain for some time where they are freely exposed to the air. Chevreul in his researches on soap said that the cleaning action was because the soap was decomposed, when brought into contact with the water, into fatty acid and alkali. The impurities are set free by the alkali and entangled by the fat acid salts, and thus removed with the lather. Thus it will be seen that vigorous rubbing is not necessary to remove the dirt, tho, quite naturally, it aids the process.

Ordinary soaps are readily soluble in water, but if the water is *hard* from the presence of lime or similar mineral substances, the alkali soap is decomposed and an insoluble lime soap is precipitated, thereby forming a disagreeable scum on the water. Not until all this lime is thrown down by the soap will the lather begin to have a detergent action. On account of the necessity for using hard soap in some localities *washing soda* is used to *break* the water; that is to precipitat the lime so that less soap will be required. In order to make a laundry soap fit for hard water, sodium carbonat is added to it in the crutching.

Experiment No. 1. To make a hard soap, dissolve in a medium-sized beaker 15 grams of caustic soda (in stick form) in 120 cc. of water, and pour one-half of this into a porcelain evaporating dish of at least 500 cc. capacity, add 60 cc. of water and 50 grams of tallow. Boil this solution for three-quarters of an hour, carefully replacing, from time to time, the water that has been lost by evaporation; then add the remainder of the solution of caustic soda and boil for at least an hour more. Water should be added as before, but the volume of the liquid may be allowed to decrease about one-third. Add 20 grams of salt, boil for a few minutes, and allow the liquid to cool. The soap will rise to the top, and the glycerin, excess of lye, and salt will remain in solution.

Experiment No. 2. Slightly acidify the water solution separated from the soap in the above experiment with dilute hydrochloric acid. If any fatty acids or impurities separate out, filter. Pour the solution into a porcelain evaporating dish, and evaporate to dryness on a water bath. Dissolve the residue in strong alcohol, filter or decant from the undissolved crystals of salt, and evaporate the alcohol. The slight residue will be sticky, and give the sweet taste of glycerin.

Experiment No. 3. Cut a good quality of soap into shavings and mix with hot water on a water bath, until well dissolved. Add dilute sulfuric acid until the solution is acid. Note that if the soap is *filled,* the sodium carbonat will cause an effervescence on adding acid. Heat on the water bath for some time or boil slowly, and the fatty acid will separate, forming an oily layer on the top. When clear this may be separated from the water by pouring on a wet filter, and the sulfuric acid removed by washing on the filter with hot water.

Washing soda, is often used, not only to soften hard water, but as a stronger

Learn the Sign-Show Card Business



Big field—unlimited possibilities—increasing demand for men with creative ideas. Our course develops ability and originality. Work intensely interesting.
EARN $25. TO $75. WEEKLY
You can do it if ambitious. Successful graduates everywhere. Our course covers every phase of work completely and thoroughly. Our graduates command big salaries. Write for catalog, samples, guarantee and Free Outfit Offer.
DETROIT SCHOOL OF LETTERING, 689 D. S. L. Bldg. Detroit, Mich.



$3 AND $4 a month WILL BUY
A Beautifully Reconstructed
TYPEWRITER
With Every Modern Writing Convenience

WRITE TODAY FOR ILLUSTRATED CIRCULAR Explaining Try-Before-You-Buy Plan
HARRY A. SMITH, 738-218 North Wells St., Chicago, Ill.

Fun, Magic and Mystery!

56 Feats in Magic, 250 New Jokes, 21 Puzzles, 1 Fortune Telling Tablet, 52 Money-Making Secrets, 15 Card Tricks, 71 Toasts, 58 Verses in Comic Poetry, 10 Funny Readings, 41 Epitaphs, and 11 Parlor Pastimes. You get all the above-mentioned and our big illustrated Catalog of 125 Magic Tricks for only 10 cents. Write today.

MYSTIC MFG. CO.,
909 Springwells Ave., Detroit, Mich.

EASIEST SHORTHAND





Learn in 5 evenings home study; then acquire speed with K. I. Shorthand. Amazingly simple, easy. Approved by experts. Write dictation, messages, etc., rapidly as spoken, after brief pleasant practice. Favorite method for personal use; make notes at lectures, meetings; keep confidential diary. Big help in any profession or business; aid in your career. Used in Army, Navy, courts, commercial schools; by public and private stenographers, teachers. Slight cost. K. I. Shorthand—for busy people, including YOU. Proof Lessons, Guarantee and Brochure with Testimonials Free, postpaid. Address: KING INSTITUTE, EL 300, Station F, NEW YORK CITY

"Hang Your Own Lighting Fixtures"

One Light Bracket $1.05—4 Light Shower $6.15 Semi-Bowls $5.85—Plate & Ball 85c, complete with glassware, Wired, Fine finishes. Send for Photos complete line.

ERIE FIXTURE SUPPLY CO.
Sta. C., Erie, Pa.



GO INTO MOVING PICTURE BUSINESS
Small Capital Starts You
on our easy payment plan. Begin now and get your share. We sell everything. Write today.
Atlas Moving Picture Co.
Dept. 50 538 S. Dearborn St., Chicago
Our Catalog FREE. Show you how to earn $25.00 to $50.00 per day

Chicago Medical School

fully accredited offers
DAY AND EVENING COURSES
leading to the Degree of Doctor of Medicine and Surgery. Exceptional opportunities for making way through school. Regular session begins Oct. 6. Matriculate at once. For full information and catalog, address **REGISTRAR**
3832 RHODES AVE. Box 18 CHICAGO

Electrical Experimenter
BOUND VOLUME No. 6

contains twelve numbers of the "Electrical Experimenter" magazine—May, 1918, to April, 1919, inclusive. There are 984 pages, 2,110 complete articles, 1,908 illustrations, 369 questions and answers. Size, 12" high; 9" wide; 2" thick.

$3.00
add postage for 8 lbs.

Positively the Greatest Electrical Book bargain in the World. We ship AT ONCE. Order today to avoid delay.

EXPERIMENTER PUBLISHING COMPANY, Inc.
Book Department
233 Fulton Street - New York, N. Y.

WE HAVE STILL SOME VOLUMES NO. 5 (1917—1918) LEFT, WHICH WE WILL SHIP AT THE SAME PRICE $3 AS LONG AS THEY LAST.
(ADD POSTAGE FOR 8 LBS.)

A NEW AND EASY WAY TO PAINT
SIGNS and SHOW CARDS
OUR PATTERNS DO THE WORK
No experience required. Anyone can paint all kinds of signs, banners, cards, etc., on any surface with our new and easy system of lettering. Complete outfit containing eight alphabets of letters, assorted styles and sizes from two to twelve inches high, also four sets of figures, etc., not printed but life size patterns cut out of durable tag board which can be used over and over again for years, also brushes, colors and book of instructions. Satisfaction guaranteed. PREPAID ------ $7.50
ACME SALES CO., Empire Bldg., Denver, Colo.

Red or Black "Vulcan" Ink Pencils
The ONLY perfect, non-leakable ink pencils at moderate prices
Two Sizes— 4¼ and 5½ inches. Extra Size—8 inches (black only) $1.75. Your name in gold inlay—$.35. FREE—Liberal supply of ink with retail orders. *Agents wanted. Big profits.* Order today. $1.50
J. R. ULLRICH & CO., 27 Thames St. New York

MATHEMATICS MADE EASY
The Arcascope—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 85 cents Postpaid. Order today before you forget.
Dept. J. L. J. LEISHMAN CO., Ogden, Utah

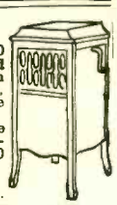
UMAKEM
Airplane Workchest, containing aircraft work table with mitre cutting board and length gauge, steel drill, steel hammer, Model Maker's steel square, screwdriver, sandpaper block, 10" scroll saw, together with finest quality reed and bass wood, aluminum, silk, para rubber, full set of blueprints, directions, and all fittings for building one 36" Bleriot Model flying Monoplane. Price $10.00. Other UmakeM Outfits 50c to $50.
W. R. PRICE, Inc.
No. 2 UmakeM Building, 127 Fifth Avenue, New York

How to Get Rid of Moles

A simple, safe home treatment—15 years' success in my practice. Moles (also BIG growths) Dry Up.
Ask for Free Booklet of Full Particulars
WM. DAVIS, M. D.
4140 State Street Perth Amboy, N.J.

MUSIC TAUGHT FREE


In Your Home. Write today for our booklet. It tells how to learn to play Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced pupils.
American School of Music, 57 Lakeside Bldg., Chicago

CLEARTONE PHONOGRAPHS
$4.00 to $200.00 Retail

Needles 45c per thousand in lots of 500,000 Motors $1.35 to $14.75 each. Tone Arms and Reproducers $1.30 to $5.75 per set. Main Springs 20c to 90c each. Records, Needles, Sapphire Points and Parts at reasonable prices.
Write for our 84 page catalogue, the only one of its kind in America, illustrating 33 different styles of Talking Machines and over 500 different Phonographic Parts.
LUCKY 13 PHONOGRAPH COMPANY
Export Dept. 46B E. 12th St., N. Y., U.S.A.

WOULD YOU KNOW WHAT TO DO?
TO HAVE YOUR WISHES COME TRUE?
TO BE HAPPY AND SUCCESSFUL?
TO FEEL THE THRILL OF NEW POWERS?
TO HAVE A WINNING PERSONALITY?
Our system of Personal Development has shown thousands. It can show YOU. First lesson in SUCCESS, and your Personality Sketch for 10c and birthdate.
THOMSON-HEYWOOD CO.
Dept. 350. Chronicle Bldg., San Francisco, Cal.

Be an Artist
Comics, Cartoons, Commercial, Newspaper and Magazine illustrating. Pastel, Crayon portraits, Poster and Fashions. Earn Big Money. *Taught by Mail or Local Classes.* Write for illustrated booklet, terms and list of successful pupils
ASSOCIATED ART STUDIOS, 13A Flatiron Bldg., N. Y.


"BOW LEGS and KNOCK-KNEES" UNSIGHTLY
Send for booklet showing photos of men with and without THE PERFECT LEG FORMS.
PERFECT SALES CO.
140 N Mayfield Ave., Dept. 50 Chicago, Ill.


Be FREE From STAMMERING
Home Exercise Course. Results GUARANTEED or NO PAY. Write for full particulars.
Sutherland Course, Educational Bldg., 70-5th Ave., N. Y.

washing agent than soap. This is a much better material than most of the so-called *washing powders* on the market. It should always be dissolved in a bottle or other vessel, and used as a solution in the quantities necessary. An excess disintegrates the fabrics, or *rots* the goods. Sometimes the washing powders or liquids on the market contain in addition to the washing soda, a little soap or ammonium carbonat or a small per cent of borax, but they are much more expensive than the common washing soda, and no more efficient.

Experiment No. 4. To test a washing powder for sodium carbonat, put a little of it in a test tube and add a few drops of hydrochloric acid. If there is a brisk effervescence it will indicate the presence of a carbonat, and if the gas that is given off colors the Bunsen burner flame yellow, it is an indication of the presence of sodium.

Bluing.

Bluing is the process resorted to in the laundry to overcome the slight yellow color of the clothes, and for the same purpose in the bleacheries where new goods are finished. Indigo was one of the substances most commonly used some years ago. It was known to the ancient Egyptians as a dye and to the Romans as a pigment. The method of using it for bluing, as it is insoluble in water, is to tie up a lump in a cloth, and when soaked in water the finely divided precipitat which is in suspension will give a blue color to the water, and to the clothes, which are to be immersed in it.

Prussian blue (Ferric Ferrocyanid) is also used for bluing. It is insoluble in water and in mineral acids, but is decomposed by alkalies and dissolved by oxalic acid. It is generally used as a solution or *liquid blue,* but this imparts to the goods a greenish-blue color. On account of the ease with which it is decomposed by the alkalies, there is danger that *iron rust* will be deposited on the goods if this form of blue is used.

Experiment No. 5. Make Prussian blue by the action of Ferric Chlorid upon potassium ferrocyanid in the presence of a few drops of hydrochloric acid. Treat this blue precipitat with an excess of sodium hydroxid, and heat to boiling. Notice the reddish brown precipitat of ferric hydrat.

Experiment No. 6. Make some Prussian blue as in the previous experiment, and add to the precipitat, in the test tube, a few crystals of oxalic acid, and warm the mixture. Notice the intense blue solution obtained (liquid Blue).

Ultramarin is an interesting artificial compound which is put upon the market in the shape of small *bluing balls.* It is similar to the native mineral called *Lapis Lazuli,* and is a double silicat of sodium and aluminum containing sulfur. Like indigo, it is insoluble in water and is simply held in suspension in the liquid. There is a difficulty in preventing the formation of blue spots and streaks with the solid blue. This blue is extensively used for coloring wall paper and for *bluing* white sugar.

Experiment No. 7. To show the presence of sulfur in ultramarin place a part of a bluing ball in water in a test tube, and add to it enough hydrochloric acid to make the solution acid. Notice the odor of escaping gas when the solution is warmed, and test it for hydrogen sulfid by holding above the mouth a piece of paper previously dipt in lead acetat solution. The paper will turn black on account of the formation of lead sulfid.

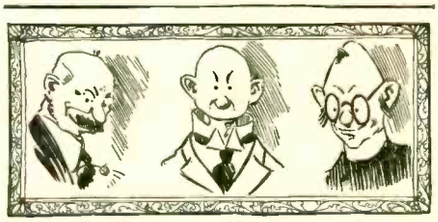
Anilin colors made from coal tar are the basis of most of the liquid blues upon the market at the present time. The soluble blues from this source are very numerous, and they are probably as satisfactory as anything for this purpose.

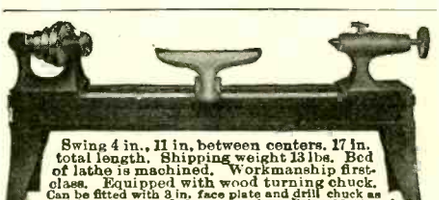

LEARN MUSIC AT HOME!
PLAY by NOTE
Piano
Organ
Violin
Cornet
Guitar
Banjo
Mandolin
Harp
'Cello
Trombone
Flute
Clarinet
Piccolo
Saxophone
Ukelele
Sight Singing
Music no longer difficult! New plan makes it easy to learn by home study. Positively easier than with private teacher. Faster progress. You will be able to play your favorite instrument in a few short months! More than 200,000 men, women and children have learned by our method. You, too, can learn in your spare time. We guarantee it.

H. S. Whittmack, New York, writes: "I compliment you on your wonderful system. Did not know one note from another, but in a short time have mastered the piano and am now composing music."

Louise Bowles, Epworth, Va., writes: "Received my teacher's certificate. I highly recommend your school and wouldn't take anything for the help it has given me."
Lessons FREE
We want to have one pupil in each locality at once to help advertise our home study method. For a short time, therefore, we offer our marvelous lessons *FREE.* Only charge is for postage and sheet music which is small. Beginners or advanced pupils. *Write* for amazing free book giving all the facts and particulars. Send a postal today!
U. S. SCHOOL OF MUSIC
1339 Brunswick Bldg., N.Y.C.

C. N. Pitts, Macon, Ga., writes: "Have completed your course on violin. Now have 15 students."


Learn to Draw at Home
Illustrators, Cartoonists, Commercial Artists earn big money. $25 to $100 a week and more. Learn at home in spare time under personal direction of Will H. Chandlee, famous newspaper, magazine, advertising artist of 35 years' successful experience.
BE AN ARTIST
Delightful, fascinating profession. Wonderful new home-study method makes drawing easy! Send coupon or postal today for special offer of complete Artist's Outfit FREE to new students. Write for handsome book, "How to Become an Artist." Don't delay—write or send coupon at once. Address
Washington School of Art, Inc.
1437 H. St., N. W.
Washington, D. C.
FREE COUPON
WASHINGTON SCHOOL OF ART, Inc.
1437 H St., N.W.,
Washington, D. C.
Send me particulars of FREE ARTIST'S OUTFIT offer and Free Book, "How to Become an Artist."
Name.....
Address.....
City.....State.....


Swing 4 in., 11 in. between centers. 17 in. total length. Shipping weight 13 lbs. Bed of lathe is machined. Workmanship first-class. Equipped with wood turning chuck. Can be fitted with 3 in. face plate and drill chuck as special equipment. Order one today. Price $5.00 cash with order. SYPHER MFG. CO., DEPT. C TOLEDO, OHIO

LEARN WATCH REPAIRING

You can learn by our modern and original system of instruction every part of the Watch Repairing Trade at home as good or better than at a shop. You can earn money while learning and secure a well paying position or start in business after completing our course of instruction. Good watch repairers are always in demand and earn from $20 to $35 per week. For particulars apply to the
Milwaukee School of Watchmaking 166 Mason St., Milwaukee, Wis.



VIOLET RAYS

STARTLING NEW ELECTRICAL TREATMENT

FOR HEALTH, ENERGY, BEAUTY

You can now try the wonderful new Violetta—Violet Ray Machine—10 days free in your own home. Give yourself daily treatments—at less than 1 cent per treatment. Rid yourself of headaches, catarrh, constipation, lumbago, insomnia, nervousness. Relieve your pain from neuritis, rheumatism, indigestion, neuralgia. Give yourself beauty treatments—remove eczema, pimples, blackheads, obesity. Make your body a human dynamo of energy and make your skin fine in texture and free from blemishes or sallowness. Double your strength, sharpen your appetite, soothe your nerves, beautify your complexion. Try Violetta 10 days free.

VIOLETTA—NOT A VIBRATOR

The Violetta does not shock or pain. It does not bind the muscles. It is not a vibrator. The Violetta soothes or stimulates, sending the magic healing power of electricity through every cell, tissue, and organ of the body. Electricity in its highest remedial form. Wonderful and painless even to infants. No other form of electricity for home use is so amazing in its results.

10 DAYS' FREE TRIAL IN YOUR OWN HOME

You can try the Violetta in your own home on our 10 days' trial plan. Not one cent do you have to pay if you are not pleased. Why suffer from physical ailments or from the handicap of a sallow, pimply, imperfect skin when you can try this wonderful treatment in your home without risk. The Violetta is used by thousands of physicians and drugless healers as well as by such prominent beauty specialists as E. Burnham, Chicago. Yvette Parlors in eighteen cities, and hundreds of others. Every penny you pay returned instantly if you are not pleased with the Violetta after 10 days' trial. Write for book describing Violetta Outfits and amazing results of Violet Ray treatments.



WRITE FOR BOOK FREE

Just send your name on a post card or use the coupon below for convenience. We want you to know what physicians, drugless healers, sanitariums, beauty specialists and individual owners say about Violet Ray treatments with the Violetta. We want you to know how it removes pain as if by magic—how it clarifies the skin almost over night—why it is painless, harmless, even to infants.

BLEADON-DUN CO. Dept. 2H.
326 West Madison Street, Chicago, Ill.

Please send me your free book and 10 days' trial offer on the Violetta Violet Ray Machine. This incurs no obligation on your part.

Name.....

Address.....

City.....State.....

MAIL COUPON OR POSTAL

We will tell you about our 10 days' trial plan and prove to you that no other machine ever made is in the Violetta class. The only self-contained Violet Ray Machine on the market. Sold direct to you or through your electrical dealer. Write today for free book and trial offer.

BLEADON-DUN COMPANY,
Dept. 2H.
326 West Madison St., Chicago, Ill.

Try the Violetta in Your Own Home For

Asthma	Earache	Obesity
Barbers' Itch	Eczema	Pains
Boils	Eye Disease	Paralysis
Blackheads	Falling Hair	Piles
Bunions	Hay Fever	Pimples
Callous	Headache	Pyorrhea
Catarrh	Goitre	Rheumatism
Chilblains	Insomnia	Skin Diseases
Colds	Lumbago	Sore Throat
Corns	Nervousness	Sprains
Constipation	Neuralgia	Tonsilitis
Dandruff	Neuritis	Whooping Cough
Deafness		

What Physicians and Users Say

Trixie Friganza, well known actress says "Cheerfully will I add my praise for Violetta. It's the best 'pain chaser' and 'soother' I've had the good fortune to find. It's WONDERFUL. It cured my brother of neuritis. As for myself I use it for facial treatments and general massage. I cannot say too much for it."

Dr. Bert H. Rice, of Vinton, Iowa, says: "I have good results with the Violetta High Frequency Instrument in all cases of neuralgia. Almost instant relief in Facial Neuralgia."

K. L. Allen, D.C., 205 Boone National Building, Boone, Iowa, says: "I have had very good results with the application of High Frequency Current in cases of Paralysis, Rheumatism and Neuritis, and think it a great help in drugless healing."

Dr. Daniels, Lisbon, North Dakota, says: "Have used the VIOLETTA in such cases as Goitre, Bronchitis, Pluerisy, Neuritis, Neuralgia and Lumbago, and find it very beneficial. In fact, I would not be without it in my office."



Experiments in Physics

By John J. Furia, A.M.

(*Continued from page* 417)

the card is turning thru 180 degrees the image remains if the speed of the card is sufficiently high. The image of the reverse side strikes the retina while the image of first side is still on it, and hence BOTH objects appear to be in view. This is the fundamental principle of the *motion picture.*

Figure (4) is another example of an illusion due to persistence of vision. A black star is drawn on a blank card. If the card is placed on the forefinger and spun around, the star will disappear and TWO circles will appear as in B, the inner one *black* and the outer one *gray.* As the card is spun around the image of the points of the star and the image of the white card between the points strike the eye in rapid succession, so that due to persistence of vision, both black and white are seen and the result is the gray circle or mixed shade. Since the center of the star is all black, the center circle is black.

Even tho money is not of much use to many of us now, the following interesting device for "Making Money" provides a fitting conclusion to any performance. A small miniature clothes wringer is brought forth. A piece of paper is cut to the size of a dollar bill. The paper is inserted in the wringer, *the handle is turned and a brand new, crisp dollar bill comes out from the other side!* This may be repeated indefinitely (provided the performer is a multi-millionaire). Figure (5) tells the secret. The two rollers are not two distinct rollers, but are made of a continuous piece of goods wound as in B. Beforehand the performer has wound some dollar bills into one of the rollers and then on performing the "stunt" places the paper in the other roller. *As he winds the paper into one roller, the dollar bill is unwound from the other roller.* If the apparatus is well made and carefully put together, a great deal of fun can be gotten from it without the *modus operandi* of the illusion being discovered.

(*To be continued*)



Diploma Awarded to the Electrical Experimenter by the United States Government To Show Its Appreciation of the Patriotic Service Rendered During the War by America's Greatest Electrical Magazine.



"I Can Succeed!"

"What other men have done with the help of the International Correspondence Schools, I can do. If the I. C. S. have raised the salaries of other men, they can raise mine. If they have helped others to advance, they can help me. To me, I. C. S. means 'I CAN SUCCEED.'"

Make up your mind right now that not another day shall pass until you have made *your* start toward success.

For 28 years men in offices, stores, shops, factories, mines, railroads—everywhere—have been winning promotion and increased salaries through the I. C. S. More than 100,000 men and women are getting ready *right now* with I. C. S. help for the bigger jobs ahead.

No matter where you live, the I. C. S. will come to you. No matter what your handicaps, or how small your means, we have a plan to meet your circumstances. No matter what career you may choose, some one of the 280 I. C. S. Courses will surely suit your needs.

When everything has been made easy for you—when one hour a day spent with the I. C. S. in the quiet of your own home will bring you a bigger income, more comforts, more pleasures, all that success means—can you let another single priceless hour of spare time go to waste? Make your start right now! This is all we ask: Without cost, without obligating yourself in any way, put it up to us to prove how we can help you. Just mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6201, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

☐ ELECTRICAL ENGINEER	☐ SALESMANSHIP
☐ Electric Lighting and Rys.	☐ ADVERTISING
☐ Electric Wiring	☐ Window Trimmer
☐ Telegraph Engineer	☐ Show Card Writer
☐ Telephone Work	☐ Sign Painter
☐ MECHANICAL ENGINEER	☐ Railroad Trainman
☐ Mechanical Draftsman	☐ ILLUSTRATING
☐ Machine Shop Practice	☐ Cartooning
☐ Toolmaker	☐ BOOKKEEPER
☐ Gas Engine Operating	☐ Stenographer and Typist
☐ CIVIL ENGINEER	☐ Cert. Pub. Accountant
☐ Surveying and Mapping	☐ TRAFFIC MANAGER
☐ MINE FOREMAN or ENG'R	☐ Railway Accountant
☐ STATIONARY ENGINEER	☐ Commercial Law
☐ Marine Engineer	☐ GOOD ENGLISH
☐ Ship Draftsman	☐ Teacher
☐ ARCHITECT	☐ Common School Subjects
☐ Contractor and Builder	☐ Mathematics
☐ Architectural Draftsmen	☐ CIVIL SERVICE
☐ Concrete Builder	☐ Railway Mail Clerk
☐ Structural Engineer	☐ AUTOMOBILE OPERATING
☐ PLUMBING AND HEATING	☐ Auto Repairing
☐ Sheet Metal Worker	☐ Navigation ☐ Spanish
☐ Textile Overseer or Supt.	☐ AGRICULTURE ☐ French
☐ CHEMIST	☐ Poultry Raising ☐ Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____

E. I. Co.'s High Grade Radio-Instruments
FOR SCHOOLS AND LABORATORIES AT REASONABLE PRICES



No. 7710

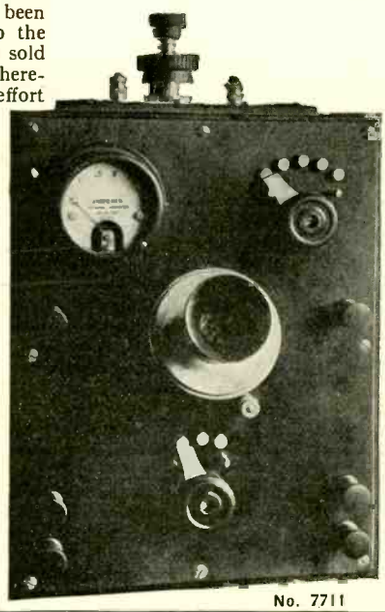
Arc for Generating Undamped Waves for Radio Telephonic & Telegraphic Transmission

These instruments are the acme of perfection in Radio Transmission. The latest and best developments in Radio during the *Great War* are embodied in this apparatus. Educational Institutions and Laboratories can now procure the most modern Radio equipment at a reasonable cost. The undamped *Wave Generator* illustrated is exceptionally well constructed of heavy aluminum. The Arc chamber is flanged in order to offer the greatest cooling surface. The Arc takes place across two solid special Tungsten electrodes which have been found particularly efficient for this work. The electrodes are fully adjustable, permitting very precise adjustment of the emitted oscillatory currents.

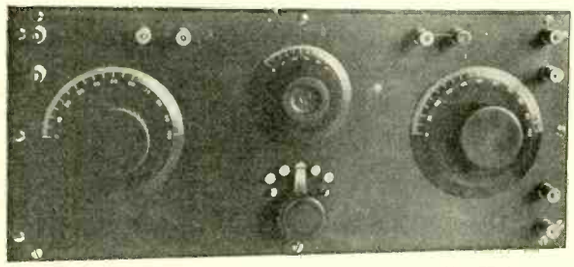
No. 7710—½ K.W. Sustained Wave Generator, as illustrated, operates on 110 V D.C. Size 6½ x 6½ x 8½. Shipping weight, 35 lbs.; price.....$50.00

This complete ***Radiophone Transmitter*** is unquestionably one of the finest pieces of Radio apparatus ever placed on the market. A Radiophone might have been sold heretofore; but it was felt that in justice to the purchaser, no instrument of this nature should be sold unless it were possible to obtain efficient results therefrom. This transmitter is the result of great effort expended in the design of a Radiophone set which should meet all requirements as to practicability and compactness combined with highest efficiency. It includes all apparatus necessary for transmission. The Arc is similar to the one illustrated elsewhere on this page.

No. 7711—Complete Sustained Wave Radiophone and Telegraph Transmitter, inclosed in a beautifully finished cabinet; size 14½ x 9 x 12½"; weight 50 pounds; as illustrated; price.....$150.00



No. 7711



No. 7712

The Short Wave Regenerative receiving cabinet shown is built in accordance with the most modern methods of reception. In work with oscillating audions it is necessary that all losses be diminuated as it was found that tuning should preferably be done with inductance alone, without using variable condensers.

This Receiving set will be found fully up to the mark in comparison with the highest priced set on the market to-day, yet its cost is well within the reach of all.

No. 7712—Regenerative Receiving Cabinet set, as illustrated; size 16¾ x 7⅝ x 8"; weight 25 pounds; price.....$50.00

The Vacuum Tube Socket illustrated was designed to be used by those who are desirous of assembling their own vacuum controls and who need a good socket to hold the bulbs. It is well designed, durable and reasonably priced.



No. 7715

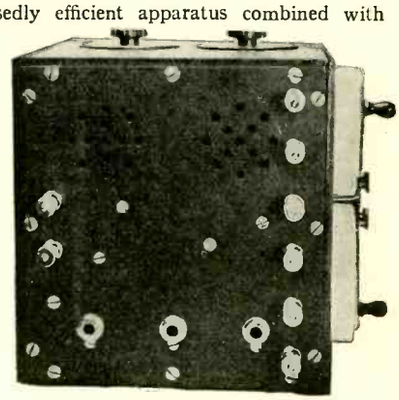
No. 7715—Vacuum Tube Socket; 2¼ x 2¼ x 1½"; weight 1 pound; price.....$1.50

This Tube socket is adaptable for both receiving and transmitting tubes.

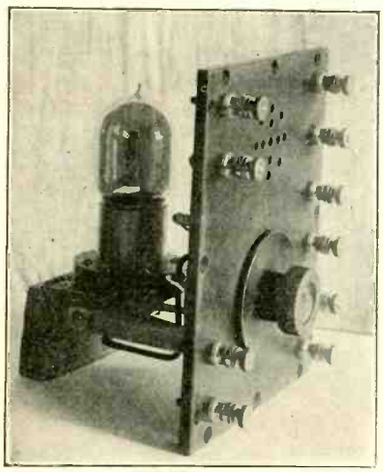
The Two Step Amplifier illustrated is undoubtedly one of the finest instruments offered to the experimenter. It is an example of unsurpassedly efficient apparatus combined with exceptional mechanical skill in its design and construction. Two Vacuum Tube sockets are mounted within the cabinet which also contains the two amplifying audio-frequency transformers which were especially designed for this instrument. It is of great consistance in amplifying live and radio telephone currents.

The telephones are plugged in any of three jacks mounted on the panel, permitting the use of either one or two steps of the amplifier or simply cutting the amplifier out entirely.

No. 7713—Two Step Amplifier, as illustrated; size 7⅝ x 7¼ x 8"; weight 7 pounds; price.....$55.00



No. 7713



No. 7714

The Vacuum Tube Control Cabinet is one of the essential instruments of the modern radio station. The Vacuum Tube holder, filament, rheostat, grid condenser and grid leak are mounted within the cabinet, the only part on the exterior being the rheostat control knob and dial. The construction throughout is on the same high level of excellence with the other instruments illustrated on this page.

No. 7714—Vacuum Tube Control Cabinet, as illustrated; size 6 x 7⅝ x 6¾; weight 5 pounds; price.....$25.00

P. S. No Tubes furnished by us with these instruments.

THE ELECTRO IMPORTING CO.

MANUFACTURERS

231 FULTON STREET N. Y

SEE OUR FULL PAGE "AD" ON PAGE 392

Telephone Solves "Lower Berth" Squabble.

(*Continued from page* 408)

The disadvantages of this system of distribution of cards are numerous, the greatest one being that while one agent may entirely fill his cards, another may not, and thus there will be vacancies in spite of a heavy demand at some other window. Added to this there is a good deal of time wasted while the ticket agent is trying to get in touch with some other agent who has a berth open, not to mention your good time and patience wasted while waiting for him to get the desired information.

But this new system which has been installed in the Grand Central Terminal obviates all this. All the time and energy that were formerly wasted are now saved by the creation of one central telephonic distributing system, which has been installed on the second floor of this railroad terminal and known as the *Pullman Distributing Office*. It is kept open all night long, and in it are maintained all the records and diagrams of every parlor and sleeping car operating out of the terminal.

Altogether this office takes care of the seventeen groups of ticket offices spread over New York City, Weehawken, and Yonkers.

This whole system was built especially to order for this railroad company, the idea being the outcome of a long and exhaustive study of the problem by Mr. Neil Mooney and Mr. Devlin, of New York City.

The equipment proper consists of a distributing board 18 feet long, 3½ feet wide and 2½ feet high. For its whole length this is surmounted by a rack containing pigeonholes which accommodate 190 sets of diagrams. This distributing board is built in three sections, with four operators to a section, each operator being assigned a certain set of trains. On the table in front of her is a set of signal lights, and she is equipt with head 'phones and a mouthpiece as shown in the illustration.

In all of the seventeen groups of ticket offices taken care of a duplicate set of buttons is given to each ticket agent. (See illustration.) He is also furnished with a key showing which operators are taking care of certain trains. By this method the agent in Yonkers or at any of the other stations presses a button, and instantly a light flashes before an operator in the distributing room, who answers "All right", —then the conversation runs like this:

TICKET SELLER:
"25.
"Chicago.
"Thursday, April 10th.
"Lower."
PULLMAN CLERK, at Distributing Board:
"All right."
TICKET SELLER:
"1776" (meaning railroad ticket number).
PULLMAN CLERK:
"Lower 12.
"Car 42.
"25.
"Chicago.
"Thursday, April 10th.
"1776."
TICKET SELLER (repeats):
"Lower 12.
"Car 42.
"25.
"Chicago.
"Thursday, April 10th.
"1776."

Translated into good English language this means that a lower berth is desired on train No. 25, the 20th Century Limited, on Thursday, April 10th, New York to Chicago. This formula reduces conversation to a minimum, and is very strictly adhered to. No girl is given "another chance".

At one side of the room are several desks which take care of nothing but telegraphic requests for reservations. Nearly a thousand requests per day are received, and it is easily seen that this forms no small part of the day's work.

Because of this concentration of distribution space may be sold until two minutes before the train leaves, when the diagrams are sent by special messenger from the distribution office to the conductor of the train.

There is one more feature that deserves mention, and that is the entire absence of all bells. All the signals and calls are made by different colored lights. The only time a bell rings is when one of the different circuits opens, or a fuse blows, in which case an expert electrician is immediately set on the job, and the trouble is fixed up very quickly.

Possibly a word as to the operators themselves would not be amiss. They are all well educated girls, some of them from college, a number of them having husbands in the American Expeditionary Force. The majority of them have been chief operators at some other exchange, and all of them have exceptional "speaking voices." The head of that department, Mr. Devlin, was very careful to make clear the difference between the "speaking" and the "talking" or "telephone" voice. A beginner there is paid $87.50 per month, and the more experienced operators get $125. In return the company demands a most rigid discipline while on duty, but at the same time everything is made as pleasant as possible for the girls. On the floor above is a big rest room fitted up with easy chairs and sofas, where the girls may go whenever they feel sick or faint.

Taken all together, the New York Central Railroad is doing its best to present to the long suffering public a good and efficient method of coping with the Pullman proposition, and they feel that their present method is nearly 100 per cent efficient.—*Photos courtesy New York Central Lines.*

Twin Cell Design of Dry Battery

(*Continued on page* 413)

each consisting of flat zinc strips 15/16 in. wide by 24 in. long, bent in the form of a letter "M." The maker points out that these zinc anodes present to the material contained in the cell a surface of around 90 sq. in., as against 42 sq. in. in a round design. It is therefore claimed that the density of current per square inch is greatly reduced with an increase of life of the cell that is of great practical importance.

The common positive electrode can be used with either negative electrode separately or together by joining the two negative electrodes by a connection. This is the way the battery is furnished. Either half of the battery will give 1½ volts, so that when only one-half the cell is used, the remaining half is kept fresh. The battery measures 1⅛ in. by 3 in. by 6 in., and weighs 2 lbs. 2 oz. The outside case is waterproof and non-conducting. On test it is claimed the battery has shown a voltage of 1.5 to 1.55 and on short circuit a current of 35 amperes.

Sent up by Italian scientists, a balloon carrying recording instruments reached an altitude of 23 miles and found the lowest temperature, 70 below zero, 12 miles from the earth's surface.



Become a Doctor of Chiropractic
Advanced Science of Spinal Adjustment

This is the day of drugless healing! In Chiropractic—treatment of disease by spinal adjustment—Science has made a forward step. Look at the newspapers and magazines—note the trend toward the principles of drugless healing, especially Chiropractic.

You can now become a Doctor of Chiropractic **through home study during spare time!** We teach you thoroughly either by mail or in class. You can know **independence and position!** Makes no difference where you live or what you do—you should be able to qualify for this great profession. Some of our graduates report that they

Earn $3,000 or More a Year

Dr. M. D. Moore, Ky., writes of having 17 patients in one day at $2 each. Dr. L. H. Roche, New Jersey, $5,550 a year. Dr. A. H. Morrow, of Illinois, reports earning $22 a day. We could name many other Chiropractors who are making good incomes. See the facts in our Free Book. It's only a question of preparation on your part, to enter a profession that is paying others $3,000 to $5,000 or more a year. Think what it would mean to you to earn such an income and to be your own boss with your own hours. Isn't this the kind of life you are desirous of leading? Well, it is now within your reach. Truly this is a chance for you!

22 CHARTS FREE

$15 Set of 8 Anatomical Charts and $16.50 Set of Nerve and Pain Area Charts

Yes, free to you without a cent, now or later. As an inducement to secure quick action, we will give absolutely free, our big, 72-page book; a $15 set of eight Anatomical Charts, beautifully lithographed in lifelike colors, and also a complete set of colored Nerve and Pain Area and Concussion Charts, regular value, $16.50.

Our Lessons Teach You How to Make Spinal Adjustments for the Speedy Relief of

Headache, Indigestion, Lumbago, Epilepsy, Pleurisy, Constipation, Rheumatism, Neuralgia, Neuritis, Catarrh, Fevers, Jaundice, Dyspepsia, Paralysis, Asthma, etc.

Learn At Home In Spare Time

We train you by mail. You can learn at home in your spare time. You receive the personal instruction of men who are prominent in this great profession. Give us a portion of your spare time, and we will quickly train you to become a Doctor of Chiropractic, ready to step out and take your position of prestige in the world.

Mail Coupon NOW! Why slave your life away in work that you don't like—work that doesn't fit with your ambition? Here's the chance you've been looking for—the opportunity your ambition has sought! Mail coupon today and see the success that may be yours as a Doctor of Chiropractic. Don't delay.

AMERICAN UNIVERSITY
Manierre Bldg. Dept. 550 Chicago, Ill.

Without cost or obligation, send me by mail, postpaid, your new illustrated 72-page book, and your Free Charts Offer.

Name.....

Street and No.....

City..... State.....

Turn A Valve and Cook



The OLIVER Oil-Gas Burner makes any stove or range a gas stove. No coal or wood. Cooks and bakes better. No fires to start. You regulate flame. Saves money, work, dirt. Burns coal-oil (kerosene). Simple, safe, easily put in or taken out. No damage to stove. Lasts a lifetime. Thousands of delighted users. In use seven years. Write us for FREE literature telling how 2 gals. kerosene equals 97 lbs. coal. *Agents Wanted.*
Oliver Oil-Gas Burner & Machine Co.
1345 N. 7th St., St. Louis, Mo.

Make Your Stove A Gas Stove

You can be quickly cured, if you
STAMMER
Send 10 cents coin or stamps for 70-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering for 20 years.
Benjamin N. Bogue, 758 Bogue Building, Indianapolis

FREE TO YOU!

Read this Remarkable Offer!



OFFER No. 1

Wireless Course

The most comprehensive Wireless Course ever printed. Contains 160 pages, 350 illustrations. Size of book 6¾"x10". Very fine flexible cloth cover.

FREE with a year's subscription.
Add 5c for postage

OFFER No. 2

Experimental Electricity Course

This masterpiece contains 160 pages, 400 illustrations. Size of book 5"x9". Printed on extra thin paper, so book can be slipped into pocket. Handsome flexible cloth cover.

FREE with a year's subscription. Add 5c postage

OFFER No. 3

How to Make Wireless Sending Apparatus
By 20 Radio Experts

How to Make Wireless Receiving Apparatus
By 20 Radio Constructors

These books are by far the most successful wireless books on the market. Size of each book 5"x7", well bound on good book paper. Covers in two colors. We really cannot praise these books too highly. Each book contains 100 pages and from 88 to 90 illustrations. **BOTH** books **FREE** with a year's subscription. Add 5c for postage

This is a very limited offer. It may be withdrawn at any time, due to the tremendous cost of paper, which IS JUST DOUBLE WHAT IT WAS ONE YEAR AGO. We have only a limited supply of these fine books on hand; after they are gone we cannot reprint the books until conditions become normal again. **Now is your chance.**

The publishers of this journal have earned an enviable reputation of giving more than 100 cents' worth for each dollar spent with them. Profit by this liberal opportunity NOW; it may never be made again.

HERE'S THE OFFER

Subscribe to the ELECTRICAL EXPERIMENTER for one year, at the regular subscription price of $2.00 per year (Canada, foreign and N. Y. C. $2.50) and we will send you either books shown in one of the above offers. If you subscribe for two years, two offers will be given, etc.

If you are a subscriber at present take advantage of this wonderful opportunity anyway. If you do, we will extend your present subscription.

This Offer Limited. *Act Now.*

EXPERIMENTER PUB. CO.
233 FULTON STREET NEW YORK CITY

FILL IN — TEAR OUT — AND MAIL

9-19

Gentlemen: Please enter my subscription to the ELECTRICAL EXPERIMENTER for the term of .... year..for which I enclose herewith $..... You will also send me at once FREE your book..... as per offer No.....

.....

.....

Name.....

Address.....

A Tell-tale Submarine Net

(*Continued from page* 406)

holding the net sets in motion the signaling alarm devices provided by the inventor.

The anchoring devices at each end of the net each comprise a buoy in the form of a cylindrical body or tube containing an air chamber and ballast at the lower end. The lower end of the buoy is connected with a number of chains having weights or anchors at their lower extremities, and all of which may be adjusted and set to maintain the net or nets at the usual depths traveled by submarines. A series of nets can be arranged at various levels so as to form an effective barrier wherever required. The buoys remain in their original position, even if the net is detached by the submarine, and can be used for replacing another net.

Each buoy carries a float chamber having a dependent stem extending into a chamber at the upper end of the main buoy and on this stem is placed a spool carrying a cable. When the net is pulled away from the anchoring devices, a set of catches disengage the spools so that the floats rise to the surface of the water and are carried along by the net. The float will thus serve to indicate that the net has been torn away from its anchorage by a submarine enmeshed therein, and moreover indicate the position of the sub-sea raider. At the same time a set of *marker floats* rise from the buoys to indicate their position.

In order to detect a submarine that has enmeshed with the net during the night, the float devices have suitable illuminating means which are easily set into operation by electric current. The float chamber contains a storage battery or other source of current connected in circuit with lamps adapted to be illuminated when the circuit is closed, by a special time-clock device connected with the release mechanism of the buoys. At the same time that the signal lamp circuit is closed in the floats, by means of the time-clock arrangement, an aërial bomb or rocket is projected into the air as shown in the accompanying illustration, this bomb being arranged in a barrel having at its lower end a charge of explosives, which is ignited by a spark plug connected up with an electric battery and spark coil circuit within the float. The bomb is fitted with a fuse which will cause it to be exploded when it reaches a certain height. A red light or flare may be produced on the floats when the bomb is projected. For this purpose a charge of *red light* or other signal powder is arranged in a compartment within the float chamber.

ELECTRIC SHIP WELDING SUPERIOR.

The displacement of riveting by electric welding in ship construction is being considered in English insurance circles, with regard to possible reduction in rates. It is claimed that welded plates stand the impact test as well as riveted plates, but underwriters require further information on the question of the results of stranding and collision. The cost of electric welding is stated to be much below that of riveting, and if similar insurance rates may be secured will undoubtedly supplant riveting to a great extent.

A New Cam Regulator for Auto Dynamos

(*Continued from page* 415)

A number of voltage regulators have been developed, but of these only two—the bucking-winding system and the third-brush system—have been generally used. To these has been recently added a third, the Cam-Regulator System.

This system is very different from the usual systems both in principle and in operating characteristics. Some of the chief advantages claimed for it are as follows: The voltage is held more nearly constant than is the case with the other systems. Ideal battery-charging conditions are provided, since the amount of current delivered to the battery is large when the battery is discharged, and small when the battery is full. The battery is not necessary to the proper operation of regulator. Hence, in an emergency the generator can be operated with the battery disconnected, and in some cases the battery can be dispensed with altogether.

The generator for this system is of the simple *shuntfield* type, and voltage regulation is effected by *inserting resistance in the field circuit.* This principle is the same as that employed in ordinary power-generator service, but the method of application is quite different.

In power service the voltage of a generator is kept constant by increasing or decreasing the *amount* of resistance in series with the shunt field as the voltage tends to rise or fall. With the cam-regulator, however, a fixt amount of resistance is always used but the voltage is regulated by varying the *length of time* during which this resistance is in the field circuit. How this is accomplisht can be best understood by referring to the diagram of the cam-regulator.

This device consists of four main parts—a magnet coil and core, a set of contacts, a cam mounted on the generator shaft, and a resister. The resister is so connected that it is *short-circuited* when the contacts are *closed,* and *in series* with the shunt field of the generator when the contacts are *open.* The arm carrying the lower contact rests on the cam and is moved up and down with every revolution of the generator shaft. The upper contact is mounted on a pivoted arm, and when the generator is not in operation, it is prest against the lower contact by a spring finger.

With the engine running at low speed, as in starting, the contacts are together and the resistance short-circuited. When, however, an increase in the engine speed brings the voltage of the generator up to the operating point (7 volts), then the magnet comes into play.

The coil of this magnet is connected across the brushes of the generator, and when the voltage rises above 7 volts, it has sufficient strength to draw the upper contact away from the lower, thus inserting the resistance in series with the generator field. Immediately the voltage starts to fall, and the magnet drops the upper contact, closing the points and cutting out the resistance. This increases the voltage again, and the magnet picks up the contact, only to drop it immediately afterwards. Since the strength of the magnet's pull depends upon the voltage of the generator, the higher the voltage the longer the upper contact will be held, and the fewer will be the number of closings per minute. This is equivalent to an increase in the amount of resistance.

The operation of opening and closing the contacts takes place so rapidly that the eye can not follow it, nor can the variations in voltage be noted on a voltmeter. In practice the regulator is adjusted to hold the voltage at approximately 7 volts at all operating speeds and under normal loads.

—Photo courtesy Westinghouse Elec. & Mfg. Co.

DRAWING
Big Pay—Easy Pleasant Work

Draftsman earn $150.00 to $300.00 a month. The work is pleasant and the hours are short.
You can get this big pay too. All you need is the new 1919 edition of the Cyclopedia of Drawing and a little of your spare time. The cost is only 7 cents a day, and we give a year's consulting service free. See the FREE examination offer below.

Cyclopedia of DRAWING
4 big volumes each 6½x8¾ in., bound in genuine American Morocco and trimmed in gold 1578 pages and more than 1000 illustrations plates, diagrams and blue prints.

The only books that thoroughly cover Mechanical, Structural and Architectural Drafting in a non-technical way. You don't have to know anything about the subject to understand them. They begin at the beginning and tell you everything about Blue print Reading—Mechanical Drawing—Machine Design—Machine Drawing—Structural Drafting—Architectural Drawing and Lettering—Shades and Shadows—Perspective Drawing—Freehand Drawing—Pen and Ink Rendering—Typographical Drafting—Drawing Instruments and Their Uses and hundreds of other things connected with the work.

Use One WEEK FREE!

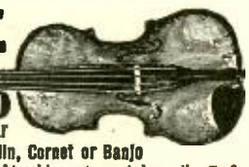
You can have these books for a whole week free without sending one cent. Just send the coupon below and all 4 volumes will come to you at once by express collect. Use them as if they were your own—go through them thoroughly and send them back at our expense if you don't want to keep them. If you do keep the books send us only $2.00. You can send the balance of our special introductory price—only $13.80 the same way—$2.00 each month.
Remember you don't take any chances. The risk is all ours and the benefits will all be yours—Send the coupon today

American Technical Society
Dept. D 256 CHICAGO, U. S. A.



American Technical Society
Dept. D 256
CHICAGO, U. S. A.
Please send me the 4-volume Cyclopedia of Drawing for 7 days' Free Examination, shipping charges collect. I will send you $2.00 in 7 days and $2.00 each month until the special price of $13.80 is paid, and you will send me a receipt showing the books are mine. If I decide not to buy I will return the books in 7 days
Name.....
Address.....
References.....

WANTED
RAILWAY MAIL CLERKS
$1100 first year
Examinations everywhere
Common education sufficient
Life Job.
Franklin Institute, Dept. J-101 Rochester, N. Y.
COUPON
Sirs:—Send me at once, free of charge, sample Railway Mail Examination questions, list of other U. S. Government positions now open and free book describing them.
Name.....
Address.....

FREE

$20
Violin, Hawaiian Guitar
Ukulele, Guitar, Mandolin, Cornet or Banjo
Wonderful new system of teaching note music by mail. To first pupils in each locality, we'll give a $20 superb Violin, Mandolin, Ukulele, Guitar, Hawaiian Guitar, Cornet or Banjo absolutely free. Very small charge for lessons only expense. We guarantee success or no charge. Complete outfit free. Write at once—no obligation.
SLINGERLAND SCHOOL OF MUSIC, Dept. 422, CHICAGO, ILL.

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section seven cents a word for each insertion. No advertisement for less than 50c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency.

Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the October issue must reach us not later than August 22.

The Circulation of the Experimenter is over 115,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Automobile Accessories.

Battery Charging Pays Big Profits. City current or gas engine operates. Easy terms. Hobart Brothers, Troy, Ohio.

Fords run 34 miles per gallon with our 1919 carburetors. Use cheapest gasoline or half kerosene. Start easy any weather. Increased power. Styles for all motors. Runs slow high gear. Attach yourself. Big profits for agents. Money back guarantee, 30 days' trial. Air-Friction Carburetor Co., 270 Madison St., Dayton, O.

Auto Motors and Supplies. Buick, Hupp, Franklin, Michigan, Everett, Hudson, Chalmers. Both water and air cooled motors, $40 each and up. Bosch Magnetos, $15 each and up. Presto Tanks, $5. Coils, Carburetors, Head Lamps, Horns, Air Compressors, Generators, Starters. Write for bargain bulletin second-hand auto accessories. Johnston, West End, Pittsburgh, Pa.

Attention! Device for carrying curtains in top of auto; complete directions; easily attached. Send $.35. No stamps. Johnston, 9 Rutherford, Binghamton, N. Y.

Agents Wanted.

Beginners. Complete "Mail Order System." C, Box 1005, Atlantic City.

10 to $25 a day profit. Biggest summer seller. Concentrated fruit drinks. Just add water. Delicious drink in a jiffy. Six popular flavors. Bestever Products Co., 2426-SE-9, Polk St., Chicago.

Insyde Tyres, inner armor for automobile tires, double mileage and prevent punctures and blow-out. Quickly applied. Costs little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, O.

Agents. Big returns, fast office sellers; particulars and samples free. One Dip Pen Co., 12 Daily Record Bldg., Baltimore, Md.

Signs for store and office windows. $50 a week easily made. Chicago Sign System, G 326 River St., Chicago.

$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Ave. D, Decatur, Ill.

Wonderful Chance—Men's shirts and furnishings at wholesale rates, or make $10 daily starting real business. Goodell Co., Duratex Bldg., New York.

We may have it. Money getter. Sample 25 cents. Box 802, Baltimore, Md.

Patents for Sale.

Wireless apparatus patent for sale. High merit. Information, pictures, address Mr. Teele, 139 Genessee St., Buffalo, N. Y.

Scenery for Hire.

Collapsible Scenery for all plays. Decorations. Amelia Grain, Philadelphia.

Old Money Wanted.

We Buy and Sell Old Coins. $2 to $500 each paid. Keep All Old Money; you may have valuable coins. Send 10c. for New Illustrated Coin Value Book, 4 x 6. Guaranteed prices. Get posted. Clarke Coin Co., Box 110, Le Roy, N. Y.

Salesmen Wanted.

Salesmen—Commercial Travelers and City Salesmen, no previous experience necessary; trained men earn from $200 to $1000 monthly; prepare now by mail for the "big paying jobs." Write for free book and special offer today. Interstate Commercial Institute, 1133 Broadway, New York.

Postcards.

Five Prettiest Women Cards, hand colored, 25c. Chas. Durso, Dept. 41, 25 Mulberry St., New York City.

Rare Real Photos: Bathing beauties, models, the kind you want. Sample, dime. Write. Artiste, Auburn, Ind.

News Correspondents.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Jacobus Advertising Service

SALES COMPELLING LITERATURE

1073 Sanford Ave. Irvington, N. J.

July 17, 1919

ELECTRICAL EXPERIMENTER,
N. Y. City.

Attention, Mr. DeMott.

Gentlemen:—Herewith two small ads. for next issue of your two magazines. We also expect one along in a day or so from a Cartoon School out in Pennsylvania, but he is making a drawing for same and no doubt this is what is delaying it. As soon as we receive it we will rush it right over to you.

Your magazines are pulling good for us and it all seems to be a good class of trade, which indicates your readers are wide awake and answer ads.

Very truly yours,

H. JACOBUS.

Cameras, Supplies—Photo Developing.

Clean, Neat, Perfect Kodak Finishing at the lowest prices. Work returned the same day received. Send film for sample print and copy of catalogue on developing, printing, enlarging and hand coloring, also copy of Photo Craft Magazine, which will help you make better pictures. Photo Craft Co., Box 69, Ann Arbor, Mich.

For 15c we will develop and furnish prints from one, six or eight exposure film or enlargement 8x10, your favorite negative, 20c to show quality and service. Associated Photo Company, Sta. A 12, Cincinnati, Ohio.

Roll Film Developed, 6c. Prints, 2c up. Send for price list. The Blad Photo System, Wareham, Mass.

Mail us 15c with any size film for development and six velvet prints. Or send six negatives any size and 15c for six prints. Or send 35c for one 8 x 10 mounted enlargement. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke, Va.

Exchange Ads.

Exchange, Buy, Sell. Wireless, electrical goods, etc. Large list 6c. State what you have and want. Zehrbach, Box 250, Hiram, O.

Wanted Tribune light car or parts. State lowest cash price and full particulars. Van Deurs, 325 Beta Place, Glendale, L. I.

Photographs wanted of Autolite and Hoyt (Gray-Davis) automobile Ammeters. Also speedometers. Will pay $1.00 each. Write Victor Todd, Rainbow Lake, New York.

Amateurs! Complete Audiotron regenerative cabinet, $18.50. Write for photo and particulars. H. Springfels, 70 E. Utica St., Buffalo, N. Y.

Let's swap! What'ye got? What d'ye want? Free Advertising. Three months, dime. Swap Bulletin, Wayne Congress, Detroit.

Sell—Gilbert's $10 Electrical Set. Tank developing outfit. Fine condition. Write. James Raiford, Route 1, Bessemer, Alabama.

2-$4.00 3-slide tuning Coils, sell for $2.50 each. 1-Murdock Loose Coupler, cost $8.00, sell for $5.00. Instruments used only 2 months. Prepaid. Sidney Kronengold, 5508—5th Ave., Brooklyn, N. Y.

For Sale—DeForest audion on panel, Oscillation Transformer and sending, receiving switch, $8. Also I.C.S. Electric Lighting Course, $20. Stamp for particulars. Eldred Hall, Solvay, N. Y.

Sell; Curtiss 3-ft. Biplane, $8.50. Guaranteed to fly. Complete arc light, $8.00. Send for photos. Merlin F. Harrod, New London, O

5000 Meter Coupler and other instruments for sale. Write quick. Ritchey Hume, University, Mississippi.

For Sale—Transmitting set, including 2" coil, helix, condenser key and gap, $15.00. Also Knapp dynamo-motor, $4.00. H. Hilton, 20 Jewett St., Amsterdam, N. Y.

Amateurs. Write me for list of Radio Apparatus for sale at big bargains. All in good order; closing my station. Wendell Holst, 3619 N. St. Louis Ave., Chicago.

65 Chemical Set, $5.00. Bricktor, $4.00. Lionel Gates, Coalport, Pa.

Sell 1/20 H.P., 110 volt, 60 cycle continuous duty induction motor, $7; 40 watt dynamo, $4.50; 20 watt dynamo, $2.25; volt and ammeter, $1.25. Adolph Gedeon, 3296 W. 50th St., Cleveland, Ohio.

For Sale or Exchange—$40 Hawaiian Guitar outfit, $25. Write. Arthur Ellwein, Wrightsville, Pa.

Chemical Laboratory for Sale. 100 Chemicals—50 pieces of apparatus, cheap. Louis Dotte, 205 West St., West Hoboken, N. J.

Must Sell. Send stamp for list of electrical goods. Earl Cook, Benardston, Mass.

Bargain. 1 K.W. Thordarson transformer, brand new, $21.00. Crawford, 13 Ten Broeck St., Albany, N. Y.

For Sale. Blue prints for connecting A.C. motors. See ad under "Blueprints." Charles Chittenden.

Sell—Valuable electrical Stereopticon. First money order gets it. Thompson, 36 John St., Worcester, Mass.

Exchange! Over 100 "American Boys," also other Magazines for something electrical, letters answered. W. Leslie, Oak Hill, Ohio.

Trade—Moving Picture Camera, 150 ft. capacity; for small lathe. Ora Coppock, Tipton, Ind.

For Sale—Nickel plated; short model Valve Trombone. Ralph D. Kors, Humboldt, Neb.

For Sale—Audion, complete, except bulb, $6.50; Walnut case, no bulb or battery, $3.50; Blitzen, ¼ K. W. transformer, mounted, $10.00; Audion coil, $1; 55 galvanized pole steps, $1.00; Double variometer, $2.50; Telegraph outfit, $1.00; 30 Algier stories, $2.50. Rule D. Egbert, Tiffin, Ohio.

Will Exchange 5 H.P. gasoline engine for shot gun. Schmelzers, 90 St. Marks Place, New York.

Sell—Electrical apparatus. Thompson, 36 John St., Worcester, Mass.

Sale—22 Remington Rifle $5.00. Two telegraph sets $4.00. No. 6 Erector $5.00. Electric Miroscope $4.00. W. Grus, 505 Clinton Ave., Oak Park, Ill.

Electrical Supplies & Appliances.

Battery Charging pays big profits with HB Equipment. Electric Light Generators and Motors can also be furnished on easy payments. Full information free. Hobart Brothers, Troy, Ohio.

Storage Batteries. Make the plates yourself, we will tell you how. Sample plate 40c. Windsor Specialty Co. (not incorporated), 5419 Windsor Ave., Chicago, Ill.

Castings, Blueprints, Engines—Gas and Steam, ⅛ H.P. up. Gears, Pulleys, Pumps, Fittings, Small Boilers. Complete circulars for stamp. Latest models. Universal Gas Motor Co., 364 Monadnock Block, Chicago.

Storage Batteries charged by alternating current. Inexpensive, Simple and Efficient; Instructions and Print $1. K. & S. Engineering, Box 124, Sewickley, Pa.

Magnets: Large Horseshoe Magnets. Will lift 12 lbs. Mail $1, stamps or Money Order. Parcel Post Prepaid to all parts of U. S. or Canada. West Side Novelty Co., Drawer No. 8 Wabash P. O., Pittsburgh, Pa.

Motor Winders. See ad under "Blueprints." Charles Chittenden.

100 induction motor winding diagrams, 1, 2, 3 phase, star delta. 2 to 12 poles inclusive. Postpaid, $5.00. W. Glass, 2108 South Broad St., Philadelphia, Pa.

Electrical Workers and all others who are interested in Electrical Work in the Reconstruction that is taking place. To send us their name and receive descriptive literature of our Modern Blue Print Chart Method of Electrical Wiring. Souvenir information card included. Electrical Wiring Diagram Co., Box C. 173, Altoona, Pa.

Lava Insulation is not molded but individually sawn, lathe turned, milled, drilled, threaded. No limitation on form, only on size. Kilned at two thousand degrees. Hard, strong, accurate, fire, acid proof. Ask for book. American Lava Insulator Company, Chattanooga, Tenn.

Chemicals.

Radioactive and Rare Metal Salts. An opportunity for experimenters to become acquainted with radioactivity and rare metals. Ten salts in neat tubes—Thorium, beryllium, unranium, cerium, and others. Price only $1.75. Radio Chemical Supply Co., 915 Westcott St., Syracuse, N. Y.

Chemicals—We have the best chemicals at the lowest prices. Write for circular. Jos. Simpson, 3880 Windsor Place, St. Louis, Mo.

Experimenters—August list and 10 formulae—5c. Chemicals and laboratory apparatus for analytical and experimental work. Do your reactions ever go wrong? Our chemicals for analytical work are guaranteed c.p. C. C. Frane, Eureka, Ill.

For Advertisers.

Jacobus Ads. Are Business Builders. Booklet Free. Jacobus Advertising Service, 1073 Sanford Ave., Irvington, N. J.

"Quick-Action Advertising—How it is Building Business for the Progressive Advertisers of America"; A little story of results told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th St., New York.

Advertise—24 words in 100 magazines, $1 lists Free. Stanford Co., 308 Hostetter Bldg., Pittsburgh, Pa.

Personal.

Are You Self-Conscious, embarrassed in company, lacking in self-control? These troubles overcome. C. E. Veritas, 1400 Broadway, New York City, N. Y.

Get Vital Strength. Retain youthful vigor. Wonderful results. Intensely interesting booklet free. Winslow H. Chase, Washington, D. C.

The Salesman Wins. Thousands of positions open. We teach traveling salesmanship by mail and guarantee offer of position or refund tuition. For interesting particulars, address Kansas Vocational Bureau, Miltonvale, Kansas.

Novelties

Here Boys! Make a Toy Aeroplane. See our Nifty ad., page 454.

Wanted to Buy

Cash for Old False Teeth. We pay up to $35.00 per set (broken or not). Also buy discarded gold jewelry, gold crowns, bridges, platinum, diamonds, watches and silver. Send now. Cash by return mail. Package held 5 to 10 days for sender's approval of our offer. U. S. Smelting Works, Dept. 73. Chicago, Ill.

Formulas.

Whiskey. I will not sell a million formulas for $1.00. My little book of selected formulas will put you wise. Every formula has been carefully selected and plainly printed. Tells you how to make excellent whiskey or Beer with a good Kick at small cost. A few good formulas are worth a million bad ones. Complete book and formulas $1.00 bill. I'm prompt too. Frank Ward, Box 503, Baltimore, Md. Dept. D.

500 Successful money-making formulas and trade secrets. Postpaid 25c. Charles Dynes, Winchester, Ind.

Motors, Engines & Dynamos.

Small Motors and Generators from bankruptcy and receivers' sales. Motors for all phases of current. Immediate delivery. Less than one-half regular prices. See display ad on page 459. Johnston, West End, Pittsburgh, Pa.

For Men.

Send us your dull razor blades. We re-edge them Good as New, any kind, 2½c each. Prompt service and satisfaction guaranteed. Dealers wanted. Keenedge Company, Inc., 184 Washington St., Chicago, Ill.

Detectives Earn Big Money. Travel. Great demand. Experience unnecessary. We train you. Write for free particulars. American Detective System, 1968 Broadway, N. Y.

Dredge's Necktie Valet removes wrinkles (without ironing) from neckties. Sample 25c. Dept. E, 190 Pilgrim, Highland Park, Mich.

Wireless.

Radio Apparatus of Quality. Manufactured to your own specifications. Radio Engineering Company, Baltimore, Md.

Switch Points. Binding posts, switch levers, and small parts, send 2c. for catalogue describing these and other goods. A. W. Bowman & Co., 23 Church St. (Harvard Square), Cambridge, Mass.

Wireless, improved switch-knob lever, complete, 25c; brass switch points with screws, 25c dozen; Magnet wire, 22-24, 50c, 26-28, 60c half pound, postpaid prices. Amateur parts our specialty. Electro-Novotoy Shop, 2100 Fifth, Charlotte, N. C.

Panel Wireless Sets and Parts. Heavy rubber Knobs. $1.10, post extra. Klaus, Eureka, Ill.

"Bargains"—6000 ¾" Spark coils without vibrators must be sold at once. Send 40c and 12c postage. Also ¾" Spark coils with vibrators, at 85c and postage. A. Dubs, 1534 Pitkin Ave., Brooklyn, N. Y.

10,000 feet strandcd aerial cable, seven strands number 22 pure copper. The need of the hour. 1 cent per foot, $9.00 per thousand. L. A. Bates, 8 Moen St., Worcester, Mass.

For Inventors.

Inventors join National Institute of Inventors, 118 Fulton St., New York City; membership society 1,900 strong; will help protect, develop, finance and market your invention. Absolutely no charge. Write for booklet.

"Sell or Finance Inventions." Read Money Talks Magazine. Send for free sample copy. 70-B Park Place, Newark, New Jersey.

Inventors. Protect yourselves. Record your idea before exposing it to anyone, even to me. Paul E. Klein, M.E., Consulting Engineer, Registered Patent Attorney, 21 Park Row, New York.

600 Mechanical Movements, also illustrations and explanations of 50 perpetual motions. My book, Inventors' Universal Educator, 4th edition, tells how to procure and sell a patent for your new invention. Government and other costs. Covers the matter from A to Z. 140 pages elegantly bound. Contains noted Court decisions on Patent cases. Mechanical Movements greatly assist inventors—suggest new ideas that might prove of great aid in perfecting inventions. Tells how to select an attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers. Price $1. Postage free. Fred G. Dieterich, 603 Ouray Bldg., Washington, D. C.

Inventions Wanted. Cash or royalty for ideas. Adam Fisher Mfg. Co., 205 St. Louis, Mo.

Inventors write me about patents. My fees payable monthly. Booklet free. Frank Fuller, Washington, D. C.

Business Opportunities.

Enter a New Business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks at small expense; no further capital required; no goods to buy; job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston, Mass.

500% Profit Monograming Autos. "Perfect" transfers. Irvin J. Wolf, Sta. E, Philadelphia.

$30 a Week. Evenings I made it with a small Mail Order Business; continued my regular job daytime. Free Booklet Tells How, 2c postage. Albert W. Scott, Cohoes, N. Y.

Make $4.00 a Day Silvering Mirrors. Complete instructions, 10c (coin). Lloyd Stultz, Middletown, Maryland.

Build Up an Income in Oil. Others are doing it—Why not you? Today is the opportunity. Join our easy monthly payment plan now—it may mean hundreds in profits. Write for information. National Oil Drilling Co., Dept. K, Houston, Texas.

Dollars Yearly in Your Back Yard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. Metz, 313 East 89, New York.

Money-Making Farms. 19 States. $10 to $100 acre. Stock, tools, crops, often included to settle quickly. Write for big illustrated catalog. E. A. Strout Farm Agency, 150 E C Nassau St., New York.

Breed Canaries—Profitable pastime—Particulars free—Bird Farm, Lynnhaven, Virginia.

Victory. Mechanical Toy Soldier window attraction. 30 inches high. Salutes, turns head, points with finger, etc., as set. Well made, nicely dressed officers, privates, Uncle Sam, etc. Electrically operated. Does some stunt every half minute or oftener as set and will salute soldier and pay no attention to other if desired. Representative wanted in each city and town. Write for prices. The John M. Biggs Co., Box 324, Chattanooga, Tenn.

Radio Amateurs; Here is an opportunity for you to secure a very efficient amateur radio set complete. Photos and description furnished on receipt of postage. Address Clarence Bornofska, 1322 Lincoln St., Racine, Wis.

Complete Course on compiling and selling names by mail to advertisers. Description free. Globe Publishing Co., 120 Syracuse, N. Y.

"Let's get started once more, fifty complete, guaranteed radio receiving sets, $1.65 each." Eureka Manufacturing Company, Independence, Iowa.

"Quick-Action Advertising—How It Is Building Business for the Progressive Advertisers of America"; A little story of results told by the advertisers themselves—not the publishers. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 W. 39th St., New York.

Start a Profitable Business manufacturing "Puffed Crisp." Delicious confection. Whirlwind money-maker. Machine, Instructions complete $6.50. Samples 10c. Bestever Products Co., 2426-PE-9, Polk St., Chicago.

Blue Prints, 236 A.C. diagrams,contains 54 single phase, 42 two phase, 50 three phase Star, 40 Delta, 12 Star-Delta. Appendix 68 changes of voltage, phases, speed, cycles, etc. 10 samples 25c. Particulars free. Charles L. Chittenden, 811 West 18th Street, Kansas City, Missouri.

Salesmen—New proposition that nets $100 to $200 weekly. Give moving picture shows at schools, colleges, universities, chuches, Y. M. C. A's, clubs, lodges, societies and homes. We furnish complete outfit. Write for particulars. W. H. Wade, Dept. 5, 14 N. Michigan Ave., Chicago.

Make Big Money opening safes and setting combinations. Wayne Strong, P. O. Box 1430, Los Angeles, Cal.

Motion Pictures.

Electric Arc Generator halves expense. Your engine operates. Easy terms. Hobart Brothers, Troy, Ohio.

Earn $1200 A Year in Spare Time writing photoplays. Experience unnecessary. Send for free book, valuable information, special prize offer. Photo Playwright College, Box 278 E-5, Chicago.

Photoplays Wanted. Big prices paid. You can write them. We show you how. Free particulars. Rex Publishers, Box 175, E5, Chicago.

Continued on Page 486

Books.

Dear Reader. If Occult, New-Thought and Scientific books appeal to you, send for my catalog, it's free. I have books on Personal Magnetism, Concentration, Spiritualism, Clairvoyance, Seership, Will, Mind, Hypnotism, Messmerism, Character Reading, Healing, Mysticism Success, Salesmanship, Mechanics, Entertainment, etc. A. W. Martens, J-49, Burlington, Iowa.

World-Romic System. Masterkey to all languages. Six textbooks, $1.44; French chart, 37c.; Spanish, 37c.; aviation dictionary, $1.50; French-English aviation dictionary, 61c. Languages, 143 W. 47th St., New York.

A Magazine Published for Boys by boys. Year, 25c. Single copies 5c. Hoosier Boy, Brazil, Indiana.

"Chicago Mysteries" Illustrated Book, 25c. Catalogue, 2c. Paul Duff, 2713 Mozart, Chicago, Ill.

Nature Laws every married and engaged person should know, 45c (no stamps). Central Company, 599 Ninth Ave., New York.

To Get Better Pictures. Read the amateur photographers' weekly; illustrated; weekly prize competitions; print criticisms; many unique features; $1.50 per year; three months' trial subscription 25c. Abel Publishing Company, 401 Caxton Bldg., Cleveland, O.

Old E. E. Back Numbers. We have some valuable old E. E. back numbers on hand as follows: 1915—Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec., price each 35c. 1916—Jan., Feb., March, May, June, Nov., Dec., price each 35c. 1917—Jan., April, May, June, Aug., Nov., Dec., each 35c. 1918—March, May, June, July, Aug., Sept., 35c; Oct., Dec., each 20c. 1919—Jan., Feb., Mar., Apr., May, June, July, Aug., 20c. We can fill orders at once upon receipt of your remittance and if you have not these numbers already, now is your chance to get them, as they probably will be snapped up very quickly. Experimenter Publishing Co., 233 Fulton St., New York City.

Tricks, Puzzles and Games.

Tricks, Puzzles, Jokes, toys, games, novelties, doll and cane racks, plays, wigs, stage supplies, escapes and illusions. Large 1917 catalogue free. Oakes Magical Co. Dept. 549, Oshkosh, Wis.

Magic. Entertain at home. Tricks, puzzles, novelties. Big Catalogue A, 25c. Martinka & Co., Inc., Harry Houdini, President, 493 Sixth Avenue, New York City.

Black Art Hindoo experiments. 1919 edition, 25c. Invisible ink. Free trick. Catalogue each order. Lindhorst Magic X Shop, St. Louis.

Magic—Card Tricks. Sensational escapes, jokes, novelties. Everything in the amusement line. Large illustrated catalogue of a thousand tricks free. Write today. Largest amusement goods manufacturers in the world. Heaney Magic Co., Desk 205, Berlin, Wis.

Illusions—Stage Tricks with 500 Illustrations. Catalog 15c. Small catalog free. Hornmann Magic Company, 304 West 34th St., New York.

Ventriloquism taught almost anyone at home. Small cost. Send today 3c stamp for particulars and proof. O. A. Smith, Room R629, 801 Bigelow Street, Peoria, Ill.

Ten Magic Numbers, Hallowe'en Fun, $1.00. Belle Mason, Binghamton, N. Y.

Health.

Cigarette, pipe or chewing habit conquered. Nature's method. Guaranteed. Write for free brochure. Edw. J. Woods, TA-300, Station F, New York.

Tobacco or Snuff Habit Cured or no pay; $1 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

Tobacco Habit Cured—$1 prepaid. Harrison, 105 Walker, Evansville, Ind.

Instruction

Questions answered. All subjects. Details free. Answerall Information Bureau, 51 Cliff St., N. Y.

Free Advice? No! Our advice is the best. We advise on any subject, no matter how complicated; we have the best experts. We also make translations from any language. Tell us about your problems. Any one can understand us. Our charges are nominal. We invite your correspondence. Phone, Forsyth 1690, if you wish. A trial will convince you. Remember, poor advice is dear at any price. Paragon Technical Bureau, 329 East Fifth St., New York City.

Telegraphy.

Telegraphy (both Morse and wireless) and Railway Accounting taught thoroughly and quickly. Big salaries now paid. Great opportunities. Oldest and Largest School—est. 45 years. Catalog free. Dodges Institute, 7th St., Valparaiso, Ind.

Help Wanted.

American Made Toys Wanted. An opportunity for homeworkers on small scale and manufacturers on large scale. Unlimited quantities needed of Toy Soldiers. Army, Navy, Marines, Cannons, Machine Guns, Warships and other Toys and Novelties. Greatest chance for industrious people for independent business. Enormous demand and future in American Made Toys, all over United States, Canada, Mexico and South America with over 50,000 10 cents stores and toy dealers. This new American industry stands out conspicuously. Factories are established, people trained, machineries made. Christmas Sets needed in millions this year. The great hit for 1919 without any competition. We are buyers of these goods all year, paying fixed prices. Attractive prices offered for painted goods. Experience or tools unnecessary. Hundred and more made complete per hour. Casting-form outfits from $3.00 up. If you mean business, send for booklet and information free. Toy Soldier Manufacturing Co., 32 Union Square, New York.

Wanted, Men. Become Auto Experts. $35 Week, Earn while learning. Franklin Institute, Dept. J. 806, Rochester, N. Y.

Men wanted for Detective Work. Write J. Ganor, Former U. S. Government Detective, Danville, Ill.

Secret Service Operatives and Detectives are in demand. Earn Big money. Travel everywhere. Fascinating work. Learn this profession by home study. Particulars free. American School of Criminology, Dept. E., Detroit, Mich.

U. S. Government Wants Clerks. Men—women 18 or over. $1,000-$1,600 year. Permanent clerical positions. List positions free. Write immediately. Franklin Institute, Dept. J. 26, Rochester, N. Y.

Stamps & Coins.

California Gold. Quarter size, 27c.; Half dollar size, 53c.; dollar size, $1.10; large cent, 1820, and catalogue, 10c. Norman Shultz, Kings City, Mo.

Stamps—61 All Different Free. Postage, 3c. Mention paper. Quaker Stamp Co., Toledo, O.

1,000 U. S. and Foreign Stamps, including Mexican Villa Dollar, 25c. C. W. Parker, 77 Kensington Heights, Meriden, Conn.

100 Different Stamps 12c.; 200, 27c. Michaels, 5600 Prairie, Chicago.

Best One Cent Approvals in America. F. P. Hand, 1117 So. 60th St., Philadelphia, Pa.

100 Different Stamps, 10c. 100 U. S., 25c. Buckey, 412 Bowen, Dayton, Ohio.

Stammering.

St-Stu-t-t-tering and Stammering cured at home. Instructive booklet free. Walter McDonnell, 105 Potomac Bank Bldg., Washington, D. C.

For the Hair.

Don't Use Soap. Shampoos containing Soap or Alkalies injure the Hair. "Tricon" Herb Shampoo made from Mexican Amole, and other Roots and Barks contain neither. Cleanses the Scalp, removes Dandruff, stimulates Growth, restores Softness and Gloss. 10 cents postpaid. Agents Wanted. W. L. McDaniel, Box 916, El Paso, Texas.

Do You Want Hair? You can have it by using The Ekdee Hair Cerate. 95% of baldness curable. Thin hair made thick. (Not a dye.) One month's trial sent postpaid for $2.10. The Ekdee Company, 800 Union Ave., North Portland, Oregon.

I Was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have good hair-growing results. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E. 32nd St., BA-300, New York.

Song Poems Wanted.

Write the Words for a Song. We revise poems, write music and guarantee to secure publication. Submit poems on any subject. Broadway Studios, 197C Fitzgerald Bldg., New York.

Write the Words for a Song. We write music and guarantee publisher's acceptance. Submit poems on war, love or any subject. Chester Music Co., 920 So. Michigan Ave., Room 265, Chicago, Ill.

Only Poems having commercial possibilities accepted. I revise poems, compose, arrange, edit and autograph music for Chicago's best music firms. Irving Ginrich, 646 Belden Ave., Chicago.

Printing.

500, 3 x 6, 2 Color Circulars, neatly printed and sent prepaid for only $1.00. Robinson's Print Shop, Portland, Conn.

500 Two-Color Letterheads, $2.05. Samples Free. Printshop, 1915 S. Kedzie, Chicago.

100 Bond Letterheads and Envelopes, $1.25 Postpaid. Garland Miller, Trimble, Ohio.

1000 Letterheads, Envelopes, Typewriter Letters, $2. Circulars, Labels, $1; samples. M. Lemond, 65 Broadway, Brooklyn, N. Y.

100 Engraved style visiting cards, 50c.; 100 emblem cards, 70c. H. Gregory, Warwick, N. Y.

Attractive Gummed Labels Samples Free! Edward Harrison, "Guaranteed Printing," Baltimore.

Miscellaneous

For Sale. Choice Silver Black breeding foxes. Reid Bros., Bothwell, Ont., Canada.

Steam-No-More for eyeglasses and auto-windshields. Send ten cents for twenty-five cent sample. Gray's Sales Agency, Port Huron, Michigan, Dept. J.

Mansfield's Automatic water and oil finder a proved success, silver medal awarded. Particulars from Edwin A. Mansfield & Co., 94 Victoria Road, New Brighton, England.

Shoes for Everybody at reasonable prices. Save money and send for free descriptive circulars. Central Sales Co., 599 Ninth Ave., New York.

Wanted. Small Gasoline and Steam Engines, Small Lathes, Drill Presses and other light machinery. Will pay high cash prices for good material. Johnston, West End, Pittsburgh, Pa.

Patent Attorneys.

Patents—My fee payable in monthly installments. Send sketch for advice. Booklet free. Frank Fuller, Washington, D. C.

Millions spent annually for ideas! Hundreds now wanted! Patent yours and profit! Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. 212 Patent Dept., American Industries, Inc., Washington, D. C.

Patents Procured, Trade Marks Registered. A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C., or 2278-T Woolworth Bldg., New York.

Inventors. Send sketch of your invention for advice regarding patent protection. Twenty years' experience. Handbook on patents sent Free. Talbert & Talbert, Patent Lawyers, 4822 Talbert Bldg., Washington, D. C.

John M. McLachlen, Atty. at Law, Patents, Trade Marks, Copyrights, 410 McLachlen Bldg., Washington, D. C.

M. F. Miller, Ouray Building, Washington, D. C., Patent Attorney, Mechanical and Electrical Expert. Best quality of work and results. Moderate charges. Advice free.

Patents. Foremost word free. Write now. Metzger, Washington, D. C.

Patent Attorney. Electrical engineer, mechanical expert; thorough personal service. Frank Ledermann, 21 Park Row, New York.

Patent Your Own Inventions. Save attorney's fees; we prepare applications; furnish full instructions and give satisfaction. Free information. Carl Larsen Co., Park Row Bldg., New York City.

Inventors' Adviser. Sent free on request. Wm. C. Linton, 918 F St., N.W., Washington, D. C., 363 University St, Montreal, Canada.

Patents promptly procured by personal expert service. Information on request. James D. Lyles, Washington, D. C.

Patents. Prompt, personal efficient service by an Attorney-at-law skilled in all branches of Patent practice. Over 12 years' actual experience, full information upon request. B. P. Fishburne, 324 McGill Bldg., Washington, D. C.

Phonographs and Supplies.

Build Your Phonograph. "Perfection" high-quality spring and electric motors, tone arms, reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Ind.

Build Your Own Phonograph and manufacture them for profit. Drawing instructions, parts, price list, blueprints, etc., complete, sent free upon request. Write today. Associated Phonograph Co., Dept. E-1, Cincinnati, Ohio.

Make Your Own Phonograph. Particulars free. DeSelO-PhonE, P. O. Box 720, Attica, Indiana.

GREATEST TOY SENSATION OF THE DAY!

FIGHTING DREADNAUGHT

SENSATIONALLY REALISTIC!!!

Here is a model of Uncle Sam's fighting monsters. Eight big guns, each of which flashes, at correct intervals, from twelve to twenty times. Extra ammunition always obtainable. Absolutely harmless.



Can be operated indoors or out. Now boys! Here's your chance to see a battleship in action, and the best of it is you can OWN the ship and command the fleet yourself! By having two or more battleships, you can arrange EXCITING NAVAL BATTLES in your own home. Price of Warship and Ammunition, 15c, three for 40c, or a fleet of 12 ships for $1.50 postpaid. Extra Ammunition, 5 cents per doz.

TOOTH-ACHE STOP

EASY TO USE



Stops the Pain; Stops the Tooth

Squeeze a little in hollow of tooth; the Ache Stops Instantly; the paste hardens, forming an antiseptic Filling. Absolutely harmless. Have it ready for the next bad attack. 25c per tube, postpaid.

Mysterious Ghost



This is not a pretty object, but there is fun in it for people who like practical jokes. The Ghost, when displayed in a perfectly dark place, glows with a ghastly cold bluish radiance, very apt to give one a "creepy" sensation. Once you know all about it, but a regular startler for those who come upon it, unexpectedly. A great joke to play on your mother-in-law. Price only 15 cents each, or three for 40 cents.

"SAFETY 1st" PINS



A clever novelty. The National "Safety First" Movement has made them very popular. Wear one and show your sympathy with the movement. Also handy for wearing at amateur theatricals and the like. Two sizes, ¾ in. (gold plated) and 1¼ in. (nickel-plated) 6c each, two for 10c p. pd.

INKLESS PEN

WRITES with WATER 500 words every time you dip. Makes its own ink. Writes fashionable violet color. Better and cheaper than fountain pens. Writes a long letter with one dip in plain water. No trouble—no bother—no muss. A pleasure to use. With Nickel Plated Reversible Holder 10 CENTS. 6 for 25c

SIMPLEX TYPEWRITER ONLY $2.50



Cheap But Good. So Simple a Child Can Use It. We Guarantee the Writing.

Though so marvelously cheap, this machine is a thoroughly practical Typewriter. We positively guarantee it to produce writing equal in every respect to that of any $1.00 machine. It does not seem possible at the price, but let us send you a specimen of its work and you will be convinced. With reasonable care it will last a lifetime. It is so simple that a child just able to read can write with it. You can learn all there is to know about it in five minutes, and an hour's practice will make you an expert operator. Every business man must have a typewriter. Illegible can writing is unbusinesslike and creates the impression that the firm is a no-account and slow-going concern. We assure you that the Practical Typewriter fully deserves its name as it is fit to do the correspondence of any business or profession, and to suit well. You should not miss this chance of securing a bargain. The letters of the alphabet, the numerals 1 to 10, and punctuation marks are so grouped that the letters most used are before the operator most of the time, enabling him to write rapidly. The rollers hold the paper in position while writing and at the end of each line a slight turn of the roller moves the tracker bar which makes a click and forces the paper forward, giving the proper line spacing, so that the lines are all an equal distance from each other, making a neat letter writing. Each typewriter packed in a strong box, with full printed instructions for use. Price complete, $2.50 sent by mail postpaid.

Johnson Smith & Co., Dept. E11, 3224 N. Halsted St., Chicago

SQUIRT RING



You may have a lot of fun with this Sparkling Gem Squirt Ring. It consists of a handsome-ly plated ring, attached to a rubber ball, so arranged that the latter is quite out of view when the ring is in the proper position. Such an attractive looking ring as this cannot fail to be the center of attraction. While the victim is absorbed in getting a clear view, you just squeeze the rubber ball and the observer experiences a very great surprise. PRICE 20 CENTS. three for 50 cents, postpaid. J. S. & Co.

Wonderful X-Ray Tube



A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your fingers, the lead in a lead pencil, the interior opening in a pipe stem, and many other peculiar illusions. A mystery that no one has been able to satisfactorily explain.

Price 10 cents; 3 for 25 cents; 1 dozen, 75 cents. Sent by mail, postpaid.

Sneezing Powder



Place a very small amount of this powder, the back of your hand, and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real source, but think they have caught it one from the other. Before the laughing and sneezing you yourself will be having the time of your life. For parties, political meetings, car rides, or any place at all where there is a gathering of people it is the greatest joke out. Price 12c or 3 for 30c. By Express Only

STAGE MONEY



With a bunch of these bills, it is easy for each possessor of them to appear prosperous. By flashing a roll of these bills at a crowd, and the passing off of a genuine bill or two from the outside of the roll, the effect created will be terrific. Try it and see what is desired. Prices, postpaid: 15 Bills 10c; 50 Bills 25c; 125 for 50c, or $1.00 thousand.

NEW BOOK ON ROPE SPLICING

USEFUL KNOTS, HITCHES, SPLICES, ETC.

How Different Knots Are Made and What They Are Used For. Knots to Use and Knots to Avoid.

A most practical handbook giving complete and simple direction for making all the most useful knots, hitches, rigging, splices, etc. Over 100 illustrations. All about wire rope attachments, lashing, blocks, tackles, etc. 37 Heraldic Knots illustrated. Of great value to mechanics, riggers, campers, boatmen. Price 20c p. pd.

Johnson Smith & Co., Dept. E11, CHICAGO

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night The very latest discovery in the scientific world, whereby, at a reasonable cost, practically unobtainable except at an exorbitant price, we have at last succeeded in producing this remarkable LUMINOUS PAINT, which, applied to the surface of any article, emits rays of white light, rendering it perfectly visible in the dark. THE DARKER THE NIGHT, THE MORE BRILLIANT IT SHINES. Quite simple to use. Anyone can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the push buttons or switch plates of your electric lights, match boxes, door knobs, and other articles; make your own Luminous Crucifixes, Luminous Rosaries, etc. Bottle containing sufficient to coat several small articles. Price 25c. Larger sizes 50c and $1 postpaid. Johnson Smith & Co., Dept. E11

MUSICAL KAZOO



With the Musical Kazoo you can, without any previous practice whatsoever, play any tune right off, imitate any bird or animal, bagpipe, snare drum, Punch and Judy, etc. No holes to finger. It is simplicity itself. Produces excellent music. You do not blow into it, but sing, speak, laugh or make any desired imitation. Used with astonishing results at society meetings, home, club or church entertainments, dances, serenades, picnics, outings, excursions. Just the thing for choruses and shows, bicycle and marching clubs, etc. Excellent for vocal or instrumental accompaniments, either with or without other musical instruments. Price 15c. 3d.

MAGIC FLUTE



Wonderfully Sweet Toned and Musical

A marvelous musical instrument. No other instrument can produce sweeter music, whether it be the joyous notes of the quickstep or the solemn strains of a church hymn—in fact, any class of music can be played upon the Humanatone without practice and it is almost a self-playing instrument. When played with a piano accompaniment, or any other musical instrument, the effect is charming. Full printed instructions for playing sent with each instrument.

Post Paid 15c

All the Latest Surprising and Joke Novelties

There's Serpents Eggs, box	10c	Cover the Spot Trick, a scien. nov.	10c
Miniature Water Pistol	10c	X Ray Novelty	10c
Cleopatra's Snake (very lifelike)	15c	Trick Pencil	10c
Paper Mustache (fool your friends)	6c	Needle Tricks (a good joke)	10c
Ford Auto Puzzle (Latest)	15c	Memorized Penny (defies the law of gravitation)	20c
Mysterious Ghost, shines at night	10c	Mysterious Tumbler and Vanishing Coin Trick	25c
Shaver Razor (very formidable)	20c	Magic Mirror (take one peep)	20c
Rubber Dagger (sensational)	20c	Magic Plate Lifter	20c
Window Smashers (great joke)	25c	Imitation Gold Teeth	5 for 10c
Lookbackroscope (see behind you)	15c	Great Burglar Puzzle	10c
Great Blind Reading Mystery Cds.	10c	Wire Puzzles, 10c. 22 different, $1.95	
Thurston's Mysterious Trick Cds.	10c		
Fighting Roosters, pair	10c		

JOHNSON SMITH & CO., Dept. E11, 3224 N. Halsted St. CHICAGO

Boys, you can have Movies at your own home with this latest model

MOVING PICTURE MACHINE

Uses Standard Films same as the larger machines. Very easily managed. Simply turn the handle. Good Variety of Films always obtainable

PRICE Complete ONLY $2.65 Postage 15c, extra including Film.

Extra Films, 15c each postpaid



THIS IS A GENUINE MOVING PICTURE MACHINE and the motion pictures are clear, sharp and distinct. The Moving Picture Machine is finely constructed, and carefully put together by skilled workmen. It is made of Russian Metal, has a beautiful finish, and is operated by a finely constructed mechanism. The projecting lenses are carefully ground and adjusted, triple polished, standard double extra reflector, throwing a ray of light many feet, and enlarging the picture on the screen up to three or four feet in area. The light is produced by a gasoline carbide generator, such as is used on the largest automobiles. This throws a dazzling white light on the screen.

It is a solidly constructed and durable Moving Picture Machine. The mechanism is exceedingly simple and is readily operated by the most inexperienced. The pictures shown by this marvelous Moving Picture Machine are not the common, crude and lifeless Magic Lantern variety, but are life-like photographic reproductions of actual scenes, places, and people which never tire its audiences. This Moving Picture Machine has caused a rousing enthusiasm wherever it was used.



JOHNSON SMITH & CO.

Dept. E 11 3224 N. HALSTED ST., CHICAGO

ANARCHIST BOMBS



Consists of a little glass vial containing in liquid form a chemical which will produce a most horrible odor. Dropped in a room full of people will cause more consternation than a lumbermen's picnic. The smell will entirely disappear in a short time. 3 Boxes for 25c, shipped by express only with a Dollar's worth of other merchandise.

ITCHING POWDER



This is another good practical joke; the intense discomfiture of your victims is enjoyed by everyone but themselves is thoroughly enjoyable. All that is necessary to start the scratching is to place a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more. 3 Boxes for 25c. Sent only by express. (Must order at least One Dollar's worth of other merchandise.)

INVISIBLE INK



The most confidential messages can be written with this ink, and the writing MAKES NO MARK. Cannot be seen unless you know the secret. Invaluable for many reasons. Keep your business and other private memorandums away from prying eyes. Great fun for playing practical jokes. Only 15c Bottle

LOVE LETTER INK



Writing written with this remarkable ink vanishes entirely in a few weeks (sooner if desired), leaving the paper QUITE BLANK. 15c p. pd.

LUMINOUS INK

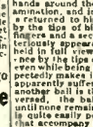
Writing can be READ ONLY IN DARK ROOM. writing shines like fire. Quite invisible at daytime. Very remarkable. 15c bottle; 3 for 40c postpaid.



JOHNSON SMITH & CO.

MULTIPLYING BILLIARD BALLS

The Best Feat of its Kind



This trick is as effective as it is surprising. The performer hands around the ball for examination, and immediately it is returned to him he rolls it by the tips of his thumbs and fingers and a second ball mysteriously appears. These are held in full view of the audience a few times, and then the performer rolls both balls down the length of the left hand, and even while being placed in position, another ball unexpectedly makes its appearance. Final y the magician apparently suffers from some kind of spasm and yet another ball is the result. The feat can then be reversed, the balls disappearing one after another until none remains. It is a very interesting trick that is quite easily performed by following the directions that accompany the apparatus. PRICE, 25 CENTS, POSTPAID. JOHNSON SMITH & CO.

GOOD LUCK RING



Quaint and unusual. A VERY striking and decorative ring, made of gunmetal. Skull and crossbone design, set with brilliant flashing gems appearing out of the eyes. A never failing object of interest. It is said by many to bring Good Luck to the wearer, hence its name Good Luck Ring, a wish we will not positively guarantee that it is certainly a very unique ring that you will take a pride in wearing. These are made to sell at 50 cents, but as a special bargain we will supply them to customers mentioning this paper, at HALF PRICE, viz., ONLY 25 CENTS, POSTPAID. JOHNSON SMITH & CO.

LOADED CIGARETTES

Just Like Ordinary Cigarettes, Sold Both Boxed and Loose



A box containing ten apparently genuine Cigarettes. They contain a trick which causes the smoker to suddenly be smosed. They smoke real, and afford as good a smoke (while they last) that the victim is taken entirely by surprise. In every respect they are entirely harmless. Price, box of ten, 10 cents, postage 2c extra.

Johnson Smith & Co., Dept. E11

THE "LITTLE GIANT" TYPEWRITER

A First Class Writing Machine For $1.25



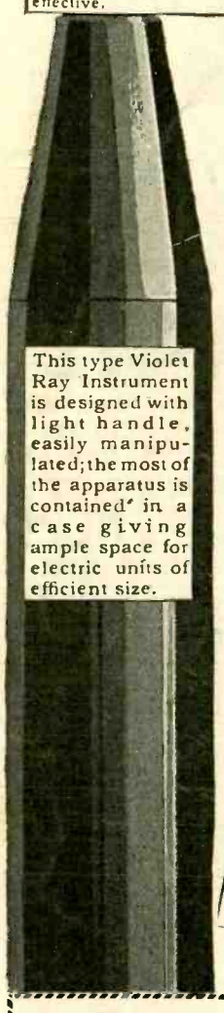
A per fect little typewriter for $1.25. There are thousands of persons who would like to own a typewriter but whose needs and business do not warrant the expense at actual cost to the purchase and there are many persons who would be glad to operate a machine if it could be had for a mere trifle. Such a machine is the "Little Giant" typewriter. It is a perf

Regain Your Health Thru Renulife VIOLET RAY Treatments at Home



Unequaled for neuritis and rheumatism

More Than 25,000 Volts
No pain, shock or muscular contraction. Entirely harmless — powerfully effective.



This type Violet Ray Instrument is designed with light handle, easily manipulated; the most of the apparatus is contained in a case giving ample space for electric units of efficient size.

There is no "quackery" or uncertainty about *Renulife Violet Ray*. It is not claimed to be a "Cure All," but it has proved in thousands of cases a practical health-producing, revitalizing agent—powerful in restoring normal physical conditions—yet gentle, soothing and perfectly safe. *You* can treat yourself. Get full information regarding uses shown on coupon below.

Users Get Wonderful Results

(Voluntary Testimonials)

"The Renulife Violet Ray High Frequency Generator is superior in efficiency because of its perfect character and control of current, compactness and perfect insulation. The smallness and lightness of Electrode holder is also a great advantage." "The doctor told me that the trouble was hardening of the arteries. I wish I had got it a year ago. I would not be without it for all the money in the world." "I cannot recommend it too highly." "I have been using mine now for a week for Sciatica and I am highly pleased with results." "I think it is one of the best little machines that was ever invented." "I have used it with excellent results for the restoration of hair and stiff and sore rheumatic finger joints." "Am well pleased with the Generator, and the kind treatment received from your Company." "My Generator has stopped my neuritis." "Every house should have a Renulife Violet Ray High Frequency Generator, for the treatment of Neuralgia, Neuritis, Sore Throat, Kernels in Neck, Cramps, Headache, Stiff Neck, Muscular Soreness, Rheumatism, Paralysis—in short, pains of all kinds."—M. D. "I have been much relieved by the use of your Violet Ray Generator." "It is fine for Insomnia." "I find it such a help in nervousness." "I would not part with it for five times the price. It is sure a little wonder." "I am more than pleased with the Generator; the whole family are using it." "A neighbor lady was suffering from lumbago and could not move, and my wife brought over the Generator and in less than ten minutes the lady was greatly relieved." "Your Generator is just the thing for me. That tired feeling has left me, and I feel like myself again." "It has relieved me of the nervousness and also it has helped me a great deal in using it for the treatment of rheumatism."

How Renulife Benefits

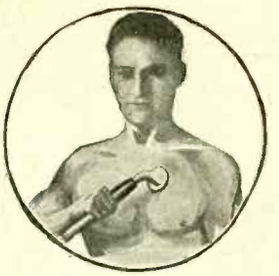
Science has demonstrated a strange relation between electricity and life cells. This instrument harnesses a tremendous current of electricity and applies in the form of Violet Rays so that the body welcomes and responds to it in a marvelous manner—no pain—shock or the slightest harmful effects. A few seconds of Renulife Violet Ray gives more benefit than hours of the old time battery methods—because a thousand times as much voltage is made use of.

The irresistible, revitalizing powers of *Renulife Violet Ray* reach every nerve cell, fibre and part of body. Blood is enriched and purified by a flood of oxygen, giving added vitality and strength. Assimilation and digestion improved—functions retored to normal—extra supply of fresh blood quickly brought to area treated, removing congestion and supplying nourishment. While relieving pains and aches, the manifest results of disorders, it removes the deep seated cause, combines the benefits of electricity, vibration, exercise, stimulation and oxidation.

Get Book "Health via Violet Ray"

Learn the whole marvelous story of the Violet Ray—this method that works with nature to restore and build up. Learn how you, at home, can now use these great curative forces of Violet Ray—heretofore only available at big expense from physicians or beauty doctors. Send coupon or postal card now and receive free book describing uses, quoting low prices (within the reach of all) and explaining liberal *Trial Plan*.

Renulife Electric Co., Inc.
1209 Marquette Bldg., Detroit, Mich.
CANADIAN RENULIFE ELECTRIC CO., Ltd.,
1209 Netting Bldg., Windsor, Ont.
Toronto Office: 612 C. P. R. Building.
[Live Sales Representatives write for proposition



Increases energy and vitality



Treatment for nervousness and general debility



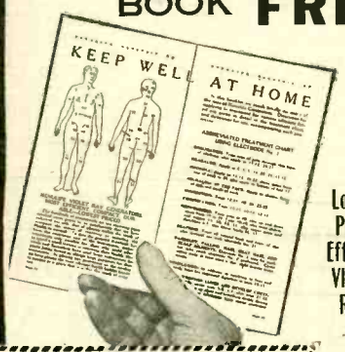
Ozone most beneficial for catarrh, throat and lungs. Also anemia



Stops falling hair — promotes hair growth. Wonderful beauty aid

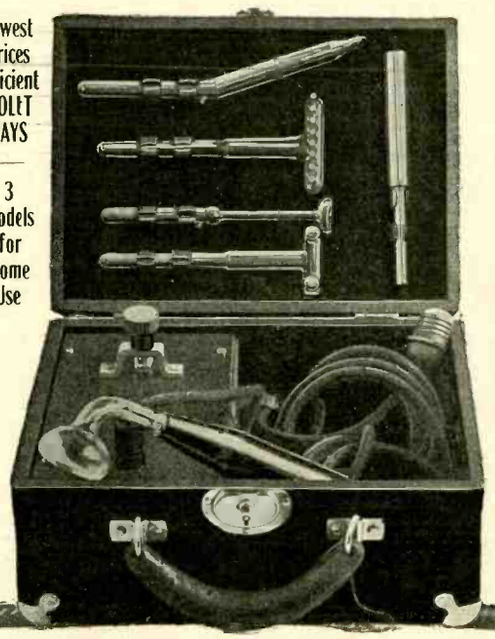
Chicago Office
Room 410
123 West Madison

BOOK FREE



Lowest Prices Efficient VIOLET RAYS

3 Models for Home Use



COUPON FOR BOOK and Special Information

RENULIFE ELECTRIC CO.,
1209 Marquette Bldg., Detroit, Mich.

Please send without obligation, your book "Health," explaining Violet Ray treatments with Renulife Generators; also give full particulars as to its application for ailments checked below.

TREATS SUCCESSFULLY

..Abscesses	..Facial Neuralgia	..Piles
..Anemia	..Falling Hair	..Pimples
..Asthma	..Goitre	..Pyorrhea
..Arteriosclerosis	..Gout	..Rheumatism
..Baldness	..Hay Fever	..Scars
..Blackheads	..Infantile Paralysis	..Sciatica
..Brain Fag	..Insomnia	..Skin Diseases
..Catarrh	..Lameness	..Throat Diseases
..Colds	..Locomotor Ataxia	..Sprains
..Chilblains	..Lumbago	..Toothache
..Dandruff	..Nervous Affections	..Weak Eyes
..Deafness	..Neuralgia	..Wrinkles
..Eczema	..Neuritis	..Warts and Moles
..Enlarged Prostate	..Paralysis	

Write your name and address in margin below and cut out with coupon

Copyright, 1919, R. E. Co.

The price goes up

Your last chance to procure a complete electrical education at as low a price as $16, payable $2 per month.



The price of the CROFT LIBRARY OF PRACTICAL ELECTRICITY must go up. We have fought against this increase as long as we could. You have, however, one more chance to purchase at the old price.

In fairness and justness to the readers of this paper, we desire to give everyone notice of the change in price before it goes into effect.

Know electricity as experts know it

No other library or course on the practical side of electricity adheres so closely to actual electrical work as the Croft Library of Practical Electricity. No other set of books or course is more modern, complete, or more easily understood. This Library, with its mine of working details, enables you to master electricity quickly, and to know it as experts do.

The standard in America

Terrell Croft has had twenty years' experience in electrical practice. He started as wireman's helper. Later he became trouble shooter, then draftsman, then electrical engineer for the Westinghouse Co. His twenty years' experience is boiled down to eight flexibly-bound pocket books which are now accepted as the standard in America.

Nothing better at any price

No matter how much you may pay for electrical literature, nor how much you spend on educating yourself in the finer points of practice, you cannot get more reliable, more authoritative, more detailed information than is contained in the Croft Library. It is an innovation in the world of electricity, as a ten-minute examination will prove.

Ten days' free trial
NOT ONE CENT IN ADVANCE

In order to receive advantage of the old price on these books, just fill out the coupon and return to us. Keep the books ten days and examine them thoroughly, putting their usefulness to every imaginable test. Then if they are not satisfactory, return at our expense.

Should they come fully up to your expectations, send us $2 per month for eight months.

McGraw-Hill Book Co., Inc.
239 West 39th Street New York



Meet Terrell Croft

Be guided in your study of electricity by an experienced electrical engineer of high professional standing, a man who gained his knowledge with his sleeves rolled up, and has met your problems in advance. He tells in plain, understandable language how to proceed by the best and most practical methods to the higher position.

FREE EXAMINATION COUPON

After November 29th, price of the set $20

McGraw-Hill Book Co., Inc.,
239 W. 39th St., New York.

Gentlemen:—Please send me the Library of Practical Electricity (shipping charges prepaid), for 10 days' free examination. If satisfactory I will send $2 in ten days and $2 per month until $16 has been paid. If not wanted, I will write you for return shipping instructions.

Name.....

Home Address.....

City and State.....

Where Employed.....

Occupation ..... (Ex. 10-19)

www.americanradiohistory.com

Electrical Experimenter

233 FULTON STREET, NEW YORK

Publisht by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer; R. W. DeMott, Sec'y;) 233 Fulton Street, New York.

Vol. VII. Whole No. 78 Contents for OCTOBER, 1919 No. 6

TREASURE SHIPS LOCATED ELECTRICALLY.....Front Cover
From a painting by George Wall
AIRPLANE DELIVERS SHIP MAIL AT SEA..... 505
MY INVENTIONS—NO. 6. THE ART OF TELAUTOMATICS.... 506
By Nikola Tesla
PARIS LETTER, by Jacques Boyer..... 509
WHAT THE X-RAYS SHOW..... 510
TREASURE SHIPS LOCATED ELECTRICALLY..... 512
By H. Gernsback
ELECTRICITY FOILS BANK ROBBERS..... 513
TO EUROPE IN THREE HOURS, by H. Winfield Secor..... 514
CAN RADIO IGNITE BALLOONS—THE OPINIONS OF NIKOLA TESLA AND OTHER RADIO EXPERTS..... 516
"PIPED COLD"—PROF. BELL HAS IT..... 517
RECLAIMING SUB-SEA TREASURES, by Joseph H. Kraus..... 518
TESTING PSYCHICAL PHENOMENA, WITH SCIENTIFIC INSTRUMENTS, by Hereward Carrington, Ph. D..... 521
HOW THE TELEPHONE TALKS..... 522
A NEW ERA ELECTRIC AUTO..... 523
"JERRY UP." EXPERIENCES OF AN AMERICAN SEARCHLIGHT SOLDIER WITH THE A. E. F..... 524
By Chas. K. Fankhauser, Jr.
GOOD DAY! MR. MARS, SAID PROF. TODD..... 525
POPULAR ASTRONOMY—THE SURFACE OF THE SUN..... 526
By Isabel M. Lewis, of the U. S. Naval Observatory.
AUTOMOBILE NEWS..... 529
EXPERIMENTS IN PHYSICS, NO. 3—ILLUSIONS..... 531
By John J. Furia, A. M.
PRACTICAL CHEMICAL EXPERIMENTS, by Albert W. Wilsdon.. 532
MAKING A MACHINE FOR TELEGRAPHING PICTURES, PART 2, by Leroy J. Leishman..... 533
BUILDING AND TESTING SMALL TRANSFORMERS..... 534
By J. W. Eshnaur.
EXPLOSIONS CAUSED BY LIGHT, by H. J. Gray..... 535
EXPERIMENTAL MECHANICS—NOTES ON TAPPING..... 536
By Samuel D. Cohen.
HOW-TO-MAKE-IT, PRIZE CONTEST..... 537
WRINKLES, RECIPES AND FORMULAS..... 538
Edited by S. Gernsback.
THE SUBMARINE'S UNDER-SEA RADIO—OFFICIAL DATA FROM TESTS BY EXPERTS OF THE BUREAU OF STANDARDS, WITH ILLUSTRATIONS..... 539
GOVERNMENT RADIO CONTROL—ONCE MORE..... 541
LATEST AMATEUR RADIO RECEIVING APPARATUS..... 542
By Chas. W. Noller
RADIO PROBLEMS IN AVIATION, by Edward R. Doyle..... 543
AN EFFICIENT RADIO CRYSTAL DETECTOR..... 544
By Robert F. Gowen, Radio Engineer
"LATEST PATENTS" DIGEST..... 545
WITH THE AMATEURS—PRIZE CONTEST..... 546
SCIENCE IN SLANG—KIDDING THE TROLLEY..... 547
By Emerson Easterling
"THE ORACLE"—QUESTION AND ANSWER BOX..... 548

EDITORIAL

The Elusive Martian Canals

IN 1877 Schiaparelli, in his *Memoria,* published the first maps of the planet Mars, on which were shown for the first time *canali*—the now famous—or infamous—Martian canals. In Italian this word does not mean canal, but channel, and it is due mainly to this erroneous conception that the word canal was introduced into the English, French and German languages. Just the same it stuck from the beginning, altho Schiaparelli did not at first take his "channels" to be "canals," as we understand the term. For canal with us always means an artificial waterway, and this Schiaparelli did not claim.

From 1877 down to Lowell and Pickering, astronomers and scientists have waged one of the most remarkable scientific battles in history. Books by the dozens, pamphlets by the hundreds were printed and are printed this very minute, discussing the *pros* and the *cons* of the mysterious canals. The one camp—the largest by far—believes absolutely in the existence of the Martian canals, be they artificial or natural. Hundreds of astronomers have seen the net-like lines, criss-crossing the face of our sister planet by the hundreds in all directions.

The other camp—the minority—flatly denies all existence of these lines. Their contention is that what the other fellow sees is nothing more than an optical illusion. The followers of this theory have never been able to see the fine lines on Mars, or if they really did glimpse them they have been unconvinced, stoutly maintaining their belief that what they saw was, of course, an optical illusion. They follow up the argument with the triumphant "proof" that the photographic plate, which always tells the truth, has never been able to record any one of the Martian canals.

This sounds like a good argument, *for there is no clear record* of an actual photograph showing the canals on Mars.

It is true that the Lowell observatory actually *did* photograph some of the more prominent canals, but these show up exceedingly faint, and would not be considered evidence by non-believers.

Plausible as this argument is, it can only deceive laymen; the astronomer, however, will smile at it, for it is preposterous.

And here are the reasons: When we look at the Martian canals, the light rays pass thru two atmospheres, that of Mars and our own. The terrestrial atmosphere is about thirty-five miles thick and very dense. The air of Mars is thin and passes the light rays easily. Unless Mars is exactly overhead—and it is far from that when nearest to the earth—we would view it thru thirty-five miles of air. But we never do. More often, because Mars is many degrees from zenith, we view it thru hundreds of miles of air. And this is what makes all the trouble. The air is nearly always in motion—very seldom the "seeing," as astronomers call it, is perfect. So when we attach a camera to our telescope the fine lines become blurred, due to the distortion, and consequently do not register on the plate. But there are several other reasons why we cannot photograph the canals. One is because the grain in the photographic plate is too coarse to show such exceedingly fine lines. Take a silk sewing thread and stretch it across your yard. You can see it readily in bright sunlight thirty or forty yards away, but the best photographic snapshot will not be able to register a trace on the sensitized plate.

Another important reason why we cannot photograph the canals is, because we cannot take instantaneous pictures for the reason that the light received from Mars is rather weak, and if we take a short-time exposure the moving atmosphere tends to blur the picture.

H. GERNSBACK.

The ELECTRICAL EXPERIMENTER is publisht on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions. Canada and foreign countries, $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 20 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. A green wrapper indicates expiration. No copies sent after expiration.

All communications and contributions to this journal should be address to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

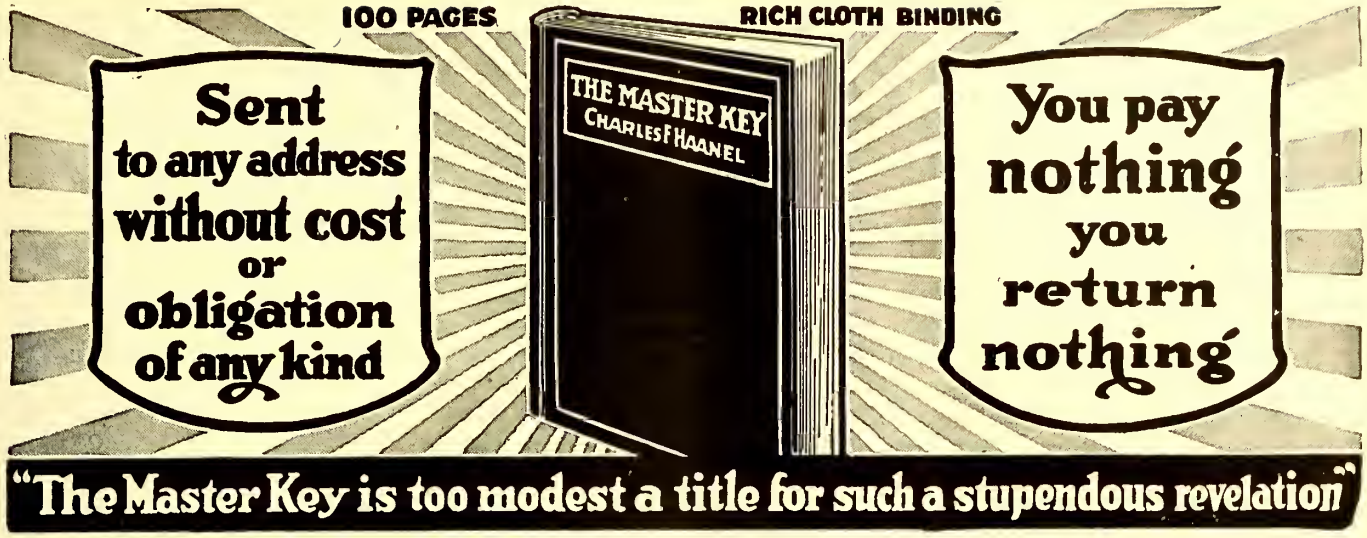
ELECTRICAL EXPERIMENTER. Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered U. S. Patent Office.

Copyright, 1919, by E. P. Co., Inc., New York. The Contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.

The ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris.

Member of the Audit Bureau of Circulation.

www.americanradiohistory.com



SOME men and women seem to attract success, power, wealth, health and attainment with very little conscious effort; others conquer with great difficulty, still others fail altogether to reach their ambitions, desires and ideals.

Why is this so?

"The Master Key" will tell you why. No one can read it and not be a changed man or woman. None but who will emerge from its magic pages with a firmer grasp of the future—a surer understanding of what he can do.

"The Master Key" is a key with which many are converting loss into gain, fear into courage, despair into joy, hope into fruition.

A copy of this magnificent, richly bound 128 page book will be sent to you, without cost or obligation of any kind, if you address

Charles F. Haanel, 203 Howard Bldg., St. Louis, Mo.

You should send for a Master Key.

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com



Wireless Operators Wanted—At once

Calls Coming in Steadily, for National Radio Institute Graduates, from all Parts of the Country. Learn Commercial Wireless, by Mail, in Ten Weeks

Commercial Radio has arrived and thousands of positions are now open in the Merchant Marine, Commercial Land Radio Service, Railroads, Radio Supply Factories, Lake and Ocean Steamship Lines, Telegraph Companies and Aerial Mail Service. We are now receiving requests for more National Radio Institute Gradutes than we can furnish.

Salaries Up to $250 a Month

With exceptional opportunity for promotion to Radio Mechanic, Electrician, or Engineer. No previous experience or training is necessary. You can Learn Wireless the National Radio Institute way, in Ten Weeks, by mail, right in your own home. With our help you can quickly qualify for a good position at big pay. Many of our students secure positions before completing the course, because it is based on actual practice and teaches what is needed to make a big success of Wireless work.

Get Your Instructions from the Nation's Capital

(Our Course is Endorsed by the U. S. Government Officials)

The National Radio Institute, headed by authorities who have been closely allied with government training of students, was established in 1914 and is the first school in America to successfully teach Wireless by Mail. The work is under the direction of J. E. Smith, E.E., director of the Radio Department, Howard University, and E. R. Haas, formerly of the Radio Division of Yale University.

We now have students throughout the world. Our location in the Nation's Capital, together with the standing of our officers and their wide acquaintance among government officials connected with Wireless activities, places us in position to give our students the best instructions obtainable and to be of the utmost help in assisting them to secure good paying positions.

Travel If You Want To

If you want to travel and see the world, go to foreign countries and increase your knowledge of world affairs, Wireless offers you the chance of a lifetime. However, you are not obliged to travel, but may secure a permanent position at one of the big Land Stations, Railroad, Telegraph or Steamship Companies if preferred.

Pay as You Learn

Our plans of payment bring a wireless education within the reach of anyone who desires to learn. A small payment down on our convenient payment plan, and small following payments, enables you to earn the cost of your tuition while actually learning to be a wireless operator.

Free Instruments to Every Student

In addition to five text books—35 special Lessons and 18 Personal Examinations—we send you, while taking our course, a Standard Automatic Wireless Transmitting and Receiving Set for sending and receiving messages. These fine instruments are Free only to National Radio Institute Students.

Oldest Wireless School in America

In addition to being the oldest and largest Wireless School in America, our location in the Nation's Capital enables our Students' Employment Department to keep in close touch with the best openings for our graduates. A Post Graduate Course is Given Free to every graduate.

FREE

Our booklet, "Wireless the Opportunity of Today," gives you complete information in regard to our course, the quick and easy methods by which you can master wireless, and other important facts you should know. It is free. Just mail the coupon. No obligation whatever on your part.

Mail This Coupon Today

National Radio Institute,
Department 131, Washington, D. C.

Send me, free of charge, your booklet "Wireless The Opportunity of Today", with full particulars regarding your famous 10 weeks' Home Study Course and your Special FREE INSTRUMENT OFFER.

Name .....

Address .....

City..... State.....

www.americanradiohistory.com

The Coupon Saves You $43

And you may pay for your Oliver at the rate of only $3 per month

For $57 you can now obtain the identical Oliver Typewriter formerly priced at $100. Thus you save nearly half. You get the finest typewriter we have ever built, our latest model, the No. 9. If any typewriter is worth $100, you will agree that it is this splendid, speedy Oliver.

With the coming of the new price, not the slightest change has been made in the machine. In every way it is exactly what we formerly priced at $100.

SEP 22 1919 U. S. PATENT OFFICE

As a man is known by the company he keeps, so is an Oliver

Among its 700,000 purchasers are such distinguished concerns as;

Columbia Graphophone Co.
Baldwin Locomotive Works
National City Bank of N. Y.
Boston Elevated Railways
Hart, Schaffner & Marx
U. S. Steel Corporation
New York Edison Co.
American Bridge Co.
Diamond Match Co.
and others of great rank

Our reason for a Lower Price

Men wonder how we have effected such a remarkable reduction in price without changing the Oliver.

Let us explain. During the war we learned many lessons in economical distribution, ways of saving.

We found that it was unnecessary to have great numbers of traveling salesmen and numerous, expensive branch houses throughout the country.

We were able to discontinue many other superfluous sales methods. As explained further in our booklet, "The High Cost of Typewriters — The Reason and the Remedy."

Old-time, extravagant methods had to go during the war. And our new plan was so successful that we are continuing it. We hope never to go back to a $100 price, which was the standard for so many years.

Free Trial—Send No Money

Our new plan is simple. It permits you to be your own salesman. You may order a free-trial Oliver directly from this advertisement, via coupon.

Note that the coupon brings either an Oliver or further information.

When you receive the Oliver, use it as if it were your own. Give it every test. Compare it.

If you agree that it is the finest typewriter at any price, and wish to keep it, then pay us at the rate of $3 per month.

If you want to return it, ship it back, express collect. We even refund the out-going transportation charges.

During the free trial, you can be your own judge, with no one to influence you.

You need not feel under the slightest obligation to buy. Let merit decide.

No Need to Wait

With such a liberal offer, made by a $2,000,000 concern, no one need be without a typewriter now. The low price removes the old-time barrier. And our easy payment plan makes it possible to have an Oliver while paying.

Mail the coupon now for EITHER a free trial Oliver or further information, including illustrated catalog.

Canadian Price, $72

The Oliver Typewriter Co.
677 Oliver Typewriter Bldg. Chicago, Ill

Was $100
Now $57



Save $43

THE OLIVER TYPEWRITER COMPANY
677 Oliver Typewriter Building, Chicago, Ill.

☐ Ship me a new Oliver Nine for five days free inspection. If I keep it, I will pay $57 at the rate of $3 per month. The title to remain in you until fully paid for.

My shipping point is.....
This does not place me under any obligation to buy. If I choose to return the Oliver, I will ship it back at your expense at the end of 5 days.

☐ Do not send a machine until I order it. Mail me your book—"The High Cost of Typewriters—The Reason and the Remedy," your de luxe catalog and further information.

Name .....
Street Address.....
City..... State.....
Occupation or Business.....

98.02

www.americanradiohistory.com



"I was astounded at my new power over men and women. People actually went out of their way to do things for me, they seemed EAGER TO PLEASE ME"

The Secret of Making People Like You

"Getting people to like you is the quick road to success—it's more important than ability," says this man. It surely did wonders for him. How he does it—a simple method which anyone can use instantly.

ALL the office was talking about it, and we were wondering which one of us would be the lucky man.

There was an important job to be filled — as Assistant-to-the President. According to the general run of salaries in the office, this one would easily pay from $7,000 to $10,000 a year.

The main requisite, as we understood it, was striking personality and the ability to meet even the biggest men in their offices, their clubs, and their homes on a basis of absolute equality. This the firm considered of even more importance than knowledge of the business.

You know just what happens when news of this sort gets around an office. The boys got to picking the man among themselves. They had the choice all narrowed down to two men—Harrison and myself. That was the way I felt about it, too. Harrison was big enough for the job, and could undoubtedly make a success of it. But, personally, I felt that I had the edge on him in lots of ways. And I was sure that the firm knew it, too.

Never shall I forget my thrill of pleasure when the president's secretary came into my office with a cheery smile, looked at me meaningly, handed me a bulletin and said, "Mr. Frazer, here is the news about the new Assistant-to-the-President." There seemed to be a new note of added respect in her attitude toward me. I smiled my appreciation as she left my desk.

At last I had come into my own! Never did the sun shine so brightly as on that morning, and never did it seem so good to be alive! These were my thoughts as I gazed out of the window, seeing not the hurrying throngs, but vivid pictures of my new position flashing before me. And then for a further joyous thrill I read the bulletin. It said, "Effective January 1, Mr. Henry J. Peters, of our Cleveland office, will assume the duties of Assistant-to-the-President at the home office."

Peters! Peters!—surely it *couldn't* be Peters! Why, this fellow Peters was only a branch-office salesman. . . . *Personality!* Why, he was only five feet four inches high, and had no more personality than a mouse. Stack him up against a big man and he'd look and act like an office boy. I knew Peters well and there was nothing to him, nothing at all.

January the first came and Peters assumed his new duties. All the boys were openly hostile to him. Naturally, I felt very keenly about it, and didn't exactly go out of my way to make things pleasant for him—not exactly!

But our open opposition didn't seem to bother Peters. He went right on with his work and began to make good. Soon I noticed that, despite my feelings against him, I was secretly beginning to admire him. He was winning over the other boys, too. It wasn't long before we all buried our little hatchets and palled up with Peters.

The funny thing about it was the big hit he made with the people we did business with. I never saw anything like it. They would come in and write in and telephone in to the firm and praise Peters to the skies. They insisted on doing business with him, and gave him orders of a size that made us dizzy to look at. And offers of positions! why, Peters had almost as many fancy-

www.americanradiohistory.com

figure positions offered to him as a dictionary has words.

What I could not get into my mind was how a little, unassuming, ordinary-to-look-at-chap like Peters could make such an impression with everyone—especially with influential men. He seemed to have an uncanny influence over people. The masterly Peters of today was an altogether different man from the commonplace Peters I had first met years ago. I could not figure it out, nor could the other boys.

One day at luncheon I came right out and asked Peters how he did it. I half expected him to evade. But he didn't. He let me in on the secret. He said he was not afraid to do it as there was always plenty of room at the top.



"People would come in and write in and telephone in and praise Peters to the skies . . . he was showered with offers of fancy figure positions."

What Peters told me acted on my mind in exactly the same way as when you stand on a hill and look through binocular glasses at objects in the far distance. Many things I could not see before suddenly leaped into my mind with startling clearness. A new sense of power surged through me. And I felt the urge to put it into action.

Within a month I was getting remarkable results. *I had suddenly become popular.* Business men of importance who had formerly given me only a passing nod of acquaintance, suddenly showed a desire for my friendship. I was invited into the most select social circles. People—even strangers—actually went out of their way to do things for me. At first I was astounded at my new power over men and women. Not only could I get them to do what I wanted them to do but they actually anticipated my wishes and seemed eager to *please me.* But let me tell you some of my experiences.

One of our biggest customers had a grievance against the firm. He held off payment of a big bill and switched to one of our competitors. I was sent to see him. He met me liked a cornered tiger. A few words and I calmed him. Inside of fifteen minutes he was showering me with apologies. He gave me a check in full payment, another big order, and promised to continue giving us all his business.

For certain reasons it became necessary for the firm to obtain a signed letter from a prominent public man. Three of our men had tried, and failed. Then I was given the job. I felt I had been made the "goat." But I got the signed letter, and with it an inside tip which enabled us to land a prize order about which our competitors are still guessing and wondering.

Then trouble sprang up at one of our factories. Then men talked strike. Things looked ugly. I was sent to straighten it out. On the eve of a general walkout, I pacified the men and headed off the strike. And not only this, but ever since then this factory has led all our other plants in production.

I could tell you dozens of similar instances, but they all tell the same story—the ability to make people like you, believe what you want them to believe, and to do what you want them to do. I take no personal credit for what I have done. All the credit I give to the method Peters told me about. We have told it to lots of our friends, and it has enabled them to do just as remarkable things as Peters and I have done.

Which reminds me: One of my wife's close friends moved to another town where she was a stranger. My wife of course knew of my method. She told it to her friend with the idea that it might be of assistance to her in meeting new people. It helped her so wonderfully that in a very short time she won the close friendship of many of the "best families" in the town. Every one wonders how she did it. But WE know.

But you want to know what method I used to do all these remarkable things. It is this: You know that every one doesn't think alike. What one likes another dislikes. What pleases one offends another. And what offends one pleases another. Well, there is your cue. You can make an instant hit with any one if you say the things they want you to say, and act the way they want you to act. Do this and they will surely like you, and believe in you, and will go miles out of their way to PLEASE YOU.

You can do this easily by knowing certain simple signs. Written on every man, woman and child are signs, as clearly and as distinctly as though they were in letters a foot high, which show you from one quick glance exactly what to say and to do to please them—to get them to believe what you want them to believe—to think as you think—to do exactly what you want them to do.

In knowing these simple signs is the whole secret of getting what you want out of life—of making friends, of business and social advancement. Every great leader uses this method. That is why he IS a leader Use it yourself and you will quickly become a leader—nothing can stop you. And you will want to use it for no other reason than to protect yourself against others.

What Peters told me at luncheon that day was this: "Get Dr. Blackford's 'Reading Character at Sight.'" I did so. This is how I learned to do all the remarkable things I have told you about.

You have heard of Dr. Blackford, the Master Character Analyst. Many concerns will not employ a man without first getting Dr. Blackford to pass on him. Concerns such as Westinghouse Electric and Manufacturing Company, Baker-Vawter Company, Scott Paper Company and many others pay Dr. Blackford large annual fees for advice on dealing with human nature.

So great was the demand for these services that Dr. Blackford could not even begin to fill all the engagements. So Dr. Blackford has explained the method in a simple seven-lesson course entitled "Reading Character at Sight." Even a half hour's reading of this remarkable course will give you an insight into human nature and a power over people which will surprise you.

Such confidence have the publishers in Dr. Blackford's course, "Reading Character at Sight," that they will gladly send it to you on approval. Send no money. Merely fill in and mail the coupon. The complete course will go to you instantly, on approval, all charges prepaid. Look it over thoroughly. See if it lives up to the claims made for it. If you do not want to keep it, then return it, and the transaction is closed. And if you decide to keep it—as you surely will—then merely remit Five Dollars in full payment.

Remember, you take no risk, you assume no obligation. The entire course goes to you on approval. You've everything to gain—nothing to lose. So mail the coupon NOW, while this remarkable offer remains open.



"In a very short time she won the close friendship of many of the 'best families' in town"

----FREE EXAMINATION COUPON----

Independent Corporation

Publishers of The Independent Weekly

Dept. B-11010 119 West 40th St., New York

You may send me Dr. Blackford's Course of seven lessons entitled "Reading Character at Sight." I will either remail the course to you within five days after its receipt, or send you $5 in full payment of the course.

Name.....

Address.....

.....

Elec. Exper. 10-19

www.americanradiohistory.com

The MOUNTAINS COME TO YOU

YOU know how invigorating and healthful mountain air is — how beneficial it is to the lungs. It is doubly invigorating right after a thunderstorm. Then the air is highly charged with ozone produced by lightning discharges thru the air. The exhilarating twang is the mixture of this ozone with diffused pine needle oil from the pines.

It is now possible for you to get exactly the same effect artificially and without leaving your home, by means of the

ROGERS OZONE GENERATOR

The Ozone Generator, figuratively speaking, brings the mountains to you, because it produces a heavy flow of ozone combined with vaporized pine needle oil. To inhale the fumes of this generator is like a trip to the most famous mountain health resorts of the country, and you can have the treatment at practically no cost, at any time you desire. For lung and bronchial troubles, especially for hay fever, catarrh, colds, etc., it gives remarkably quick relief.

Our Ozone Generator can be used with any high frequency violet-ray machine, but it is specially built for our own make as illustrated. Made entirely of glass and can be used by anyone.

In connection with this machine we recommend our Type D Violet Ray, High Frequency Generator

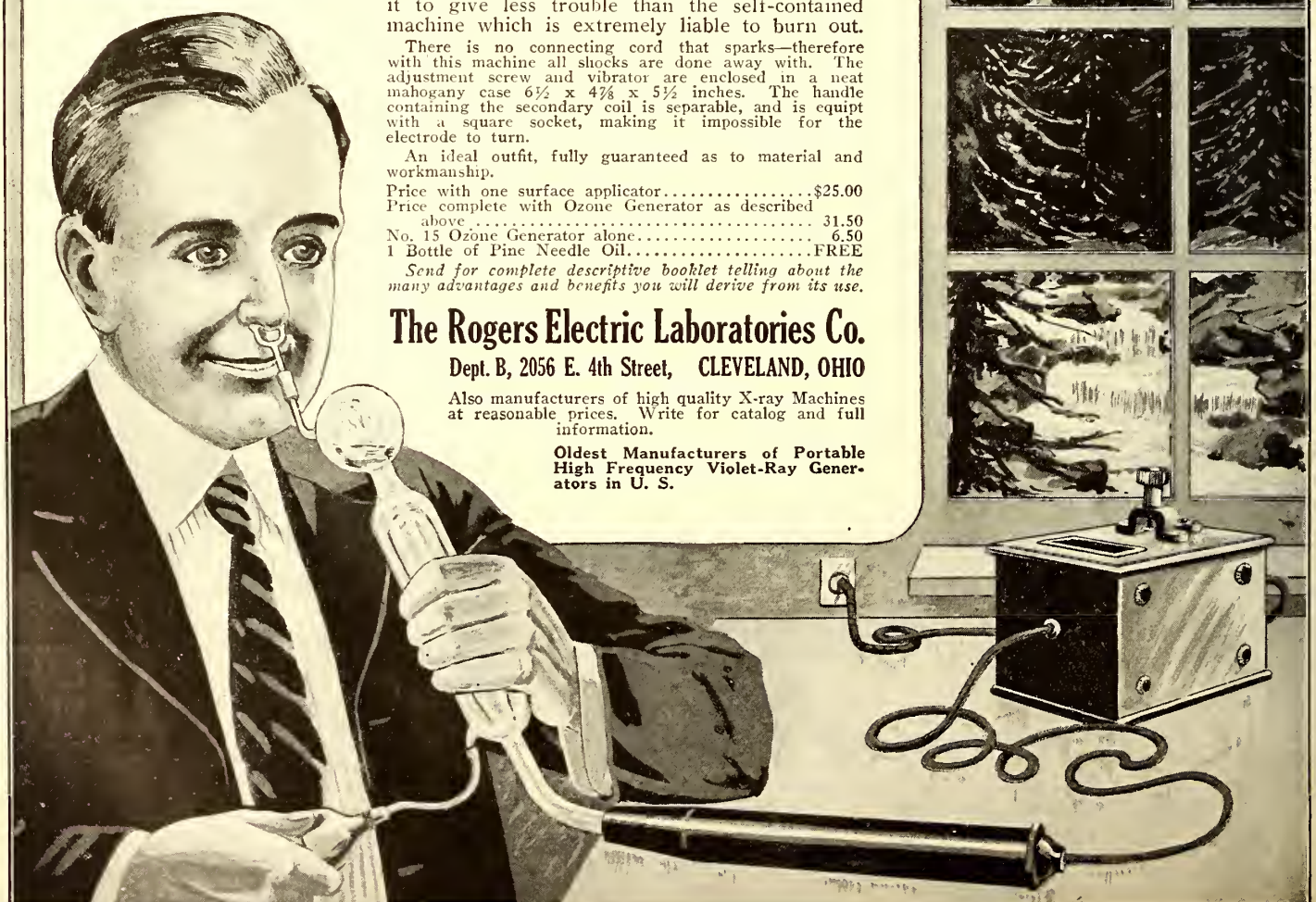
This is a powerful machine of very substantial construction, and the range of adjustment is very wide. We recommend this machine, because we have found it to give less trouble than the self-contained machine which is extremely liable to burn out.

There is no connecting cord that sparks—therefore with this machine all shocks are done away with. The adjustment screw and vibrator are enclosed in a neat mahogany case 6½ x 4⅞ x 5½ inches. The handle containing the secondary coil is separable, and is equipt with a square socket, making it impossible for the electrode to turn.

An ideal outfit, fully guaranteed as to material and workmanship.

Price with one surface applicator.....$25.00
Price complete with Ozone Generator as described above..... 31.50
No. 15 Ozone Generator alone..... 6.50
1 Bottle of Pine Needle Oil.....FREE

Send for complete descriptive booklet telling about the many advantages and benefits you will derive from its use.



The Rogers Electric Laboratories Co.

Dept. B, 2056 E. 4th Street, CLEVELAND, OHIO

Also manufacturers of high quality X-ray Machines at reasonable prices. Write for catalog and full information.

Oldest Manufacturers of Portable High Frequency Violet-Ray Generators in U. S.

Why Some Foods Explode in the Stomach

And How 48 Hours Makes New Stomachs from Old

By R. S. THOMPSON

A MAN'S success in life depends more on the co-operation of his stomach than on any other factor. Just as an "army moves on its stomach" so does the individual. Scientists tell us that 90% of all sickness is traceable to the digestive tract. Yet in a surprisingly large number of cases even chronic stomach trouble can be remedied in from 48 to 72 hours.

Physical efficiency is the back-bone of mental efficiency. Unless our stomachs are effectively performing their functions in the way Nature intended, we can't be physically fit. And unless we're physically fit, we can't be thoroughly successful.

As Dr. Orison Swett Marden, the noted writer, says, "the brain gets an immense amount of credit which really should go to the stomach." And it's true — keep the digestive system in shape and brain vitality is assured.

Of course, there are successful men who have weak digestions, but they are exceptions to the rule. They succeeded *in spite* of their physical condition. Ten times the success would undoubtedly be theirs if they had the backing of a strong physique and a perfect stomach. There are a thousand men who owe their success in life to a good digestion to every one who succeeded in spite of a poor digestion and the many ills it leads to.

The cause of practically all stomach disorders — and remember, stomach disorders lead to 90% of all sickness —is wrong eating.

Food is the fuel of the human system, yet some of the combinations of food we put into our systems are as dangerous as dynamite, soggy wood and a little coal would be in a furnace—and just about as effective. Is it any wonder that the average life of man today is but 39 years — and that diseases of the stomach, liver, and kidneys have increased 103% during the past few years!

The trouble is that no one has, until recently, given any study to the question of food and its relation to the human body. Very often one good harmless food when eaten in combination with other harmless foods creates a chemical reaction in the stomach and literally explodes, giving off dangerous toxics which enter the blood and slowly poison our entire system, sapping our vitality and depleting our efficiency in the meantime.

And yet, just as wrong food selections and combinations will destroy our health and efficiency, so will the right foods create and maintain bodily vigor and mental energy. And by right foods we do not mean freak foods — just good, every-day foods properly combined. In fact, to follow Corrective Eating it isn't even necessary to upset your table.

Not long ago I had a talk with Eugene Christian, the noted food scientist, and he told me some of his experiences in the treatment of disease through food. Incidentally Eugene Christian has personally treated over 23,000 people for almost every non-organic ailment known, with almost unvaried success. An enviable record when one considers that people nearly always go to him after every other known method has failed. And the remarkable part of it all is that Eugene Christian's methods often remedy chronic cases of stomach trouble in 48 hours.

One case which interested me greatly was that of a young business man whose efficiency had been practically wrecked through stomach acidity, fermentation and constipation, resulting in physical sluggishness which was naturally reflected in his ability to use his mind. He was twenty pounds under weight when he first went to see Christian and was so nervous he couldn't sleep. Stomach and intestinal gases were so severe that they caused irregular heart action and often fits of great mental depression. As Christian describes it, he was not 50 per cent efficient either mentally or physically. Yet in a few days, by following Christian's suggestions as to food, his constipation had completely gone, although he had formerly been in the habit of taking large daily doses of a strong cathartic. In five weeks every abnormal symptom had disappeared—his weight having increased six pounds. In addition to this he acquired a store of physical and mental energy so great in comparison with his former self as to almost belie the fact that it was the same man.

Another instance of what proper food combinations can do was that of a man one hundred pounds overweight whose only other discomfort was rheumatism. This man's greatest pleasure in life was eating. Though convinced of the necessity, he hesitated for months to go under treatment, believing he would be deprived of the pleasure of the table. He finally, however, decided to try it out. Not only did he begin losing weight at once, quickly regaining his normal figure, all signs of rheumatism disappearing, but he found the new diet far more delicious to the taste and afforded a much keener quality of enjoyment than his old method of eating, and he wrote Christian a letter to that effect.

But perhaps the most interesting case that Christian told me of was that of a multi-millionaire—a man 70 years old, who had been traveling with his doctor for several years in a search for health. He was extremely emaciated, had chronic constipation, lumbago, and rheumatism. For over twenty years he had suffered from stomach and intestinal trouble which in reality was super-aciduous secretions in the stomach. The first menus given him was designed to remove the causes of acidity, which was accomplished in about thirty days. And after this was done he seemed to undergo a complete rejuvenation. His eyesight, hearing, taste, and all of his mental faculties became keener and more alert. He had had no organic trouble—but he was starving to death from malnutrition and decomposition—all caused by the wrong selection and combination of foods. After six months' treatment this man was as well and strong as he had ever been in his life.

These instances of the efficacy of right eating I have simply chosen at random from perhaps a dozen Eugene Christian told me of, every one of which was fully as interesting, and they applied to as many different ailments. Surely this man Christian is doing a great work.

I know of several instances where rich men and women have been so pleased with what he has done for them that they have sent him checks for $500 or $1,000 in addition to the amount of the bill when paying him.

There have been so many inquiries from all parts of the United States from people seeking the benefit of Eugene Christian's advice and whose cases he is unable to handle personally that he has written a course of little lessons which tell you exactly what to eat for health, strength and efficiency. This course is published by The Corrective Eating Society of New York.

These lessons, there are 24 of them, contain actual menus for breakfast, luncheon, and dinner, curative as well as corrective, covering every condition of health and sickness from infancy to old age and for all occupations, climates, and seasons, including special summer menus which enable you to withstand the heat and retain winter's vigor.

Reasons are given for every recommendation based upon actual results secured in the author's many years of practice. Technical terms have been avoided —every point is explained so clearly that there can be no possible misunderstanding.

With these lessons at hand it is just as though you were in personal contact with the great food specialist, because every possible point is so thoroughly covered that you can scarcely think of a question which isn't answered. You can start eating the very things that will produce the increased physical and mental energy you are seeking the day you receive the lessons and will find that you secure results with the first meal. And if you suffer from acid stomach it is quite likely that your trouble will successfully be overcome in from 48 to 72 hours.

If you would like to examine these 24 Little Lessons in Corrective Eating, simply write The Corrective Eating Society, Inc., Dept. 16410, 443 Fourth Avenue, New York City. It is not necessary to enclose any money with your request. Merely ask them to send the lessons on five days' trial, with the understanding that you will either return them within the time or remit $3.00, the small fee asked.

The reason that the Society is willing to send the lessons on free examination without money in advance is because they want to remove every obstacle to putting this knowledge in the hands of the many interested people as soon as possible, knowing full well that a test of some of the menus in the lessons themselves is more convincing than anything that can possibly be said about them.

Please clip out and mail the following form instead of writing a letter, as this is a copy of the official blank adopted by the Society, and will be honored at once.

CORRECTIVE EATING SOCIETY, INC.
Dept. 16410, 443 Fourth Ave., New York City

You may send me prepaid a copy of Corrective Eating in 24 Lessons. I will either remail them to you within five days after receipt or send you $3.

Name .....

Address .....

City .....State.....

www.americanradiohistory.com



"THE 100% WIRELESS MAGAZINE"

Partial CONTENTS OF OCTOBER ISSUE:

Arc Undampt Transmission.
By Ensign P. H. Boucheron, U.S.N.R.F.

Developing Audions for the Amateurs.
By E. T. Jones, Associate Editor.

Cascade Amplification at Radio Frequencies.
By Thomas Benson.

Save Your Old Coupler.
By M. B. Lowe.

Audion Protective Device.
By Edgar Terrain Johnstone.

Selector Switch for "Rogers" Underground Antenna.
By Stanley J. Brown.

How to Make A Good Variable Condenser.
By A. Warr.

A New Radio Dynamic Controlling System.
By Lieut. W. R. Coventry.

Long Wave Receiving.
By H. L. Beedenbender.

Magnet Control for Vacuum Tubes.
By Herbert Webb.

An Amateur's Retrospect.
By Scott E. Vance.

A Short Wave Receiving Transformer.
By Raymond Evans.

Improved "B" Battery Construction.
By J. G. Reed.

An Undampt Transmitter of the De Forest Type.
By E. Dynner.

What "Radio Amateur News" Is:

With its fourth issue RADIO AMATEUR NEWS holds the field undisputedly as the greatest radio magazine in print today. In point of circulation, number of articles, illustrations, RADIO AMATEUR NEWS now leads all other wireless magazines. Take for instance the September issue with its fifty-six pages; there were fifty-one separate purely radio articles and 112 illustrations. *Over twenty-five thousand copies were printed and circulated.*

Each issue of the RADIO AMATEUR NEWS now contains 56 pages (or more) and an artistic cover in two colors. The illustrations average 125 every month and there are from 40 to 50 up-to-date articles, some by our biggest radio scientists, in every issue.

RADIO AMATEUR NEWS is the greatest and biggest radio magazine in print today.

RADIO AMATEUR NEWS is the only INDEPENDENT monthly wireless magazine in existence. It caters to no commercial interests—it has no boss save its readers. It is "different"—it has the latest radio news. It is a scientific magazine but it caters largely to the RADIO AMATEUR—it is by and for the Amateur. It is publisht by the publishers of the ELECTRICAL EXPERIMENTER, but there will be no duplication of articles in the two magazines. Both are entirely different—but both together will give you ALL the radio news of all the world. Whether you are a professor or an Amateur, get a sample copy or order it from your Newsdealer today.

Junior Radio Course By E. T. JONES Associate Editor

A distinctly new feature began with the September issue in our new **Junior Radio Course.** In the October issue Lesson No. 2 will appear complete. This course is intended for the beginner and everything presented will be in plain English—even the merest tyro in radio will find no trouble in understanding and assimilating the knowledge. The series is a very important one and nothing like it has ever appeared in print before. Everyone owes it to himself in this new age to know something about wireless and this course will enlighten all laymen. Profusely illustrated with pictures that anyone can understand.

15c The Copy

$1.50 A Year

Canada and Foreign $2.00 A Year

SEND 15c FOR SAMPLE COPY TODAY

56 PAGES
125 ILLUSTRATIONS

SPECIAL OFFER

Gentlemen:

Please enter my subscription for RADIO AMATEUR NEWS for the term of one year for which I enclose herewith $1.50. For this you will send to me immediately your great Wireless Course, containing 160 pages, 350 illustrations, size 6¾ x 10" with fine flexible cloth cover. I have added 5c extra for postage. (I have written my name and address in margin below.)

EXPERIMENTER PUB. CO., 231 Fulton St., N. Y. C.

www.americanradiohistory.com



In one way or another your whole income is staked upon your memory every day!

A Simple Test To Measure Your Memory

Could You Get By With This Big Employer Who Judges His Men On What Their Minds Retain? Try It.

NOT long ago a large eastern concern was looking for a man to fill an important position as district manager.

Several hundred applications for the job were received. The choice finally narrowed down to four names, and from these the successful candidate was to be selected.

Before the decision was made these four men were asked to do what seemed to them a most unusual thing. They were put through a test such as they had never before heard of, and each man understood that he would be judged, to a large extent, on the showing he made.

The job was filled at last and the man who won out was probably more surprised at his success than any of the others would have been had they gotten it. He knew that his experience was far less than that of two of the applicants, he was younger than any of them and it had seemed to him all along that his case was anything but hopeful. He determined to find out just why the firm put so much reliance on the simple test that each man had been asked to take.

"That little device is one of our most valuable aids in finding the men we want as employees", an officer of the company told him. "We apply it to every person who seeks a position with us from office boys up to high priced executives. The result is that our whole organization is a great deal more efficient than in the old days.



David M. Roth

"We borrowed the test from the works of David M. Roth, the memory expert, and it is our experience that one of the surest ways to know a man's mental power is to measure his memory. The fellow with a good memory has the qualities that go with a good memory and those are the things we pay big salaries for."

THIS firm had installed in a special room a replica of a store show-window facing into the room as a real store window faces the street. Behind its glass were arranged perhaps fifty different articles which were manufactured by the company itself and formed a part of their regular line. The window was well lighted and every article in it was something familiar to all.

Each man who takes the test is permitted 30 seconds to observe and memorize the objects in the window. Then he is required to leave the room and write down as many as he can remember. The proportion of them that he is able to recall determines his memory rating and, largely, his chances for getting the job.

You can measure your memory at home by means of this same test. Have someone select and arrange twenty-five articles of ordinary household use on a table. Let those who are taking the test observe them in silence for 15 seconds. Then let each person go into another room and write down the names of as many of the articles as he can remember. The result will reveal a surprising state of affairs. It will dismay you to find how quickly and absolutely the names of familiar articles, some of which perhaps you see and use every day, will slip out of your mind and refuse to return.

But the most interesting part of this test is the way it exposes the tremendous handicap you are struggling under in your daily work.

When you find what a small number of the articles on the table you are able to name after the most intense effort to impress them on your mind you begin to realize how many facts of value, how much useful knowledge, how many names, faces and figures that would make you a better man in your job drop out of your mind and are gone, leaving you in point of knowledge and experience barely ahead of where you were the month before or the year before.

Do you wonder at the importance of the memory test in hiring men for high-salaried permanent positions? Can you doubt the tremendous money value of a trained, dependable memory in business and the professions?

A STRIKING instance of this very thing came to light recently.

Forty years ago in the state of Virginia a boy of thirteen was forced to quit school and go to work when his father died. He became an apprentice in a blacksmith shop.

Today he is Vice President in charge of Production of the American Locomotive Company and one of the biggest executives in the country. He is C. K. Lassiter and his job is one of the hardest in all the range of American business. He keeps six plants with thousands of employees running smoothly. He knows every detail of the machinery in every one of these plants. He has to see that the company's locomotives are turned out on schedule time, and that each one reaches its buyer in good condition and working order.

In an interview with Mr. Lassiter appearing in the **American Magazine** for May, 1919, he says:

"My memory is today my greatest asset in business. . . . I learned to work for knowledge and to hold on to what I gained."

Such testimony is the usual thing from big leaders in all lines of work. It is because a good memory is so much more than the mere ability to recall the name of the man you met last week or the telephone number which you neglected to write down. These are merely the smaller conveniences of a good memory—the daily advantages that make you more efficient.

But in its larger phases, power of memory is power of judgment, power of foresight, power of knowledge. It matters very little what you learn today if the benefit of your experience is not with you tomorrow, or a year from tomorrow. Your judgment is only as good as your memory, because all sound decisions must be based on something learned in the past. Otherwise they are mere guesses, —gambles.

Foresight,—that quality which marks the most successful men everywhere—is nothing more nor less than applied memory. We can only foresee what **may** occur from our experience of what **has** occurred in the past. A simple matter of memory.

And all knowledge itself exists only through the ability to remember things that have been learned, information gained through experience, facts that have come to our attention at one time or another, ideas that have reached us from all sources and the knowledge of others expressed to us in speech or in printed words.

SO it is that the words "I forgot", and all these words stand for, have come to be regarded by men generally as a confession of needless weakness and an admission of failure.

And it has been David M. Roth who has showed the world just how needless a poor memory is. He has given to the public the secret of how to improve even a poor memory in a single evening. By the Roth Method hundreds of thousands of people all over the country have discovered for themselves that it is easy to have a sure-fire memory. And they have gained clearer thinking powers, stronger leadership and better self-possession along with their better memories.

One man not long ago wrote to Mr. Roth:

"You should have said that any person can improve their memory in two hours."—Charles A. Horan, 1541 W. Lehigh Ave., Philadelphia, Pa.

and another:

"The Roth Memory Course has been worth hundreds of dollars to me already."—L. D. Smith, Buffalo, Okla.

Such letters come in by the hundreds from men and women who asked to see the seven lessons of the Roth Memory Course while half in doubt about its simplicity, usefulness and power to build a leakproof memory. They have become as enthusiastic as you will be when you find that a better memory is so easy to have and so close at hand.

PROVE it? Mr. Roth, through his publishers, The Independent Corporation, gladly assumes that burden.

Send no money whatever. Simply put it up to him to show you that the Roth Course will improve your memory in a single evening's reading and give you a 100% better memory inside of a week. He is so sure of it that he will leave all argument to the seven easy lessons which comprise the course. They will be sent you all charges prepaid as soon as you give us your name and address. Use the coupon below. If the course does not satisfy you simply return it any time within five days and you owe nothing. Fair enough, isn't it?

But unless you are different from hundreds of thousands who have accepted this offer before, you'll know that you want to own the course inside of thirty minutes after you open the first lesson. When you decide to keep it, send only $5 in full payment.

Yes, it is worth finding out about. Very much so.

Free Examination Coupon

Independent Corporation
Publishers of The Independent Weekly
Dept. R11010, 119 West 40th Street, New York

Please send me the Roth Memory Course of seven lessons. I will either remail the course to you five days after its receipt or send you $5 in full payment of the course.

Name .....

Street No. .....

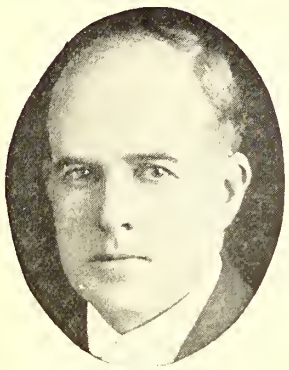
City ..... State .....

Elect. Exp. 10-19

www.americanradiohistory.com

Electricity
taught by a practical man!

Home Study Courses of Definite Value
For Experienced Men and Beginners



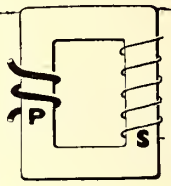
PERSONALLY CONDUCTED

by a man who has long experience as a consulting electrical engineer and who has developed the ability to impart his knowledge to others.

RIGHT in your own home, if you are ambitious, you can fit yourself for an electrical position and graduate forever from the ranks of those who are held back because of lack of technical knowledge. I don't make any false statements about the wonderful salaries you will command. But I do promise, if you are in earnest, to give you unusually valuable service that has enabled many others to increase their earnings greatly.

Each Lesson Meant for You

My method is different from others. It is based upon my years of practical experience. It leads the student quickly over fundamentals right up to practical information, such as is experienced in everyday work. You get my personal attention. It's really a class where you who want to learn and I who know the angles of the electrical industry from experience, get together. This method has been so successful that my students are sending others to me and a number of concerns require their employees to take my course.



Advancement

is made possible to any ambitious man—whether a beginner or experienced in electrical work—who will conscientiously devote his spare time to my course of study.

Tough Problems Made Simple

There isn't a problem that can't be solved if you have the proper foundation of knowledge. There is no limit to what you can achieve with the aid of the practical electrical information supplied in my course. It's up to you. I can't tell you much in this little space. Let me send you my catalog.

RESULTS OF MY SERVICE

Practical Electricians Recommend My Course to Others.
My Students Are Invariably Promoted and Get Better Salaries.
Over 65 Per Cent. of My Students Are Engaged in the Electrical Business.
Over 11 Per Cent. of My Present Enrollment Came Through Satisfied Students.
Beginners Get Employment in Electrical Work After Taking My Course a Short While.

The Right Way to Pay

You pay me a small amount each month. You may stop any time and your payments will then stop. I don't want your money if I'm not teaching you satisfactorily.

Apparatus Supplied

Electrical material, charts, electrical apparatus, drafting material, etc., are furnished with the course without charge.

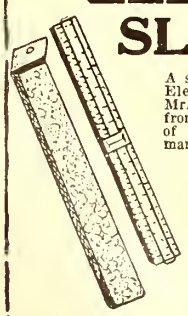
Write me frankly about yourself—what you are doing now and what you hope to do. Let's get together on your problems.

SEND FOR MY BOOK which clearly tells you how the work is handled, what I have done for others and the benefits you can expect to receive.

YORKE BURGESS, Superintendent

BURGESS ELECTRICAL SCHOOL, 745 E. 42nd Street, Chicago, Illinois

Instructions on the
ELECTRICAL SLIDE RULE



A set of concise lessons on the use of the Electrical Slide Rule has been prepared by Mr. Burgess in response to many requests from those who desire to take up the use of this instrument which is invaluable to many electrical men.

A High Grade Slide Rule

in a leather case and the COMPLETE COURSE OF INSTRUCTION will be supplied at a VERY REASONABLE COMBINATION PRICE. We have selected the rule best adapted for the purpose and the lessons will enable you to thoroughly understand its use. Write for full information.

Burgess Electrical School
745 E. 42nd St., Chicago, Ill.

BURGESS BLUE BOOK
ELECTRICAL MEN AND STUDENTS



A pocket hand-book for ELECTRICAL MEN and STUDENTS. Contains over 200 CALCULATION FORMULAS and worked-out problems showing their use. Also DRAWINGS of ELECTRICAL APPARATUS and DEVICES of which the *inside connections* are clearly shown. ALTERNATING CURRENT CALCULATIONS and dozens of everyday problems are covered. Recommended by electrical men all over the country. Used in technical schools. Purchased by electrical concerns for employees and customers. There is no other book like it.

PRICE $1.00

A $1.00 bill brings the book. We refund your money if you are not fully satisfied.

We give information on electrical subjects, design and perfect electrical devices and apparatus. Power plants, electric railway and operation and railway signals a specialty. Write us your needs and let us furnish data and advise you. Our service is prompt, reliable and satisfactory.

BURGESS ENGINEERING CO.

Yorke Burgess, President
Consulting Electrical Engineering
750 East Forty-Second Street, Chicago, Illinois.

www.americanradiohistory.com

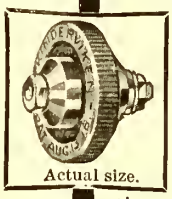
SKINDERVIKEN TRANSMITTER BUTTON

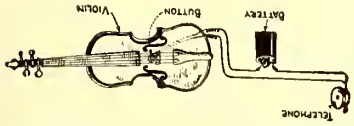
MOST SENSITIVE MICROPHONE

FOR $1.00

YOU can easily make a highly sensitive detectophone by using a Skinderviken Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. Think of the fun you would have with such an instrument! It's very simple, too, and inexpensive.

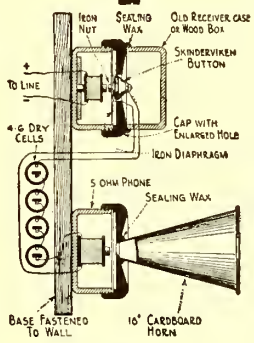
You can install an outfit in your home and hear the conversation being held all over the house. You can connect up different rooms of a hotel. *This outfit was used by secret service operatives during the War. It is being used on the stage.*


Actual size.



So much for its commercial adaptations! *You* can procure apparatus of the same type.

One of the main advantages of the Skinderviken Transmitter Button lies in its ultra-sensitiveness. You can place it in any position you like. It is the greatest invention in micro-phones and has won recommendations from men of high standing in the scientific world. It is being used all over the world. You can mount it most anywhere. Card board boxes, stove pipes, stiff calendars and hundreds of other places will suggest themselves to you. The buttons cannot be seen by any one in the room as they are so small and light. Only a small brass nut is exposed to the view.



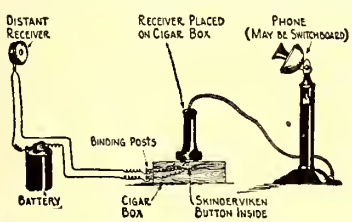
Full directions for connecting up the button for use as a detectophone are given in booklet which is sent with each button.

The only instruments needed to complete a detectophone outfit, in addition to a Skinderviken Transmitter Button are a receiver, battery, and, if desired, an induction coil.



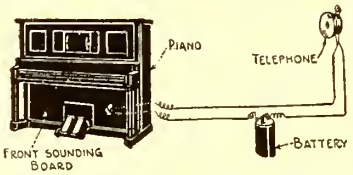






AMONG electrical experimenters the button has created a sensation. It is not uncommon to receive unsolicited letters like these: "I received transmitter button today and I wish to inform you that it works great and is *the best I have ever seen or heard of for the price.* I will certainly recommend it to my friends. I wish to thank you for your good service."

"I have been using one of these transmitter buttons, and it has proved to be worth more than its value in my experimenting." "I received one (Transmitter Button) some time ago, and they are just O. K. for experimenting." "I have been using one of these transmitter buttons for experimental work and it certainly lives up to all you say for it *and then some.*"

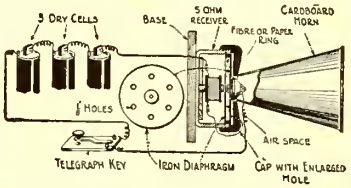


Mr. H. Gernsback, editor of this magazine, who is the dean of electrical experimenters, said: "In the writer's opinion, obtained by actual elaborate tests, the Skinderviken Transmitter Button is probably the most efficient device of its kind on market today, due to its simplicity and other outstanding features. Should have a great future."

The same circuit connections apply to all experiments, regardless of how the transmitter button is mounted.

The Skinderviken Transmitter Button operates on one or two dry cells. It often happens that two cells produce too much current and the sounds are deafening. We recommend either one fresh cell or two worn out cells.

We have the utmost faith in this transmitter button. We guarantee satisfactory service or we will refund the purchase price. Boys—Young and old—send in a dollar bill RIGHT NOW! You can't lose. If you're not satisfied, you receive your dollar back. Isn't that fair?



JOHNSON SMITH & CO., Dept. E-12, 3224 N. Halsted Street, Chicago

USE THIS COUPON

Johnson Smith & Co., Dept. E. 12, 3224 N. Halsted St., Chicago, Ill.

Gentlemen:—Please ship at once to address below.....Skinderviken Transmitter Buttons for which I enclose $.....

Name .....

Address .....City .....State.....

www.americanradiohistory.com

FREE TO YOU!

Read this Remarkable Offer!



OFFER No. 1

Wireless Course

The most comprehensive Wireless Course ever printed. Contains 160 pages, 350 illustrations. Size of book 6¾"x10". Very fine flexible cloth cover.

FREE with a year's subscription.
Add 5c for postage

OFFER No. 2

Experimental Electricity Course

This masterpiece contains 160 pages, 400 illustrations. Size of book 5"x9". Printed on extra thin paper, so book can be slipped into pocket. Handsome flexible cloth cover.

FREE with a year's subscription. Add 5c postage

OFFER No. 3

How to Make Wireless Sending Apparatus
By 20 Radio Experts

How to Make Wireless Receiving Apparatus
By 20 Radio Constructors

These books are by far the most successful wireless books on the market. Size of each book 5"x7", well bound on good book paper. Covers in two colors. We really cannot praise these books too highly. Each book contains 100 pages and from 88 to 90 illustrations. **BOTH** books **FREE** with a year's subscription. Add 5c for postage

This is a very limited offer. It may be withdrawn at any time, due to the tremendous cost of paper, which IS JUST DOUBLE WHAT IT WAS ONE YEAR AGO. We have only a limited supply of these fine books on hand; after they are gone we cannot reprint the books until conditions become normal again. **Now is your chance.**

The publishers of this journal have earned an enviable reputation of giving more than 100 cents' worth for each dollar spent with them. Profit by this liberal opportunity NOW; it may never be made again.

HERE'S THE OFFER

Subscribe to the ELECTRICAL EXPERIMENTER for one year, at the regular subscription price of $2.00 per year (Canada, foreign and N. Y. C. $2.50) and we will send you either books shown in one of the above offers. If you subscribe for two years, two offers will be given, etc.

If you are a subscriber at present take advantage of this wonderful opportunity anyway. If you do, we will extend your present subscription.

This Offer Limited. ***Act Now.***

EXPERIMENTER PUB. CO.
233 FULTON STREET NEW YORK CITY

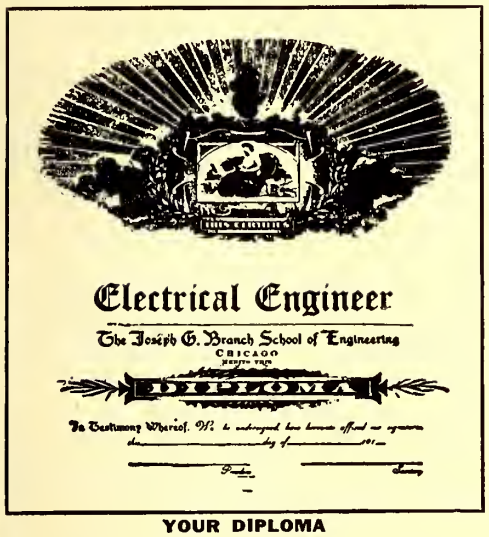
FILL IN — TEAR OUT — AND MAIL

10-19

Gentlemen:
Please enter my subscription to the ELECTRICAL EXPERIMENTER for the term of .... year..for which I enclose herewith $.....
You will also send me at once FREE your book..... as per offer No.....
.....
.....
Name.....
Address.....

www.americanradiohistory.com

You can be a Graduate
ELECTRICAL ENGINEER



YOUR DIPLOMA

We trained over 1,000 men last year for the U. S. Government

Our methods of teaching saves you time and money in becoming a graduate, practical, Electrical Engineer—at Big Pay.

There is a large and constantly increasing demand for Graduate Electrical Engineers. Our Diploma is accepted as evidence of a competent, trained electrician. Hundreds of our Graduates are now big, successful Electrical Engineers. They will tell you what we have done for them. We can do the same for you—in your *spare time at home.* Read how these results are accomplished.

Your object in taking a correspondence course is to *Increase your Earning Power.* To learn exactly what you need and not waste your time and efforts on superfluous matter, is the shortest means to that end. The *Joseph G. Branch School of Engineering* specializes in equipping you with the *practical* and *usable* knowledge that enables you to qualify as an Electrical Engineer in the shortest time, yet our course is practical and complete. *This we definitely guarantee.*

You Get Intensive, Selected, Personal Instruction

Our courses are simple, practical and easily understood. Everything is made clear. You do not become involved in difficult technical matter of no practical value, and which is so discouraging to the student, but you go straight into the principles of the subject and the application of these principles. Every one of our students gets *personal* instruction, so that his progress is steady and sure. *You can't fail* with this course if you will simply follow our very clear directions. One of our students says: "Your course is strong for the Engineer. It gives him the vital working knowledge of the subject which makes him a competent Electrical Engineer in a very short time and at a very moderate cost." Many Electricians earn

$2,500 to $7,500 a Year

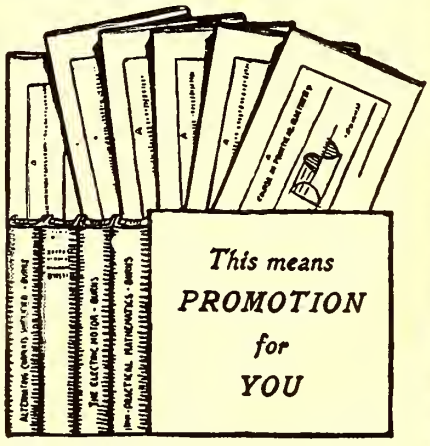
The course in Electrical Engineering covers the installation and operation of all kinds of modern electrical machinery and appliances, including power plant work, viz.: Practical Electricity, Alternating Currents, the Electric Motor, Practical Mathematics and Electrical Wiring. Under Practical Electricity both direct and alternating currents, high potential and high frequency currents are covered.

You get *everything* that will make you a proficient, *practical* Electrical Engineer—without the loss of time spent on endless theory and difficult technical work of other methods. This has been made possible by the thirty years of practical experience of Mr. Joseph G. Branch, B.S., M.E., in the engineering field. This is now presented to you in compact, usable and easily learnable form. There is no course which will put you on a big salary basis in so short a time.

SEND FOR COMPLETE CATALOG, TESTIMONIALS AND LIST OF POSITIONS SECURED

Complete, Practical Correspondence Courses in

Electrical Engineering
Mechanical Engineering
Stationary Engineering
Mechanical Refrigeration
Drafting
Drawing and Designing
Power Engineering
Power Plant Accounting
Practical Chemistry
Practical Mathematics
Ingenieria Electrica (Spanish course)
Marine Engineering



THESE BOOKS FREE!

With the Electrical Engineering course you get, FREE, these splendid text books—all *Standard Works.* These books alone are worth more than the price of the course. Each book by a recognized authority:

Practical Electricity — *The Electric Motor*
Alternating Currents Simplified
Electric Wiring — *Practical Mathematics*

You need this Electrical Library. Here is your chance to get it *free.*

Due to Mr. Branch's long experience in and close contact with the engineering field the courses embrace such questions as are usually asked by the various Boards of Examining Engineers throughout the country. Our graduates will testify to the ease with which they were able to pass these examinations, and the cooperation received from us in helping them get positions.

A Diploma from the Branch School of Engineering is a sure step to a better position and a larger salary. You can soon have your Diploma—without interfering with your present work.

SPECIAL OFFER

The price of the course is extremely low and just now we are making a Special Limited Offer to those who reply to this advertisement. This remarkable offer reduces the cost of the complete course to a very low figure. You will be astonished to find how little this tremendously valuable training will cost you. Mail coupon at once for full particulars and Special Terms. Jos. G. Branch School of Engineering, Dept. E, 542 Dearborn Street, Chicago.

USE THIS COUPON

Jos. G. Branch School of Engineering
Dept. E, 542 Dearborn St., Chicago

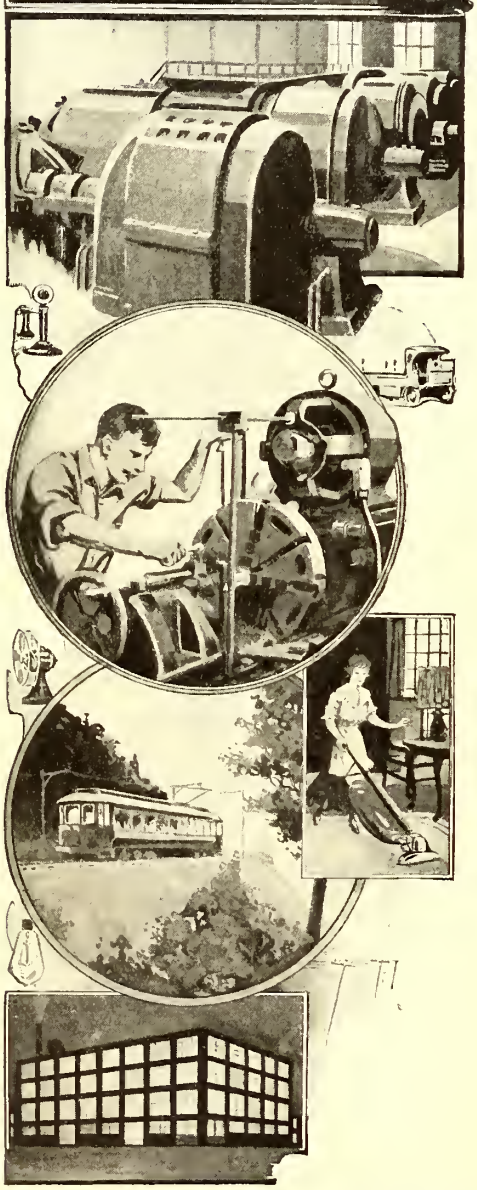
Without obligation you may send me information about your Special Offer on your course checked below:

Electrical Engineering
Mechanical Engineering
Stationary Engineering
Mechanical Refrigeration
Drafting
Drawing and Designing
Power Engineering
Power Plant Accounting
Practical Chemistry
Practical Mathematics
Ingenieria Electrica (Spanish course)
Marine Engineering

Name .....
Address .....
City ..... State .....
Present Position .....

www.americanradiohistory.com





Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 5,500 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Special Automobile Ignition Course

We have just installed a special automobile ignition course for auto mechanics, garage men and owners. The course covers completely ignition, starting, lighting and other electrical equipment in connection with automobiles, motor boats, etc.

Let us explain our complete courses to you in person. If you can't call, send now for 64-page book—it's FREE to you.

New York Electrical School
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

_____(NAME)

_____(ADDRESS)

New York Electrical School

29 West 17th Street, New York

www.americanradiohistory.com

ELECTRICAL EXPERIMENTER

H. GERNSBACK – EDITOR
H. W. SECOR – ASSOCIATE EDITOR

Vol. VII. Whole No. 78 OCTOBER, 1919 No. 6

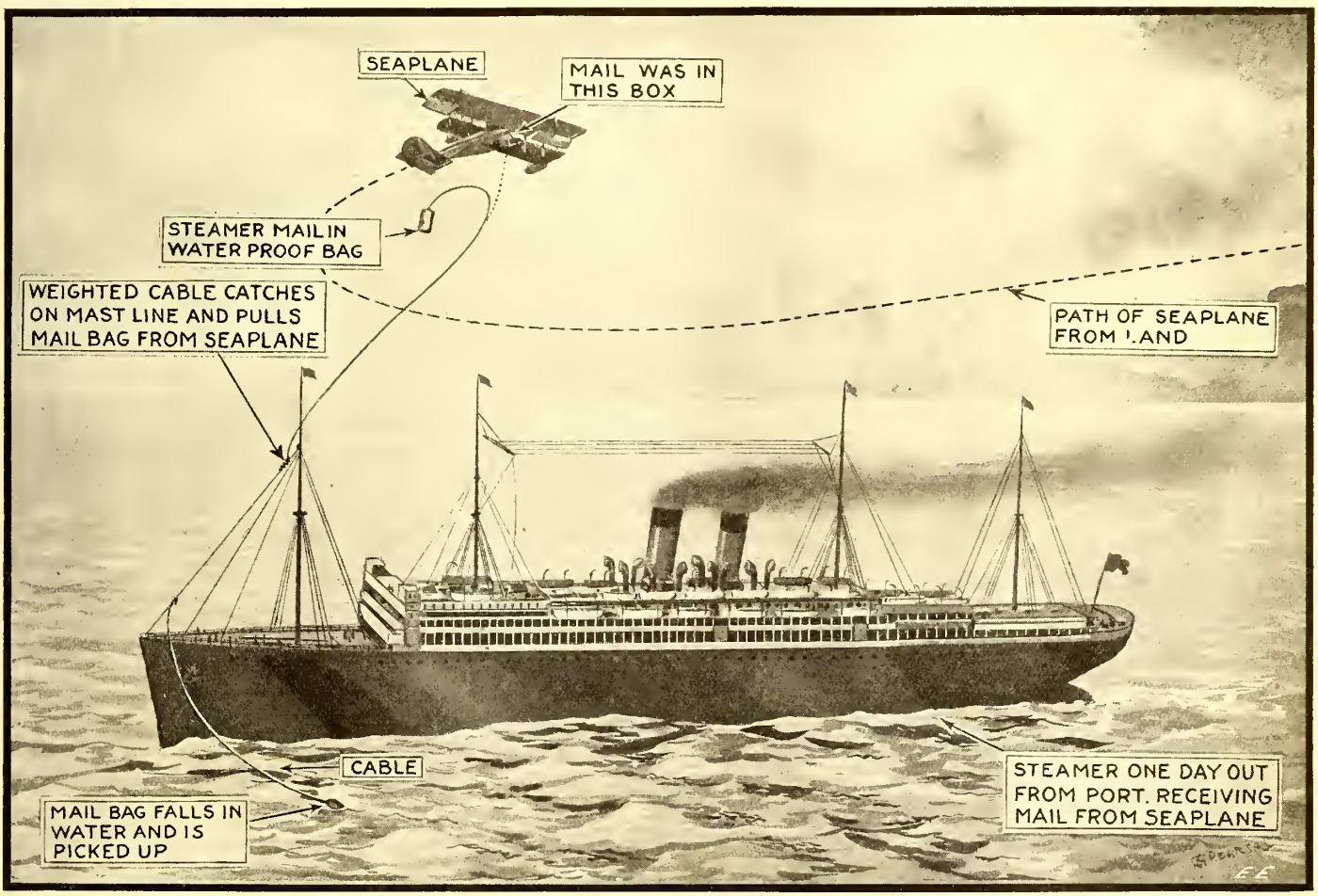
Seaplane Delivers Ship Mail at Sea

OCEAN travelers on the S.S. *Adriatic*, the sailing of which on August 15th marked the reopening of the White Star Line's service to Cherbourg and Southampton, witnest the successful attempt of the Post Office Department to use aircraft for the first time in delivering European mail to a steamer. Congratulatory messages were sent by passengers to Postmaster Thomas G. Patten and officials of the Acromarine Plane and Motor Corporation, who were responsible for the demonstration.

The hydroaeroplane, piloted by C. J. Zimmerman with Richard Geisinger as mechanic, left the surface of the Hudson River off Eighty-sixth Street, New York, at 1:30 P. M., an hour and a half after the Adriatic had sailed. Before the mail pouch was placed on board the plane Zimmerman, the pilot, was sworn in by Daniel E. Jordan, Assistant Superintendent of Mail, as an employe of the Post Office Department.

Overtaking the Adriatic at Ambrose Channel the plane flew for a distance ahead of the steamer and then, turning around, flew directly toward her. As the plane past over the Adriatic at a height of about 50 feet above masthead, a specially devised weighted cable with shock absorbers was released, catching and wrapping itself around a cable which ran from the masthead to the deck, as shown in the accompanying illustration. The mail pouch, which was contained in a pocket constructed of laminated wood on the forward right fuselage, was pulled out when the cable contracted, dropping into the water. The pouch, also specially constructed to insure its being waterproof, was then hauled on board.

The achievement was witnest by Postmaster Patten, Inglis M. Uppercu, President of the Aeromarine Plane and Motor Corporation, and a party of guests who went down the bay on the yacht *Lounger*. The passengers on the steamer cheered as the seaplane glided away.



Copyright, 1919, by E. P. Co.

The Latest Mail Carrier—the "Seaplane." A Seaplane Successfully Delivered Mail to the S.S. Adriatic When She was a Considerable Distance at Sea, thus Demonstrating How the "Mail Time" Between America and Europe can Be Greatly Shortened.

www.americanradiohistory.com

My Inventions

By Nikola Tesla

VI. THE ART OF TELAUTOMATICS

How Tesla's Mind Recuperates.

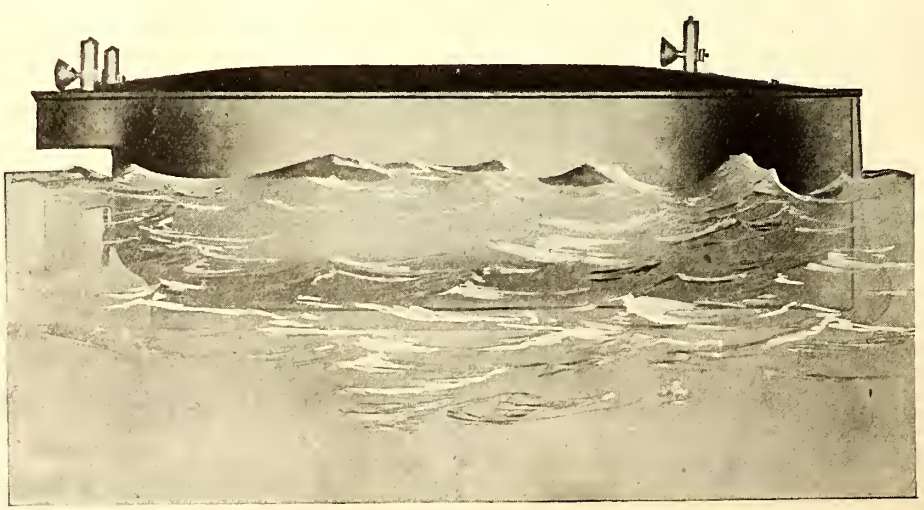
NO subject to which I have ever devoted myself has called for such concentration of mind and strained to so dangerous a degree the finest fibers of my brain as the system of which the Magnifying Transmitter is the foundation. I put all the intensity and vigor of youth in the development of the rotating field discoveries, but those early labors were of a different character. Although strenuous in the extreme, they did not involve that keen and exhausting discernment which had to be exercised in attacking the many puzzling problems of the wireless. Despite my rare physical endurance at that period the abused nerves finally rebelled and I suffered a complete collapse, just as the consummation of the long and difficult task was almost in sight. Without doubt I would have paid a greater penalty later, and very likely my career would have been prematurely terminated, had not providence equipt me with a safety device, which has seemed to improve with advancing years and unfailingly comes into play when my forces are at an end. So long as it operates I am safe from danger, due to overwork, which threatens other inventors and, incidentally, I need no vacations which are indispensable to most people. When I am all but used up I simply do as the darkies, who "naturally fall asleep while white folks worry." To venture a theory out of my sphere—the body probably accumulates little by little a definite quantity of some toxic agent and I sink into a nearly lethargic state which lasts half an hour to the minute. Upon awakening I have the sensation as though the events immediately preceding had occurred very long ago, and if I attempt to continue the interrupted train of thought I feel a veritable mental nausea. Involuntarily I then turn to other work and am surprised at the freshness of the mind and ease with which I overcome obstacles that had baffled me before. After weeks or months my passion for the temporarily abandoned invention returns and I invariably find answers to all the vexing questions with scarcely any effort. In this connection I will tell of an extraordinary experience which may be of interest to students of psychology. I had produced a striking phenomenon with my grounded transmitter and was endeavoring to ascertain its true significance in relation to the currents propagated through the earth. It seemed a hopeless undertaking, and for more than a year I worked unremittingly, but in vain. This profound study so entirely absorbed me that I became forgetful of everything else, even of my undermined health. At last, as I was at the point of breaking down, nature applied the preservative inducing lethal sleep. Regaining my senses, I realized with consternation that I was unable to visualize scenes from my life except those of infancy, the very first ones that had entered my consciousness. Curiously enough, these appeared before my vision with startling distinctness and afforded me welcome relief. Night after night, when retiring, I would think of them and more and more of my previous existence was revealed. The image of my mother was always the principal figure in the spectacle that slowly unfolded, and a consuming desire to see her again gradually took possession of me. This feeling grew so strong that I resolved to drop all work and satisfy my longing. But I found it too hard to break away from the laboratory, and several months elapsed during which I had succeeded in reviving all the impressions of my past life up to the spring of 1892. In the next picture that came out of the mist of oblivion, I saw myself at the *Hotel de la Paix* in Paris just coming to from one of my peculiar sleeping spells, which had been caused by prolonged exertion of the brain. Imagine the pain and distress I felt when it flashed upon my mind that a dispatch was handed to me at that very moment bearing the sad news that my mother was dying; I remembered how I made the long journey home without an hour of rest and how she passed away after weeks of agony! It was especially remarkable that during all this period of partially obliterated memory I was fully

IN this article, Dr. Tesla dwells on the future possibilities of his magnifying transmitter, especially in connection with the art of Telautomatics, which was first conceived by him and doubtless constitutes one of his most brilliant gifts to the world.

Tesla was the first to build and successfully operate Automata in the form of boats steered and otherwise controlled by tuned wireless circuits and agents ensuring reliable action despite of all attempts to interfere.

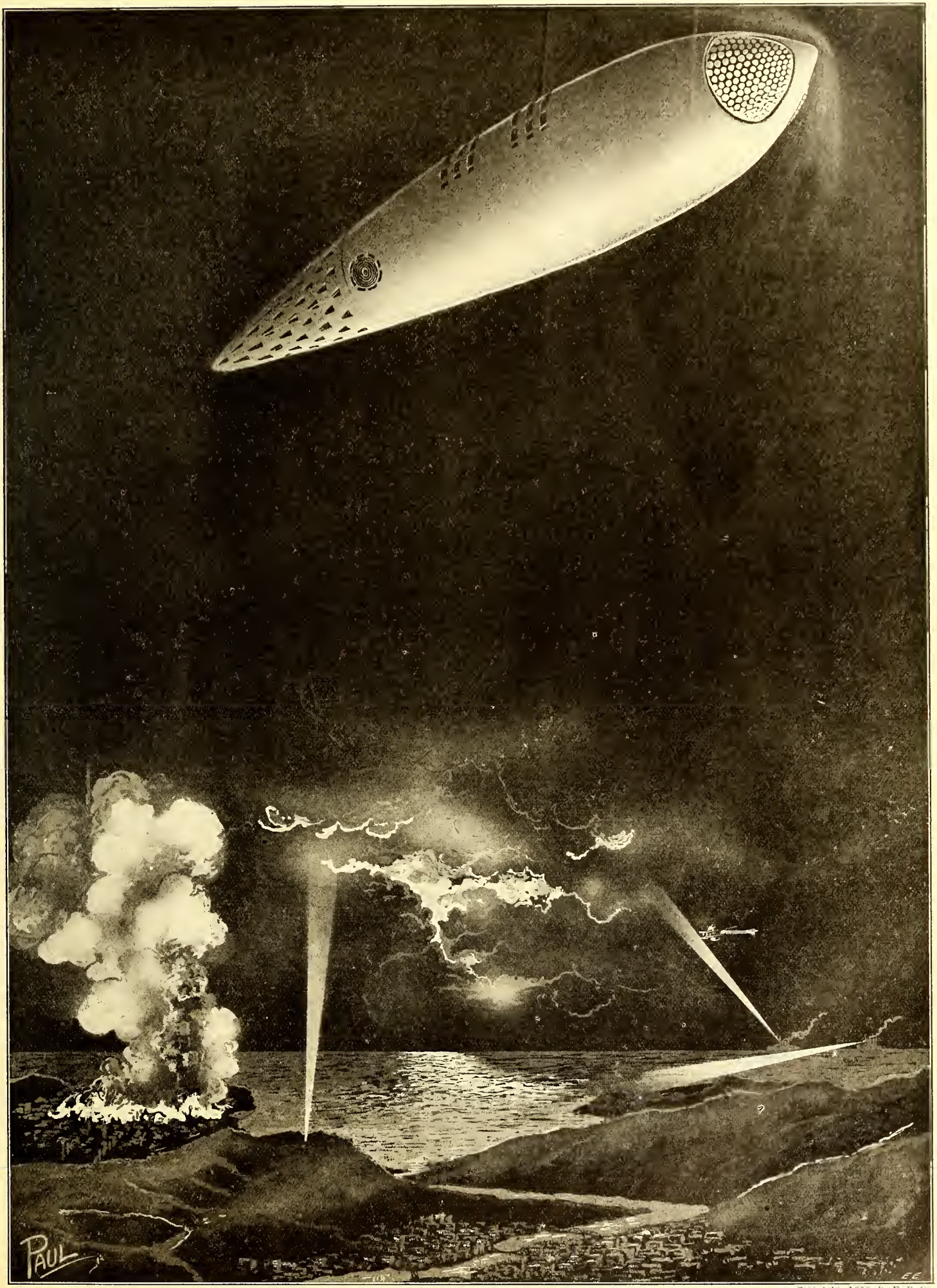
But this was only the first step in the evolution of his invention. What he wanted, was to produce machines capable of acting as though possessed of intelligence. It will be readily perceived that if Dr. Tesla has practically realized his conception, the world will witness a revolution in every field of endeavor. In particular will his inventions affect the art of warfare and the peace of the world.

Dr. Tesla dwells eloquently on a number of topics agitating the public mind, and this article of his is perhaps the most brilliant and absorbing he has written.



One of the Telautomatic Boats (Submersible) Constructed By Tesla and Exhibited By Him in 1898. Controlled By Wireless Without Aerials.

www.americanradiohistory.com



Copyright, 1919, by E. P. Co.

Tesla's New Self-Propelled Aerial Tel-Automaton. Devoid of Propeller, Sustaining Wings and All Other Means of External Control. Can Attain a Speed of 350 Miles Per Hour, and Will Reach a Predetermined Point a Thousand Miles Away Accurately Within a Few Feet.

www.americanradiohistory.com

alive to everything touching on the subject of my research. I could recall the smallest details and the least insignificant observations in my experiments and even recite pages of text and complex mathematical formulae.

My belief is firm in a law of compensation. The true rewards are ever in proportion to the labor and sacrifices made. This is one of the reasons why I feel certain that of all my inventions, the Magnifying Transmitter will prove most important and valuable to future generations. I am prompted to this prediction not so much by thoughts of the commercial and industrial revolution which it will surely bring about, but of the humanitarian consequences of the many achievements it makes possible. Considerations of mere utility weigh little in the balance against the higher benefits of civilization. We are confronted with portentous problems which can not be solved just by providing for our material existence, however abundantly. On the contrary, progress in this direction is fraught with hazards and perils not less menacing than those born from want and suffering. If we were to release the energy of atoms or discover some other way of developing cheap and unlimited power at any point of the globe this accomplishment, instead of being a blessing, might bring disaster to mankind in giving rise to dissension and anarchy which would ultimately result in the enthronement of the hated regime of force. The greatest good will come from technical improvements tending to unification and harmony, and my wireless transmitter is preeminently such. By its means the human voice and likeness will be reproduced everywhere and factories driven thousands of miles from waterfalls furnishing the power; aerial machines will be propelled around the earth without a stop and the sun's energy controlled to create lakes and rivers for motive purposes and transformation of arid deserts into fertile land. Its introduction for telegraphic, telephonic and similar uses will automatically cut out the statics and all other interferences which at present impose narrow limits to the application of the wireless. This is a timely topic on which a few words might not be amiss.



Dr. Tesla is Rapidly Becoming Younger. Judge for Yourself from His Latest Photograph.

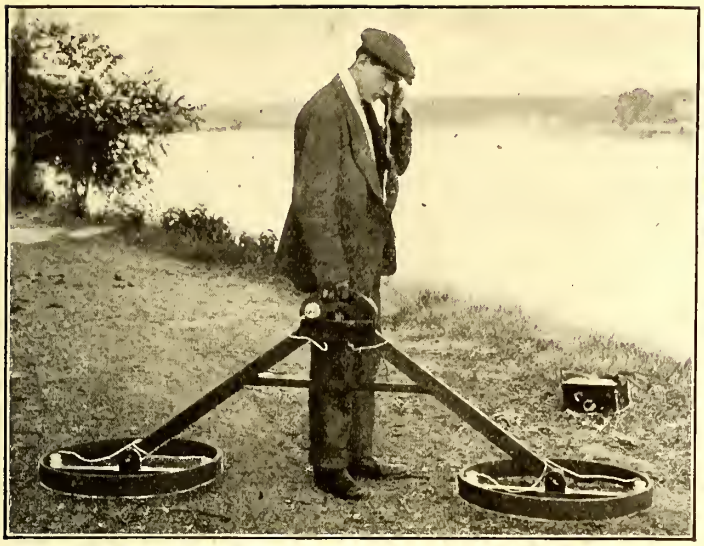
Tesla Raps "Static" Men Vigorously.

During the past decade a number of people have arrogantly claimed that they had succeeded in doing away with this impediment. I have carefully examined all of the arrangements described and tested most of them long before they were publicly disclosed, but the finding was uniformly negative. A recent official statement from the U. S. Navy may, perhaps, have taught some beguilable news editors how to appraise these announcements at their real worth. As a rule the attempts are based on theories so fallacious that whenever they come to my notice I can not help thinking in a lighter vein. Quite recently a new discovery was heralded, with a deafening flourish of trumpets, but it proved another case of a mountain bringing forth a mouse. This reminds me of an exciting incident which took place years ago when I was conducting my experiments with currents of high frequency. Steve Brodie had just jumped off the Brooklyn Bridge. The feat has been vulgarized since by imitators, but the first report electrified New York. I was very impressionable then and frequently spoke of the daring printer. On a hot afternoon I felt the necessity of refreshing myself and stepped into one of the popular thirty thousand institutions of this great city where a delicious twelve per cent beverage was served which can now be had only by making a trip to the poor and devastated countries of Europe. The attendance was large and not over-distinguished and a matter was discussed which gave me an admirable opening for the careless remark: "This is what I said when I jumped off the bridge." No sooner had I uttered these words than I felt like the companion of Timotheus in the poem of Schiller. In an instant there was a pandemonium and a dozen voices cried: "It is Brodie!" I threw a quarter on the counter and bolted for the door but the crowd was at my heels with yells: "Stop, Steve!" which must have been misunderstood for many persons tried to hold me up as I ran frantically for my haven of refuge. By darting around corners I fortunately managed—through the medium of a fire-escape—to reach the laboratory, where I threw off my coat, camouflaged myself as a hard-working blacksmith, and started the forge. But these precautions proved unnecessary; I had eluded my pursuers. For many years afterward, at night, when imagination turns into spectres the trifling troubles of the day, I often thought, as I tossed on the bed, what my fate would have been had that mob caught me and found out that I was not Steve Brodie!

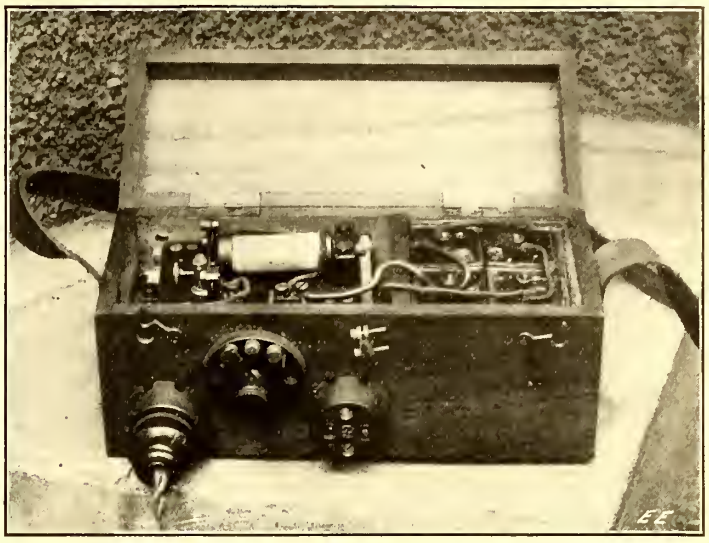
Now the engineer, who lately gave an account before a technical body of a novel remedy against statics based on a "heretofore unknown law of nature," seems to have been as reckless as myself when he contended that these disturbances propagate up and down, while those of a transmitter proceed along the earth. It would mean that a condenser, as this globe, with its gaseous envelope, could be charged and discharged in a manner quite contrary to the fundamental teachings propounded in every elemental text-book of physics. Such a supposition would have been condemned as erroneous, even in Franklin's time, for the facts bearing on this were then well known and the identity between atmospheric electricity and that developed by machines was fully established. Obviously, natural and artificial disturbances propagate through the earth and the air in exactly the same way, and both set up electro-motive forces in the horizontal, as well as vertical, sense. Interference can not be overcome by any such methods as were proposed. The truth is this: In the air the potential increases at the rate of about fifty volts per foot of elevation, owing to which there may be a difference of pressure amounting to twenty, or even forty thousand volts between the upper and lower ends of the antenna. The masses of the charged atmosphere are constantly in motion and give up electricity to the conductor, not continuously but rather disruptively, this producing a grinding noise in a sensitive telephonic

(*Continued on page* 550)

www.americanradiohistory.com



This New French Inductive Water Pipe Locater Can Be Used by Either One or Two Men.



A Close-up of the "Chanoit" Electric Water Pipe Locating Apparatus. A Battery and Induction Coil Are Used.

Paris Letter

By JACQUES BOYER
Paris Correspondent "Electrical Experimenter."

ENGINEER CHANOIT has conceived the idea of using a new electrical induction balance invented during the war by Prof. Gutton for the location of non-exploded shells, to locate underground water terminals of the waterpipe distribution system.

The new apparatus is a little different in form, but the principle is the same. This induction balance "Alpha" (Model 1919) consists of two flat coils mounted in series in the same circuit, and in which alternating current induces currents in two neighboring coils. In these coils the wire is wound in such a way that the electromotive forces are reversed every instant. The coils measure 70 centimeters in diameter; the wire is wound at the rate of 20 turns on the primary and only 10 turns on the secondary. As to the armature, sieve chassis are used. A wooden traverse mounted across the diameter insures the rigidity of these drums, covered by a rubber tissue to protect the wire wound on the same. Attached to the traverses are two wooden uprights mounted at an angle toward each other, and supporting at their junction a special regulating system.

Induction Balance Locates Water Pipes

If both pair of coils are exactly identical, the electro-motive forces would be compensated and a telephone connected in circuit would remain silent. But in view of the impossibility of obtaining a perfect similarity between these two pair of coils, a variable inductive regulator is added, enabling the neutralization of the mutual induction of the two primary and secondary circuits. All that is necessary is to mount in each of the circuits a small coil with four turns of wire, which is illustrated in the photograph herewith, in the center of the instrument underneath the handle; one of these coils moving inside, the other around the common center. This rotation in modifying the mutual induction of the two circuits, permits the regulation of the "Alpha" balance instrument at the moment of use.

When a mass of iron is in the neighborhood of one of the pair of coils, it creates an asymmetry which wards off the compensation. The 'phone will then give forth a sound. Moreover, in a portable box there is mounted with a condenser a battery of four cells, or a storage battery, which excites a vibrator. The electro-motive forces of self-induction in the coil of the vibrator, charge and discharge the condenser periodically, realizing in this manner the primary excitation.

When the employees of the Water Department want to proceed, they attach the apparatus to their backs, mount their bicycles, and ride toward the pipe line which they want to explore. Once upon the grounds, they mount the apparatus and connect the wires. Usually two work together, but one man alone can do the work satisfactorily. If working in pairs, the observer goes along the road with the balance, holding the same at a little distance over the ground, his assistant following with the box containing the battery, condenser and vibrator. If working alone, the man puts his box on the ground and moves it as he goes along. When passing over a buried waterpipe up to a depth of one yard, the 'phone will indicate by its characteristic buzz the exact location of the same.

New Hospital Call Switch

Most modern hospitals are equipt with *hospital call systems*, which, in many instances give fairly satisfactory service, but one trouble often arises from their use because a great majority of them employ some form of standard electrical device which the patient uses to signal the nurse. The device usually consists of a pendant type of push button fastened to a flexible conductor which is hung over the head of the bed. These standard wiring devices are not intended for such service, and there is considerable wear and tear on the cord, and as a result the cord frequently becomes worn, thus making the signal inoperative.

A new device called a Hospital Call Switch has just been developed. It is made for a standard switch outlet box, and the wiring for it does not extend beyond the box. No flexible conductors or pendant switches are required for its use, and consequently, the annoyance of having these parts worn or broken is eliminated. It is so constructed that the patient can only complete the circuit to signal the nurse, and she can push it "off" only at the bed-side.



A New Hospital Call Switch. Individual Indication At Each Bed Is Effected. The Nurse Cannot Ignore It.

The accompanying illustration shows one of these new switches installed in the wall near the patient's bed. A pull chain, to which a linen cord is attached, is used to pull the switch "on." The push-button, located above the horn, thru which the pull chain extends, is used by the nurse to push the switch "off." In a ward, where two or more switches are used on the same signal, the protruding button indicates to the nurse which patient called. The signal remains "on," therefore, until the nurse comes to the bed to push the switch "off." Hence there is no excuse for the patient's call not being observed and answered.

www.americanradiohistory.com

What the X-Rays Show

Scientific and Industrial Applications of X-Rays in War and Peace

THE X-ray to most of us conjures up visions of white robed nurses, surgeons, and hospital operating rooms. But today the X-ray, discovered by Wilhelm Conrad Röntgen in 1895, gives promise of becoming one of the world's greatest and most useful accomplishments. No longer is the X-ray confined alone to hospital and physicians' diagnostic requirements, but it has been used in the past few years, especially during the World War, for many hitherto undreamt of purposes. In fact, one could write a book on the industrial applications of X-rays which would read like a romance. How they helped to foil the German conspirators in America who tried to plant infernal machines and contraband rubber and nickel into bales of cotton; how steel needles and other metal objects were actually placed into bags of powder in U. S. Government arsenals by pro-German workers; how defects were allowed to pass in shells, other ammunition and guns, and dozens of other dangerous practices, as well as interesting scientific developments —all of these are a matter of history now.

Figure 1 of the accompanying illustrations shows a large X-ray machine being used to detect the presence of contraband rubber or metal placed in bales of cotton. A number of these X-ray machines were used at the leading cotton shipping ports of the South during the war. Infernal machines timed to go off at sea were often detected in this way, altho little or nothing was ever said about these discoveries for very good reasons. If these discoveries on the part of Uncle Sam's secret service and shipping experts had been made public at the time, naturally the perpetrators of such crimes would have directed their energies to other ways and means of attaining their objects.

More romantic perhaps is the application of the X-ray for discovering the presence of pearls or the nuclei of pearls starting to grow in oysters. Figure 2 shows the X-ray apparatus in use for this purpose. Previously, many thousands of oysters were annually obliterated by being opened in an effort to determine the presence of pearls or pearl nuclei. All of this is now obviated, thanks to the X-ray, and if Mr. Oyster does not show up with a pearl nuclei, he is replanted in his natural habitat, the water, once more. Here it develops to maturity. If an undeveloped pearl is detected by the X-ray pearl expert, then the oyster is at once laid aside for further treatment.

Bullets and shell have been examined by thousands, as shown in Figure 3, by powerful X-rays. The X-ray in this case shows the amount of powder in the shell, how it is loaded, et cetera, and the same is true also for bullets. A different shadow is cast on the X-ray plate or fluoroscope for each different material, so that differentiation between each substance is readily possible. Defects in the loading and assembling of shell were frequently detected in this way at the great shell factories and arsenals during the war, thus preventing misfires and premature explosions, with a possible large loss of life.

Concrete ships have been rapidly coming to the fore in the past few years, and were developed to quite a large extent during the war, many being built in this country and abroad. No matter how expert the inspectors on such hulls may be, they cannot tell in any case how the interior of the concrete structure looks, especially the steel reinforcement bars, which may have become bent or misplaced during the pouring process.

Figure 4 gives an idea of how valuable the special portable X-ray outfits prove in finally checking up the hulls of such vessels before they are launched. A bent or misplaced steel reinforcement or an air-pocket, either of which would constitute a serious altho unnoticeable weakness in the hull, can be quickly detected by the X-ray. For such large area X-ray examinations a fluoroscope is invariably used, and not the photographic plate.

How many railroad accidents have been caused by defective car wheels? Many of them, if the truth were known. And why is this? Simply because the iron wheels appeared to be all right, and withstood possibly a fair mechanical test, but inherently they possest a weakness, perhaps in the form of air pockets or invisible cracks caused by strains in cooling when they were cast, etc., etc.—defects which only the X-ray can and does detect at once in a minimum of time.

For such purposes an X-ray is used in the manner here illustrated at Figure 5. The X-ray tube together with exciting spark coil, batteries, et cetera, are placed in a portable carrying case, which can be placed behind the car wheel or other object. The fluoroscope, or, in special places, the X-ray plate in its light-proof holder, is placed before the car wheel or other object. A few seconds' exposure to the X-ray gives a *skiagraph* or X-ray photograph on the plate, which is afterward developed and printed, or the image may be, and usually is, examined on the negative itself, no print being made. Of course, if the fluoroscope is used for directly viewing the object under examination, then the object is seen clearly at once, and various parts of it examined by moving the fluoroscope over the surface.

Many lives have been lost due to the explosion of anarchists' bombs and infernal machines, not only when they happened to explode in locations where they were *planted,* but also when they have been under the process of examination by bomb experts of various city police departments. The examination of bombs and infernal machines now bids fair to presently become as concrete and specific a procedure as weighing a pound of coal. The X-ray has already been used with marked success in determining the structure of such dangerous devices beforehand, which is of course a great stride in advance of the erstwhile method of "yanking" the bomb apart and "waiting to see what would happen." See Figure 6.

Even the field of Art, including cubist paintings, has been invaded by the mechanistic X-ray tube with its prying eyes, the discerning powers of which will not be denied. To the Scientist and his X-ray tube must come the Artist or the Art Connoisseur with his ancient and almost priceless Rembrandt, Van Dyke, Corot or Blakelock, the *authenticity* of which may be in question. A number of notable forgeries in supposedly valuable paintings have been detected by the scrutinizing X-ray. Figure 7 shows the X-ray being used to determine the authenticity of old paintings.

Another fruitful field in which the X-ray has proven its value many times is in the examination of large diamonds and other precious stones. Instead of X-raying the diamond to determine its value as a diamond, another application in this same field lies in its use at one of the large South African diamond mines for the purpose of detecting the presence of a diamond within the body. This may sound somewhat startling at first, but there have been cases where diamond miners have even "swallowed" diamonds in order to smuggle them out of the mines. Therefore, at this particular mine all of the miners undergo an X-ray examination, as shown in the accompanying illustration, Figure 8, before they leave the mine at the end of the day's work.

The modern Dentist has found that the X-ray is the only means whereby he can be sure that he is properly diagnosing the ailment of his patient. As pointed out in an exhaustive article by Dr. Henry A. Cotton, Medical Director of the New Jersey State Hospital, Trenton, N. J., in the August issue of this journal, defective teeth are sometimes due to *abscesses* and other growths forming at the roots, whch are not visible in any other way by physical examination, except by the X-ray. Such abscesses are the cause of serious organic and systemic disorders and ailments, such as rheumatism, neuralgia, stomach and intestinal troubles, and many other ills which would

(*Continued on page* 603)

The "November" Electrical Experimenter

Church Sermon Heard for a Mile —Audions and the Maguavox Did It. Think of heoring a humon voice a mile away. Sounds uneauuy—doesn't it?

Slow Movies—How they are taken with a new arc-light more powerful than sunlight. By Joseph H. Kraus.

The Electrical Driven Battleship "New Mexico"—Some excellent interior photos, the first taken below decks on a U.S. man-of-wor.

Magnetic Storms—How sunset, wind and other weather phenomena actually cause "magnetic storms." By Prof. Lindley M. Pyle, Department of Physics, Washington University.

Rochelle Salt—It tolks, acts as a microphone, and also as an amplifier.

"My Inventions"—Part VII—by Dr. Nikola Tesla, himself. A particularly interesting ond educotive poper which you should not miss.

"Plan-T"—The cleverest Radio story you ever read. It's gripping plot keeps you guessing to the very last.

Talking to Mars, by Prof. Brainin.

How the Electrical Engineer Works—His daily work in a large engineering works explained in an interesting way by H. Winfield Secor.

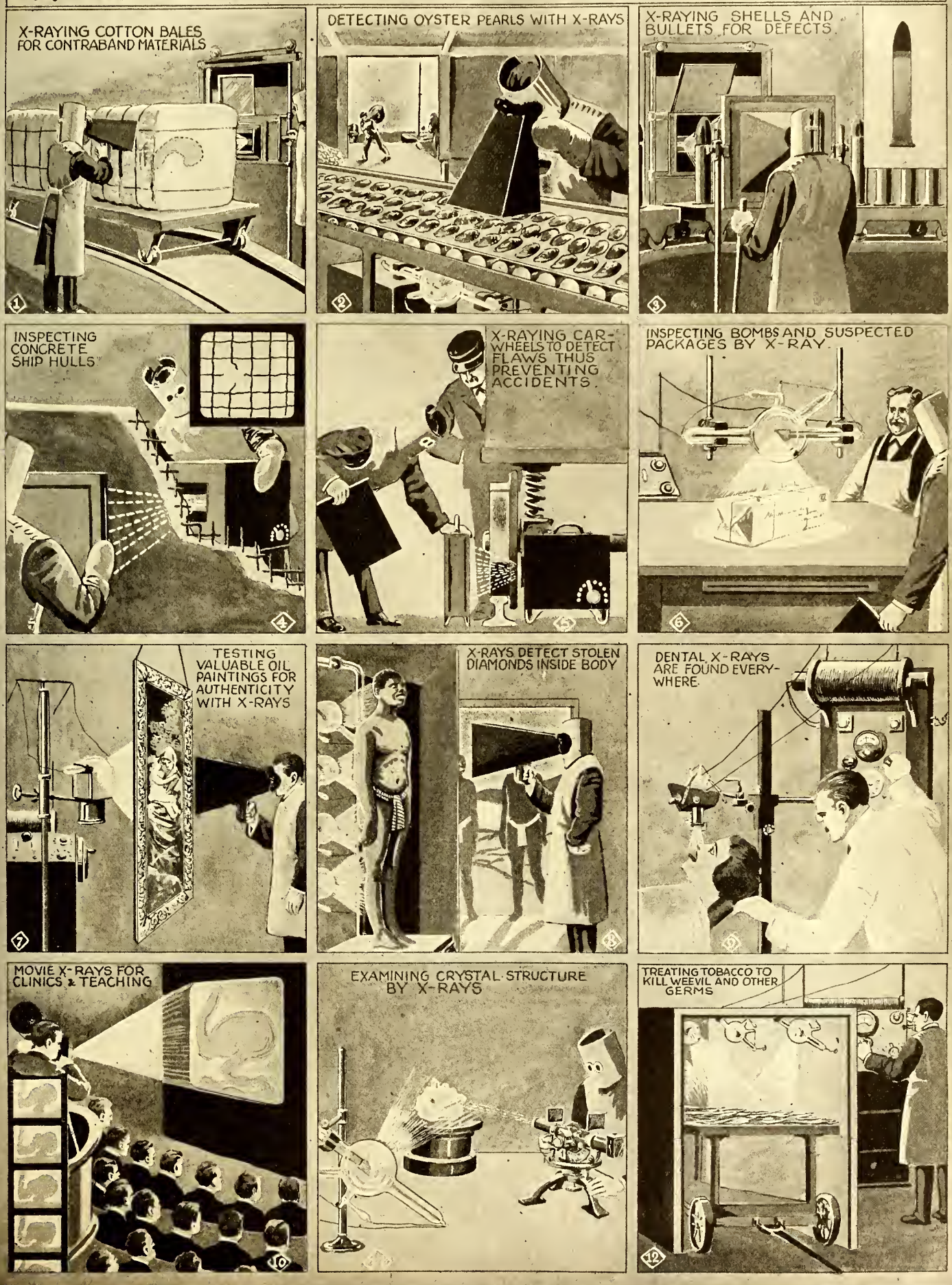
Magic for Everybody—by Joseph H. Kraus.

A new artiele on "Psyehical Phenomena," by Dr. Hereward Carrington.

Besides all the usual Departments —Mochine Shop Practise; Practical Chemical Experiments; Experimental Physics; The Coustructor; How-to-Moke-It; Populor Astronomy.

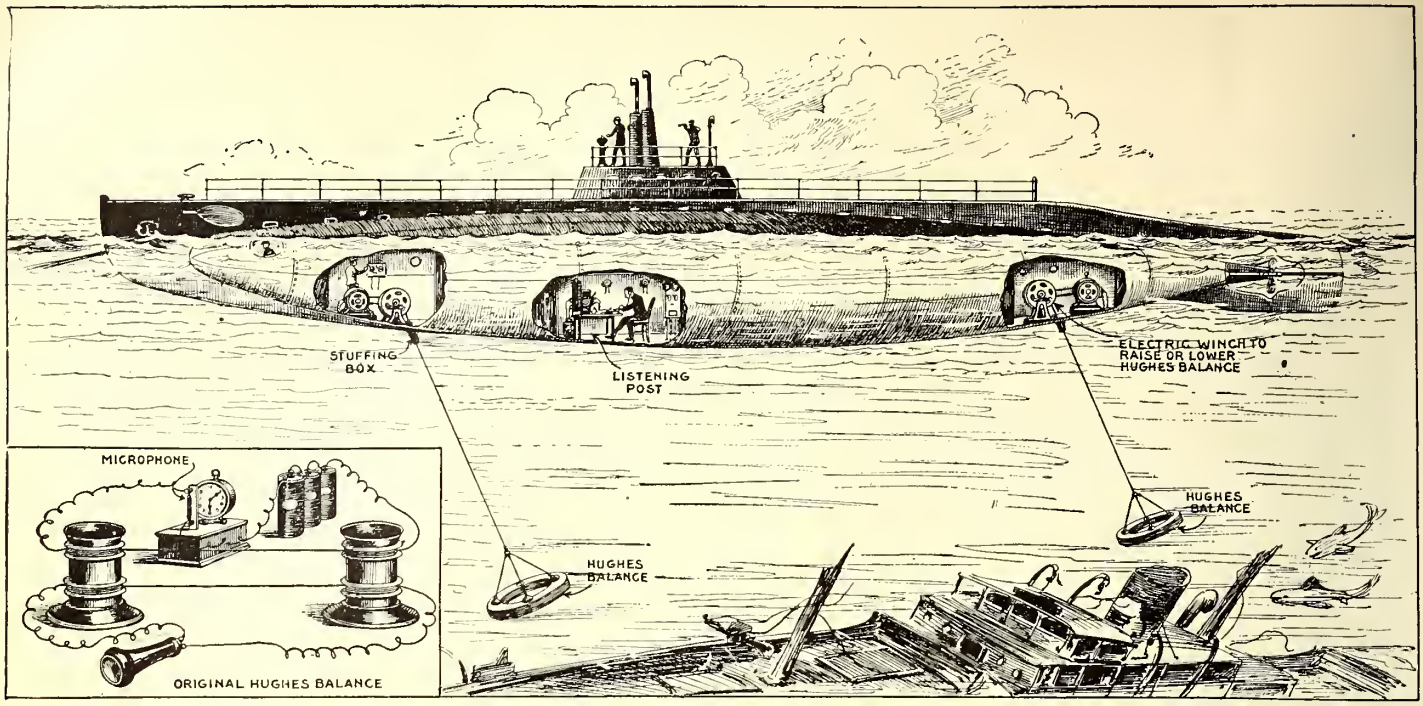
www.americanradiohistory.com

WHAT THE X-RAYS SHOW



(FULL DESCRIPTION ON OPPOSITE PAGE)

www.americanradiohistory.com



Copyright, 1919, by E. P. Co.

As Our Front Cover Illustration Shows, this New Invention for Locating Sunken Ships Can Be Operated Without the Aid of Divers or Diving Machines. It is Based on the Hughes Induction Balance, Where a Slight Change in the Induction Between Four Balanced Coils Causes a Sound to Be Heard in One of the Circuits.

Treasure Ships Located Electrically

By H. GERNSBACK

THE salvage of 440 vessels and the recovery of property valued at $250,000,000 is the record in four years of the British Admiralty Department, which under Rear-Admiral Philpotts has been conducting salvage operations in home and foreign waters.

Thus reads a recent newspaper clipping. But the $250,000,000 worth of property recovered represents only a very small percentage of the ships that had been sunk during the present war as well as during the past century.

The ocean is dotted with sunken ships containing such fabulous treasures that it is difficult for the mind to grasp the enormous figures. It runs way up into the billions, and while we do not pretend to claim that all of this property, even if recovered, would be of value, there still remain many billions' worth of sunken treasures which can be salvaged today.

When a ship with a cargo sinks, that cargo is not always valuable if recovered. For instance, it might have had on board grain or other perishable goods, which, even if salvaged, would be found useless. But many other ships containing mixed cargoes, such as metal, coal, bullion, certain chemicals, etc., do not deteriorate even if they have been on the bottom of the ocean for years, and the great majority of sunken ships contain at least a large part of their cargo, which is quite imperishable.

Then, too, if a vessel is raised within one or two years after it has been sunk, it can in many cases be refitted and will do service just as good as new, after it has been overhauled. Here the ship whose intrinsic value is quite high is well worth salvaging, if there is a possibility of us doing so.

The main trouble in the past has not been so much in actually salvaging the ship, but in *accurately locating it* so that divers or the diving apparatus can be brought into action. It is one thing to know the *approximate* position where a ship has been sunk, but it is quite another matter to know the *exact spot*. In other words, tho we have a chart which gives the spot on which a ship has been sunk, *this spot may measure five square miles or more,* and if the ship is located in any channel or such parts of the ocean where there are heavy undercurrents, such a ship will soon be covered over with sand, moss, barnacles, etc., which effectively hide the ship and make it very difficult for the divers to locate it.

Many a salvaging company has found to its regret that it is one thing to obtain a commission to raise a sunken ship and quite another to actually locate it in order to start the salvaging operation. How then are ships located?

We have several means at hand. One of the simplest is to send down divers, using powerful under-water searchlights, and then make a systematic search in order to find the wreck. This is not only a lengthy and difficult procedure, but when the ship lies at a great depth the high water pressure makes it impossible for the divers to reach the bottom.

The next method is to use grappling irons or anchors, which may be termed the "fishing" method. This, perhaps, is the least satisfactory as it takes a long time and does not always bring results. It is at most a long and weary procedure, and very expensive on account of the enormous time losses involved.

We still have another method which, while not new, is not known as well as it deserves. It is a purely electrical method in locating sunken ships. It is very efficient, and the cost is negligible as long as we own a ship or a submarine on which to install the apparatus. The writer advances the idea of using the submarine in a peaceful mission to raise the ships wantonly sunk by its war sisters during the world war.

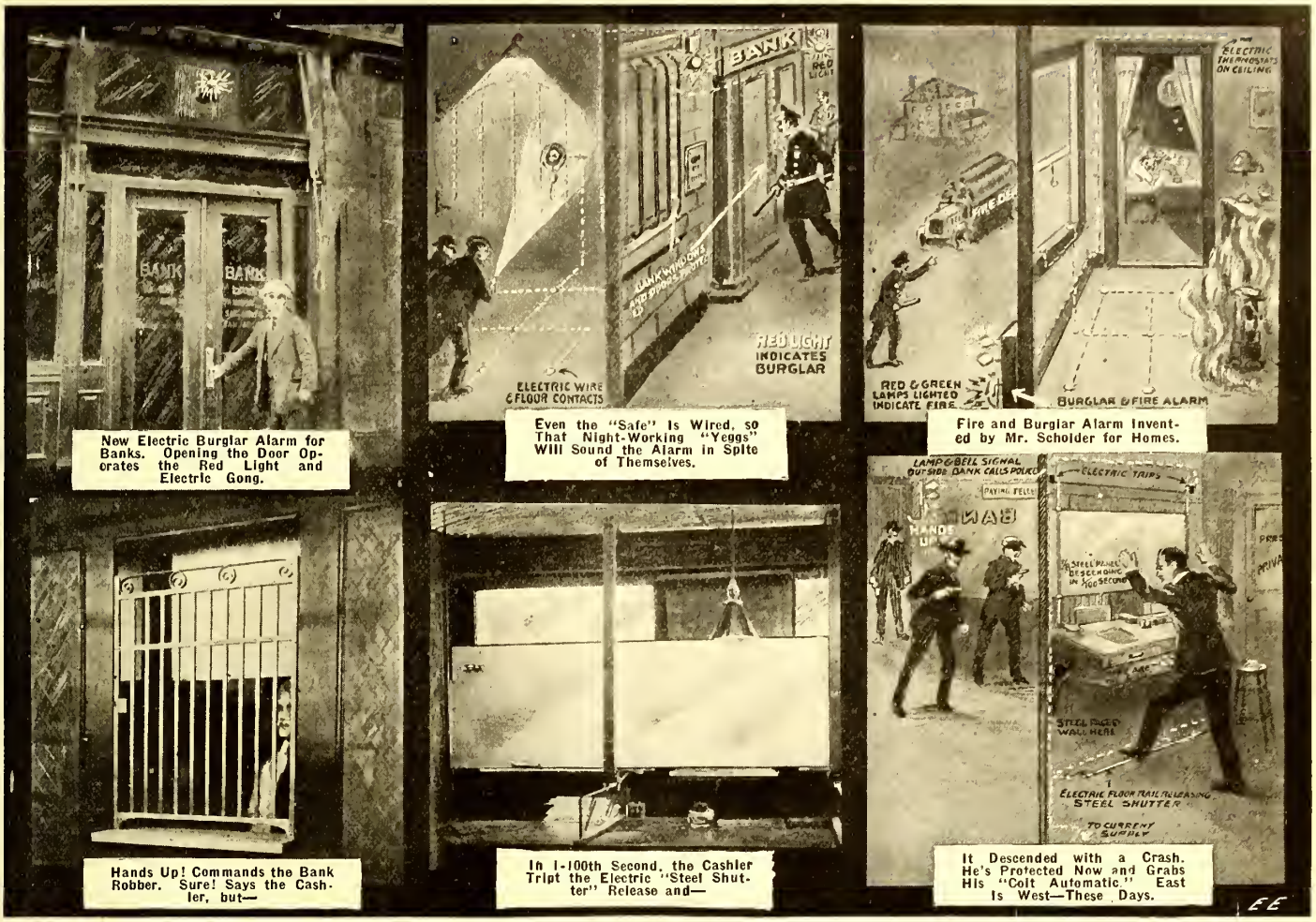
In order to detect the sunken hulls, use is made of the induction balance invented by Hughes in 1881. The insert in our illustration on this page shows the basic principle of the apparatus. Two wooden or hard rubber cups about four inches high and one and a quarter inches in diameter are turned out. Upon each of these cups we now wind 150 yards of single silk copper wire No. 32, which gives us a spool about a quarter of an inch high. Each wooden cup has two such windings, as will be noted from the illustration. These two wooden cups now form the pans of the thus constructed induction balance. The connections are made as in the illustration; the two lower windings connecting with an ordinary telephone receiver, while the other two spools are in series with a microphone and three dry cells. We now have an instrument of extraordinary sensitivity. In the position shown in the illustration, if you pick up the telephone receiver no sound is heard because the two parts of the balance are in equilibrium. If, however, we drop into one of the cups a piece of metal, no matter how small, the electrical compensation will be disrupted, due to the difference of resistance thus created, and we now hear the clock ticking in the telephone.

This instrument is so extraordinarily sensitive that even if two equal coins are dropt, one in each cup, the telephone will sound just the same because these two coins are not *exactly* of the same weight nor of the same alloy. The slightest chemical difference will thus be shown in the induction balance. For that reason this instrument has been used a good deal for exploration work, and the idea to use the induction balance for finding sunken vessels is by no means a new one. It has been used successfully for a number of years.

Our illustration shows how it is accomplished. If we fit out a submarine as shown, which has two induction balances lowered into the water and which are trailed from underneath, the telephone receiver on board located in the control station will give forth no sound as long as the two balances move thru the water. But the minute one of them comes within the vicinity of a wreck, say within five hundred feet or more, the electrical balance will be disturbed immediately, and the telephone will sound its warning to the operator. The nearer the balance comes to the wreck the louder the sound will be. It is thus a

(*Continued on page* 559)

www.americanradiohistory.com



Electricity Foils Bank Robbers

BANK robberies being so prevalent at the present day induced a very ingenious inventor, Mr. Scholder, of New York, to try out a new invention after he had had it patented. In the Bronx, New York, there is a small bank, entirely too small for the business it is doing, which decided that the only way to safeguard itself, its employees and its patrons was to install an electric Burglar Alarm, which would not have the disadvantages of other alarms, and at the same time work more efficiently than any such device yet perfected. Accordingly a contract was given to the inventor, and the device was promptly installed. A demonstration showed its utmost reliability in every respect. The device is now installed in the Cosmopolitan Bank, Prospect Avenue, Bronx.

It consists of various applications of alarm and signaling systems, original and patented by the inventor. Should a burglar attempt to enter the bank, an alarm is immediately sounded in the form of a large gong and a red lamp flashes; this lamp is so protected outside of the bank that neither the gong nor the flashers can be tampered with, as shown in the photographs. The gong is enclosed in a perforated steel box, of which there are four, one at either entrance of the bank, one in the basement and one in the bank proper. Should one of the gongs thru any chance be destroyed, the other three gongs will immediately set up an alarm, reinforced by the red light flashes, which attract passers-by or any policeman on beat. A special novelty of this protective system is that installed at the tellers' windows. These are equipt with steel drops 1/8" thick, which are held in place by electric latches, one at each end, the drops running the entire length of the window and high enough to protect those behind from any trouble or misfortune. Should any system of robbery such as has been tried in other banks be attempted here, and the robber enter, levelling his gun with a cry of "Hands Up!" a *slight* foot movement on the part of the teller will immediately release the drop with a terrific bang, as this steel curtain (which effectively protects him from being shot) drops down. Immediately, both inside and out, alarms and electrical flashes announce the hold-up, preventing the killing, accidentally or purposely, of any of the employees and the loss of property as well. The bank is so protected that no burglar can enter the premises thru doors, windows or any other opening; even should he attempt to tunnel into the bank and tear a portion of the wall down, he would be instantly detected. As far as safes and safety vaults are concerned, it is impossible for even an experienced safecracker to touch anything from the inside, whether the outside door is opened by knowing its combination, or by dynamiting the safe, inasmuch as an insert of the safe consisting of a fiber frame, lined with web-like wires, will cause an instant alarm.

Now a word about the device. This consists of a double contact or 2-way relay, which will prevent either cutting, short-circuiting or interference in any way with the wires, this relay actuating an automatic drop. This drop is connected with flashers and well-concealed wires running to the bell and lights, so that any attempt to cut or destroy the signaling devices will set off the alarms in other parts of the building and at other exits. The bank is thoroly wired, and an attempt of breaking thru the walls would be immediately frustrated. Thermostatic fire alarms thruout the building are arranged in a like manner, and wired to a distinct annunciator, which warns of any conflagration by means of the intermittent or continuous bell alarm, and flashes of both red and green lights, the two together indicating *fire,* and the red alone indicating burglary. The approach to the safe itself is thoroly wired. The alarm can be arranged in such a way as to notify the Police Headquarters, at the same time attracting the attention of all those about. The writer has seen an actual demonstration of the device, and in which attempts were made to force open the door. Another scene demonstrating the "hands-up" attempt to make the teller "fork over" met the response on the part of the teller by a prompt lifting up of his hands. Immediately a steel curtain dropt down with a terrific crash (in about 1/100 second), hiding the teller from view and protecting him from all harm. The release of the curtain, together with the crash and alarm is enough to scare any yeggman, no matter how bold he may be.

www.americanradiohistory.com

To Europe in Three Hours

By H. WINFIELD SECOR

ASSOCIATE MEMBER AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

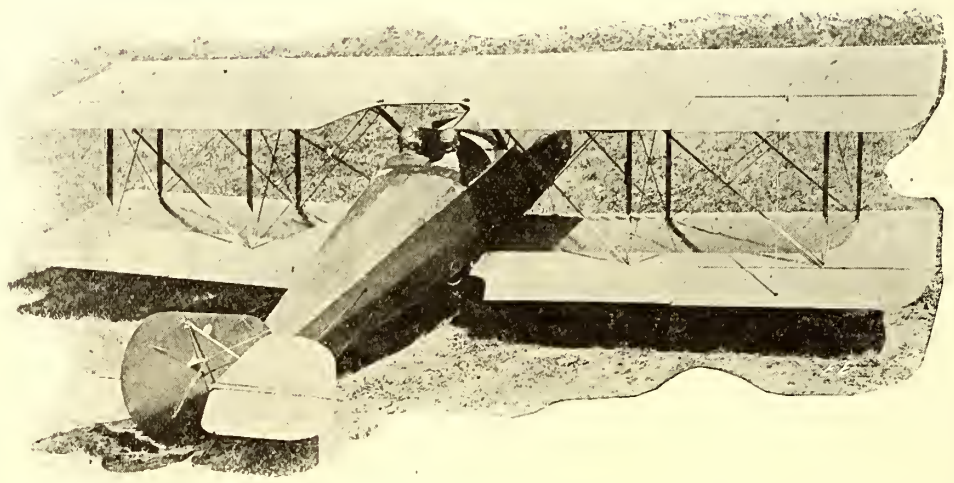
SEVERAL attempts have recently been made to improve on the high altitude flight records, the highest point so far reached being that attained by the French flier, Adjutant Casale, who unofficially reached a height of 33,136 feet. A few weeks ago Mr. Roland Rohlfs, chief test pilot for the Curtiss Engineering Corporation, established a new official altitude record at Mineola, L. I., N. Y., when he soared to a height of nearly 31,000 feet (30,700 feet Unhomologated). Some of the experiences of Mr. Rohlfs, as well as those of Major R. W. Schroeder, A. S. A., who held the best previous American altitude record of 28,900 feet, made on September 18th, 1918, are given elsewhere in this article.

AIR PRESSURE RAPIDLY DECREASES AT HIGH ALTITUDES

It is undoubtedly a common belief that the only requisites necessary in ascending to a great height in an airplane are great stamina and a one hundred per cent physique on the part of the flier, a good plane and engine and devices arranged so as to overcome the effects of the severe cold felt at the higher altitudes, such as 25,000 to 30,000 feet. There are many other factors, however, which come to bear on this important matter of flight in the upper rarefied air strata, one of the most important of which is the rapid reduction in the atmospheric pressure on the body at such altitudes as 30,000 feet and above. Before going further, it should be said that there naturally must be a limit to the permissible reduction of this air pressure in order to live. If we reduce this pressure to a very small fraction of the normal pressure at sea level, which is 14.72 pounds for every square inch of the body surface, then it becomes evident that the pressure of the blood as it is pumped thru the veins by the heart will burst them. If a frog is placed under a glass bell and the air exhausted, the frog will blow to pieces, due possibly for one reason to the air trapt in the lungs, which bursts these tissues when the external pressure is removed from the body, and due to a second and very important reason—that so long as the heart keeps pumping the blood thru the veins of the body this pressure, which is considerable indeed, will cause these vessels to burst. Persons often ask, "How high will our birdmen, with every possible airplane refinement, be able to fly, and if, generally speaking, there is no limit, provided planes and engines can be built which will operate properly in the upper rarefied air strata?" The answer is—that there is certainly and most decidedly a "limit," and we would state here that it is our belief that unless specially arranged engines and carburetor systems, fitted with the new atmospheric compressor and enclosed cabs, possibly *vacuum bottle* cabs, to protect the crew are used, then when flying in an ordinary machine where he will have to breathe the air direct from the atmosphere (even with the aid of oxygen), he cannot hope to ascend to a greater height than 38,000 to 40,000 feet.

The Physics of the Upper Atmosphere. How High Can We Fly and Why?

The author became particularly interested in this matter and went to the trouble of taking up this subject with the New York branch of the U. S. Weather Bureau, and desires here to give thanks to the courtesy of Mr. J. H. Kimball of that Bureau, who kindly looked up records on some wonderful pilot balloon tests and observations made by the U. S. Weather Bureau Service. Figures for the air pressure and temperature at various altitudes are presented in the illustration herewith, where some interesting speed figures are given for various types of aircraft as well as steamships. It is interesting to note at this juncture that the amount of increased speed for the future is all with the airplane or dirigible—and *not* with the ocean-going steamship. Ocean-going steamships have about reached their highest speed, due to several engineering reasons. Such a vessel displaces constantly a very large amount of water, and the laws governing this are very well known, and have been worked out by technicians to a very high degree in the past ten to fifteen years. It is doubtful if we shall ever see a steamship which can cross the ocean in a shorter time than *three days*, unless an unreasonably large amount of horse-power is consumed for the purpose, which, of course, is diametrically opposed to the high efficiency standards demanded of all such transportation carriers today.



The Thomas-Morse Airplane that Established a new Gliding Record of 35 Miles. A Glide of 35 Miles with a Dead Motor was Recently Made by R. C. Marshall, Test Pilot for the Thomas-Morse Aircraft Corporation. It Is Said that this is a World's Record for Gliding. "Tex" Marshall, as He is Called, Flew from Ithaca to the Head of Cayuga Lake, a Distance of 35 Miles, and Then Flew Upward Until He Reached a Height of 17,500 Feet. He Then Cut Off His Motor and Glided Toward Ithaca. When He Reached the City, It Is Stated, He was Still at a Height of More than a Mile, and Might Have Glided Fifteen Miles Further.

The airship, on the other hand, has the advantage that as it ascends to higher altitudes it meets with less resistance, and not only this, but another wonderful phenomenon of nature occurs—the higher air strata are known, as tests have shown, to be moving at a very high velocity, and so it is readily seen that if an airplane ascends to an altitude of 20,000 to 30,000 feet, or even less, that it may strike a strata of air traveling eastward, or perhaps westward, having a velocity of 200 miles an hour or more. Hence, if the airplane can travel at 100 miles an hour, then its net velocity in a given direction will be 300 miles an hour!

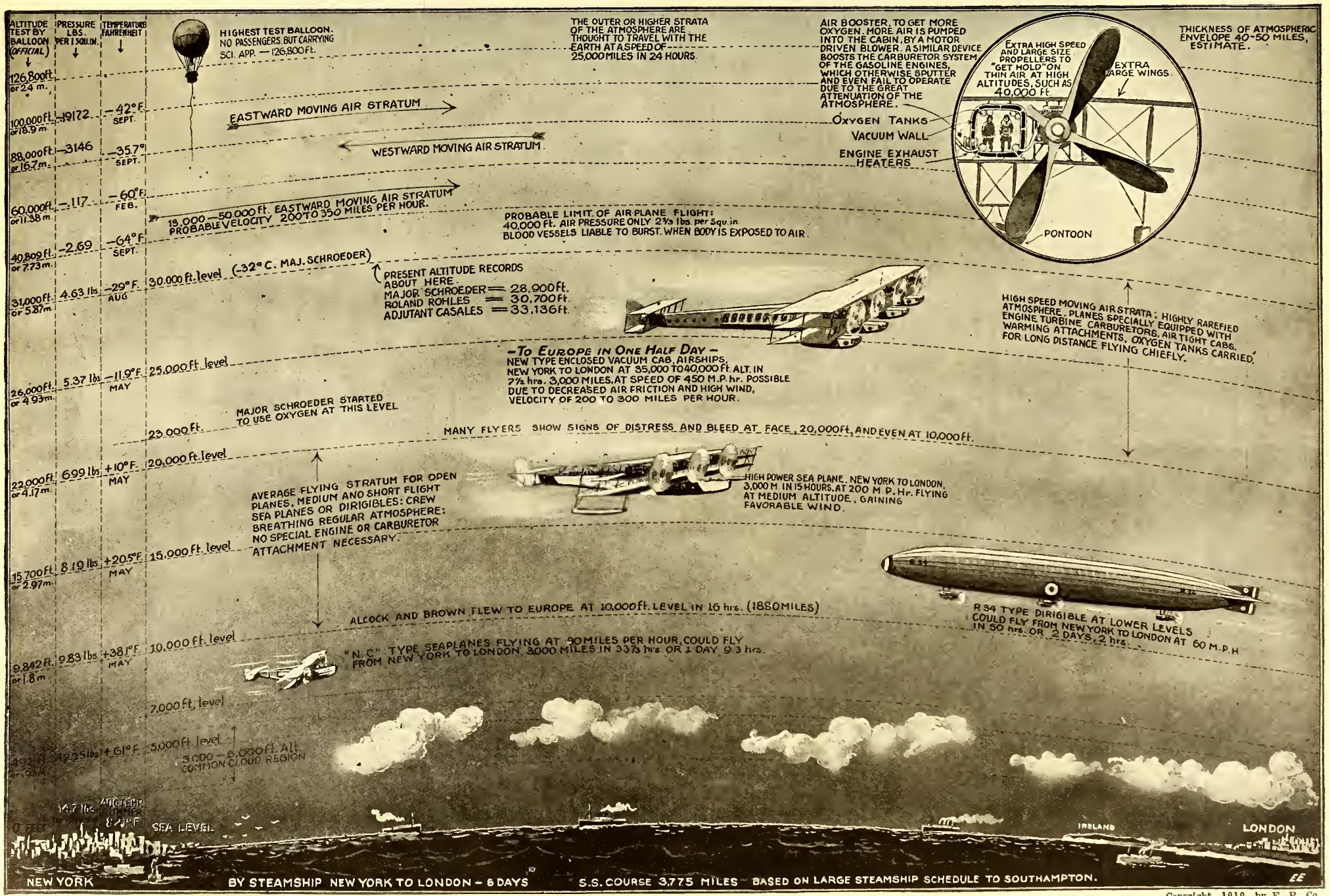
It is believed that the successful pioneer transatlantic flight of Messrs. Alcock and Brown, totaling 1,880 miles, which was made in sixteen hours, at an average speed of 116 miles an hour, was due to the fact that they ascended to a height of 10,000 feet, where they found an air current traveling Europeward with a high velocity. Such is the belief of Mr. Roland Rohlfs, the Curtiss pilot who has just made a new altitude record of 31,000 feet, and who expects to ascend to 33,000 feet or higher in a new flight.

The rarefaction of the atmosphere increases rapidly once an altitude of 30,000 feet is reached, and several writers on the subject have in recent years mentioned that for this reason particularly they do not believe that aviators will ever ascend higher than 40,000 feet in an open-type machine, where they have to breathe the ordinary atmosphere, even with the aid of oxygen supplied from a tank. This belief has been voiced by Mr. Harry E. Dey, a well-known American engineer, in an article which appeared some time ago in *Aeronautics*. He gives several other reasons therein for his faith in this belief. As the figures show in the accompanying illustration, the air pressure has been reduced about 60 *per cent at a height of 26,000 feet,* or 4.9 miles above sea level. Here we find the air pressure has dropt to 10.9 inches on the barometer, equivalent to 5.37 pounds per square inch. Such a marked reduction as this, as proven in all altitude flights so far attempted, have a very strong and undesirable effect on the flier. It affects the pulse or heart beat, the respiration, and in fact every part of the body, causing in some cases severe nausea, and at times fainting spells, when the pilot cannot tell whether he is flying upside down, sidewise, or in normal position. Major Schroeder, the American army flier, had all these sensations and more in his 105-minute ascending and 20-minute descending trip at Dayton, Ohio.

Let us look at the air pressure and temperature at 31,000 feet, or 5.8 miles. An official test made by the U. S. Weather Bureau at Huron, S. D., in the month of August shows an air pressure of 4.6 pounds per square inch, or a reduction of 68 per cent in the pressure found at sea level, where the aviator started to rise, probably no longer than an hour previously. Imagine

(*Continued on page* 573)

www.americanradiohistory.com



Copyright, 1919, by E. P. Co.

To Europe in one-half day and possibly in three hours—that sounds almost preposterous and impossible to say the least, does it not? But a scientific study of the peculiar atmospheric conditions existing in the higher altitudes, such as thirty thousand to forty thousand feet, gives great promise, as several authorities have pointed out, of giving us airplanes of to-morrow which will so far surpass the present aircraft that there will be no comparison. In the first place, the upper air strata is known to travel at a very high velocity, which will carry a plane at from three to four times its sea-level speed. Besides all this, the rapid decrease in air friction would enable the plane to go much faster than at lower levels where the air is denser. "Vacuum cab" airships will undoubtedly have to be used to fly at the higher altitudes with extra large wings and propellers to support the craft in the thin air.

www.americanradiohistory.com

Can Radio Ignite Balloons?

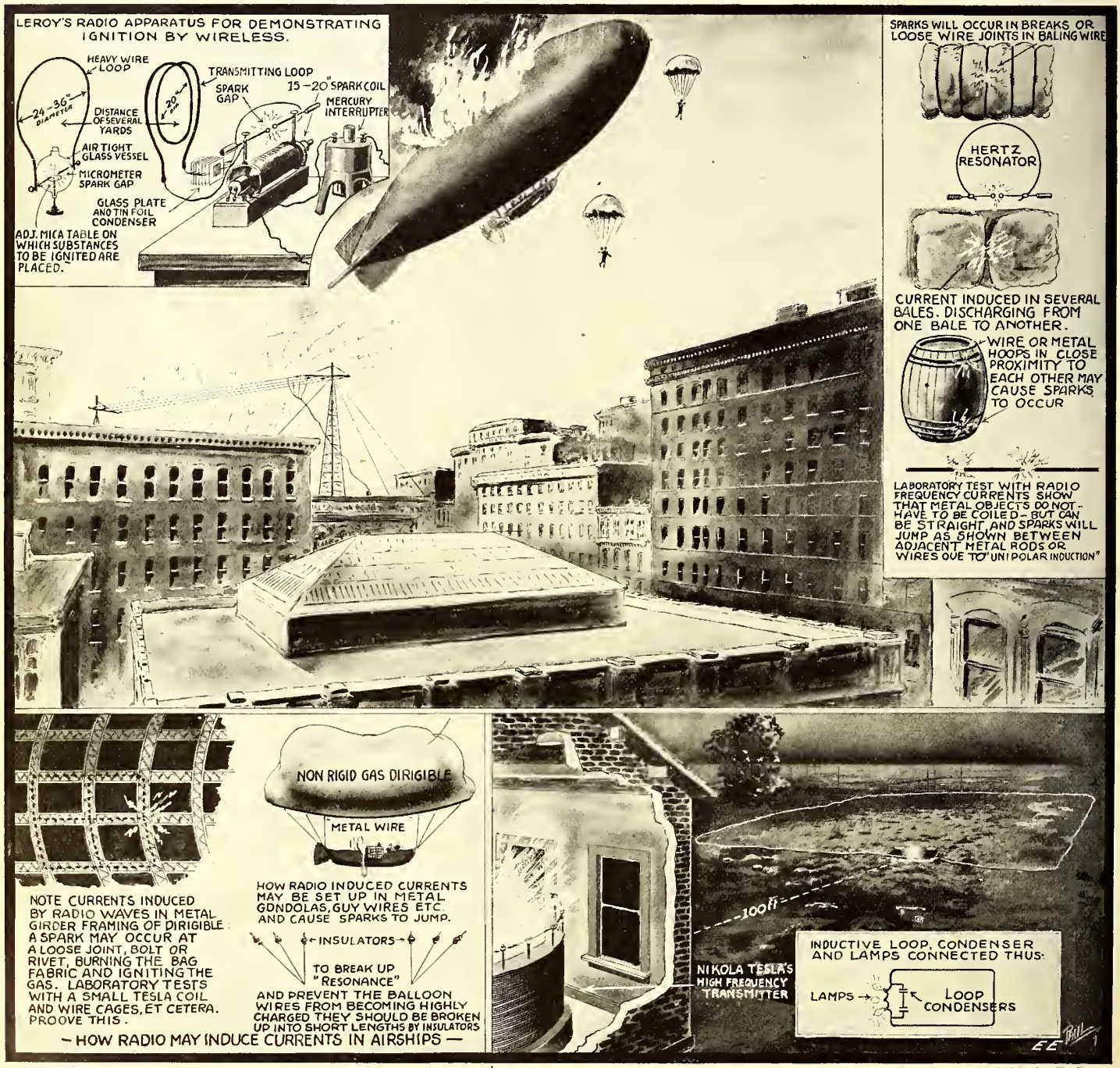
The Opinions of Nikola Tesla and Other Radio Experts

AS a result of the newest theory, that powerful induced currents emanating from the Naval Radio Station in Chicago produced the spark that ignited the Goodyear dirigible airship which plunged in flames thru the roof of a bank building in that city, resulting in death for thirteen persons and injury to twenty-seven others, naval communication officers will aid the authorities in fixing responsibility for the disaster. It was ascertained that technical experts had suggested *this* theory, because the big ship sailed over or near the Transportation building, from the roof of which are projected the antennae of the Naval Radio Station. The building thru the skylight of which the blazing dirigible fell was the Illinois Trust and Savings Bank.

Lieut. F. S. Mason, of the Great Lakes Naval Training Station, district communication service officer, while refraining from agreeing with the theory, said he would cooperate with the investigating officials. Pilot John Boettner, of the ill-fated dirigible, said he had not been aware of the location of the naval radio station. H. M. Byllesby, head of a large engineering corporation and foreman of the coroner's jury of technical men, said experts had suggested the *radio theory* to him.

Col. J. C. Morrow, chief air officer of the central department of the army, the principal witness at the inquest, was a passenger in the dirigible on a trip preceding the fatal one. At that time he said the ship was in safe condition. The pilot he considered competent. He thought the possibility of sparks from the exhaust igniting the gas bag very remote, but said he had not formed an opinion as to the cause of the accident.

(*Continued on page* 591)



Copyright, 1919, by E. P. Co.

Herewith Are Shown Some of the Plausible Reasons Why the Recent Chicago "Blimp" Disaster Might Have Been Caused By a Spark Induced By An Adjacent Radio Station. The Photo In the Lower Right-hand Corner Shows Three Incandescent Lamps Lighted to Full Candlepower, At a Distance of 100 Feet from Dr. Nikola Tesla's Colorado High Frequency Power Plant. The Oscillator Was Worked At Less Than Five Per Cent of Its Total Capacity.

www.americanradiohistory.com

"Piped Cold"—Prof. Bell Has It

IN the July issue of the ELECTRICAL EXPERIMENTER, the Editor advocated the *piping of cold air* to various parts of dwellings and office buildings, using, if possible, the wintering steam piping systems and radiators. Well, great minds, etc. Here comes prolific Dr. Alexander Graham Bell, inventor of the telephone, airships, and ship salvage schemes, with an actual working installation of "piped cold." This idea occurred to Dr. Alexander Graham Bell when the Washington weather became extremely sizzling. Former President Taft, when he was in the White House, had a refrigerating device put in the offices, which since has fallen into disuse, but Dr. Bell believes he procured better results by his "home made" cooling arrangements in his Connecticut Avenue residence. In a communication to the *National Geographic Society*, Dr. Bell describes how he tricked the thermometer out of some 35 degrees—and you can try this out in your own home if you are "handy" about the house. Says Dr. Bell:

I have found one radical defect in the construction of our houses that absolutely precludes the possibility of cooling them to any great degree. You will readily understand the difficulty, when you remember *that cold air is heavier than warm air.* You can take a bucket of cold air, for example, and carry it about in the summer time and not spill a drop, but if you make a hole in the bottom of your bucket, then, of course, the cold air would run out.

I began to think that it might be possible to apply the bucket principle to at least one room in my Washington home, and thus secure a place of retreat in the summer time. It seemed to be advisable to close up all openings near the bottom of the room to prevent the escape of cold air and open the windows at the top to let out the heated air of the room.

Now, it so happens that I have in the basement of my house a swimming tank, and it occurred to me that since this tank holds water, it should certainly hold cold air; so I emptied the water out to study the situation. The tank seemed to be damp and the sides felt wet and slimy.

I reflected, however, that the condensation of moisture resulted from the fact that the sides of the tank were cooler than the air admitted. Water vapor will not condense on anything that is warmer than itself, and it occurred to me that if I introduced air that was very much colder than I wanted to use, then it would be warming up in the tank and becoming dryer all the time. It would not deposit moisture on the sides and would actually absorb the moisture there.

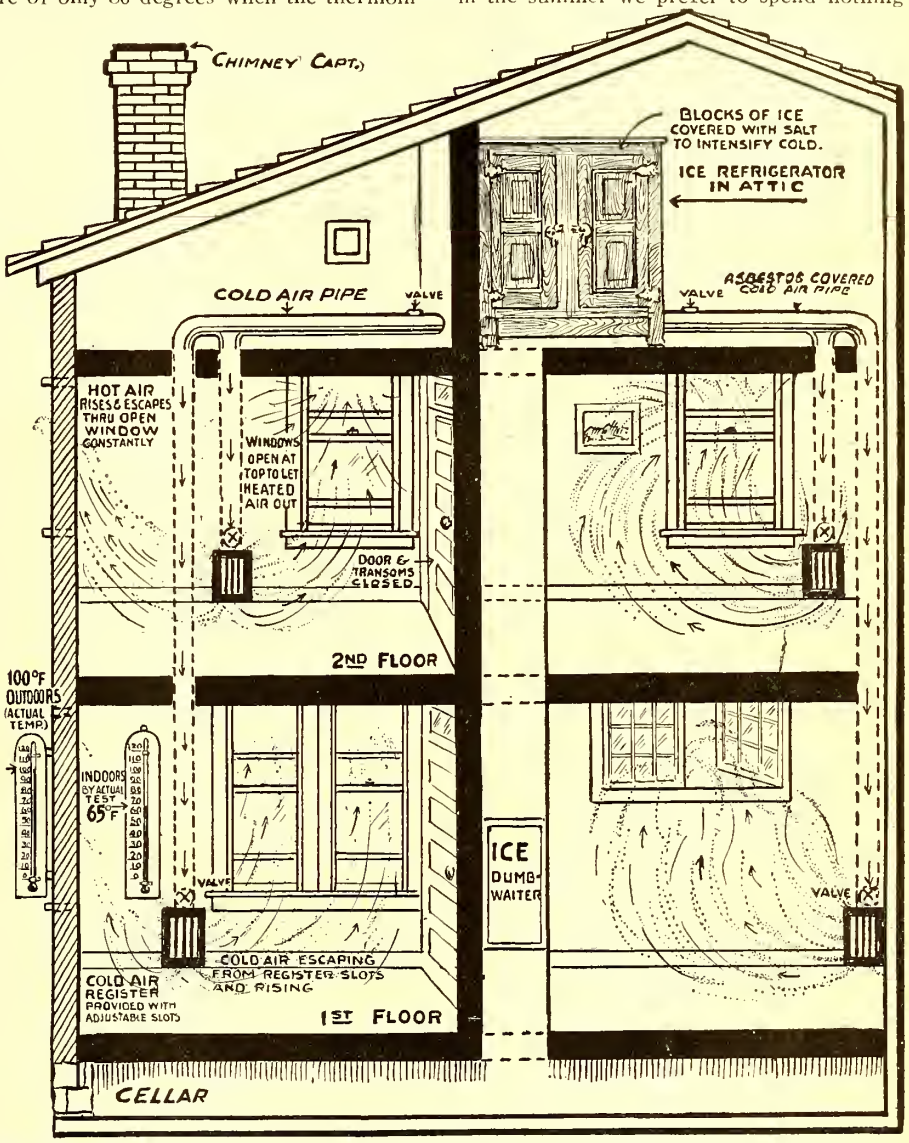
I therefore provided a refrigerator, in which were placed large blocks of ice, covered with salt, to intensify the melting and freezing action of the ice. This was placed in another room at a higher elevation than the tank, and a pipe, *covered with asbestos paper,* was employed to lead the cold air into the tank.

The first effect was the drying of the walls, and then I felt the level of the cold air gradually rising. At last it came over my head. The tank was full, and I found myself immersed in cool air. I felt so cool and comfortable that it seemed difficult to believe that Washington stood sizzling outside. I climbed up the ladder in the swimming tank until my head was above the surface, and then found myself breathing a hot, damp, muggy atmosphere. I therefore speedily retreated into the tank, where I was perfectly cool and comfortable.

Guided by this experience, I tried another experiment in my house. I put the refrigerator in the attic (see drawing herewith) and led the cold air downward thru a pipe covered with asbestos into one of the rooms of the house. The doors were kept shut and the windows were opened at the top. The temperature in that room was perfectly comfortable, *about* 65 *degrees!*

Some time ago the papers were speaking of an ice plant that had been installed in the White House, and congratulated the President, then Mr. Taft, upon a temperature of only 80 degrees when the thermometer showed 100 degrees outside. Under similar conditions (100° F. outside), I enjoyed in my home a temperature of 65 degrees (the ideal temperature), with a delicious feeling of freshment in the air.

The system proposed by Prof. Bell occupies very little space. In fact, it could be placed very easily in tenement houses utilizing the area between the ceiling and the roof, as all houses have at least a three-foot clearance between these two points. No doubt in the future, owners of houses will be compelled to install cooling systems.



"Piped Cold"? Sure! Why Not? Said Prof. Alexander Graham Bell, Inventor of the Telephone. In His Washington, D. C., Residence He Installed a Refrigerator in the Upper Story as Here Shown. The Cold Aid Descends Thru the "Pipes," and Chases the Heated Air Out Thru the Open Window Tops. 100° F. "Outside" and 65° F. "Inside"—Tells the Story. It Works!

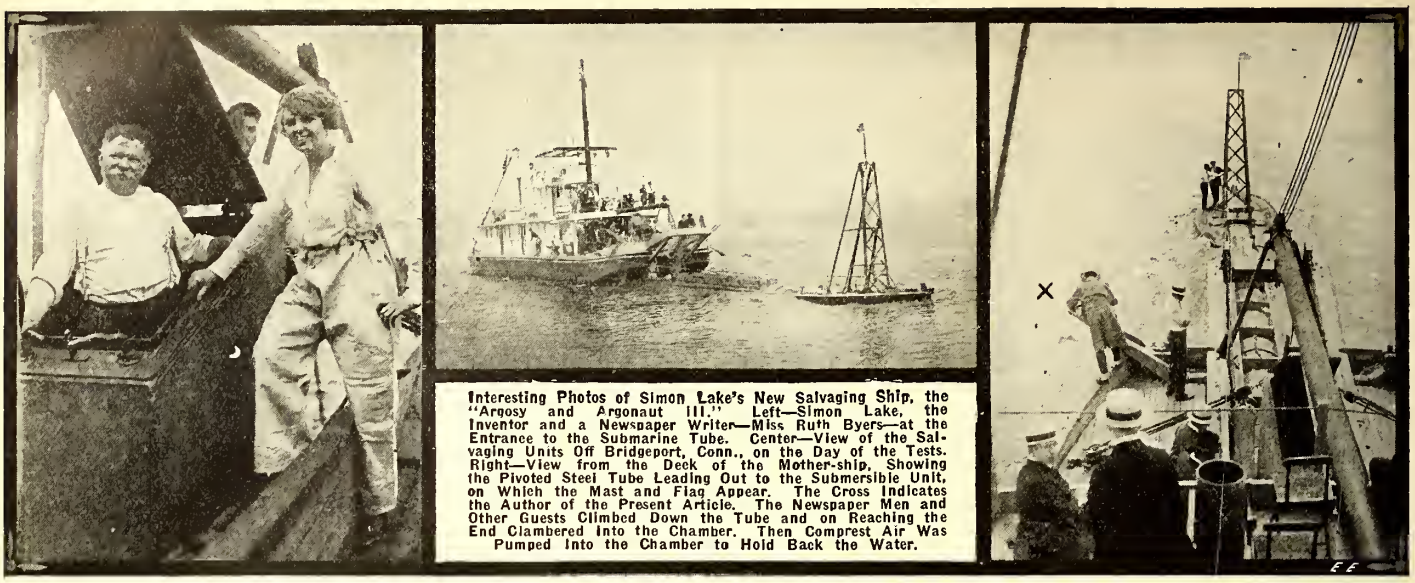
ORIGINAL EDITORIAL BY H. GERNSBACK IN THE JULY ISSUE

One of the most profound annual summer mysteries of the twentieth century—at least to the writer—is our hot office or our hot home. We would not think of an unheated house or office in the dead of winter with the temperature near the zero point, but curiously enough we allow ourselves to suffer cruelly from the heat in the summer time when the temperature rages up in the nineties. Is it not a most curious world in which we live?

We think nothing of spending fabulous sums in the winter for our coal supply in order to keep warm and comfortable. But in the summer we prefer to spend nothing and suffer untold misery in consequence. Babies and grown up sick folk die like flies by the thousands on account of the heat, while we stand by helpless, or rather as if we were devoid of all intelligence, while the totally unnecessary slaughter goes on incessantly. How our grandchildren will read with astonishment that for decades human beings had their houses piped for heat, but had not enough sense to run a freezing solution or other freezing agent thru the self-same pipes in the torrid summer days!

There might be an excuse for our criminal negligence if we had not the means at hand to keep us cool and comfortable in summer. But we really have all the means, all the apparatus; in fact, everything—including: (*Continued on page* 550)

www.americanradiohistory.com



Interesting Photos of Simon Lake's New Salvaging Ship, the "Argosy and Argonaut III." Left—Simon Lake, the Inventor and a Newspaper Writer—Miss Ruth Byers—at the Entrance to the Submarine Tube. Center—View of the Salvaging Units Off Bridgeport, Conn., on the Day of the Tests. Right—View from the Deck of the Mother-ship, Showing the Pivoted Steel Tube Leading Out to the Submersible Unit, on Which the Mast and Flag Appear. The Cross Indicates the Author of the Present Article. The Newspaper Men and Other Guests Climbed Down the Tube and on Reaching the End Clambered into the Chamber. Then Comprest Air Was Pumped Into the Chamber to Hold Back the Water.

Photo © by International Film Service

Reclaiming Sub-Sea Treasures

By JOSEPH H. KRAUS

Walking on the Ocean's Bed Without a Diving Suit—Simon Lake's Newest Invention

A LETTER.

"We expect to have our first press trial of the 'Argosy and Argonaut' on Friday morning, August 1st.

"Very truly yours,

"SIMON LAKE.

"Dictated but not signed."

THIS was a portion of the letter from the inventor of the modern submarine which greeted me not so long ago. With August 1st coming on the next day, it meant hustle and get out. So the two of us, my camera and I, departed for Bridgeport. The next morning found me at the Stratford Hotel with a party of about forty editors and cameramen, representing newspapers, photograph agencies and motion picture concerns, all there bright and early awaiting our trip to the salvage ships. Not very long afterward a short walk brought us to the pier to which one of Mr. Lake's vessels was moored. A little joking while the refreshments were being placed on board, the blow of a whistle and we departed for the open sea. About one-half hour's ride brought us to the good ship *Argosy and Argonaut.* This is a combination of two ingenious devices used for ship salvaging and wreck recovering. The "mother ship," about 100 feet long, has a 65-foot tube connected to it in a little *well* in the forward part of the ship. At the end of the tube is the submarine, which is hinged directly with it so that entrance may be effected thru the tube while the submarine is at the bottom of the water. A few trips around the vessel while the cameramen ground out hundreds of feet of "movie" news film and the submarine going thru maneuvers, demonstrated to us the ease and safety with which the device would work.

The launch which was taking us around soon pulled up alongside of the salvage vessel. We clambered on board once more, all ready for the descent, a demonstration of which was to be given in a very short time. Mr. Lake then singled out the parties, four or five of which went down into the tube at a time, and each group had some of the most interesting stories to tell. Altho before starting down I thought songs like "Nearer, My God, to Thee" or "Asleep in the Deep" would have been very appropriate for the occasion, no one even as much as hummed them. We were all too engrost in the surroundings and awed by the masterful engineering spectacle around us.

THE DESCENT.

A hatchway measuring about 3 by 4 feet opens into the 65-foot tube, which latter tube is well lighted by electric lamps, the current for which is supplied from the mother ship. Current is likewise provided to actuate all the mechanisms in the submarine. The tube, 4½ feet in diameter, has struts across the bottom. These struts are 6 inches apart and assist in getting a foothold in the tube. A rail on each side helps to hold you in a "hunchback" position. It is necessary, in order to descend in this tube, to stoop over, and for safety's sake to go down backward, as a "bump on the bean," as someone called it, is not such a pleasant thing to get, and there is less chance of "bumping" in walking down backward than in attempting to go down the other way. Furthermore, the body would not have to be bent at such a great angle descending backward. Soon the tube narrowed, and instead of the rail on each side, a large number of steel ribs greeted our clutching fingers. Mr. Lake being first, directed us to wait a while, and started to release the air pressure in the diving chamber. A hiss of escaping air and dense clouds of mist filled the lower end of the tube completely. Shortly a massive iron door opened, just large enough to admit a person's body. "All in!" and we filed thru the opening, or rather crawled thru it. We now entered the equalizing chamber, about 5 feet long and 3½ to 4 feet wide. Swinging the door closed again, Mr. Lake opened the valve which admitted air, so that the pressure in this chamber would be the same as that in the operating chamber.

"Should you feel deafening in your ears, swallow," were Mr. Lake's words. Well—we swallowed! It reminded me more of "evolution" than anything else in my life. Have you ever been to the aquarium, and noticed the way some of the big fishes gulp water so as to oxygenate their blood? Well, that was *us.* The door into the operating chamber now permitted its being opened as the air chamber was equal in pressure.

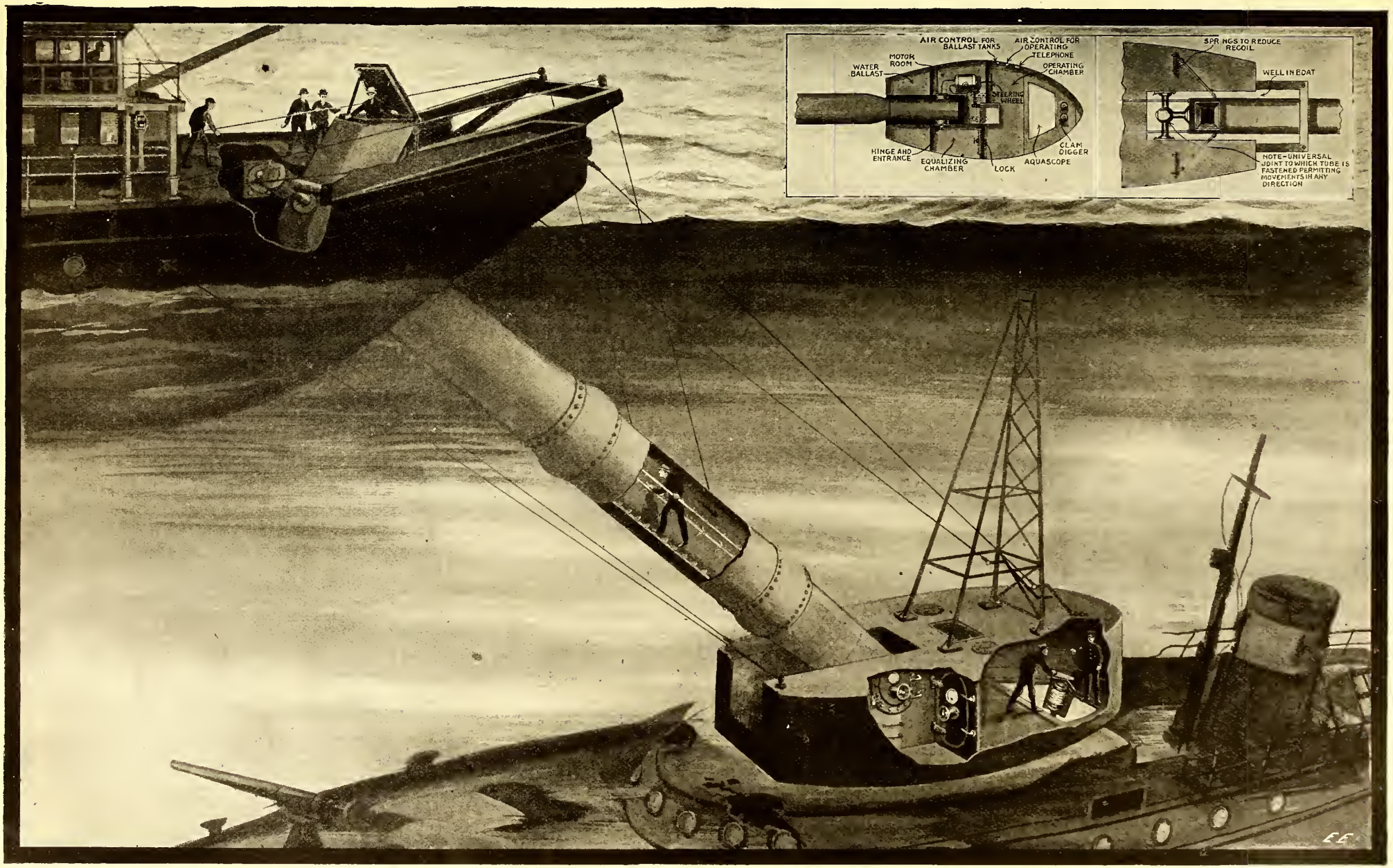
This room is about 9 feet long and 8 feet wide at its broadest point, and sort of triangular in shape. What immediately attracted our attention was a hole in the floor of this chamber. There in front of us was a sheet of water about 6 inches deep, perfectly smooth on top with glistening white sand beneath. It seemed as tho it had been smoothed out and the sand cleaned for our reception. A signal, and the submarine moved forward, the water under us passing in slight ripples, and the sand moving away quite rapidly. Some of the most wonderful seaweed and shells were past, which could be seen easily with the use of no lights whatsoever, the water being of a beautiful translucent green (it's mighty hard to keep a swimmer out of water of that nature). A short time down in the operating chamber completed our visit to Father Neptune, and we again past thru the air-lock in order to give some of the others a chance to see this most wonderful spectacle.

HOW THE SALVAGE SHIP WORKS.

Now a word about the apparatus. The *Argonaut,* which is the mother ship, is 100 feet long with a beam of about 45 feet. It is driven by two 75 horse-power gasoline engines. These drive two propellers each, one forward and one aft. The propellers are so arranged that the forward pair may be disconnected, whence each engine drives the ship by means of the rear propeller. A very complex system of signalling is used on this vessel. The devices work by electricity or manually, by means of which the officer on deck can signal the engineer below in the engine room. In this engine room also is a 125-volt generator driven by an independent engine coupled to it. The energy derived from it is used to charge storage batteries, which supply the 110-volt D.C. for the lights and motor appliances used in the "sub." An air pump operating constantly supplies the air pressure for the "sub" and maintains a pressure of 75 to 80 lbs. per square inch at all times.

There is another extremely ingenious idea which Mr. Lake has incorporated in his salvage work. The device referred to is a semaphore arrangement on the masts of the salvaging ship. This semaphore consists of two arms, which are operated

www.americanradiohistory.com



Copyright, 1919, by E. P. Co.

Simon Lake's New Salvage Machine for Reclaiming Sunken Vessels

Hundreds of millions of dollars' worth of cargo and ships lie sunken in the ocean and in coastal regions, which can be salvaged either partly or in whole, when the proper engineering means have been provided. It appears that the new salvaging vessel recently perfected by Captain Simon Lake, of submarine fame, will perform such operations in a very expeditious and efficient manner; and this belief is all the more strengthened by the successful tests made during the past August in Long Island Sound in the vicinity of Bridgeport, Conn. Captain Lake made successful explorations of the bottom of Long Island Sound at depths up to 50 feet and over. The principle of the device is as follows: A mother ship of fairly large proportion carries a pivoted steel tube at one end as the illustration above herewith shows. The lower end of this steel tube which forms a passage-way for the salvaging crew, is fitted by means of a large pivot joint to a "submarine" as it is called, and which in fact it really is. When one climbs down thru the tube, he finds himself in a rear chamber of the "submarine" and directly he passes thru an air-lock door, shown in the plan view above, into the forward air-lock. In this forward compartment air at high pressure is constantly forced in thru a pipe passing down thru the pivoted tube. This air pressure keeps the water down to the level of the floor. There is an opening in the floor as shown and the crew may walk on the sand of the bottom as the submarine is pushed along by the mother vessel. The present illustration shows two men sawing off the starboard light on the sunken "Mary Alice", an armored yacht.

www.americanradiohistory.com

from the deck, by means of which signals are transmitted to the two smaller vessels which accompany the *Argonaut*. These smaller vessels are known as *wreck-finding vessels*, much speedier than the salvage ship (*Argonaut*), and at the same time smaller in size. They are likewise equipt with semaphores for replying to signals. In this way Mr. Lake can guide the course of the wreck-finding vessels without the use of wireless. The submarine proper is 22 feet long and divided into a motor room, opening into the left hinge, and an equalizing chamber, opening at the right hinge, thru which we had to pass in order to reach the operating chamber up forward. On each side and to the rear are two ballast tanks; also one midway between and below these. A large 110-volt motor actuates the wheels under the submarine proper. This motor is controlled from the operating chamber, i. e., the forward-most chamber of the submarine, and is likewise steered from this latter chamber. By its means the *Argosy*, or submarine proper can rest on the bottom of the ocean. These traction wheels under the submarine may be steered in any direction, and the mother vessel may, by this means, be drawn along by the action of the submarine itself, the submarine having the mother ship in tow, so to speak. Entering the right equalizing chamber from the tube, there is a massive iron door (which seems strong enough for a safe) with heavy latches. The door in the equalizing chamber is closed and comprest air is admitted slowly so as to allow the body to become accustomed to the increase in atmospheric pressure. When this is done gradually there is no grave risk.



A Remarkable "Pre-War" Caviar Map of the World's Greatest Ship Graveyard. The Wrecks Pictured Have All Occurred During a Period of Fifteen Years. This Great Loss of Shipping Was One of the Principal Causes Leading Up to the Construction of the Kiel Canal. This Chart Was Prepared, Before the War, by the German Hydrographic Office. Captain Lake's Submarine Salvaging Scheme, Which He Has Successfully Demonstrated, Represents an Invention that Is Expected to Reclaim 75 Per Cent of the $6,000,000,000 Worth of Ships and Cargo Lost During the War. Altho Simon Lake, the Inventor of What for a Better Name Might Be Called a "Salvaging Submarine," Gave His Demonstration Off Penfield Reef, Near Bridgeport Harbor, Conn., He Declared that It Would Be Just as Successful Where the Waters Were 300 Feet Deep. Tests Have Been Successfully Made at a Depth of Fifty Feet. The Salvaging Submarine Really Consists of Two Boats, the Argosy and the Argonaut. The Argonaut Is the Mother Ship and the Argosy the Submarine Attachment or Submarine Tube that Can Be Lowered or Raised by Means of Powerful Engines on the Mother Ship. A Larger Vessel with a Tube 300 Feet Long Is Being Planned for Use in Deeper Waters. One of the First Vessels to Be Salvaged Will Be the Bark "Hussar," Which Was Sunk in Hell Gate, N. Y., During the Revolutionary War with a Treasure of $5,000,000 in Gold on Board.

Some notion of what a difference in air pressure may make can easily be understood when one realizes that every foot below the water level there is an increase of .43 pound on every square inch of the body surface, which means an increase of 1,376 pounds for the entire body. Under normal conditions, the body is subject to a pressure of 14.7 pounds per square inch, which is atmospheric pressure. At a depth of 150 feet the pressure is more than four times that to which we are accustomed, and is an additional 64½ pounds per square inch, or 32,250 pounds increase on body over atmospheric pressure. Under these circumstances the blood is driven back from the surface of the body, the veins become deplete of blood, and a greater amount of blood is forced into the arteries, hence causing the heart action to be of necessity a good deal stronger in order to force the blood thru the contracted arteries. For much the same reason, a deafening sound is produced. This is due to the fact that air pressure on the diafram of the ear (tympanic membrane) causes an inward depression of the diafram

The Eustachian tube which connects the middle ear with the buccal cavity, normally closed, opens a slight fraction of a minute during each swallow, and by this means allows for an equalization of the air pressure on both sides of the tympanic membrane. That is the reason Mr. Lake gave us orders to swallow on opening the valves, which would increase the pressure to that of the water at that depth. Even at depths of 40 to 45 feet the sudden *descent* may prove dangerous, and a too hasty *ascent* may be followed by intense bleeding of the nose and ears, and perhaps a more dangerous hemorrage in the body. All troubles of this nature are due, as we have said, to hasty ascent or descent. There are several pathological reasons for death, which may result from causes such as these, but as that is more a matter for the medico, it will not be discust in detail here.

THE OPERATING CHAMBER.

This chamber is divided up into a forward portion and the controlling portion. Up forward is the *Aquascope*, or underwater telescope, by means of which one can see out into the water. That is to say, the Aquascope is a large glass door, which will allow a person to look thru it or open it and get out and walk, so to speak. There is a depth of 6 inches of water from the interior of the chamber to the bottom of the ocean or deck of the vessel when the submarine is in position, so it's just as easy to walk here without getting any wetter than if wading in a brook. In this chamber likewise is a telephone, which communicates with the deck of the "mother vessel," as are likewise controls for all operations, such as derricks, degrees of air pressure and signals. In the aft portion of the submarine are three air tanks, which are placed one at each side, and one in the center and below the other two. It is only necessary to allow the water to pass into these containers, and the increase in weight will carry the submarine to the bottom, or anywhere midway between. It may likewise be forced out and the submarine made to rise to the surface.

The tube itself is hinged in such a manner that an up and down motion does not materially affect the submarine, neither does the side to side motion of the mother ship have any effect. A sort of universal joint, very powerfully constructed, holding the tube in position, while ropes connected to the pulley blocks on the deck prevent the tube from rocking either way to a great extent, due to the fact that these blocks in turn connect to springs.

Is salvage practical commercially? Well, let us quote a few cases. *La Lutine*, an old hulk of a British frigate, sailed from Yarmouth Roads for Hamburg on October 9, 1799, carrying a large amount of treasure in the form of gold and silver bars and coin. She struck a sand bank at the entrance of the Zuyder Zee and was lost. The minimum estimate of the coin on board is valued at $2,085,335. All attempts to recover the treasure have been futile, or nearly so (only $500,000 having been reclaimed), altho its location is exactly known. Inasmuch as the position in which she lies is an exposed place, divers have been unable to recover the cargo. Vessels around Hell Gate and other treacherous Atlantic ports can be easily salvaged—or at least their cargoes salvaged.

As for salt water spoiling cargoes, Mr. Lake has recovered cotton which has been submerged from two to five years, nothing but a very slight portion having been spoiled. Silk has likewise been recovered. Hardly any article decreases in value, even tho lying at the bottom of the ocean for a long period of time. Not only may cargoes of this nature be recovered, but also coal, a special device being utilized in this case. It will be noted in one of the photographs that a well runs down thru the center of the submarine. In this well is placed a hose running to a centrifugal pump, located on the deck of the mother ship. Nor does this pipe call for the services of a diver, as it can be brought into position by means of either an electric winch, or by lowering the submarine over the space where the coal is to be pumped. Mr. Lake's present vessel is, of course, by no means a large salvaging ship, nor will its operation be as cheap as a much larger vessel capable of doing much more work. Coal has been recovered from the bottom at an actual cost of less *than* 5 *cents a ton*, 15 *tons having been recovered in a minute*. It has been said that coal submerged in salt water is a good deal better than coal which has been left in the open, inasmuch as it burns away almost entirely, leaving a pure soft white ash. Hence many housewives sprinkle salt over their fires to make them brighter.

A very wonderful method of salvaging sunken ships has also been conceived and worked out by Mr. Lake.

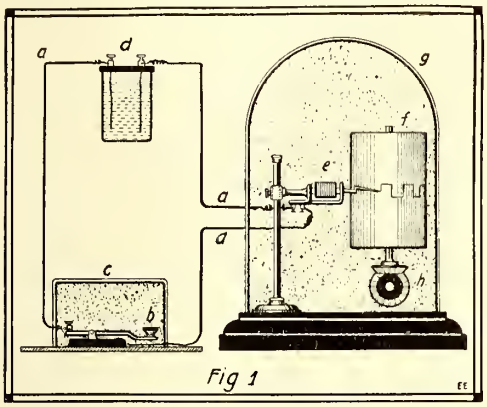
www.americanradiohistory.com

Investigating "Psychical Phenomena" With Scientific Instruments

By HEREWARD CARRINGTON, Ph. D.

An Account of Some Recent Researches In This Field of Inquiry

IT is generally conceded that Aristotle possest the greatest single intellect the world has ever known; yet any school-boy today knows more of the structure of our universe than did Aristotle! The reason for this is that Science has more fully penetrated the secrets of Nature, and we now know approximately the constitution of matter and a good deal concerning life and mind. How has this progress been possible? Only in one way. Improvement in the *mechanical instruments* by means of which we study Nature. We might "speculate" as to the constitution of matter for a thousand years, but we should never have arrived at our present positive *knowledge* had it not been for the delicate and sensitive instruments which are today in the hands of the physicist and the chemist, and employed by him in his laboratory.



In a Series of Séances Conducted in Naples, the Apparatus Here Shown Was Used to Investigate the Psychic Phenomena. The Psychic "Power" Successfully Prest the Key, Thru a Cover, and Caused the Magnet Needle to Record on the Revolving Drum.

Doubtless much the same law will be found to apply in the realm of "psychics." Until we can apply definite "laboratory methods," and study psychical phenomena by means of physical instruments far more delicate than our senses, it is probable that the present state of things will continue to exist; but it is my firm belief that, were a laboratory fitted up with physical and electrical apparatus, suitable for this work, and if we could by their aid study a promising case of "psychic" or "mediumistic" phenomena, we should (within ten years or so) arrive at some definite conclusions! We should then know something about the *laws* and conditions under which telepathy, clairvoyance, telekinesis (the movement of objects without contact), et cetera, operate, and not until this is done, I believe, will such positive conclusion be reached.

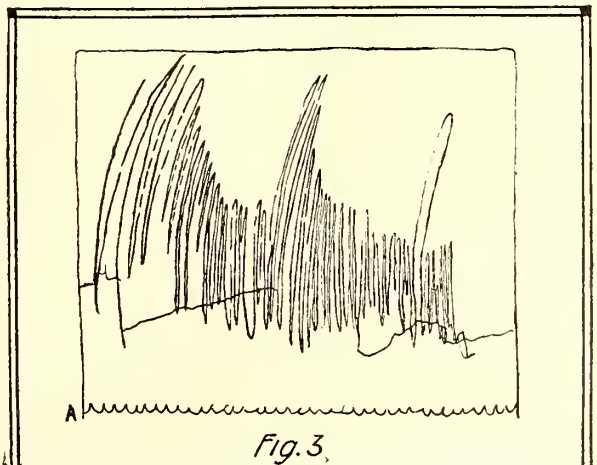
Of course the reader may object, just here, that I am assuming such phenomena to be *true*—while the tendency of many present-day scientists is to regard them as unreal, hallucinatory, and the result of fraud. I cannot spare the time in the present article to argue the point. While I admit freely that a very large percentage of such phenomena *are* so produced, and while I freely admit that probably 98 per cent of so-called "mediums" are fraudulent; I am equally emphatic in declaring that a residuum of genuine phenomena exists—that supernormal manifestations *do* occur, and that everyone who investigates *carefully enough* and *long enough* will find them. This has been not only my own experience, but that of every person who has investigated this subject with an impartial mind for any length of time. As Sir Oliver Lodge said, in writing of this very question:

"The result of my experience is to convince me that certain phenomena, usually considered abnormal, *do* belong to the order of Nature, and as a corollary from this, that these phenomena ought to be investigated and recorded by persons and societies interested in natural knowledge."

Based on this conviction, Sir Oliver Lodge wrote, as far back as 1894, in a paper entitled "On Some Appliances Needed for a Psychical Laboratory":

"If the investigations are to go on easily and well, special appliances must be contrived and arranged conveniently for use, precisely as is done in any properly fitted laboratory. It has already doubtless been realized that one of the needs of the future is a *psychical laboratory*, specially adapted for all kinds of experimental psychology and psychophysics. . . ."

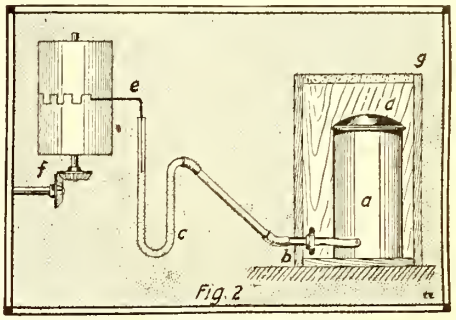
Sir Oliver Lodge suggested at the time, among other necessary appliances, a delicate registering balance,—so adjusted that it would record the medium's weight, unknown to her, at all times during the séance—the fluctuations in weight, if any, to be recorded on a revolving drum. Means ought also to be provided for studying the temperature, pulse, muscular exertion, breathing, etc, etc. The lighting of the room should be carefully attended to and capable of the slightest gradation. Means should be provided for obtaining moving pictures of the séance from without the room, unknown to the medium. Were the sittings held in complete darkness, these photographs could be obtained by means of ultra-violet light, with which the room might be flooded. In addition to these devices, we may add others—such as X-ray tubes, high-frequency currents and a delicate field of electric force,—while instruments for testing the ionization of the air (if it exists) in the immediate vicinity of the medum, during a séance, should also be employed,—together with the more strictly psychical instruments and devices which have been utilized of late years.



A Sample of the Tracings Obtained By Psychic Powers Acting On the Apparatus Shown At Fig. 2.

Electrical apparatus *has*, in fact, been utilized on several occasions to test so-called "psychical mediums" in the past. Italian investigators, particularly, have excelled in this. In a series of séances conducted in Naples, the following apparatus was employed. (Fig. 1.)

A telegraphic key (b) was connected by wires (a,a) to a battery (d) and to two screws, connecting them with an electro-magnet (e) to the opposite end of which was attached a needle. The point of the needle touched a revolving drum (f), with a smoked surface, driven by two interlacing, cogged wheels. The whole of this registering apparatus was enclosed under a glass bell-jar (g). The telegraphic key itself (b) was covered by a cardboard box (c). The "powers" manifesting were asked to press the telegraphic key *without* tearing the cardboard box (that is, *thru* it). When the key was deprest, this would be instantly communicated to the electro-magnet, and cause the needle to oscillate,—these oscillations being marked upon the smoked surface of the revolving drum. A number of successful tests were conducted by means of this apparatus.



Another Form of Psychic Force Recorder. Here the Pressure Exerted On the Rubber Cap "d", Thru the Cloth "g", Caused the Liquid in Cylinder "a" to Move Downward and Actuate the Manometer Needle "e", Which Traced the Variations On a Revolving Drum "f".

A variation of this was then employed (Fig. 2). A cylinder filled with water (a) was connected by means of tubing (b) to a U-tube, or manometer (c), filled with mercury. Upon the further side of this tube floated a bent wire (e) inserted into a small cork. The point of this wire, again, was so adjusted as to come into contact with the smoked surface of a revolving drum (f), driven as before. The top of the cylinder (a) was covered with a rubber cap (d), and this whole apparatus was inserted under a wooden box (g) having a cloth top.

Now, if the rubber covering (d) were prest upon, this would force some of the water, in a, along the tube, b, and the added air-pressure would depress the column of mercury in the manometer, causing the floating needle to rise on the opposite side, and scratch upon the revolving drum. Fig. 3 shows some of the tracings which were obtained in this way—the force acting thru the cloth top, g.

The instruments thus recorded a *definite physical, intelligent force.*

It may interest my readers to know that, at the time of his death, M. Curie,—who had been completely

(*Continued on page* 566)

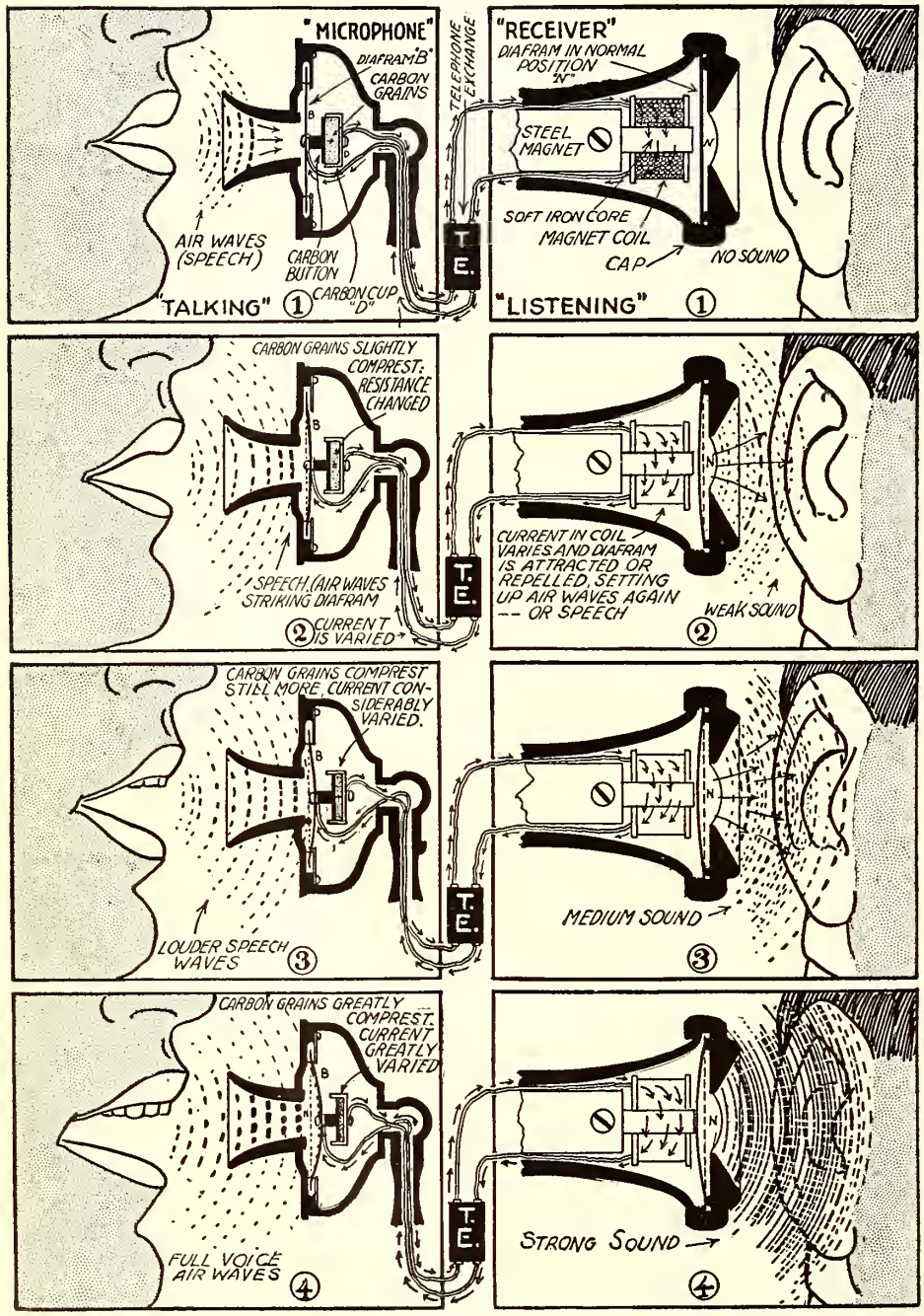
www.americanradiohistory.com

How the Telephone Talks

ALMOST all of you use a telephone constantly and give very little thought as to the actual working of it. Just how many people know what happens when you throw your voice into the transmitter of the modern telephone? Very few, I'll warrant. By means of the drawings, the transmitter is very clearly shown in detail, and the voice may be traced from the time it leaves the mouth until it goes into the line thru the transmitter. The whole operation, of course, takes place almost instantly.

Fig. 1 is the detailed construction of the transmitter. A is the mouthpiece; B is a very sensitive iron or mica diafram; C a carbon button and disc attached to the diafram B; D is a small box filled loosely with carbon granules.

When you speak, the resulting air waves set up by your voice impinge against the diafram B, which vibrates in exact tune with the air waves. The carbon disc C, being attached to B, also vibrates in syntony with the air vibrations, and therefore the contact between the carbon granules and the carbon disc varies in proportion to the force of the air waves striking against the diafram. As a consequence of this action, the electrical resistance between the carbon disc and the carbon granules varies with the strength of the air waves.



"How the Telephone Talks" Is Here Illustrated in Diagram and Picture. This Shows, of Course, Only a Few of the Actions Occurring in "Telephoning"—In Fact the Action Here Taking Place Occupies But a Fraction of a Second.

Consider Fig. 1, which shows schematically the telephone transmitter or mircrophone as well as the receiver, reproducing the spoken word, and which was employed in the manner shown by the Bray Studios in making an animated film story entitled "How the Telephone Talks."

Fig. 1 shows the exact instant that the mouth starts to open when a vocal air wave is set up as indicated by the curved dotted lines. The air waves tend to expand spherically whenever possible, and the vibrations or rings representing the air waves expand rapidly (the velocity of sound thru air being about 1,100 feet per second), and, as will be evident, the expanding air wave will, in the fraction of a second, reach the tightly stretched microphone diafram just inside the mouthpiece, to which is attached one of the carbon electrodes forming the carbon granule chamber. This stage of events in the story of the telephone is illustrated at Fig. 2. Here the first ripple of the expanding air wave propagated from the vocal organs and mouth of the speaker, is just impinging against the diafram and causes it to bend inward as shown. When the mouth first starts to open, Fig. 2, the air waves are quite weak. The movement of the microphone diafram and the carbon electrode attached to it is consequently slight, as well as the change in the current thruout the circuit to the receiver at the other end of the line. At this stage it is well to look at the receiver, Fig. 2, in which we see that the diafram has been attracted inward, or toward the electro-magnet core, by the increased strength of current caused by the reduction in the resistance of the carbon granules in the microphone. Simultaneously an air wave corresponding in frequency and pitch to that originated by the speaker at the transmitter end of the circuit, is thus produced by the movement of the receiver diafram. As becomes evident, the strength of the reproduced sound or air waves which eventually leave the receiver diafram, causing the mechanism of the ear to respond in the well-known physiological manner, will be exactly proportionate to the strength of the original sound or sounds at the transmitter.

At Fig. 3, the speaker's mouth has, a few seconds later, opened wider and the speech waves are louder and more powerful. These stronger air waves strike the microphone diafram thru the mouth-piece and cause it to move in a still stronger manner, which in turn causes a greater compression of the carbon grains, as shown in Fig. 2, and the receiver diafram is attracted or repelled with proportionately greater effect. If a medium strength sound is produced by the speaker at the transmitter end of the circuit, then the sound reproduced at the listening end would be a medium strength sound also.

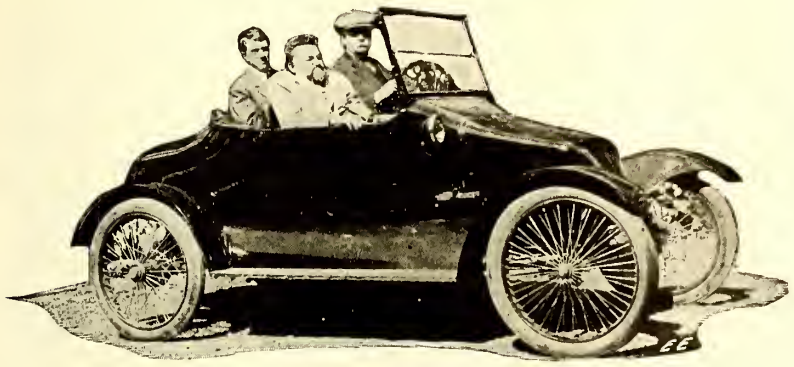
Fig. 4 shows one case of a full, loud voice condition on a telephone circuit. The full vocal power air waves set up by the speaker opening his mouth to the normal maximum strike the microphone as shown. The carbon grains are in turn compress to a greater extent, more so than in Fig. 3, and the current in the circuit is now intensified decidedly, owing to the porportionately greater change in the resistance of the carbon grains, and the receiver interprets these changes very faithfully. The greater variations of the current in the transmitter-receiver circuit affect the receiver magnet by passing around the coil of wire wound on the end of the magnet as shown, and these powerful changes are instantly communicated to the diafram, attracting it with great vigor, so that it almost touches the magnet poles in some cases. The diafram now vibrates back and forth with maximum movement, giving forth sonorous air waves corresponding to the waves originated at the transmitter. The human ear held close to the receiver interprets the air wave vibrations in the well-known manner, and thus we hear once more the voice of the speaker transmitted perhaps over several hundred or several thousand miles of telephone wire, reproduced in our very presence, mysteriously—yet very simple, when you know how it is done.

www.americanradiohistory.com

A New Era Electric Auto

A New Combination Gas-Electric Car

THE new Dey Electric Automobile here illustrated created a mild sensation some time ago, and in an interview with Dr. Charles P. Steinmetz, the latter made the statement that Mr. Dey had solved the problem of the



The New Gasoline-Electric Automobile Which Its Inventor—Harry E. Dey, Seen at the Wheel,—Expects to Sell at $500.00. At the Left—Dr. Charles P. Steinmetz, the Famous Electrical Engineer, Who Believes Mr. Dey has the Best Idea Yet in Electric Automobiles. The Storage Battery Is Charged While Running.

$500.00 electric automobile. This car has many points of novelty over other vehicles. It naturally follows that such must be the case in order to cut the weight and cost of the lightest and cheapest electrics now on the market in half; and at the same time not reduce the factor of safety, or the size of the car, which has the same dimensions as the Ford.

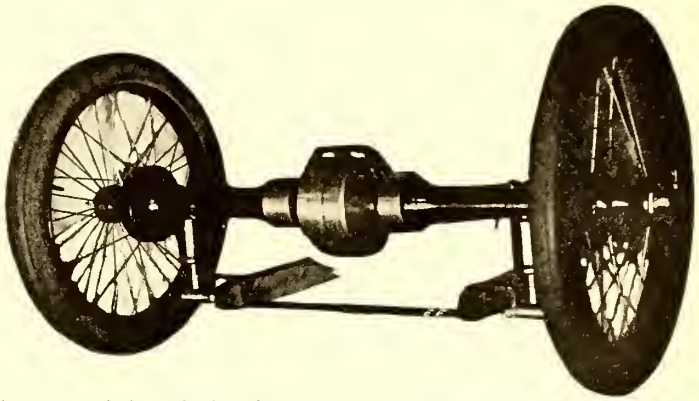
Its most revolutionary feature is the motor, which has *both its armature and field magnet rotatable;* one element connecting with one driving wheel thru a pair of reduction gears, while the other element connects in a similar manner to the other wheel. This arrangement produces a perfect *differential* substitute; and, in addition to saving the cost and weight of this complicated piece of mechanism, *it increases the capacity of the motor* 100 *per cent* for a given rotative speed, for the parts revolving in opposite directions *cut the magnetic lines twice as fast,* thus producing the results of a motor of double the velocity; besides this also adds to the electrical efficiency. The weight of this motor is still further reduced by turning it inside out, as it were; the armature, which is a toothed Gramme ring, encloses its field which has six poles, all energized from one coil. The field design is ideal for low field losses and light weight; its total weight, with shaft, being less than 20 pounds. Its iron portion is well adapted for drop forging. The total weight of the motor, which has a capacity equal to the standard automobile motors weighing 150 pounds, and upward, is but 51 pounds.

The motor is centered on the center line of the axle. An eccentric, of 7/32 inch throw, is fixt to the outer end of each shaft; an internal gear is carried by, and rotates upon, the field shaft eccentric, a roller bearing taking care of the friction. An external gear, concentric with the shaft, is keyed fast to the stationary housing and meshes with the internal gear; the latter connects by means of a flexible jointed shaft, practically a floating axle, to the wheel hub. It will be noted that only one of the gears is rotatable, the other one being held absolutely rigid. At the armature shaft end the construction differs by mounting the external gear, instead of the internal one, upon the eccentric, and keying the internal one to the housing. From this point the construction duplicates the other end. When the internal gear is the rotative element, as at the field shaft end, the direction of rotation remains unchanged between the motor and the wheel; but with the external gear as the rotating member, as used at the armature end, the direction is reversed. The opposing directions of the armature and field magnet are thus rectified without recourse to intermediate gears. The internal gears are 3½ inches pitch diameter and the external 3 1/16; this gives a reduction ration of 7½ to 1.

This car can well be termed the *nutless* car, there being so few used in its construction; all the surfaces are free of any bolt head projections. As the current is taken into the motor by means of slip rings there is no necessity of disconnecting wires when removing motor.

The experimental car was designed with a hand operated control and wheel steering. It was found in testing this out in heavy traffic, however, that hand control and wheel steering do not make a desirable combination, for in an emergency both hands are required upon the wheel; and in addition there is a time element involved in shifting the hand from the wheel lever that cannot be permitted. In the latest design the control is very similar to that of a gas car, with the shifting of gears left out. For speed variation a foot lever is used in a manner identical with that of the clutch lever; when the foot is removed the car runs at full normal speed; a slight pressure inserts resistance, producing the equivalent of a slipping clutch; as the pressure is increased resistance is added by infinitesimal steps, until finally the current is completely shut off; further movement converts the motor into an electric brake, and an extreme movement applies the mechanical brake. There is besides an additional emergency brake and also the ability to reverse the motor, thru resistance, for that purpose. An accelerator pedal, acting upon the field, increases the speed to 30 miles per hour, or more. Another lever provides "Forward," "Reverse" and "Neutral"; it is interlocked with the speed control, so as to shift only when there is resistance in the circuit or the motor is entirely cut off. The ability to reverse while the power is still on (thru resistance) provides quick manipulation for "seasaw" work.

On down grades the motor will recharge into the battery at speeds as low as eight miles per hour; and the car speed will automatically *slow down* as the grade increases; thus making the driving unusually safe. An increase of speed may be obtained at any time, however, by means of the accelerator.

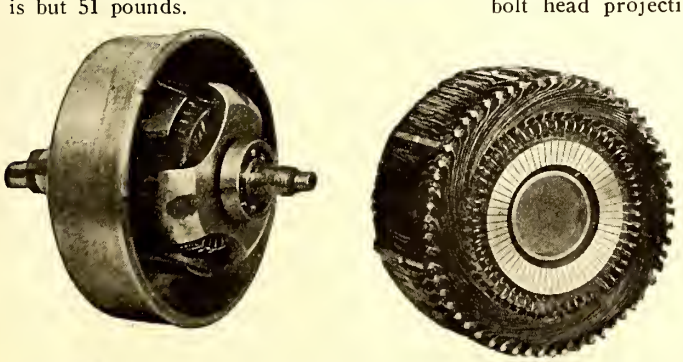


The Rear Axle and Electric Motor Propelling the New "Dey" Electric Vehicle. It is Twice as Efficient as the Ordinary Electric Auto, Owing to the Fact That Mr. Dey has Designed His Motor to Have the Field and Armature Both Rotate. This Doubles the "Torque Speed" and Reduces the Weight of the Motor. Also the Storage Battery Is Smaller Than in Any Other Machine.

The storage battery is carried beneath the floor, attached to the truss rod posts. This permits the body to be used exclusively for passengers and luggage; and also avoids all troubles due to spilled electrolyte. The method of suspension is such that the battery can be readily lowered to the floor by one person, and the top is accessible for adding water by lifting a trap door in the floor. This location is ideal for small power consumption, and gives a very low center of gravity that conduces to an easy riding and safe car.

While light weight has always been a hobby with the inventor, he does not believe in obtaining it at the expense of reliability or a limited sphere of action. One-half of the total weight of a car should be charged against the battery; this will provide power in excess of 100 miles per

(*Continued on page* 562)



The "Dey" Electric Auto Motor—at Left, the "Revolving Field"—at Right, the Revolving Armature and Internal Commutator.

www.americanradiohistory.com

"Jerry Up"

By CHARLES K. FANKHAUSER, JR.

Late of the 56th Regiment of Engineers, U. S. A., Only Searchlight Regiment in the A. E. F.

THE author wishes to state that the following is an account of some of his personal experiences with the 56th Searchlight Engineers during six months of active service in Flanders.

After the usual cross-country tour of France *à la box cars* (always labeled 8 *chevaux*, 40 *hommes*, meaning 8 horses, 40 men), and a week's pleasant (?) sojourn in a rest (?) camp, Co. F. arrived at Champigny, near Langres. It was here that we were to receive our training in the gentle art of bagging Hun 'planes. Our searchlight "training" was merely a continuation of "squads east and squads west," punctuated at frequent intervals with the refreshing (?) pastime of manicuring France with pick and shovel.

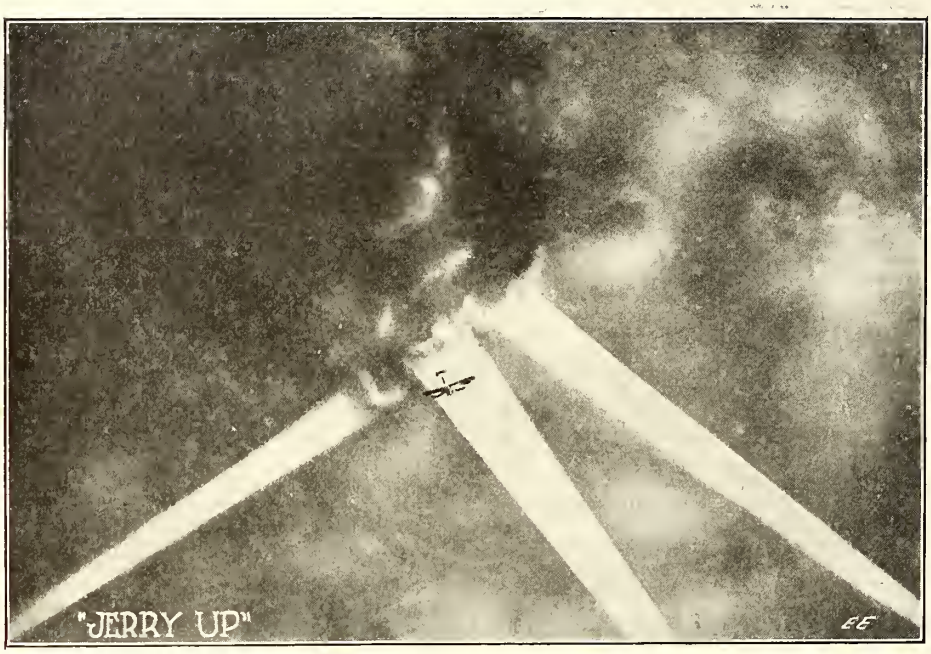
But there is an end to all things. One fine afternoon early in August, 1918, found me, with six others from Co. F., at S.3., S.3 being the official title of one of a series of English searchlights strung along the "India rubber" line near Lille. There we learned what a searchlight really was for. We couldn't help it.

That evening, shortly after dusk, "Jerry" started over in his giant bombing 'planes to get the big steel plant just behind us. We wanted to leave the immediate vicinity *"toute suite,"* but no! We were informed by the hilariously amused "Tommies" in charge that we not only had to stay there, but had to shine a big sixty centimeter light right on "Jerry." We protested that he could hit us quite easily enough without our "advertising" our location. But once again—no! We had it all wrong. The sergeant ordered us to take action. We got the light on a big Gotha and immediately down came six bombs! Wang-o!! and then some. The jar of the first blew the arc out in the light and the rest blew out all our ambition and desire to be "defenders of Democracy."

After our first scare it wasn't so bad. We learned that a searchlight is a very poor target, even tho it is somewhat conspicuous. After that it was just a thrilling game. "Jerry" was an awful coward when it came to the limelight stuff. He preferred to work in the dark. Just as soon as we got him into the beam he invariably dropt his presents and made tracks for home. That is, he tried to. He did not always succeed. Our three-inch A.A.'s sometimes interfered. (A.A. in plain United States means "anti-aircraft.")

The three-inch guns were another little diversion for us. We had frequent practical illustrations of the law of gravity much in the same manner that Newton first observed it. Only our apples were made of *steel.* Said apples being originally intended for "Jerry." He being directly over our heads, and aforesaid steel failing to reach its objective, it returned to us by the shortest possible route. A straight line. (Business of digging out tin lids in a hurry.)

Did the German Airplanes Like the Allies' Searchlights? Yes They Did—NOT!



Actual Photograph of a German Bombing 'Plane Caught in the Shafts of Allied Searchlights. This Photo Was Taken From an Allied 'Plane. "Jerry" Was Tickled Silly to Have His Path Illuminated; Yes, He Was—and Showed It by Dropping 100-Pound "Forget-Me-Nots" on the Searchlight Crews—Fine, Only They Made Such an Awful Noise When They Landed.

Our parabaloid sound locators would tell us when a 'plane was coming and give us the bearing, then I, being wheel man, would send the long finger of light searching out into the blackness, looking for "Jerry."

The alarm was always given "Jerry up," and when we heard that, there was "action" and lots of it. I'll say so.

Each light had quite an elaborate telephone system, with lines running to several "spotting" posts and connected with all the other lights and gun sections thru a central telephone exchange.

This telephone system was a fine idea. The only thing wrong with it was the fact that the French farmers had a strange fondness for double-strand, cotton covered field telephone wire, and we never could convince them that we did *not* put the wire down for them to play with or build fences with. Otherwise the system was fine, and gave us many hours of diversion repairing it. Especially after a line had been plowed, harrowed and scraped for an afternoon or so.

The third night out I bumped up against the real English alphabet. I was on duty at the 'phone board. S.4 rang in and this is what I got: "Esses 3? Message to Lieutenant ——. Ac-ac-esses 4. Eight pip-emma, eight oblique fifteen oblique eighteen. Esses-e-n-don emma-e-esses-esses-ac-g-e t-a-ac-don-j-u-t-e-n-t——"

That was enough for me. I thought the whole B.E.F. was shell-shocked. I went for help. My mistake. It was only the usual "Pip Emma" system. The system of spelling used in all telephone communications in the B.E.F. Certain letters that are apt to be confused with others are given a special pronunciation as, s is pronounced "esses," p is "pip," m is "emma," d is "don," b is "beer," a is "ac."

I finally got the main idea of the thing, but never used it. When we "Yanks" used the 'phone we talked United States, not English.

But taking it as a w(hole) an A.A.S.S. emplacement isn't half bad—providing it doesn't rain and there are no rats and no cooties, and you don't mind sleeping in mud and—oh, well, if you like that sort of thing and don't care particularly whether you sleep or not.

SEARCHLIGHTS AND SOUND DETECTORS IN THE A. E. F.—A CORRECTION.

We publish herewith a correction from the War Department, office of the Chief of Engineers, Washington, D. C., concerning our article on page 310 of the ELECTRICAL EXPERIMENTER for August, 1919, entitled "Locating Airplanes in Night Fighting." To quote Captain James O. Jensen, Corps of Engineers, U. S. A., in his communication: In the third column it goes on to say:

These powerful searchlights, besides being available for enemy spotting, are also much used as a means of signalling. This is one branch of **the Signal Corps'** *work which has proven one of the big factors in helping to win the war.*

The particular work described in the article is a function of the Corps of Engineers, and was not and is not handled by the Signal Corps.

The 56th Regiment of Engineers constituted all the searchlight personnel in the A. E. F., and was the only organization engaged in using searchlights and sound detectors to combat enemy night flying 'planes.

EX-SOLDIERS, ATTENTION!

We want to publish some more articles similar to that appearing on this page by Mr. Charles K. Fankhauser, Jr., describing personally some first-hand experiences with the American Expeditionary Forces. Of course such articles intended for publication in the ELECTRICAL EXPERIMENTER should deal with more or less scientific phases of military life in France. Not only do we extend this invitation to all ex-military men, but also to the sailors of the sea. There is many a good tale to tell based on facts, we are certain, from the many personal experiences we have heard related by our friends who went overseas from time to time.

www.americanradiohistory.com

Good Day! Mr. Mars, said Prof. Todd

A SERIOUS attempt to get into communication with the planet Mars was made at Fort Omaha on Sunday, July 13, when Prof. Avis Todd of Amherst, accompanied by Capt. Leo Stevens, head instructor of the balloon service of the War Department, tried to send a balloon to the highest point ever reached. Capt. Stevens holds the world's record of 29,500 feet, made at Franklin, Pa., in 1912.

Prof. Todd has perfected instruments upon which he has been working for years, is the report from Fort Omaha, and with these he hoped to get into communication with the people of Mars, providing he could get far enough away from the earth's attraction.

Six years ago Capt. Stevens took Prof. Todd to a height of 22,000 feet, but his effort then to communicate with Mars failed. Five years ago Prof. Todd went to the Andes in South America for the same purpose but failed again.

One of the Government's big spherical balloons was used.

WHAT SIR OLIVER LODGE SAYS.

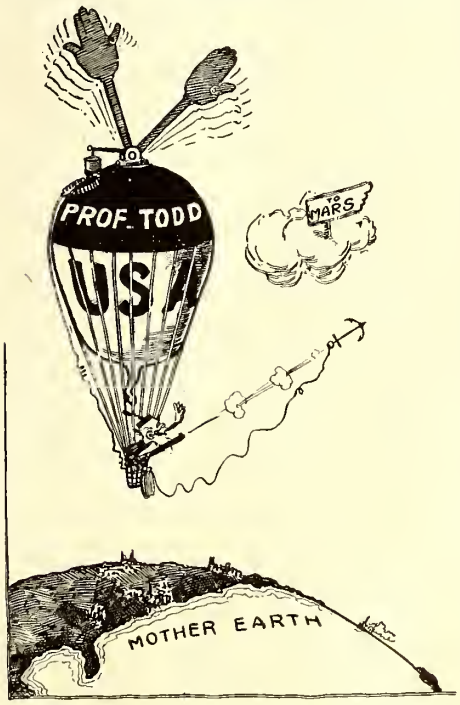
Communication with other planets by wireless telephone is not regarded by Sir Oliver Lodge, one of Britain's most eminent scientists, as a possibility too fantastic to be summarily dismist by savants.

Projection of a stream of electrons across the spaces of infinity by employing the vacuum relay or "audion" and utilizing ultra-violet light or the X-ray—these and other equally marvelous visions are conjured up by Sir Oliver in an article in *The Mail,* of London, under the caption of "Shall We Talk to Other Planets?"

Sir Oliver Lodge is inclined to believe that some simpler and more direct mode of transfer of ideas will be developed, but he does not censure William Marconi for his enthusiasm as to the possibility of interplanetary communication by wireless telephony.

"The wonders of wireless telegraphy and wireless telephony," says Sir Oliver, "are the outcome of researches in pure science which were originally initiated and pursued with no thought of practical application.

"By combining all that was known about oscillating electric circuits and about the emission of electric waves in accordance with Maxwell's theory, the problem of tuned or selective wireless telegraphy was solved, let us say, in 1897. Researches initiated by Crookes, and others, and developed by J. J. Thomson, have been prest into the service; and, first by Professor Fleming and then by others, have greatly improved the receiving capacity to wireless stations, so that it is possible in America, with quite a small receiving area, to hear the great high powered radio stations in Europe. And recondite mathematical investigations have proved that hearing at the Antipodes is far from theoretically impossible.



Prof. Todd, U. S. A., Sailed Martian-ward Some Moons Ago in a Large Army Balloon, in Order to Try Out Some of His Newest American-Marsotonian Wigwags on the Inhabitants of that Planet—

THE EFFICIENT AUDION FOR INTER-PLANETARIAN RADIO.

"In free space there are no such disabilities as are met with in the cramped space of a submerged cable, and speech, said to be of remarkable distinctness, can be reobtained from electric oscillations which have encountered nothing more perturbing than the air. Air does not help—so far as it acts it hinders; vacuum would be better, but the ether is sufficiently forcible to overpower minor obstructions, and it is found capable of transmitting securely and squarely whatever is ingeniously given to it and still more ingeniously received.

"The main instrument made use of for this purpose is the vacuum relay (audion); and the essential power which has been harnest both for sending and for receiving, is the extraordinary mobility and tractability of the little electric units or *electrons* which are given off by matter under certain conditions in great numbers, which fly with incredible speed approaching the velocity of light, and which in a sufficiently high vacuum are beautifully amenable to control.

"Electrons in motion constitute an electric *current* and a stream of them can be deflected either by a magnet or by an electric charge brought near them. Suppose, then, that an oscillating electric charge, oscillating in correspondence with the vibrations of the human voice, is brought into the neighborhood of a stream of electrons, this stream can be made to vibrate in unison. It can be laterally deflected or waved to and fro if that is what is wanted; or it can be alternately encouraged or retarded if that is preferable. It responds to every impulse, and it responds instantaneously.

ELECTRONS FROM A HOT WIRE.

"To get such a stream of electrons many ways might be employed. Ultra-violet light falling on a metal is one method. The X-ray is another. But the simplest plan is to employ a hot wire. A suitable wire can be kept hot by an electric current, and it can be made one of the poles of a battery so that a stream of electrons constantly emerges from it. This stream can then be controlled, as has already been vaguely indicated, by a multitude of devices, some of which have been already described and used—used very effectively—but none of which is as yet likely to have reached perfection.

"That is the principle. The rest is detail. *Fine and ingenious detail,* but detail which can take many forms; and those forms are more suitable for description in the technical press. Suffice it to say that such a device if talked into can supply a current varying with all the tones of the voice; and this varying current can be used to transmit electric waves after the usual methods adopted in wireless telegraphy.

"Then at the other end an ordinary wireless collector can receive them, can reproduce feebly the varying electric currents which originated them, and can then hand them over to a vacuum relay supplied with local energy, where they will modify an electron stream in the way above indicated. The feeble received current can, in fact, so control the stronger electric current which the relay is emitting from a local battery that every fluctuation can be imparted to that stronger current. This electron derived current, relayed again if desired, can then be applied so as to be heard in an ordinary telephone—the marvelously simple and familiar instrument that translates varying electric currents into articulate sound and applies it to the human ear.



—But History Does Not Recordeth What the "Martians" Thought of the Yankee Professor's Signs. Perhaps They Don't Believe in Signs Up There; Anyway, You Probably Locate the Nearest "Near-Beer" Sky Garden by a Mental Telepathic Wave Shot Out Broadcast by the Enterprising "Bevo" Dispenser.

"What the ultimate outcome of this power of long-distance telephoning may be I will not attempt to prophesy.

"The ether waves, once generated, are quite independent of matter. Matter is employed at the sending and at the receiving end, but in all the space between the efficient and necessary transmitting medium is vacuum, ether, the space between the worlds.

"I do not wonder that Mr. Marconi, in his enthusiasm of the power of speech-transmission which is thus coming into being, speaks of possible communication with other planets. Every one, including himself, must foresee immense difficulties about that; and for myself, I venture to anticipate that science will recognize a simpler and more direct mode of interchange of thoughts and ideas, tho perhaps not with dwellers, if there be any, in other planets, before a physical process of transmission from world to world, in the complicated code called *language* is feasible."

www.americanradiohistory.com

Popular Astronomy

By ISABEL M. LEWIS
Of the U. S. Naval Observatory

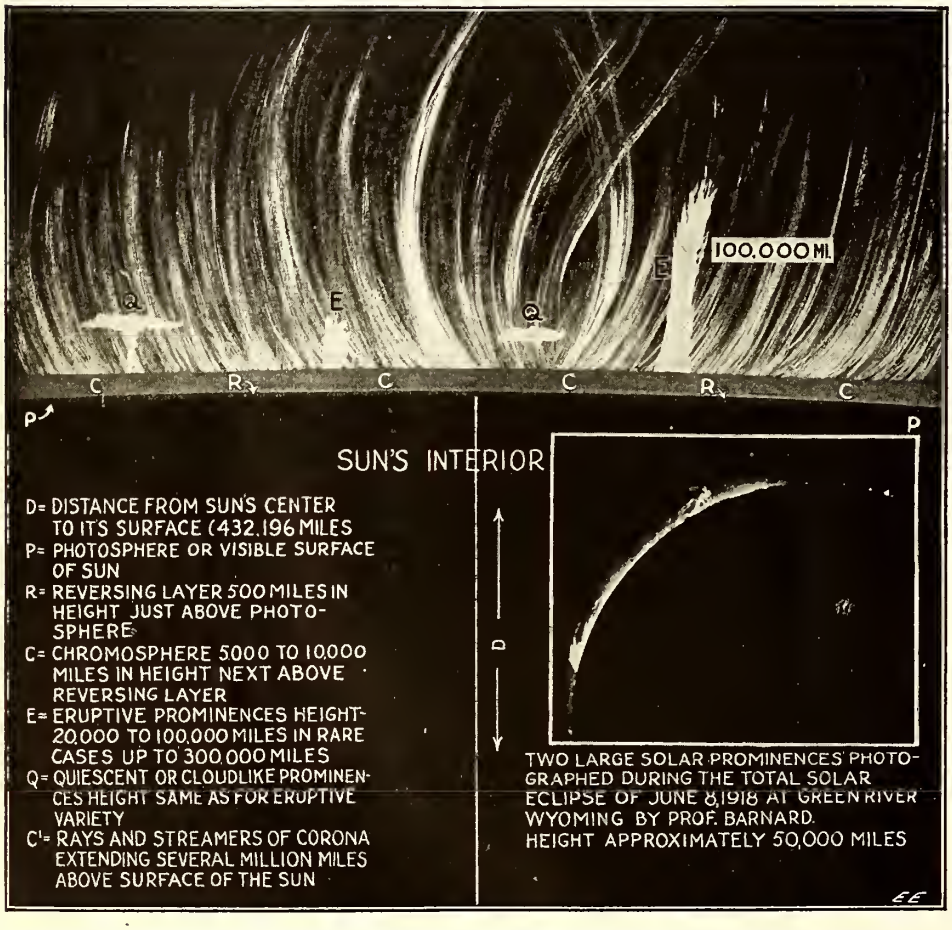
The Surface of the Sun

SUN'S ENERGY UNEXPLAINED MYSTERY.

THE source of the radiant energy of the sun is one of the unexplainable mysteries of the universe. For millions of years the sun has been pouring forth its light- and heat-giving rays at a most prodigal rate without the slightest sign of decreasing strength.

As seen from the sun, the earth is not much more than a point on the celestial sphere, appearing very much as one of the nearer planets, Venus or Mars, does to us.

The amount of the solar energy that is intercepted by the earth must be, therefore, almost infinitesimal compared with the total amount poured forth from the surface of the sun. It has been estimated, in fact, that all the planets together receive less than one one hundred millionth (1/100,000,000) of the total radiant energy of the sun in the form of light and heat, the remainder passing on to the stars beyond at the rate of 186,000 miles per second.



Yet the almost inappreciable amount of energy that our own little planet Earth receives from the sun as compared with the total output is, in reality, *one and a half horsepower per square yard,* or 230,000,000,000,000 horsepower for the whole earth!

It is this seemingly inexhaustible supply of energy that is behind all forms of terrestrial life and activity and if it should fail us the earth would become a barren and lifeless planet in less than one year.

7000° CENTIGRADE.

The surface temperature of the sun is, according to Abbot, at least 6,000°, and may be as high as 7,000°, absolute centigrade, which is 3,000° hotter than the hottest terrestrial source, the electric arc, which is considered to be at a temperature of 4,000° C.

Since all terrestrial elements vaporize in the electric arc, it is concluded that no known element could exist at the surface of the sun except in a gaseous condition. As to the condition of the sun's interior, whether it is entirely gaseous or partly fluid, there is some doubt. The low density of the sun, only one and four-tenths the density of water, precludes a solid interior, and it is now generally considered that the sun is entirely gaseous thruout, tho the tremendous pressure and temperature that must exist far beneath the upper radiating gaseous strata of the sun may produce changes in the elements beyond human comprehension and understanding. *It is even possible that the continual and mysterious replenishing of the solar energy that is poured forth so extravagantly may be brought about by a breaking down of the atoms within the sun's interior and a release of all the sub-atomic energies in a manner analagous to the action of radio-active substances.*

Since we cannot reproduce terrestrially the abnormal conditions of temperature and pressure existing within the sun's interior, we can only speculate as to the nature of the forces at work therein.

When we consider the surface of the sun, however, we are more in a position to understand and interpret correctly the evidence that is furnished us in abundance and in the greatest detail and an understanding of the nature of the forces at work at the surface of the sun and in its enveloping atmosphere may lead later to an explanation of the forces at work far beneath.

THE PHOTOSPHERE.

The visible surface of the sun is spoken of as the *photosphere.* Even the smallest telescopes will show its peculiar "rice-grain" structure, consisting of intensely brilliant flecks or nodules about 500 miles in diameter, which are resolvable by the higher power telescopes into smaller elements averaging 100 miles in diameter, against a darker background. It has been estimated that these bright nodules or rice-grains occupy only one-fifth of the total surface of the sun, yet radiate three-fourths of the total light.

Most astronomers believe that the "rice grains" are the summits of highly heated columns of gas, convection currents arising from the sun's interior, and that the darker portions between are due to cooler descending currents.

It is well known that the photosphere or visible surface of the sun appears to be much brighter in the center of the disk than near its circumference. This is due entirely to its gaseous nature and to the fact that it is surrounded by an atmosphere of dense enveloping cooler gases. Rays from the center of the disk travel a shorter distance thru the sun's atmosphere than the rays from the rim and therefore suffer less absorption by surrounding gases. We look further down into the sun's interior near the center of the disk than in the direction of its circumference.

The photosphere is the region where sun spots appear and they are found in zones extending from 8° to 35° on either side of the solar equator, never appearing exactly at the equator or near the poles.

SUN-SPOTS ARE SOLAR CYCLONES.

The disturbances that produce sun-spots and many allied phenomena occur cyclically in periods of approximately eleven years. The first outburst of the disturbance is manifest in the appearance of sun-spots in high solar latitudes. These break out and disappear and break out again with increased vigor, working gradually downward toward the solar equator. The maximum spottedness for a given period occurring in latitude about 16°. The disturbance finally dies out within 8° or 10° of the equator, but even before one cycle of disturbance has entirely passed away a new cycle has broken forth in high latitudes. So during the period of minimum spottedness there are four distinct belts, two in low latitudes, due to the dying disturbance, and two in high latitudes, due to the new disturbance. At sun-spot maximums there are two well-marked zones of great intensity, approximately 16° north and south of the sun's equator.

Sun-spots are solar cyclones, occurring usually in groups, tho large single spots appear less frequently. Each spot is quite sharply divided into an umbra* and a penumbra.† The umbra is the darker central portion, the funnel of the whirling cyclone, and the penumbra is composed of the outspreading gases. The peculiar "thatch-straw" structure of the penumbra is due, it is believed, to the fact that the

* The dark central part of a sun-spot.
† The boundary of light and shade of a sun-spot.

www.americanradiohistory.com

columns of gases that usually rise vertically from the sun's interior and from the "rice grains" of the photosphere are drawn into a horizontal position in the penumbral regions of a sun-spot and therefore we get a longitudinal rather than a cross sectional view of them.

The umbra of a sun-spot is anywhere from a few hundred miles to fifty thousand miles in diameter, frequently exceeding the earth in size, while the penumbra occasionally reaches a diameter of two hundred thousand miles.

The darkness of sun-spots is only relative to their more brilliant background. Owing to the rapid expansion and cooling of gases the temperature existing in sun-spot regions is far below the normal solar temperature and lies between 3,000° and 4,000° C. At this temperature it is possible for the more refractory chemical compounds to form, the oxides and the hydrides, and the spectra of sun-spots reveal the presence of titanium oxide and magnesium and calcium hydride. At the higher solar temperatures prevailing elsewhere over the photosphere and in its overlying gaseous envelopes all chemical elements occur in a free state, intermingling as incandescent vapors without the formation of any chemical compounds.

Strong magnetic fields exist in sun-spot regions and the sun-spot cycle is attended by marked magnetic changes, not only on the sun, but in the earth's atmosphere as well.

THE SUN'S RADIATIONS.

A most interesting discovery has been made in recent years in regard to the nature of the radiations of the sun. It has been found as a result of continuous measurements of the value of the constant of solar radiation by the observers of the astrophysical observatory of the Smithsonian Institute that the sun's radiations are variable with a two-fold period. One of these has a range of about three per cent during the sun-spot cycle, and the second is an irregular variation with a period of several days, weeks or months and a range that is usually about three per cent, but occasionally runs as high as seven or ten per cent.

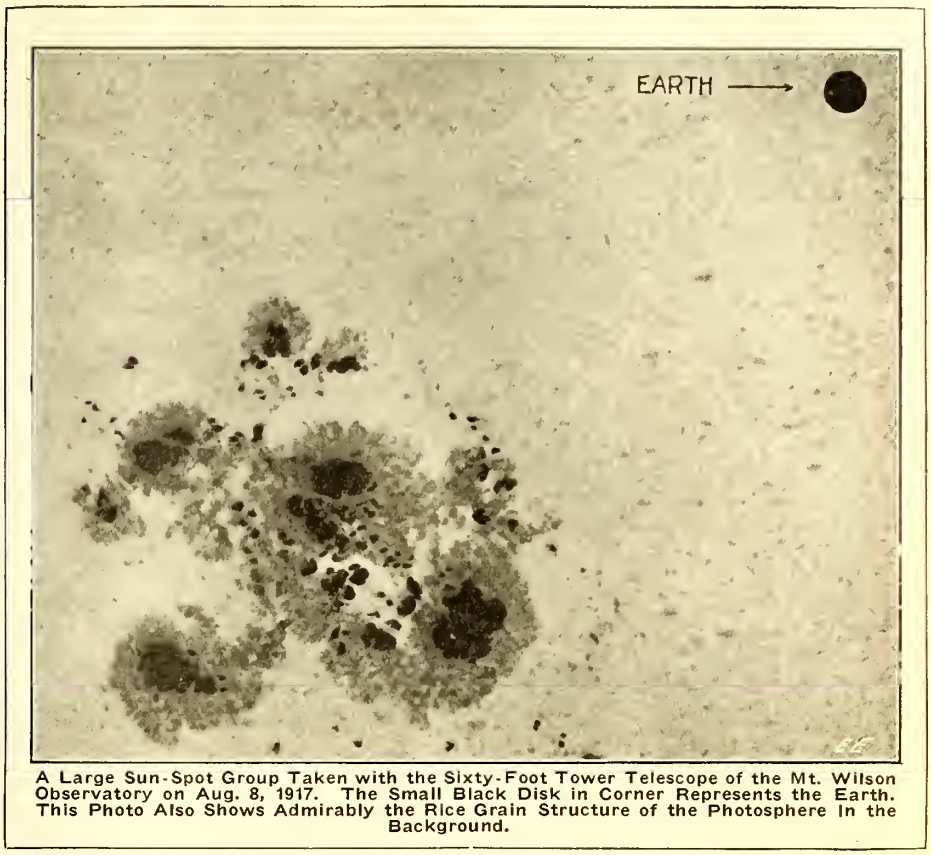
These variations in the solar radiation are considered very important and are now receiving considerable attention since they appear to be attended by appreciable changes in the earth's temperature and weather conditions.

The Smithsonian Institute hopes to establish in the near future a number of stations in widely separated rainless districts of the globe for the purpose of obtaining more accurate determinations of these variations with a view also to making available data for the more accurate predictions of weather changes in various parts of the world.

THE MYSTERIOUS REVERSING LAYER.

Directly above the photosphere of the sun lies the "reversing layer," which is about five hundred miles in depth and is composed of the incandescent vapors of all the chemical elements that are known to exist in the sun, which are also the same familiar elements that exist on the earth. With the exception of coronium, the unknown element in the solar corona, there is no element in the sun that has not been found on our own planet.

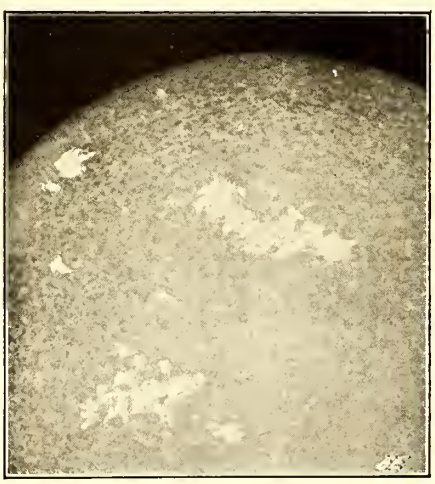
The "reversing layer" receives its name from the fact that it reverses the solar spectrum. It produces the dark absorption lines found in the spectrum that serve to identify all the elements existing in the sun, and during the time immediately preceding and following a total eclipse of the sun it produces what is known as the flash spectrum. When the photosphere, which gives the bright continuous background of the solar spectrum, is concealed by the moon the normally dark lines of the reversing layer—dark only by contrast with the bright background—become momentarily intensely bright lines against a dark background. The flash spectrum only lasts a second or so, as the reversing layer itself is soon covered by the moon.



A Large Sun-Spot Group Taken with the Sixty-Foot Tower Telescope of the Mt. Wilson Observatory on Aug. 8, 1917. The Small Black Disk in Corner Represents the Earth. This Photo Also Shows Admirably the Rice Grain Structure of the Photosphere In the Background.

THE CHROMOSPHERE.

Just above the reversing layer lies the *chromosphere*, which is between five thousand and ten thousand miles in depth. Many of the gaseous vapors of the reversing layer are found in the chromosphere, thrown there continually by the vast upheavals of gases that are constantly disturbing the surface of the sun. The greater the solar activity the more is the chromosphere charged with the vapors of the lower strata of the sun's atmosphere. The gases that are most characteristic of the chromosphere, however, are the incandescent gases of hydrogen and calcium, which give it the pink or reddish tinge so noticeable during total solar eclipse. Helium is also found in great abundance in the solar chromosphere.



This Photograph Shows the Distribution of Calcium Over the Surface of the Sun. It was Taken with the Spectro-Heliograph, an Instrument for Photographing the Sun in the Light of a Single Spectral Ray. The Brilliant White Patches Are Intensely Hot Clouds of Incandescent Calcium Vapor, Referred to as "Calcium Flocculi," Surrounding Sun Spots. The Flocculi Show the Same Peculiar Mottlings or Rice Grain Structure that Is Visible in the Photosphere.

Rising from the photosphere with the tremendous velocity of 100 or more miles per second, it can be seen at all times by properly screening off the light from the photosphere the vast solar eruptions known as the *prominences*. These are composed chiefly of hydrogen, tho other elements also appear, especially near the bases of the prominences. They are of two varieties, the quiescent, or cloud-like prominences, that float high above the solar surface for days at a time in some instances, and resemble terrestrial clouds in form, and the eruptive, or metallic prominences, that dart up from the surface of the sun in an infinite variety of forms that may be entirely changed in the short interval of fifteen or twenty minutes.

PROMINENCES 300,000 MILES HIGH.

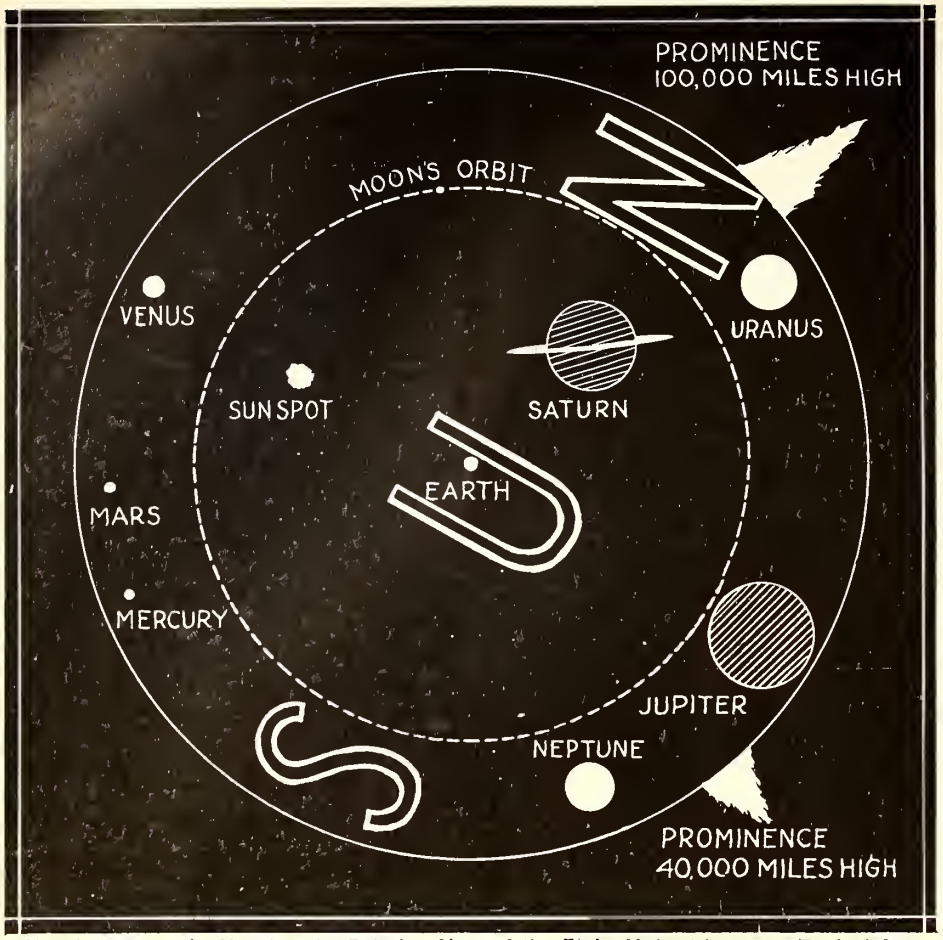
These eruptive prominences usually attain heights of thirty or forty thousand miles on the average, but *exceptional prominences reach heights of more than one hundred thousand miles and in a few rare cases have reached elevations of nearly three hundred thousand miles, or one-third of the solar diameter.*

They are one of the most spectacular and beautiful of all solar phenomena, only second in interest to the solar corona, which is the outermost of all the solar envelopes and also the most tenuous. The extent of the corona is enormous. Its outer streamers extend usually to distances of several million miles from the center of the sun. Measurements of the coronal light during total eclipses of the sun have shown that its intensity is only about one-half that of full moonlight, and it seems almost impossible to devise methods for detecting it, except during total eclipses, on account of this extreme faintness of its light. Experiments along this line are now being undertaken by means of the photo-electric cell, however, and astronomers have not yet given up all hope of detecting the corona in full daylight.

SUN'S CORONA OF ELECTRICAL NATURE.

The corona is largely electrical in its

www.americanradiohistory.com



Sketch Diagram 2—Showing the Relative Sizes of the Eight Major Planets, a Typical Sun-Spot and the Visible Surface of the Sun with Prominence at Edge. (The Planets Appear Projected Against the Disk of the Sun.) The Earth Marks the Position of the Center of the Sun's Disk.

nature, but it shines also partly by reflected sunlight from widely separated particles of matter and partly by light of incandescence, as well as by electrical excitations. The nature of the unknown element coronium has not yet been determined, but its wave length was accurately measured during the eclipse of June 8, 1918, as well as the positions of several other unknown lines in the coronal spectrum, which will greatly aid in their future identification.

The relations existing between the sun-spot cycle and the change in the form of the corona, which is very pronounced, is not yet clearly understood.

The sun, it is now known, is in the midst of a strong magnetic field. Also strong magnetic fields exist in sun-spot regions and the cycle of sun-spot change is attended by marked changes in many forms of solar activity. The frequency of eruptive prominences, the brightness and form of the corona, magnetic storms and weather changes on the earth are all closely associated with the sun-spot cycle.

The cause of this sun-spot cycle, with all the attendant changes in the general solar activity, and the source of the radiant energy of the sun still remain the two chief unsolved secrets of the sun.

QUESTIONS AND ANSWERS.

Question 1. How much would a man weigh on one of the smaller asteroids?

Answer. Most of the asteroids are simply huge mountains of irregular shape but assuming that the average asteroid is approximately spherical in form and ten miles in diameter its surface gravity equals its mass divided by its radius squared, or $g^1 = \frac{m^1}{r^{1\,2}}$ in which all quantities are expressed in terms of the corresponding quantities for the earth.

To find the asteroid's mass m^1 in terms of the earth's mass its volume, in terms of the earth's volume, is multiplied by its density in terms of the earth's density.

It is generally believed that the density of the asteroids is approximately the same as the density of the moon or six-tenths of the earth's density, therefore

$$m^1 = .6v^1 = .6\left(\frac{5}{4000}\right)^3 \qquad \left(\frac{5}{4000} = r^1 \text{ is}\right.$$

radius of asteroid in terms of earth's radius) and $g^1 = \frac{.6v^1}{r^{1\,2}} = \frac{3}{4000}$

in which g^1 is the asteroid's surface gravity expressed in terms of the earth's surface gravity.

If a man weighs 160 pounds on the earth he would therefore weigh three four-thousandths of 160 pounds on an asteroid ten miles in diameter—*or about two ounces.*

It can also be shown that if he should throw a stone from his hand with a velocity exceeding three feet a second it would never return to the asteroid but would revolve around the sun in an orbit of its own.

Question 2. Will you please explain what the "celestial sphere" is? Why do astronomers refer repeatedly to the "celestial sphere" and yet say that the form of the star system is flattened in the direction of one plane—the Milky Way—and may be a spiral?

Answer 2. The celestial sphere does not actually exist. For convenience in computing the relative positions of all celestial objects such as the sun, moon, planets and stars it is customary to consider that the earth is at the center of a sphere of infinite radius and that the positions of the heavenly bodies are projected upon the surface of this sphere.

The celestial equator, for instance, is simply the intersection of the earth's equator with this imaginary celestial sphere and the Right Ascensions and Declinations of the stars give their positions on this celestial sphere with reference to the celestial equator just as longitude and latitude on the earth give the position of some terrestrial point with reference to the earth's equator.

The ecliptic is the intersection of the plane of the earth's orbit with this imaginary celestial sphere of infinite radius.

The problems of astrophysics dealing with the nature and form of the visible universe are associated with the *actual* relative positions and motions of the heavenly bodies thru space and not with their projected positions upon the celestial sphere of infinite radius.

Question 3. Are sun spots holes in the surface of the sun thru which one sees into the sun's interior? I have seen this view expressed in some text book.

Answer. No. This view was held by some astronomers fifty years or so ago but it is now known to be erroneous.

Sun spots are solar storms or cyclones of a periodic nature with periods of maximum and minimum frequency of appearance. Highly heated gaseous material rises from within the sun to its surface in cyclonic whirls and spreads out over the solar surface, cooling rapidly by expansion. Into the vortex of this whirl are drawn down overlying gases, chiefly of hydrogen and calcium. The darkness of sun spots is due to the fact that the rapid expansion and cooling of the gases in these regions lowers the temperature in sun spots far below the temperature of the normal solar surface and they therefore appear dark in contrast to the more highly heated neighboring surface.

WHAT THE SUN DOES.

It is estimated that the earth receives every second from the sun enough heat to raise 600,000,000 tons of ice water to the boiling point, or to melt 480,000,000 tons of ice without change in temperature. If this is the amount that the earth receives, think of the amount that must be passing off into space and other planets. This amount has been computed to be 2,200,000,000 times as great as that which the earth receives.



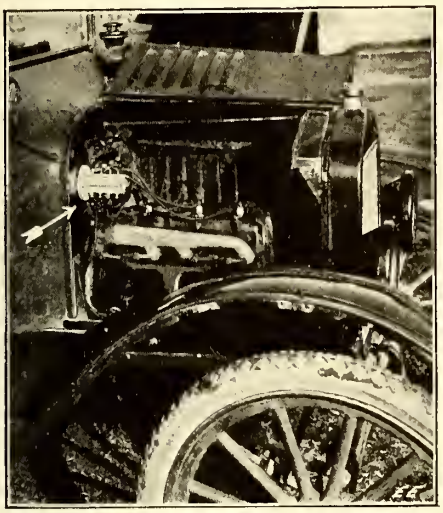
An Exceptionally Large Solar Prominence, 280,000 Miles High, Mar. 25, 1893, by Yerkes Observatory.

www.americanradiohistory.com

. . . AUTOMOBILE NEWS . . .

A NEW IGNITION ALL-SPARK DEVICE.

There is a new device in the auto world that does some remarkable things, according to its makers.



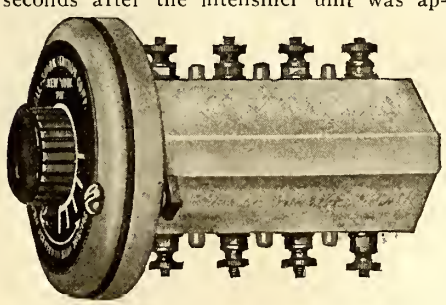
Ford and Other Four Cylinder Cars and Trucks Can Be Improved for All Around Running by the Addition of This New Spark Intensifier Indicated by the Arrow.

The object of this device is to eliminate all spark-plug troubles on Fords and other four-cylinder cars and trucks, and prevent the constant cleaning and buying of new spark plugs.

The most important feature is that it will not be necessary to change plugs on trips—when you want to get somewhere in a hurry, or it is raining and cold—in the middle of the night.

The device can be attached quickly, and only needs an extra set of plug wires run to it; it is placed on the dash panel, as the illustration shows. This device, which may be attached to the dashboard or any convenient place on any car, is really a *spark intensifier*. The device is so designed that the secondary current passing thru it is increased in voltage to such an extent that it will leap across practically any ordinary spark gap.

A great number of government tests were made with this unit installed upon government trucks as well as upon Ford automobiles. The illustration shows this device installed upon a Ford car. The plugs had previously been discarded as worthless, yet by the use of the new spark intensifier unit, the engine functioned perfectly. Shortly after this test a second was conducted in which the crankcase was filled with 23 quarts of oil. Without the unit the engine was run until all the plugs were sooted to such an extent that except for one cylinder, they ceased to fire. Within a few seconds after the intensifier unit was applied, however, the engine functioned properly and continued to do so until the oil in the crankcase fell back to its normal amount.



Close-up of the New All-Spark Intensifier for Four Cylinder Cars—Government Tests Have Shown Its Distinct Efficacy.

ELECTRIC INTAKE HEATER ENDS STARTING TROUBLES.

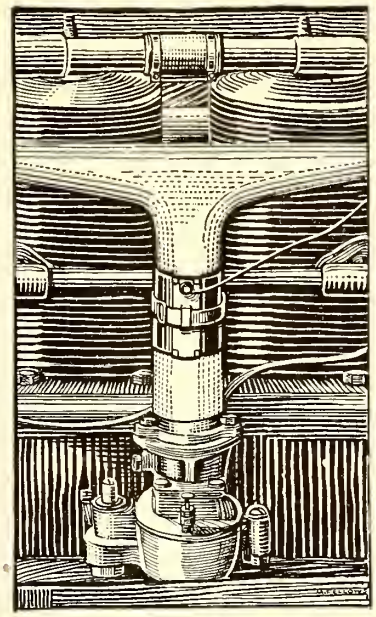
An electric intake heater is the simplest, most logical and surest device offered to automobile owners to assure easy starting of the motor in cold weather. It heats the intake manifold or carburetor by means of an *electric resistance coil*. This heats the air in the pipe and when the throttle is opened the gasoline mixes with the warm air, giving a vapor which ignites immediately.

This electric intake heater will start a motor in *one minute on the coldest day*.

This device can be installed by anyone. It consists of a resistance coil confined in a brass shell which is attached to a brass strap. It is operated from the storage battery by means of an electric wire and is controlled by a button on the dash.

In one minute or less, it heats the intake pipe or carburetor sufficiently to provide a highly combustible mixture which ignites instantly when the motor is turned over. This heater not only makes starting easy, no matter how long the car has stood in the cold, but it overcomes the disadvantage of priming with raw gasoline.

The device also reduces carbon, and most important of all, it saves the battery, as it uses only the same amount of current as the head and tail lights. The intake heater is made for both 6 and 12 volt batteries, single or double wiring system, and can be made to fit any car.

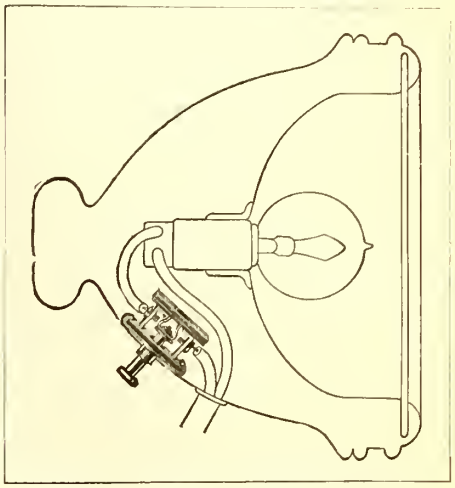


This New Electric Intake Heater Is Claimed to Start the Motor in One Minute on the Coldest Day. It Works on Batteries.

THIS SPOTLIGHT HAS SWITCH.

One of the new developments in auto specialties is a push-and-pull spotlight switch, made for mounting within the shell of a spotlight. Many years' experience in making switches for the automobile trade has proven that such a switch must have large *wiping* contact surfaces to prevent excessive contact resistance, and that the contactor must *float* on the operating shaft, so that vibration and side strain on the button will not cause the lights to flicker.

The insulating parts are made of fiber, the frame of stamped steel, the contacts of brass, and the contactor of phosphor bronze. These parts are riveted together into one solid unit which does not loosen or change alignment when subjected to vibration or strain. The mechanism is not enclosed because this switch is installed inside of the spotlight shell with the button protruding. Either rivets or machine screws can be used to fasten the switch to the shell. No plate is required; drilling one hole the size of the button and two for the rivets or screws permits mounting the switch as shown in the accompanying illustration.



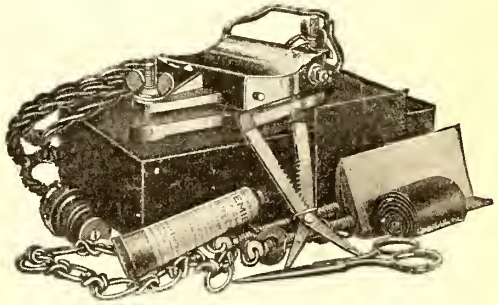
Showing New Electric Spotlight Switch Mounted in Shell of Spotlight, and Wiring Connections.

ELECTRIC VULCANIZER WORKS ON CAR BATTERY.

Never let the little cuts or sand blisters on your tires develop into blowouts. Use an electric vulcanizer like the type here illustrated and repair them. Clean the cut, fill in Para rubber according to directions, apply the vulcanizer and press the red button.

When complete vulcanization takes place, the button automatically "pops" out and the device then cools off. It represents a distinct advance for the motorist in caring for his tire troubles.

This handy little electric vulcanizer, which can be used on casings and tubes, is claimed to be absolutely automatic in operation and connects to battery or lighting circuit. These vulcanizers are furnished to operate either from 110-volt lighting circuit or storage batteries. The standard voltages of the latter type are 6-12-18-30 volts, and when operated direct off the storage battery on your car are positively guaranteed not to damage the battery in the least nor to interfere with its efficiency for starting, lighting or ignition. The 110-volt type will operate from both alternating and direct current. A smaller model of this vulcanizer is made by the same concern which is adapted to repairing tubes only.



Efficient Electric Vulcanizer for Casings and Tubes—It Operates on 110 Volts or Batteries When so Specified.

www.americanradiohistory.com

Legless—He Drives Auto Skilfully

SHOULD you ever be wandering in the streets of New York, or any other large city in the United States, and come across an immense crowd, larger than any ever gathering around an automobile with punctured tires or engine trouble, you will know that the owner of this auto is Mr. Fred Hammel, America's greatest "legless" traveler and autoist. At first one sees absolutely no reason for an immense gathering at a stalled auto. But upon closer inspection it is apparent that even more people might sensibly be gathered there, for Fred Hammel is a cripple. But there is nothing unique in cripples. One sees hundreds of them on the streets of our big cities every day. There is, however, something very unique in Mr. Hammel's skill. His inventive ability coupled with ingenuity have enabled him to build a device by which he can control his automobile, even tho legless from the knees down. To watch him make repairs on the road is a wonderful sight. It seems as tho Dame Nature endowed him with some supernatural ability, inasmuch as he uses his two short legs and his hands, climbing about on all fours with greater ability than we can use our hands and legs. He scrambles over the machine, up at the top of the roof and down again, with the agility of a cat, never missing his foothold or slipping, and at times it seems as tho he is flying in pursuit of his troubles.

A "joy-ride" with him is all that the word implies—and then some. The writer had the opportunity of making a trip thru the crowded streets of New York, across the Brooklyn Bridge to South Brooklyn and back again, being stopt by traffic cops at almost every street crossing, and starting out among the first of those who dart out immediately after the traffic director's whistle blows. Occasionally, some poor fool would step out in front of the machine, and then it seemed as tho one's heart were in his throat, either to swallow it again, or—. But Fred lets his hand glide to the brake lever on his car with absolute calmness, and exerting a slight pressure on this lever causes the car to be brought up to within a few feet of the passer-by. One would think that fifteen or twenty minutes of this kind of excitement would inure one to it. However, this was not the case. Shooting across the Broklyn Bridge at about 45 miles an hour on a down-grade, we suddenly loomed upon an Army truck. Unfortunately, some individuals were working in front of this gigantic truck, when the chauffeur of the truck noticed them almost too late, and jammed on his emergency brakes. About forty feet behind we were sallying forth at 45, and you can just imagine how it must feel for a passenger to be riding on this auto, knowing the chauffeur to be handicapped inasmuch as he cannot apply his feet to the brakes. Again Mr. Hammel's coolness prevailed. With one hand going to the lever, and a pressure ever so gentle, as tho he did not care whether the machine stopt or not, we "fetched" up, so to speak, to within about *five inches* of the truck in front of us. I already saw a smashed radiator and myself being dashed off to the hospital—but not so. The brakes were loosened, and we were on our way again.

Now a word about the machine and its fittings. The photographs clearly depict the appliances used. The three hand levers are of his own design and construction, so adapted that each one controls a distinctive pedal. When it is desired to apply the brakes, it is only necessary to pull its respective hand lever. On the brake lever likewise is a button for the electric horn. On

(*Continued on page* 564)





Without Legs Fred Hammel Drives His Car About the Largest Cities With as Great a Certainty as Any Autoist Possest of All His Limbs. The Hand Levers and Electricity Do the Trick.

Electricity Steers Blind Man

When a young man of Seattle became blinded early in the summer of 1918 he at once set his inventive genius to work to develop an electric direction indicator which would enable him to get about without the use of a cane. As a result of his labors, he holds a patent on a device which not only enables him to get about without a cane, but one that has great possibilities as an aid to navigation on the seas or in the air or as a self-acting course indicator for timber cruisers, surveyors, explorers, prospectors and men who follow similar callings.

The device, as shown in the picture, is attached to the belt of the wearer. It contains two buzzers, wired to points which come in contact with the needle of a specially constructed compass when the wearer digresses from the set course, and indicates the direction to take.

The mechanism is composed of the compass and two buzzers. A signal is given when the wearer deviates from a set course. The signal is the result of a movement of the compass needle when it touches either of the two pins suspended from the cap of the compass, which closes a circuit and rings the buzzer on the side of the course on which the wearer is digressing.

(*Continued on page* 599)



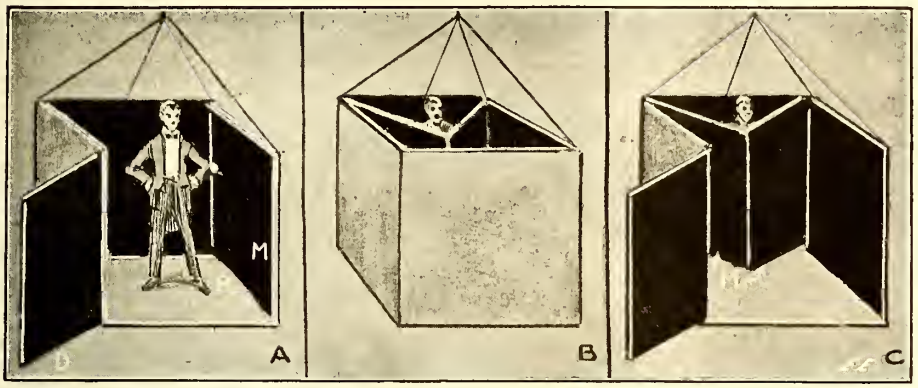
The Electric Direction Indicator, Worn by Its Blind Inventor, Who Developed It to Enable Him to Get About Without a Cane. The Specially Constructed Compass Is Worn in Front. The Two Metal Projections, One on Each Side of the Compass, Are the Buzzers. Clasps at the Sides of the Belt Hold Two Triple Cell Batteries, Which Supply the Current for the Device.

www.americanradiohistory.com

Experiments in Physics

By JOHN J. FURIA, A. M.
DEPARTMENT OF PHYSICS, N. Y. UNIVERSITY

3--Illusions

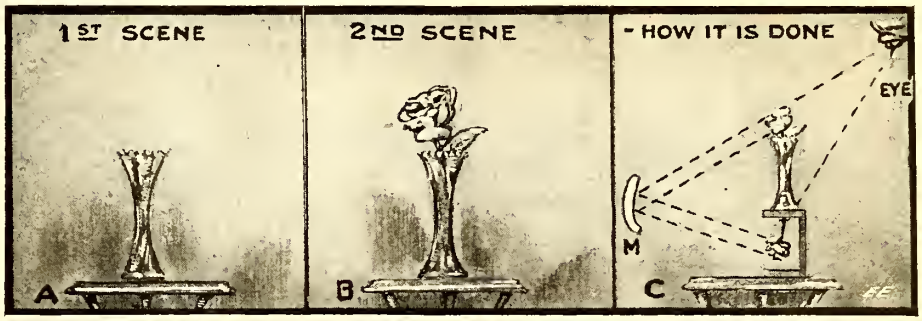


How the "Magic Cabinet" Trick Is Often Performed. First the Person Steps Into the Cabinet at A; the Door Is Closed and the Box Hoisted Up. The Person in the Cabinet Pulls the Two Hinged Mirrors "M" Together; Next the Door Is Opened and—Presto! the Man Has Disappeared—Apparently! Fig. 5.

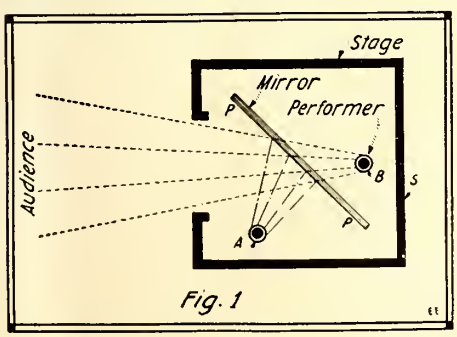
THE optical type of illusion, which is the main type and most elaborate, can be divided into two general classes: (1) The virtual image class, and (2) the real image class. By a *virtual image* we mean an unreal image, one which is caught on a screen. The images we see in the ordinary mirror or "looking glass" are of this type. By a *real image* we mean an image which actually can be touched and caught on the screen. The stereopticon, magic lantern and motion picture machine images are real (caught on the screen). The image formed by a camera lens on the plate or film or ground glass is, of course, a real one. *The eye is capable of seeing both the real and the virtual images,* and this forms the basis of all optical illusions. A plane mirror, highly polished plate glass or other plane surface, always gives a *virtual image.* Because of the possibility of being able to see an actual object thru plate glass and semi-silvered glass, they are almost universally used for feature illusions on the stage.

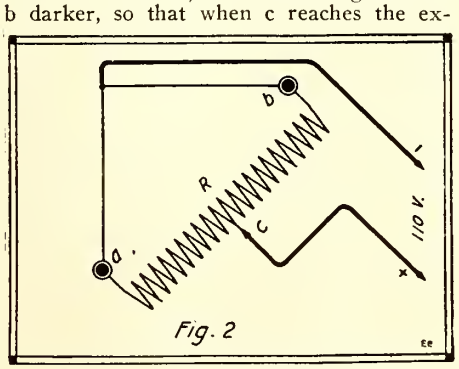
Figure 1 represents the top view of a simple theater stage and illustrates how eminent magicians like Kellar and Thurston made their transformations. The performer stood before the audience while the stage gradually dimmed, and brightened, and lo and behold, the smooth-faced performer changed before the eyes of the audience into a devil. The stage dimmed and brightened again, and the devil was transformed into a skeleton. Then, as an added attraction to the bald-headed first-rowites, the skeleton transformed into a scantily clad chorus girl or a bathing beauty. Finally the audience saw before it, bowing and smiling, in his full-dress suit —the performer. The effect on the audience was immense; the principle and *modus operandi* of the illusion is ridiculously simple. In figure 1, s are the walls of the stage draped in black velvet, p is a piece of highly polished plate glass perpendicular to the floor and arranged at an angle of 45° to the audience. The performer stands at B, in the direct view of the audience. His confederate stands in the wings at A, out of view of the audience. Since the stage is black, neither the performer nor the confederate will be visible *except when illuminated.* A and B are illuminated by a dimming device diagrammed in figure 2. R is a variable high resistance, a and b are lamps connected in parallel illuminating the performer and his confederate at A and B, respectively. As the variable contact is moved to the left, a becomes brighter and b darker, so that when c reaches the extreme left b is practically extinguished. Similarly, as c moves to the right, b becomes brighter and c extinguished. Referring to figure 1 again, when B is illuminated and A dark, the audience sees the performer directly thru the glass. When B becomes dark and A bright, B cannot be seen and A is seen by reflection from the polished surface of the plate glass. Thus as B becomes dark and A light, the performer disappears and changes into a devil (the confederate at A). In the meantime B, being invisible, the performer walks off the stage, makes up as a skeleton and returns to his position. As A is darkened and B brightened, the devil changes into a skeleton. This procedure is followed until finally the performer appears again before his audience to receive his applause. See figure 3.

Figure 4 illustrates the type of illusion making use of the 45° mirror. T represents a revolving table hidden behind the scenery s, P is a good quality mirror placed at an angle of 45° with the vertical. I is the reflected image of the person lying on the revolving table. The person appears suspended in mid-air. If the table is moved along the floor the person appears to move along in mid-air. If the table is revolved the person appears to spin around in mid-air as if pivoted thru his middle. If the person on the table moves his arms or feet the image suspended in mid-air appears to do this also. It is obvious that the person may be made to appear to be flying about, and by interposing a plate-glass tank of clear water in front of the tilted mirror the person appears to be swimming, eating, etc., in the tank of water without having to come up for air. All sorts of variations have been introduced in connection with this simple illusion.



The "Magic Flower Vase." Viewed From a Certain Angle You Apparently See a Flower in the Vase—Can Even Smell it! Advance and Examine the Vase—It's Empty! Figure "C" Explains the "Magic" Paraphernalia. Fig. 6.





How the Magician Changes Into a "Stage Devil" Before Your Very Eyes. His Image as Well as That of His Assistant Can Be Flashed Up Alternately, on the Glass Sheet PP. The Diagram, Fig. 2, Shows the "Dimmer" Used to Switch the Illumination from Image A to Image B, Gradually.

The disappearing cabinet or cage is another of the popular feature stage illusions using tilted mirrors. A man steps into cage or cabinet while the door is open. The cage or cabinet is hoisted up midway between the stage floor and the ceiling. The man shuts the door on himself. The cage or cabinet is let down within a few feet from the floor, the door is opened and the occupant is found missing. The door is closed again, the performer fires a smoky shot. The door is again opened and—presto! the occupant is again seen in the cabinet. One has but to refer to figure 5 to see how simple this illusion is. In figure 5-A P is the performer, M and M are mirrors tight against the sides, D is the door.

(*Continued on page* 572)

www.americanradiohistory.com

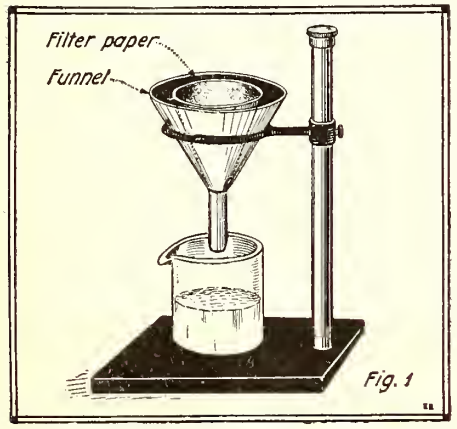
Practical Chemical Experiments

By ALBERT W. WILSDON

Composition of Fruits and Their Food Values.

AT this time of the year, fruits are utilized as a very important part of our daily foods and a little knowledge of their composition and value will not be superfluous. "Fruit" in the restricted sense, includes the pulpy substance enclosing the seeds of various plants, and especially those which are edible in the raw state.

A *green* fruit does not differ very materially from the leaf in composition, but in the process of ripening, under the influence of sunlight, the fruit undergoes a remarkable change in color, texture, composition, and flavor. During this change period it ceases to act on air like a leaf, but to the contrary, *begins to absorb oxygen and liberate carbon dioxid gas.* As the process of ripening goes on, both the *invert sugar and the sucrose increase and the starch and free acid decrease.* Following the disappearance of the starch the sucrose disappears quite rapidly on account of its change to invert sugar. Malic acid appears to decrease, but this phenomenon is largely due to the fact that it is formed

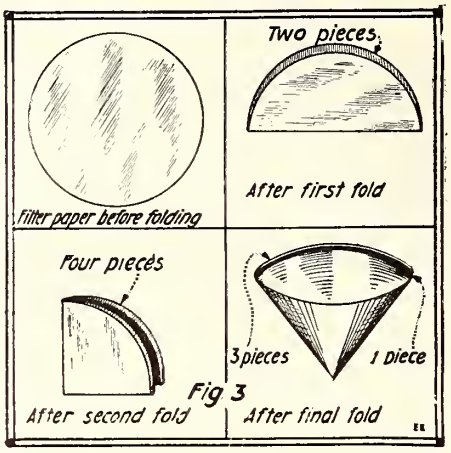


This Form of Filtering Stand May Be Used for All Experiments Requiring Filtering. Fig. 2 Depicts a Convenient Method Which Is Adaptable in Every House.

in the early history of the fruit, and becomes diluted by its growth. It is supposed that while ripening the insoluble pectose changes into pectin and secondary substances of a gelatinous nature. The tannin that made the fruit astringent also disappears. *As the fruit becomes over-ripe, some of the sugar and acid is oxidized, and the fruit in consequence loses its agreeable flavor.* On cold storage this latter condition is deferred, owing to the low temperature, but a very short exposure to air, at ordinary temperature, causes the fruit not only to appear over-ripe, but to decay quite rapidly. Thruout the process of decay, which is assisted by fermentation, carbon dioxid and alcohol are at first formed from the sugar, and later the alcohol is oxidized to acetic acid, and finally in the decayed fruit the seed is set free, ready to start a new plant.

WHAT GIVES TASTES IN FRUITS.

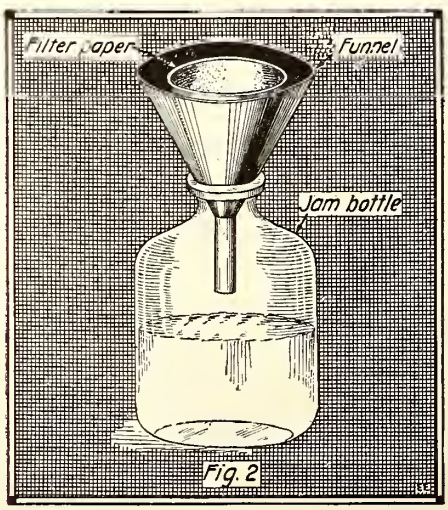
The agreeable tastes possest by fruits are due to the right proportions of the constituents mentioned in the foregoing test, and also to the compound ethers and essential oils which may be present. These flavoring substances are, many of them, present in such small quantities that they are not mentioned in the analysis. Some fruits



Notice that When Finished, the Paper Filter Will Be Conical in Shape and Will Have Three Folds on One Side and One on the Other.

which seem to "melt in the mouth" really do contain considerable soluble matter. It is a well-known fact that sugar disguises acids, and that an agreeable taste in preserved fruits is often due to a judicious mixture of the acid and the sweet. The most important nutritive material in fruits is in the carbohydrate group. Altho starch is present at cetrain stages of growth, sugar is the most abundant of the carbohydrates. This is usually invert sugar, but *apricots, pineapple, and apples contain also cane sugar.* This fact has an important bearing on the dietetic use of fruits, as invert sugar is, in some diseases, as diabetes, more easily assimilated than cane sugar.

The pectus bodies above referred to are not very well understood, but are supposed to be related to the carbohydrates. The insoluble glacto-araban is supposed to give the property of hardness to unripe fruits and vegetables, and is the basis of making jelly. The statement has been made that as the fruit becomes riper the pectose is changed by the action of acids into pectin, a vegetable jelly, which causes the juice, after boiling, to gelatinize when cooled. *This may be noticed in the juice that exudes in the baking of apples.* It is supposed that by boiling too long these



A Clean Ordinary Jam Bottle Will Be Found Efficient as a Filtering Stand When a Funnel Is Used Which Is Sufficiently Large to Rest on the Mouth of the Jam Bottle. If the Stem of the Funnel Is too Long It May Be Cut with a Triangular File.

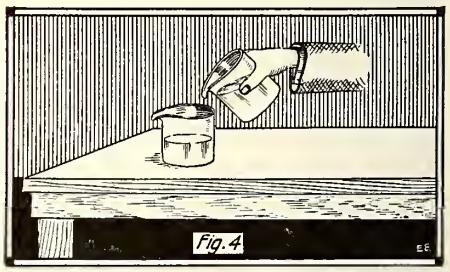
pectous compounds are concentrated into a more soluble modification, and, if this is true, it may serve to explain the fact that sometimes fruit juices that have been boiled for a long time become thick and viscid, but do not form a true jelly. *A partially ripe fruit is better adapted to making* jelly than is one that is fully ripe.

From the foregoing it is evident that pectin bodies are substances of undetermined function very widely distributed in plant tissues. They occur both in soluble and insoluble forms.

In the studies of these bodies the most important problem appears to be the quantitative determination of the pectin bodies occurring in a given tissue, because such a method could be used to determine the function of the material in plants; whether for example, it is a reserve material, a by-product, is used for structural purposes, or has all three functions or two of them; whether the nature of the pectin body changes with the growth of the tissue, or possesses a practically constant composition; whether the pectin bodies obtained from the different sources are identical, are mixtures of the same substances in varying proportions, or are inherently different.

EXPERIMENTS.

Experiment No. 1. To the filtered apple



The Addition of the Various Reagents Mentioned Will Produce the Results Mentioned in the Text. If Possible, It Is Advisable to Use Either Beakers (Lipt) or, if Not Available, Ordinary Drinking Glasses Will Answer the Purpose. These Permit Easier Handling to Those Performing the Experiments.

juice of a ripe apple add an equal bulk of alcohol, and a gelatinous mass consisting largely of pectin will be precipitated. This may be dried, and it will be found that the powder thus obtained is soluble in cold water.

Experiment No. 2. Stew a handful of cranberries, filter the juice, and allow to stand till cold, when an abundant jelly is obtained.

Experiment No. 3. Test some green fruit, a persimmon or banana, for tannin by extracting the juice, filtering, and adding a small quantity of ferric chlorid. The production of a black, or greenish-black, color indicates tannin.

The acidity of fruits is due to the presence of the free acids, Malic, Citric, Tartaric, or their acid salts. They not only have an agreeable acid taste and serve as appetizers, but when oxidized in the body are converted into the corresponding carbonates, and these help to render the blood more alkalin and the urine less acid.

Experiment No. 4. Add to a solution of Malic acid, calcium chlorid, ammonium chlorid, and ammonium hydroxid in excess. There should be no precipitat, but upon adding to this three volumes of alcohol, calcium malate should separate out as a precipitat.

(*Continued on page* 578)

www.americanradiohistory.com

THE CONSTRUCTOR

Making a Machine for Telegraphing Pictures

PART II

By LEROY J. LEISHMAN
Expert in Telephotography

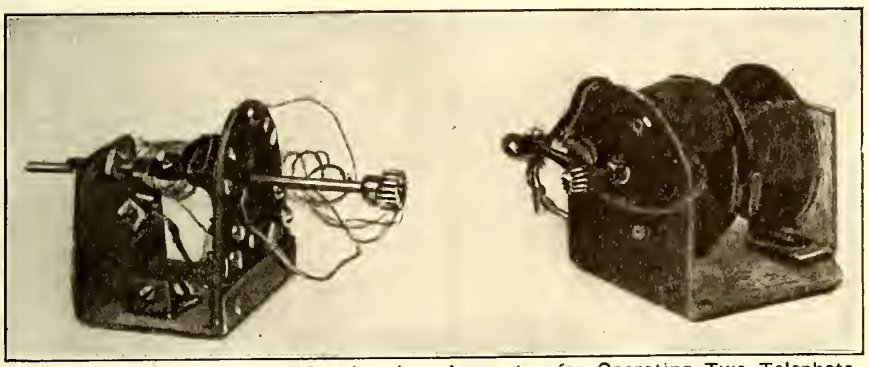


Fig. 3—A Simple Electrical Synchronizer Apparatus for Operating Two Telephotographic Machines. The Commutator of the Motor is Used at the Transmitter and the Motor at the Receiver.

WE can use a rod connection, or one of several different electrical schemes which permit the machines to be operated at long distances away from each other. However, only two electrical synchronizers will be explained. The simplest and least fascinating way to synchronize the machines is by a rod connection H (Fig. 1), with the instruments only a few feet apart. A few rods, such as those used for shafts, can be connected with couplings and one machine placed at each end with the cylinder rods toward you. Make two or more supports for this connecting rod to hold it at the same height as the cylinder shafts, to which it runs at right angles. Place a crown gear I (Fig. 1) or K (Fig. 2) on each cylinder rod, with the teeth turned *toward* you on one machine and *away* from you on the other. Now slip an upright on both ends of the synchronizing rod and place a small gear J (Fig. 1) flush with each end to mesh with the crown gears.

Fix the uprights or supports in place so that the proper connection is maintained and so that both machines run together, regardless of which cylinder is turned. The machines may be operated by a crank attached to the end of one of the cylinder rods, or by a motor properly geared down.

The cylinders themselves must turn at about *one revolution in three seconds.* This may seem quite slow; but it must be remembered that this is a very inexpensive home-made set, and that T. Thorne Baker and Dr. Korn operate their cylinders at only one revolution in two seconds, and that the most delicate sets for one of my systems utilize drums operating as slow as a revolution in one second. Faster work can be done with some of my latest apparatus; but the system is far different from the one for which these machines are used, and the machines are too costly and complex for the average experimenter to build. So let us be content with one revolution in three seconds.

A Simple Electrical Synchronizer.

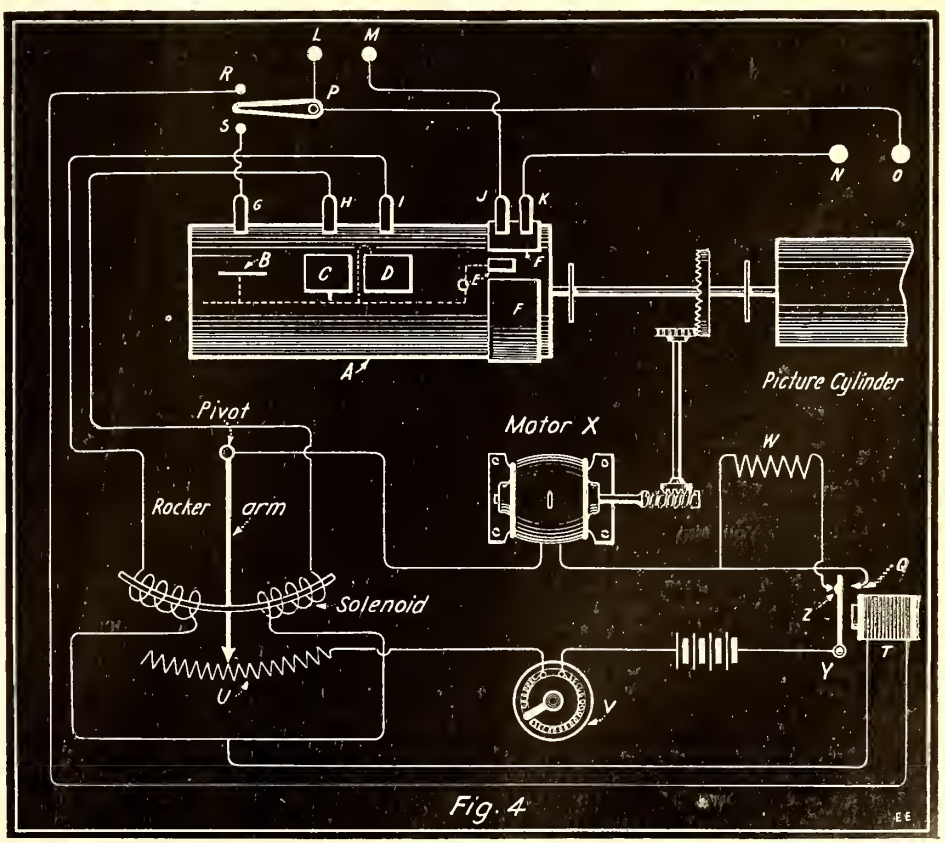
A simple electrical means for synchronizing the two machines utilizes a motor for one machine and its commutator for the other. (See Fig. 3.) The armature of the motor is separately excited and has but two poles; while the field has three poles connected in series, with the connections tapt between the magnets for the three wires which extend to the three segments of the commutator of the other machine. Two diametrically opposite brushes rotate against this commutator and cause the field to rotate in synchronism. The current can be supplied to the brushes by collector rings. As before mentioned, the armature of the motor is separately excited.

The shaft supporting the brushes must be geared (nothing but gearing will do) to the sending machine, and the motor must be geared *in exactly the same manner* to the receiving machine. The sending machine can be operated by hand or by a motor as desired, and the receiving machine will then operate in exact synchronism.

An Automatic Electrical Synchronizer.

The most interesting and ideal synchronizer of all requires no extra wires whatsoever. The principal part is a wooden or other non-conducting drum A (Fig. 4), the shaft of which is connected to the shaft of the cylinder upon which the pictures are sent and received. B is the edge of a piece of metal electrically connected with the shaft. C and D are pieces of graphite connected on opposite sides to metal strips

(*Continued on page* 562)



Layout for Improved Electrical Synchronizer to Be Used for Operating Telephotographic Transmitting and Receiving Apparatus Here Described.

www.americanradiohistory.com

Building and Testing Small Transformers

By J. W. ESHNAUR

BUILDING a small transformer is not a difficult matter if you know the proper sizes and amounts of wire to use and the size and quantity of iron to put in the core. If you do not have this data at hand, you are pretty sure to meet with failure, and in the words of the funny paper ask, "How do they do it?"

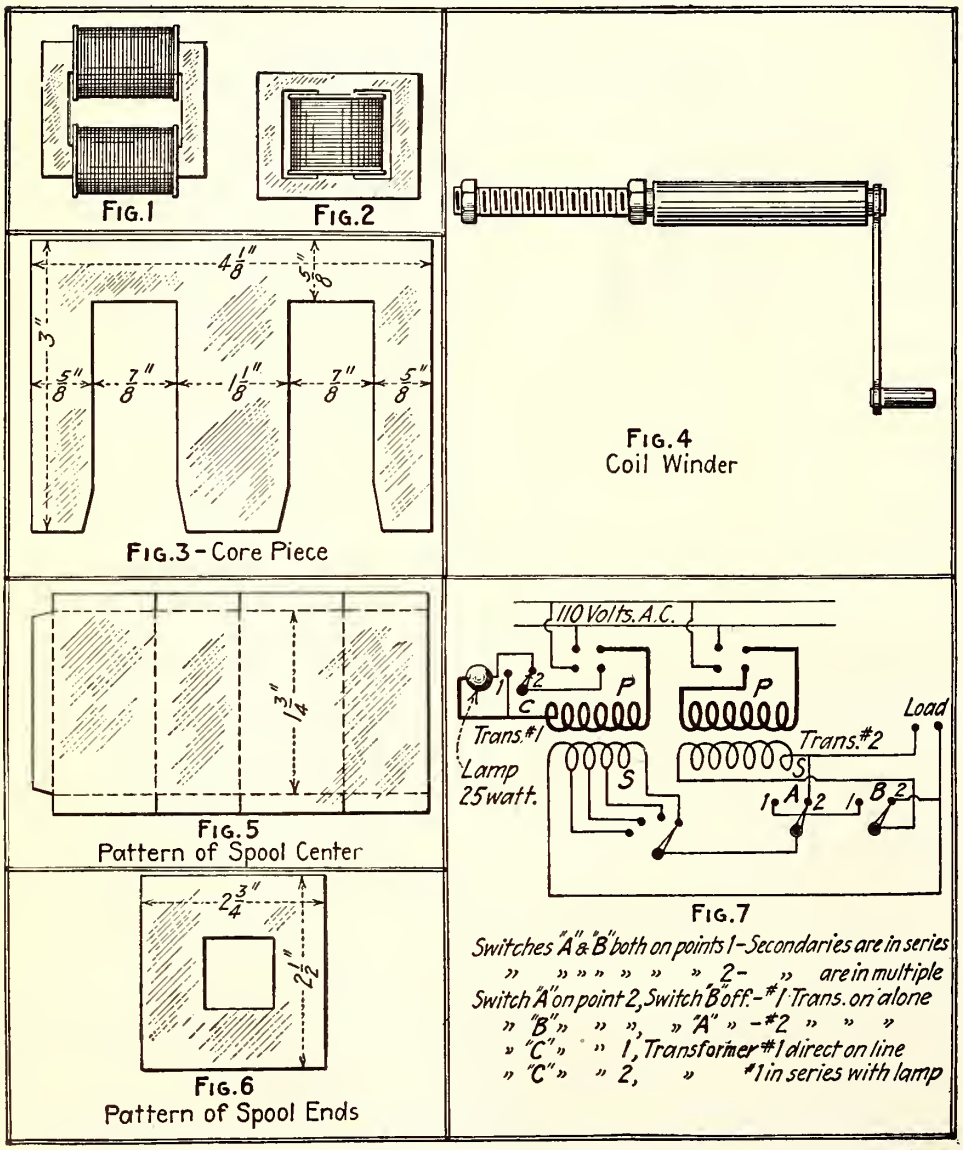
The principal trouble in a small transformer is its tendency to heat *when under no load*. This is caused by losses in the core and Primary winding, the technicalities of which it is not necessary to go into here. Properly constructed, a transformer may remain on the line indefinitely under no load and will not heat. Under a load it will warm up slightly, but excepting on a *dead short* of the Secondary, it will not get dangerously hot.

SHELL AND CORE TYPES.

There are two general types of transformers in use, known as the core type and the shell type, shown respectively in Figs. 1 and 2. The shell type is the easiest to construct and probably the most satisfactory in every way for the Amateur, therefore I will deal with it only. The following instructions are for a transformer to deliver voltages ranging from 2 to 20 volts, but further on I will explain how you may vary the size so as to obtain any voltage you may desire.

BUILDING THE CORES.

First prepare the annealed sheet-iron core pieces. These are made from very soft, thin sheet iron (tin-can stock has been used), and are cut in the shape of the letter E, the dimensions being given in Fig. 3. It is best to make a pattern from some slightly heavier stock being careful to get all parts square and close to size. When the pattern is finished, lay it on the iron to be used for the core pieces and with a sharp scriber mark out a piece. Cut this out, using a sharp cold chisel to cut along the back of the piece between the tongues which cannot be reached with the tinsnips. Lay this piece on the pattern, first one way and then the other, and if the lines all coincide you are all right, if not file the pattern in the spots which are out and try again until the pattern and the core pieces line up pretty close. Now cut enough core pieces to make a pile 7/8" high when tightly comprest. Put all the pieces in a pile with the tongues all in one direction line them up as closely as possible and clamp the back of the E in the vise and file the inside edges smooth. Do the same with the end and middle tongues. You need not file the outside edges unless you so desire, as it is only a matter of looks whether they are smooth or not, but the inside must be quite true or you will have trouble in entering them into the spool.



Here's Something You Have Wanted for a Long Time—Data and Instructions for Building and Testing Small Transformers

WINDING THE COILS.

In order to wind the coils evenly, it is necessary to have some form of winding apparatus. If you have no lathe, you can easily make a winding machine as shown in Fig. 4. A 3/8" bolt about 10" long, with threads cut down about 6"; a piece of 1/4" pipe 1/2" longer than the width of your vise jaws, and a couple of 3/8" nuts are about all that is necessary. Saw the head off the bolt and put on a handle. Slip the pipe on the bolt and run one of the nuts down close to the end of the pipe, leaving just enough end play for the bolt to turn easily. Put the pipe in the vise and this part is ready. Now take a piece of wood, slightly larger in dimensions than the middle tongue of the core piece, and bore a 3/8" hole thru the center lengthwise. Then plane it down taking care to keep the sides as near parallel to the hole as possible, until it is 1/16" larger than the core or 15/16" x 1 3/16".

The spool is made from good, stiff cardboard. Lay out a piece as shown in Fig. 5. Cut on the (solid) lines and bend on the (dotted) lines. It is best to form this part of the spool right on the block you have just finished. The end pieces are shown in Fig. 6. Cut the hole in the center just large enough to fit snugly over the center form. Bend up the short ends and glue them in place. Place the completed spool on the block, slip the block on the spindle of the winding apparatus, lock it in place with a nut, and when the glue is dry you are ready to wind the coils.

THE SECONDARY WINDING.

The secondary winding is put on first. It consists of four layers of No. 18 enameled magnet wire with a tap taken off each layer. Punch a hole in one end of the spool, put the end of the wire thru about 4" and proceed to wind the wire on evenly until the first layer is complete. Cut the wire, leaving about 4" beyond the end of the layer. Punch a hole in the end of the spool and push the wire thru. Put the end of the wire remaining thru the same hole and solder the two together, just outside the spool. Cover the layer of wire on the spool with a layer of paper and wind on the second layer, taking a tap off at the end in the same manner as before, and so on to the end. Number each tap as you take them off and cover the completed secondary with several layers of paper, or, better still, with two layers of Empire cloth (oiled linen).

THE PRIMARY.

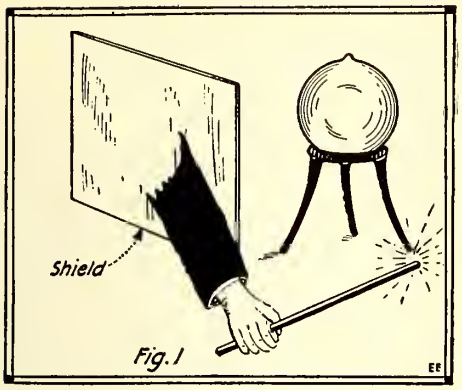
The primary consists of twelve or fourteen layers of No. 28 enameled or silk-covered magnet wire. Solder a piece of No. 18 wire to the end of the No. 28 wire, make a full turn of the No. 18 around the

(*Continued on page* 580)

www.americanradiohistory.com

Explosions Caused by Light

By H. J. Gray



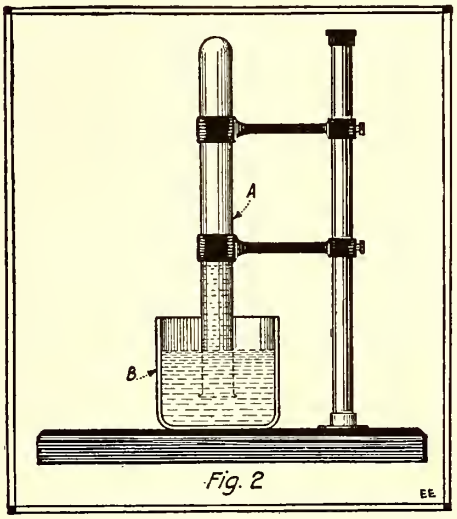
A Mixture of Chlorin and Hydrogen Gases, If Sealed up In a Glass Bulb, Will Combine In Diffused Light to Form Hydrochloric Acid Gas. Exposure to Direct Sunlight or Burning Magnesium Wire Ignites Forcibly the Gas so Formed.

THAT photographs are taken by virtue of the chemical properties of light is a fact that is familiar to everyone, and is indicated by the very word *photography*. But there are many other interesting examples of the action of light in promoting chemical action which have no bearing on the photographic art. Under the influence of the *actinic* rays in sunlight, and the light of magnesium, the electric lamp, etc., elements are made to combine and compounds are decomposed into their elements or broken down into simpler and more stable compounds, while certain of the chemical elements are converted into a different form or allotropic modification.

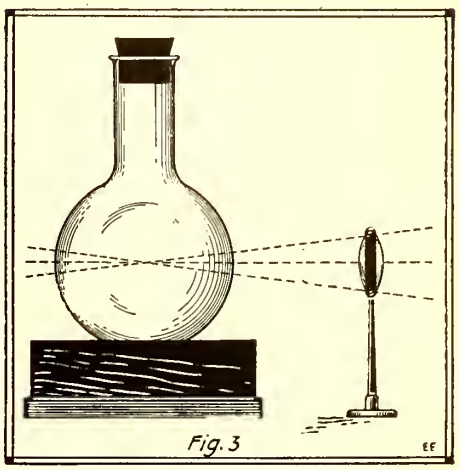
Octahedral sulfur (the form in which native sulfur crystallizes) can be readily dissolved in carbon disulfid. If such a solution is prepared and exposed to a beam of very strong light the clear liquid becomes turbid by formation of insoluble white amorphous sulfur. Yellow phosphorous is also altered by exposure to light.

If a mixture of chlorin and hydrogen gases is sealed up in a glass bulb and exposed to diffused daylight, the gases gradually combine to form hydrochloric acid gas, but the combination does not take place in the dark. Exposure to direct sunlight causes the gases to combine at once with an explosion that shatters the bulb. The same effect is produced by burning a piece of magnesium wire, as in Fig. 1, the experimenter being shielded by a suitable screen.

Another example of chemical synthesis brought about by the action of light is the combination of chlorin and marsh gas (or methan) to form methyl chlorid. Let a tall and wide glass tube, A, Fig. 2, be filled with strong brine and inverted over a vessel, B, containing the same solution, the tube being supported with its mouth beneath the surface of the liquid. One-third of the tube should be filled with chlorin by bubbling the gas thru the brine—in which it is much less soluble than in pure water—and then another third of marsh gas introduced in the same way. The tube must not be exposed to direct sunlight or the gases will combine with explosion but if left in diffused daylight for a few hours the liquid will be found to have risen in the tube which now contains only methyl chlorid. The hydrochloric acid produced at the same time will have been absorbed by the brine, and the resulting vapor will occupy only about one-third the original volume.



The Combination of Chlorin and Marsh Gas Under the Action of Diffused Light, Giving Methyl Chlorid, Which Explodes When Exposed to Direct Sunlight.



The Glass Vessel Contains Sulfur Dioxid Gas. A Strong Electric Light Beam Is Focust on It Thru the Lens Shown, Causing a Mist to Appear and Finally a Fog Which Fills the Bottle. Removing the Light, the Fog Disappears.

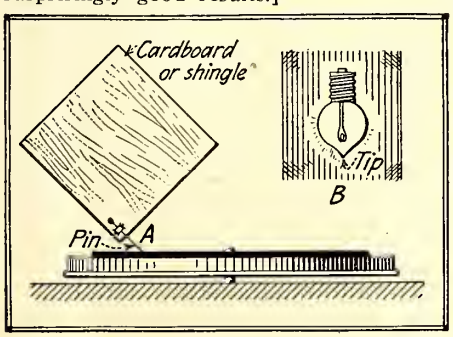
Examples of decomposition by light action are more numerous. Mercurous oxid has to be kept in the dark if required in a laboratory, because it is gradually decomposed by exposure to light, forming mercuric oxid and mercury. Many other metallic salts are similarly reduced by light, hence their use in photography. Those of silver and uranium are particularly sensitive. Glue or gelatine containing a little potassium bichromate is rendered insoluble and leathery by exposure to light, a property that is made use of for rendering glued joints watertight.

If a large clear glass flask is filled with sulfur dioxid gas and closed with a rubber stopper, a further experiment can be made if a strong electric light is available. The light should be concentrated by means of a lens, as shown in Fig. 3, and past thru the flask. In a few moments a mistiness will appear, and after a short time the vessel will appear to be filled with fog. This is caused by the decomposition of sulfur dioxid into sulfur trioxid and sulfur. Upon removing the strong light these products will soon reunite to form the original and invisible sulfur dioxid.

Novel Phonograph Reproducers

Procure a stiff piece of cardboard about 1 foot square and insert a needle into it so as to project from the corner of the cardboard in the fashion illustrated herewith. See Fig. A.

The projecting point is held on the revolving phonograph disc. Best results will be obtained if the cardboard reproducer be held in the fingers where the needle passes thru it. The music is surprisingly clear and can be heard at a distance of 30 feet. [Ed. Note: A wooden shingle gives surprisingly good results.]



Want Some Fun? Try One of These Phonograph Reproducers.

By simply placing the tip of an electric light bulb (see Fig. B) on the disc, the music can be heard about 1 foot away.

Contributed by RUSSELL H. ANDERS.

A SILENT ALARM CLOCK.

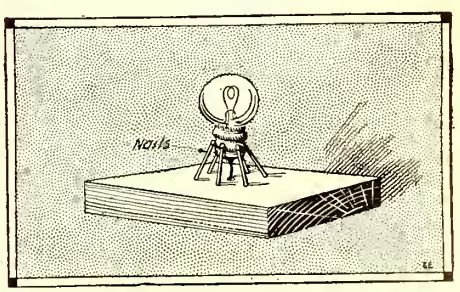
About the most gentle way in which to awaken a person is by the rays of the sun falling on the sleeper. This principle is incorporated in the silent alarm proposed herewith. A nitrogen tungsten lamp of high wattage is mounted within a reflector which is in turn mounted on either the headboard or footboard of the bedstead in an adjustable manner so that the light rays may be focust upon the pillow. This light is controlled by a time-switch or suitable alarm clock arrangement to turn the current on at a predetermined time; the circuit should be opened by a switch located at a point distant from the bed. It is also advised that a good lens be used to increase the strength of beam if necessary. After one is awakened, the flood of light will render the chance of dropping off into further slumber improbable, and you will be persuaded to rise and "douse the glim."

Contributed by J. A. WEAVER.

A Shoe-Nail Receptacle

First procure seven old shoe-nails an inch or so long and a piece of board. Drive six of the nails into the board in the form of a circle, ¾ inch in diameter. In the center of this circle drive the remaining nail, leaving all 7 nails protruding at least ½ inch. Next bend the six nails toward the central one until they will clamp a miniature base lamp. Drive the center nail down until, with the bulb in the improvised clamp, the base will just touch the center nail.

Contributed by E. C. PADDOCK.



Ever Want a Miniature Receptacle in a Hurry? Here's How to Make One From Old Shoe-Nails.

www.americanradiohistory.com

Experimental Mechanics

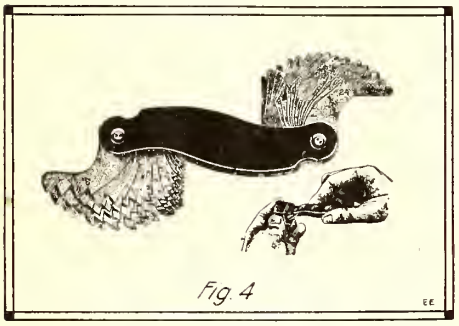
By SAMUEL D. COHEN

LESSON XV

IN the earlier lessons of this Course, the subject of "thread-cutting" was taken fully under discussion; the same being applied, however, to threads cut by means of the lathe only. The lathe is by no means the only method by which threads can be cut, either internally or externally. The most common method of cutting threads in metal or any other materials is by the application of taps and dies. The latter being used for cutting external threads, while the former are used for cutting internal threads.

There are various types of taps and dies that can be used for this work, and these depending upon the character of the work in which the threads are to be cut. The most common thread as obtained from a tap are those of the 60 degree "V" variety. This type of thread is the most commonly used and for this reason it is recommended for the novice. Taps and dies are most easily procured and you will find that very little effort is imposed upon the user of the tool in obtaining an accurately cut thread.

There are three principal types of *taps*, namely:—the *taper*, *plug* and *bottoming*. These three taps are indicated in Figure 1. The *tapering* tap being used for starting the thread, the *plug* tap being used for smoothing the starting thread obtained



To Ascertain the Pitch of the Thread on a Bolt or Nut, a "Thread Gage" of the Type Shown Here is Usually Employed.

by the taper type, and lastly, in finishing a thread, the *bottoming* tap is employed. The latter tap is also used in places where the depth of the hole is limited and it is desired to produce a sharp V-thread in said hole.

The difficulty encountered in attempting to use the bottoming tap first is that it is difficult for the body of the tap to grip the metal. This can be avoided by slightly chamfering the hole and applying a sudden twist on the tap. (See photo Fig. 3.) Should the hole wherein the thread is to be formed be long enough, it is then recommended at all times to use at least the plug tap as a starter, and not a bottoming tap.

It is strongly urged at all times when using a tap that plenty of oil shall be applied to the working surface. Standard commercial machine oil will serve the purpose. In brass, especially when tapping large holes, soluble oil should be applied.

Taps are usually held in *tap wrenches* as indicated in Figure 2. Do not use monkey wrenches or tools that have an L-shaped handle in operating a tap. This is an important rule to be remembered, as when using the latter type handle it is difficult to start the tap into the metal into which the thread is to be cut at exact right-angles to the tap. Often the tap is broken when utilizing such a tool. It is thus clearly seen

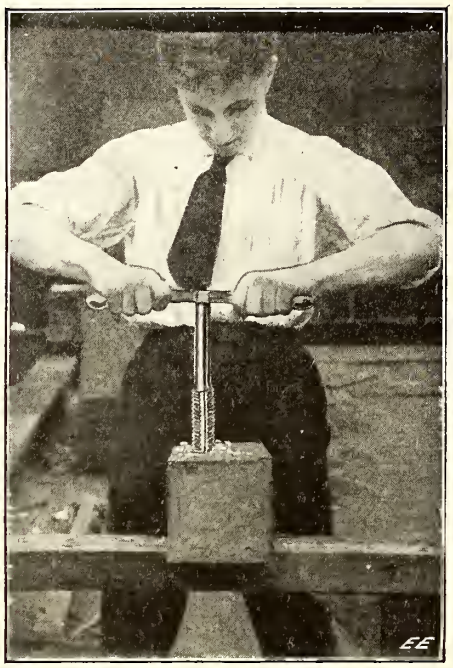
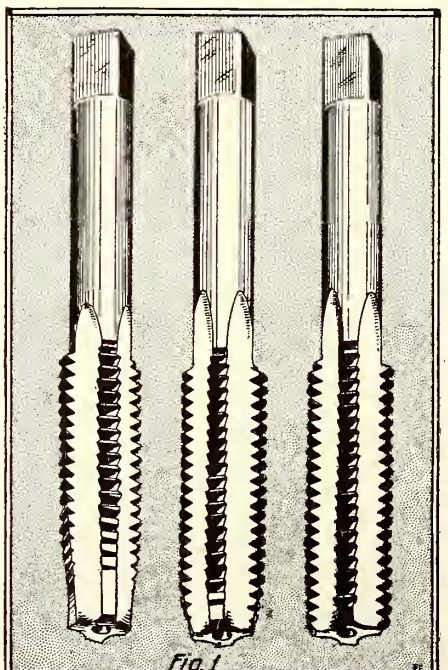


Fig. 3.—Don't Try to Run a Tap in With a Lop-Sided motion, as by Using a Monkey Wrench; Always Use a Balanced, Two-Handle Tap Holder as Here Shown.

the exact reason for using a tool having a T-shaped handle is that the applied force to the tap is uniformly distributed.

The following may be of assistance to the novice as regards lubrication for different materials which are commonly used. As previously mentioned—in brass work, the tap should be lubricated with soluble oil or standard machine oil. Same being applied in tapping bronze.

In copper and aluminum where tapping is most difficult, it is strongly recommended to use kerosene or turpentine as the lubricant.



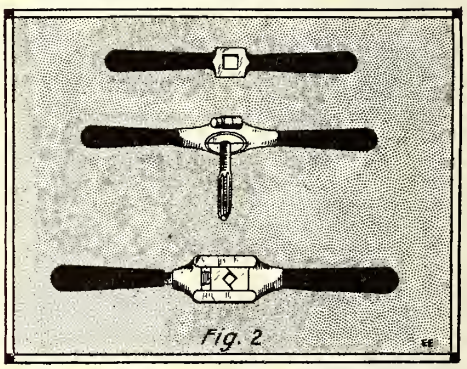
Left—Taper Tap. Center—Plug Tap. Right —Bottoming Tap.

In tapping these materials, it is urged that the tap be given a to-and-fro motion; this being necessary in order to eliminate any possibility of causing the metal to adhere to the tap and thereby preventing binding of the tap. At times it is also recommended to remove the tap from the threaded portion and remove all of the dust particles that may be in the metal and flooding the same with the above-named lubricant, before attempting to proceed with the tapping. Tool and machine steel, especially of the high carbon grade, require standard machine oil as a lubricant while tapping.

The following materials do not require any lubricant for tapping: fiber, bone, bakelite, formica, hard rubber and cast iron.

Miscellaneous Notes on Tapping.

All threading of machine parts and castings is not done by means of the standard tap wrench by hand, but in some cases the threading is done in a *drill press* or in a *lathe*. In machine shop practise large holes often have to be tapt measuring two inches or more in diameter. It is manifestly impossible, or at least impractical, to attempt to tap such a hole by hand, altho it is sometimes done in an emergency. For such a job, the first point to be watched should be



Three Common Forms of Tap Wrench Used in Machine Shop Practise.

to get the tap firmly over the opening, the edge of the hole being eased off a little with a file if necessary to start the tap. It is a common trick in tapping holes such as this to place the part or casting on the table of a large drill press and center it so that the spindle of the press comes directly over the hole to be threaded. The tap is then placed in a position over the hole and the spindle either fitted with a chuck to hold the tap, or in some cases the spindle simply carries a tapered *center* which presses against the center hole in the end of the tap. By throwing in the back-gear of the drill press, any pressure desired can be obtained on the tap and under these conditions the tap is threaded into the material by turning it slowly with a large wrench; in the case where the person doing the tapping is sufficiently skilled the tap can be held in the drill press chuck, and by throwing in the compound back-gear so as to cause the spindle and tap to just barely turn, the hole is thus tapt out. By throwing the reverse lever on the drill press, the tap can be *backed out* when the tap has been threaded thru the hole a sufficient distance. The "feed" is worked by hand.

Many small parts and castings, etc., are easily and accurately tapt in the lathe.

(*Continued from page* 579)

www.americanradiohistory.com

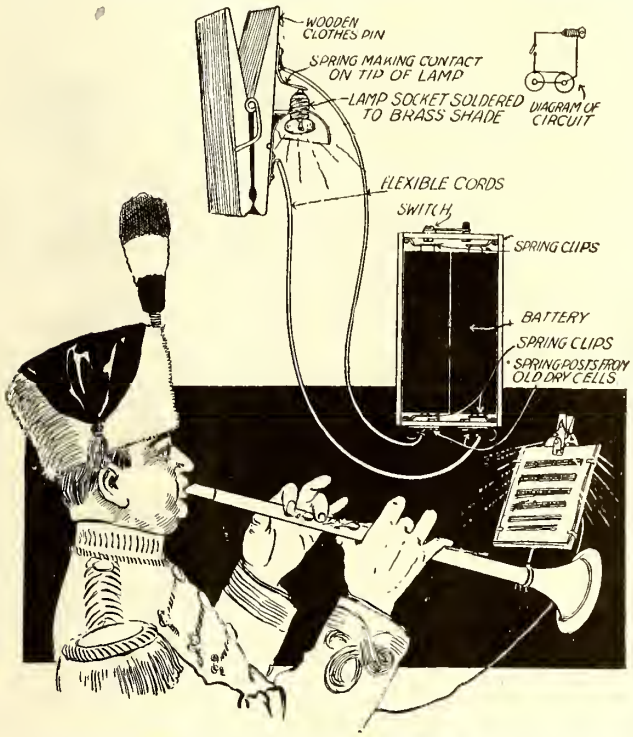
HOW-TO-MAKE-IT

This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 is awarded; for the second best idea a $2.00 prize, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

FIRST PRIZE, $3.00

MARCHING LIGHT FOR MUSICIANS.

Herewith is a sketch of a Novel Musicians' Light for musicians when marching at night. I have used one for some time and find it very satisfactory. The description follows:



An Electric Light of Many Uses—Here Shown Lighting up the Bandsman's Music.

The box is made of a cigar box or other light wood, of a size to accommodate two flashlight batteries of the type you desire to use, and may be provided with a hinged cover to facilitate replacing the batteries. One end of the box is provided with a small lever switch for opening and closing the circuit. The other end is equipt with two spring clips taken from old batteries.

Secure a piece of brass and bend it in a semi-circle with a projection on one side to be fastened to the wooden clothes pin as shown in the sketch. A lamp socket from an old flashlight is placed thru a hole made in the top of the shade and soldered. Over this is placed a flat bent spring, secured to the clothes pin with small wood screws, and close enough to the socket as to make a firm contact with the lamp when screwed into the socket.

The flexible cords should be of sufficient length to reach from a convenient pocket, in which the batteries will be carried, to the music lyre on the instrument.

The batteries are connected in multiple or parallel to give longer ampere-hour capacity.

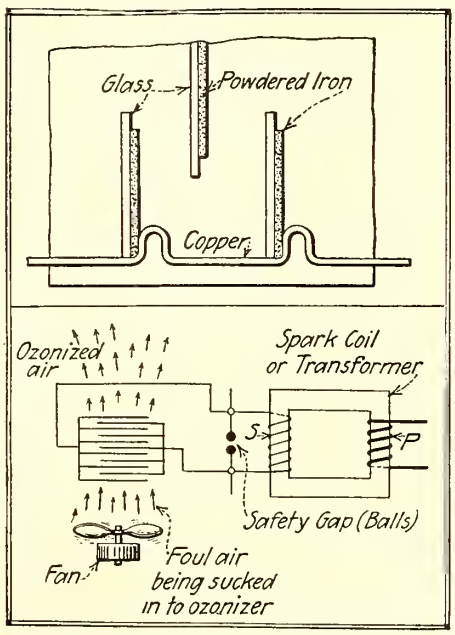
Contributed by A. L. AVERY.

SECOND PRIZE, $2.00

OZONE AND ULTRA-VIOLET RAYS FOR PURIFYING THE AIR.

The many uses for ozonized air makes its production in quantity of growing importance, and apparatus suitable for such work is of increasing interest. A convenient design for apparatus of this nature is shown herewith and consists essentially of glass plates, covered with powdered iron, and fixt alternately to the top and bottom of a suitable receptacle. To make the iron adhere properly it may be mixed with shellac and applied in a thin layer. The glass plates come into contact with copper conductors both at the top and bottom of the receptacle, and a brush discharge of electricity will take place between the two sets when the conductors are connected with the secondary of a spark coil or transformer, giving at least 6,000 to 7,000 volts. Air is forced thru the receptacle by means of a blower, and the air currents will take a zigzag course around the ends of the plates, thus coming into intimate contact with the discharging current.

Contributed by HAROLD C. RIDGELY.



A Home-Made Ozone and Ultra-Violet Ray Generator for Purifying the Air.

THIRD PRIZE, $1.00

AN ODD "SPARK" PHOTO.

The accompanying photograph represents a spark picture which can be easily duplicated with interesting results by any electrical experimenter who possesses a small spark coil, or static machine and Leyden jar. This picture which was contributed by Mr. C. J. Forrest of Blenheim, N. Z., shows a "New Zealand Highlander" in full regalia, and was taken in the following manner:



This Odd "Spark" Photo Was Made by One of Our New Zealand Readers. It Represents a New Zealand "Highlander" and Was Obtained by Passing a Spark From an Electro Thru a Photo Plate, to a Tin-Foil Sheet.

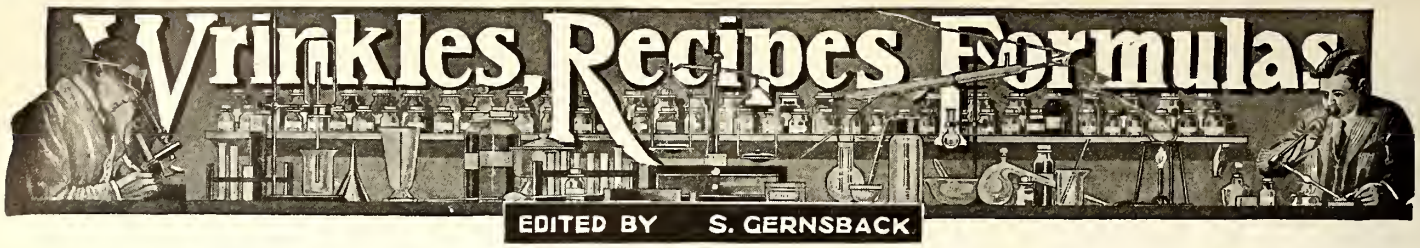
The odd results shown were obtained by placing an old postcard block (printing block) on the film side of a photographic plate, and then placing a piece of metal underneath the plate. The metal block bearing the image was connected to the outside coating of one Leyden jar on a small static machine, while the piece of metal below the photograph plate was connected to the outside coat of the other Leyden jar on the machine. The handle of the static machine was then turned and a spark allowed to jump between the discharging knobs. The photo plate was then developed in the usual manner with the results here shown.

HASTENING ACTION OF NITRIC ACID ON COPPER.

To hasten the action of nitric acid on copper, drop a minute amount of sodium carbonate in the acid. This is especially good when the acid is too weak to readily decompose the copper.

Contributed by BENSON FREEMAN.

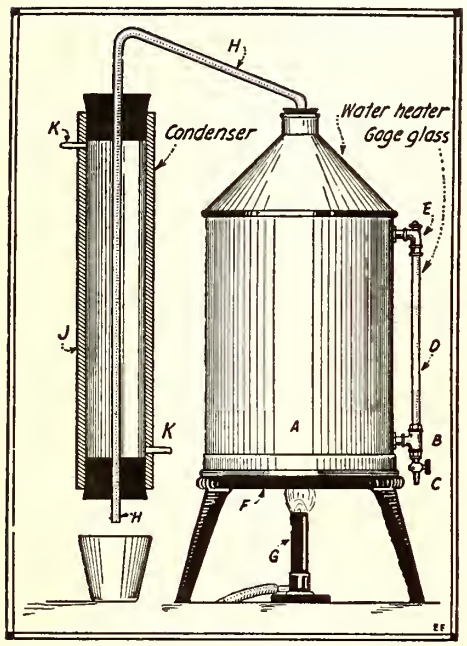
www.americanradiohistory.com



LABORATORY HOT WATER SUPPLY.

By H. J. Gray.

A supply of hot water is a great convenience in the laboratory or workshop, and while a tin kettle and a gas ring will serve very well as a makeshift, it is not a difficult matter to fit up a more serviceable installation. The arrangement illustrated was constructed by the writer for



Distilled Hot Water Any Time You Want It. It's Easy With This Laboratory Hot Water Heater, Which Anyone Can Make With a Little Ingenuity.

use in a small private laboratory. The water is heated in a large oil can, A, which should be the largest obtainable. Near the bottom a brass T gas-pipe fitting, B, is soldered into a hole made to receive it. A small brass tap, C, is screwed into the lower arm of the T, while the other supports a length of glass tube, D, the other end of which is fitted into a brass elbow joint, E, near the top of the can. The glass tube forms a gage to indicate the depth of water within the can. It can be fixt like the water gage in a model boiler. In fact, instead of using gas fittings the necessary parts may be obtained from a dealer in model engineers' sundries if preferred. The gas fittings with a glass tube fixt by means of leather packing, with a piece of thick indiarubber tube to cover the joint outside, make a good substitute for a time. The can is supported on a strong iron stand with a piece of asbestos millboard, F, beneath it to protect the bottom from the flare of a Bunsen burner, G, used as a source of heat.

In order to utilize the escaping steam a condenser was fitted to the side, as shown. This consists of a bent glass tube, H, passing thru a hole made in a sound cork closing the mouth of the oil can, so as to just reach inside. The lower part of this tube is cooled by water circulating thru a wider tube, J, which has a waxed cork at both ends and two side tubes, K K. Cold water enters thru the lower side tube and escapes from the upper one, indiarubber tubes being used to make the necessary connection with a full pail placed above the condenser and an empty one on the floor. The boiler may be filled by siphon action so as not to disturb the condenser fittings by removing the cork. Simply connect an indiarubber tube to the tap, drop the other end in a pail of water standing at a higher level, and suck a little air out from the end of the condenser tube to start the siphon. The water which falls from the end of the condenser tube is preserved as distilled water—always a useful thing to have in a laboratory. Of course the longer the water is allowed to boil the greater the quantity of distilled water formed.

WAX THE CORKS—IT PAYS.

Corks can be made quite air- and water-tight by dipping for a second or two in melted paraffin wax heated in a tin over a spirit lamp. The wax should not be made too hot or it swells the corks unpleasantly and also becomes deteriorated.

When chemicals are put away for a considerable time, and in cases in which they are liable to deteriorate by contact with the air a seal of paraffin wax will form a simple and efficient safeguard. Keep the wax in a shallow tin—the lid of a blacking tin will do very nicely when cleaned—and melt by gently heating over a spirit lamp. Cut the cork flush with the top of the bottle and dip momentarily into the molten wax. The writer has stored even very deliquescent substances for many months in this way without a trace of moisture appearing.

PEROXID FOR ACETYLENE LAMPS

A little peroxid of hydrogen—the stuff ladies use for making the hair golden—works wonders in an acetylene lamp. About a teaspoonful added to the water in the generator causes a marked increase in the brilliance of the light, and is in no way detrimental to the metal parts of the apparatus.

SAWING BOLTS AND SCREWS.

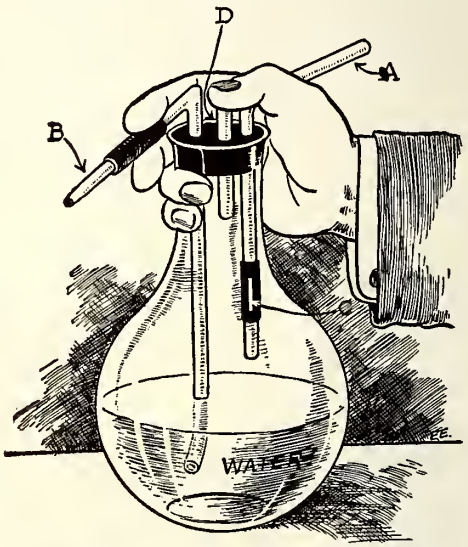
It is sometimes necessary to trim the end of a bolt, or to remove a portion in order to shorten it. In such cases it is a good plan to keep a nut some distance up the bolt, finally running it off to remove any burr left by the saw. Otherwise there is usually some difficulty in starting a new nut, and the threads may sustain permanent injury as a result of the attempt to force a nut over the end.

SHOT FOR CLEANING BOTTLES.

A method of removing obstinate stains from bottles that is often recommended is to pour in some water and small shot and shake until the bottle is clean. This, it is true, removes the dirt, but it generally leaves behind some streaks and particles of lead adhering to the glass which can be distinctly seen in a good light. For chemical and photographic purposes the lead is as bad or worse than the dirt, and must be completely removed before the bottle is used for storing solutions. A little nitric acid should be kept for this purpose, diluted with an equal bulk of water. A good rinse with the acid will dissolve all traces of lead, after which the bottle can be washed in the ordinary way. The acid may be used repeatedly.

A HANDY LABORATORY WASH-BOTTLE

The continuous flow wash-bottle shown in the accompanying sketch will be readily appreciated by those who have used the old type wash-bottle requiring constant blowing. It is simple and effective and should be a valuable asset to every laboratory. It is composed of a flask, stopper and three



We Have Seen Many Types of Laboratory Wash Bottles, But This is an Ideal One—Simple to Use and Easily Made.

tubes, B, D and A; B being the outlet, D for releasing the pressure and A for blowing. Slipt over the lower end of tube, A, is a short section of the rubber tubing with a small stopper inserted at the free end. A slit is then cut into the rubber tubing, as shown at C. This has the effect of a check valve, allowing air to pass thru the slit C, in only one direction, that being into the bottle.

In operating, the flask is held in the right hand with the outlet tube between the index and second fingers and the thumb over the tube D. It is then ready for blowing, which is done in the regular way thru the tube A. The air passes thru the valve, thereby setting up a pressure in the bottle which causes the emission of water from the outlet. The flow from the bottle will then continue until the pressure is relieved by the displacement of the water. As it is possible to create approximately 2 pounds pressure in one blow, considerable water is ejected before the pressure is exhausted and the flow stops. Should it be necessary to stop the flow instantly, or before it would do so by itself remove the thumb from the tube D.

Contributed by RUDOLPH C. LANG.

NON-FERROUS MAGNETIC ALLOY.

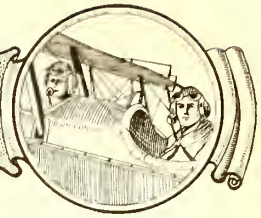
Though manganese itself is only feebly magnetic, while copper and aluminium are destitute of magnetic properties, an alloy of these three metals is found to possess magnetic properties comparable with those of cast iron. The alloy in question contains 60 per cent copper, 26 per cent manganese, and 14 per cent aluminium.

Contributed by H. J. GRAY.

www.americanradiohistory.com



RADIO DEPARTMENT



The Submarine's Under-water Radio

IN a general way it is known that during the war a method was found to communicate with a submerged submarine from shore or sea. How this is done and how it came to be discovered that it could be done not until now has been made public. Like a good many other revelations it came when the researchers were at work on another problem.

The scientists of the radio section of the Bureau of Standards stumbled on the secret and the lucky ones to suspect it were two young assistants not long out of high school. Their experiments and the development of what is known as the "loop aerial" for submarine radio communication by the bureau, resulted in a device so simple and perfect, and producing such wonderful results, that the navy has adopted it and is equipping all its undersea craft with this style of loop.

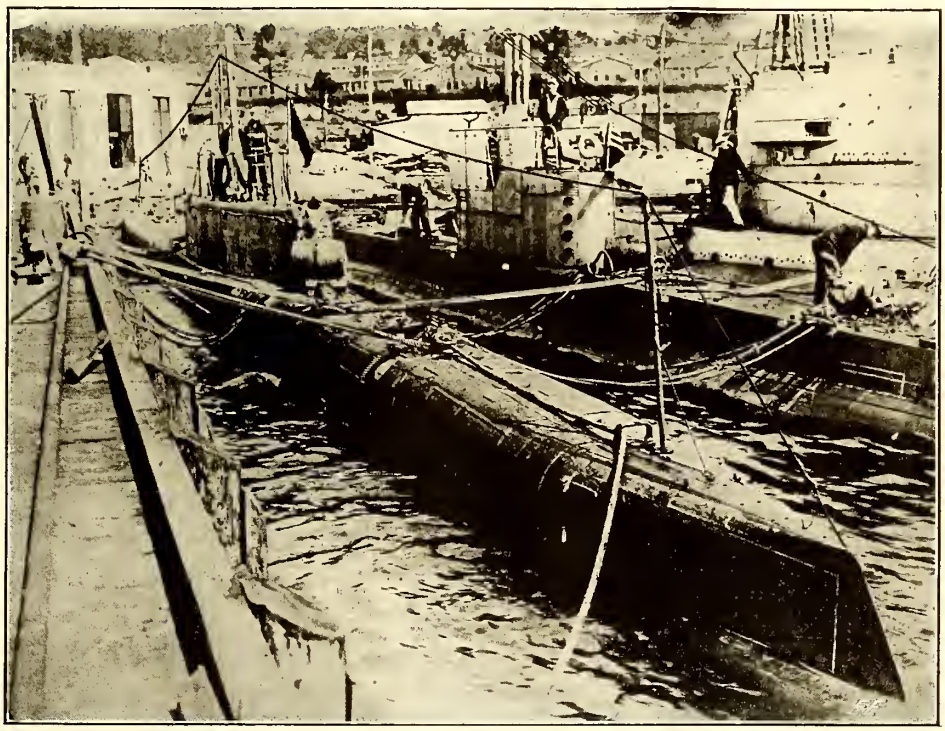
In the fall of 1917 a series of experiments was undertaken by the bureau to develop an apparatus for the detection of enemy submersibles. Mr. J. A. Willoughby and Mr. P. D. Lowell were engaged in the work. They had a notion that a closed "loop" or rubber encased coil of wire offered the best chances for success. They made one and threw it one night into a tank of fresh water on the grounds of the bureau near Chevy Chase, Md., a suburb of Washington. To their delight they received a signal from the big radio station at Arlington. The next night they submerged the coil in the tidal basin of the Potomac near the new Navy Building. Again the signal came with no difference in strength whether the loop or coil was suspended in air or sunk in the river.

DISCOVERY OF THE "LOOP'S" EFFICIENCY.

The significance of this discovery struck both young men. Here was a way possibly to detect the presence of enemy submarines, but surely to talk with our own, which was equally important, had been thought impossible. This was in November.

In December improvements in the submerged coil brought the reception of signals from Lyons, France; Paris and San Diego, Cal. By March last year excellent signals were received on a single turn coil 150 feet long by sixty feet high having a wave length range of 100 meters to 15,000 meters. Experiments continued.

In April Mr. Willoughby discust with Lieutenant Commander H. P. St. Clair, of the Radio Division of the Navy, the use of "loops" on submarines for both transmission and reception under water. Both he and Mr. Lowell were sent to New London to work under Commander McDowell in charge of the base, to install the apparatus for a try out on submarine D-1. It is a simple contrivance, the metal frame of the submarine itself being a part of it, this being used as a "ground" just as the earth is used in land telegraphy. The circuit is thus made complete. As finally perfected the loop consists of two insulated wires grounded at the extreme ends of the hull carried over suitable supports to the conning tower and thence thru "radio-lead-ins" down into the boat to the receiving and sending apparatus.



Equipping U. S. Submarines with New Under-water Radio Antenna. The Antenna Comprises the Single, Heavily Insulated Wire Passing from Bow to Stern, Over the Conning Tower. Messages Have Been Received 6,000 Miles When the Loop Was Submerged 8 Feet.

SUBMARINE USED AS "GROUND."

A new type of loop was tried on the U. S. S. G-3, in which the lead-in wires were brought in from the upper side of the "loop" instead of the lower and the entire loop was insulated from the hull. Better, but not satisfactory, results were obtained. Up to this time the frame of the boat had not been used as a "ground."

The lower side of the "loop" was removed and the ends of the wire fastened to the bow and stern. The top of the "loop" was submerged eight feet; *signals from Nauen, Germany, were clearly heard.* Very sharp indications of direction were obtained when under water or on top of it. And soon other stations were heard, including *Carnarvon, England, Rome, Italy, and various merchant vessels.* Later experiments showed that communications can be carried on at sea under all conditions more efficiently with the closed "loop" aerial than with the ordinary elevated antenna.

To receive short wave lengths the loop must be near the surface of the water, whereas a wave length of 10,000 meters can be received at a depth of twenty-one feet. Still longer lengths can be heard at greater depths.

TRANSMISSION UNDER WATER.

Signals can be transmitted from the loop to a distance of *ten or twelve miles* when the submarine is completely submerged, the maximum distance being obtained when the top of the "loop" is practically at the surface. The distance decreases to two or three miles when the loop is eight or nine feet below the surface. Submergence of the boat during the reception of or transmission of a message does not alter the wave length. If the maximum depth for the wave length being used is exceeded, communication is then interrupted.

The report of the Bureau of Steam Engineering of the Navy Department in its summary of underwater radio experiments says:—

(*Continued on page* 560)

In October "Radio Amateur News"

Arc Undamped Transmission.
By Ensign P. H. Boucheron, U.S.N.R.F.

Cascade Amplification at Radio Frequencies.
By Thomas Benson

Selector Switch for "Rogers" Underground Antenna.
By Stanley J. Brown

A New Radio Dynamic Controlling System.
By Lieut. W. R. Coventry

Long Wave Receiving.
By H. L. Biedenbender

A Short Wave Receiving Transformer.
By Raymond Evans

Improved "B" Battery Construction.
By J. G. Reed

An Undamped Transmitter of the De Forest Type.
By E. Dynner

Developing Audions for the Amateurs.
By E. T. Jones, Associate Editor

An Exceptionally Well Designed ½ K.W. Transmitter.
By W. H. Priess

www.americanradiohistory.com

The Wireless Ukulele

The accompanying pen and ink sketch by our friend, Emerson Easterling, sure does bring back the golden memories of the good old "Amateur Radio" days. Just imagine, friends and fellow citizens, what a wonderful mental exhilaration it is to slip on the "cans" and hear the wireless telephone hum the strains of the Hawaiian ukulele, as played by the natives on the moonlit beach of far-away Wakakai. Oh boy! that sure is the life, and it doesn't require any excessive strain of the mental fibres of your cerebrum and cerebellum to picture the fair Hawaiian maidens dancing the Hula Hula to the tantalizing strains of the Hawaiian Elite orchestra. All this and more does the wireless amateur enjoy at some time in his glorious and educational career, but if Secretary of the Navy Daniels has his way there "ain't agoin' to be no sech animal" as a Radio Amateur from Portland, Maine, to the "Barbary Coast." No siree. In onion—we mean "union," there is strength. So get together, fellow Radio-bugs, and think up all the good arguments and good deeds you can about Amateur Radiodom. Talk about it at your radio club meetings.



The "Radio-Bug" Has it on All of Us—He May Put on the "Cans" and Listen to the Ukuleles Strumming Gaily in Far-off Hawaii, and With a Little Imagination—Well Say, Who Couldn't See the "Hula Hula" Maidens Dancing in All Their Native Charm?

Unique Radiophone Helmet



Photo Underwood & Underwood

The Radio Telephone Apparatus Worn by an Airplane Pilot in the Recent Successful Experiments With This Wonderful Voice-Transmitting Wireless.

Recently Secretary of the Navy Daniels spoke by wireless telephone with a naval seaplane in flight, 150 miles away from Washington, where the apparatus was located which Secretary Daniels used in talking to the plane.

The accompanying photograph shows the interesting radio telephone receiving helmet used by aviators, and which effectively cuts out all extraneous sounds and noises, including that from the airplane engine. These helmets are made of rubber and leather, and the telephone receivers are mounted in the best quality sponge rubber in such a way as to effectually prevent the transmission of sound, even thru the bones of the head.

The wireless telephone conversation held with Ensign Harry Sadenwater, while flying at a distance of 150 miles from Washintgon, when Secretary Daniels asked him *via radio* what kind of a flight he was having, constituted a new record in the field of Airplane Radio-telephony.

The microphone is of a new type and is open back and front, so that the air waves in front are balanced by those in the back. The engine noises are thus nullified and only the voice air waves are effective in vibrating the diafram of the microphone.

A FOOL THERE WAS.

(With apologies to Kipling)

A FOOL there was, who a wireless made,
Even as you and I.
Two coils of wire together he laid,
With the bill at the junk shop still unpaid,
Tho he called his father's purse to his aid,
Even as you and I.

Oh, the years he'd waste and the tears he'd waste,
And the work of his head and hand
Belong to the science he did not know,
And now we know that he never will know,
And never will understand.

A Fool there was and his coin he spent,
Even as you and I.
The money that should have gone for rent
He paid for receivers. for he was bent
To pull from the skies a radio sent
Even as you and I.

Oh! the news he'd get, and the use he'd get
From this instrument he had planned;
But his scheme didn't work, he didn't know why,
And now we know he never knew why,
And never did understand.

He sent a wave as broad as a car
Even as you and I,
Which even Fessenden couldn't bar,
His coil was large and the spark went far,
And mixed with a message for N.A.R.,
Even as you and I.

And it wasn't the kale, and it wasn't the jail
That filled his soul with despair,
But 'twas the losing the set
That he'd famished to get,
For he'd violated the "laws of the air."

By—
Osborne Anderson,
Ernest A. Innes.

HOW RADIO IN THE CLOUDS FOILED THE GERMANS.

Sounds real mystical, doesn't it, radio in the clouds? And it proved just as mystical as it sounds for a long, long time to many hapless German aviators, and other wearers of the ex-Kaiser's iron cross. Airplane radio among the clouds was finally worked out into a regular melodrama by the Yankee wireless experts and fliers in France. It usually required two Allied airplanes at least to play this game, and the villain Hun aviator was invariably brought to justice sooner or later, once the stage had been set.

The setting was arranged in the following manner: An Allied aviator would rise from the ground and fly toward the rear of his own lines, so as to secretly gain a high altitude, and he would then return toward the front, flying so high as to be almost invisible. Presently another Allied flier would join him. Then the trap would be set for the German flier, or fliers. One of the planes would rise above the clouds and hover in a certain locality, out of sight, while the other plane would remain fully exposed, and in some cases even drop to a lower altitude so as to be more visible to the enemy. It would not be long before a German flier would be seen sneaking up in an effort to surprise the Yank. But here is where modern science, in the rôle of wireless telephony, which was so wonderfully developed by the American Signal Corps during the war, is to step in. The aviator watching for the German signals his approach and his position to his fellow aviator hiding above or in the clouds, by a wireless telephone message. At the critical moment the final information is given by radiophone to the hidden flier, and he pounces out of the clouds on the German, who often leads him a merry chase, but our second flier who had been on the watch joined in, so that it was a case of two to one. Sometimes there were several German planes, and then it often happened that two or three Allied fliers had to battle with an equal, or even double and triple number.

See Col. 2 5-6 - 14 ↓ for next page.

www.americanradiohistory.com

Radio Problems in Aviation

By EDWARD RICE DOYLE

Former Radio Officer, Air Service, U.S.A.

THE day is not far distant when all airplanes used in long distance flights will be required to carry standard *wireless equipment*, permitting of communication over distances equal, if not greater, than the ranges of sets required on passenger steamship liners. The reason is obvious. An airplane in distress is far more helpless than a ship and in case of forced landing, relief is almost always an immediate necessity.

Even in cross-country flying a good radio outfit is a necessity in holding a true course and in signaling ahead for special parts or supplies to save time at intermediate landing points *en route*.

The requirements for a reliable radio apparatus on airplanes bring up certain problems which are still unsolved and subject to considerable experiment at this date, when American ingenuity has been able to advertise its achievements in airplane radio. These intensive problems will attract the highest radio engineering skill in their solution.

The problems may be considered as:

1. Directional control of transmitted signals.

2. Wave length adjustment of incoming and outgoing signals.

3. Transmitting ranges and sensitivity of receiving apparatus.

Under the first item, that of directional control, the engineer faces a very difficult task. The design of the aërial has always been the critical factor in directional control, and it is greatly limited by the facilities which an airplane offers for setting up the antenna.

The most effective control has been secured by the single trailing wire antenna. (See Fig. 1.)

A length of about 300 feet of wire is allowed to swing in the air held down partly by a weighted "fish." Thus the metallic parts of the airplane form the counterpoise and as the trailing wire swings backward in a characteristic curve the major electrostatic field is projected downward ahead of the airplane at about 45 degrees.

This gives a directional effect directly ahead of the airplane. Signals behind the plane or to the side of the lateral axis are greatly weakened. Even when the plane banks on a turn, the signals ahead die down rapidly. Hence to transmit in any given direction the plane must be pointed in the direction of the receiving station and to find that direction by compass is not as easy as it seems.

Furthermore, an airplane might have to reverse its direction every time it desired to communicate with a given station, and on long flights this lack of control would be extremely inefficient, in view of the fuel thus lost and the time consumed.

In land radio for long distance transmission the towers supporting the aërial are built for a given directional effect. Where non-directional effect is desired an umbrella type of antenna is used. However, since the airplane must get the maximum efficiency in range from the least amount of aërial weight, an umbrella type antenna, even if practicable, would not be suited to the airplane.

When it is attempted to arrange a fixt antenna (as opposed to the trailing type, which is free to sway) on an airplane the limiting conditions of aërial capacity and structural areas impose very harsh conditions on the designer. Consider the capacity of a wire equal to the wing span of an airplane, seldom more than 30 feet, and with no means of suspending the aërial over a foot above the wing surface, and with comparatively little metal in the wing itself to give the desired field its maximum capacity. Wing spread is the longest overall dimension of the airplane in any case.

Fixt wire antennæ on airplanes have never attained results commensurate to their cost in installation and in reduced flying efficiency; for every wire that is thus exposed to the air means increased *head resistance* and a few wires can multiply head resistance to a very serious extent.

One design of fixt wire antenna which was used in the army combined the fixt type with the trailing type. (See Fig. 2.)

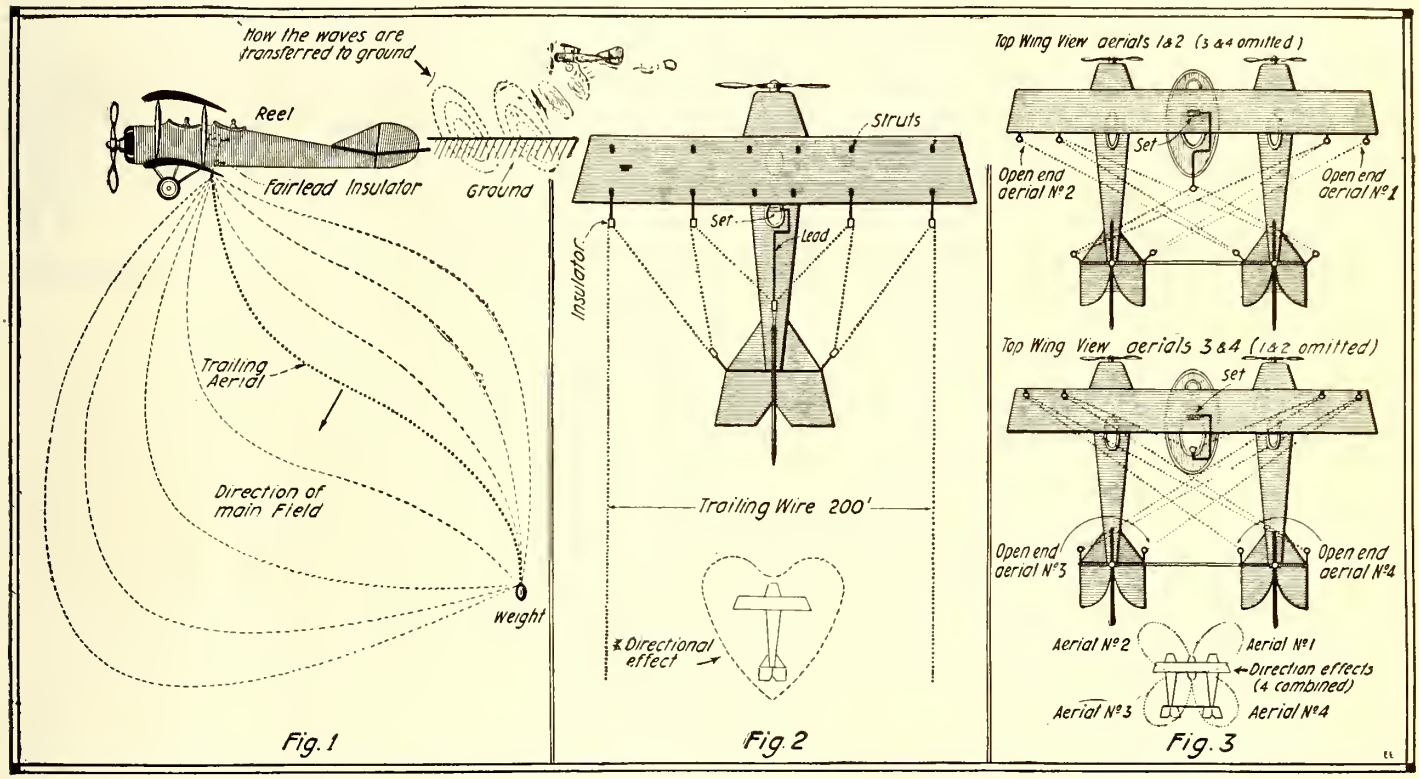


Fig. 1—This Illustrates the Simple Trailing Type of Airplane Radio Antenna, Used to a Great Extent During the War. It Can Be Reeled Up Quickly But Possesses Several Disadvantages. Fig. 2—A "W" Type, Combined Fixt and Trailing Radio Antenna, Successfully Used for Inter-plane Communication. Top View. Fig. 3—Radio Antenna Rig-up Proposed By the Author, for Double Fuselage Biplane. The Quadruple Antenna and Its Directional Effects Are Clearly Illustrated.

Here the ends of the wire were not weighted and as they were constantly liable to become tangled in the controls such fine wire had to be used that their effective capacity, low enough with any practicable airplane antenna, was further reduced. Furthermore, the trailing wires were awkward in landing and in taking off, since they could not be reeled and the fixt wire system was an added menace, due to the fire hazard which they involved.

This "rig-up," however, was effective for *interplane communication* over short distances, not exceeding a mile, using a 200 watt fan-driven generator. Communication to the ground was easily establisht, but receiving from the ground was difficult. The directional effect was low ahead and strong to the rear of the airplane.

The results obtained in army aviation radio were generally satisfactory for their purpose, but in the broad field of commercial aviation, the *directional control* must be far more highly developed before the radio apparatus can be relied upon.

The same structural conditions which impose so many difficulties on directional control also affect selectivity of wave lengths. As is well known, a long wave length is more efficient for long distance transmission. To get long wave lengths a great deal of inductance and capacity are needed. The land radio operator little considers the

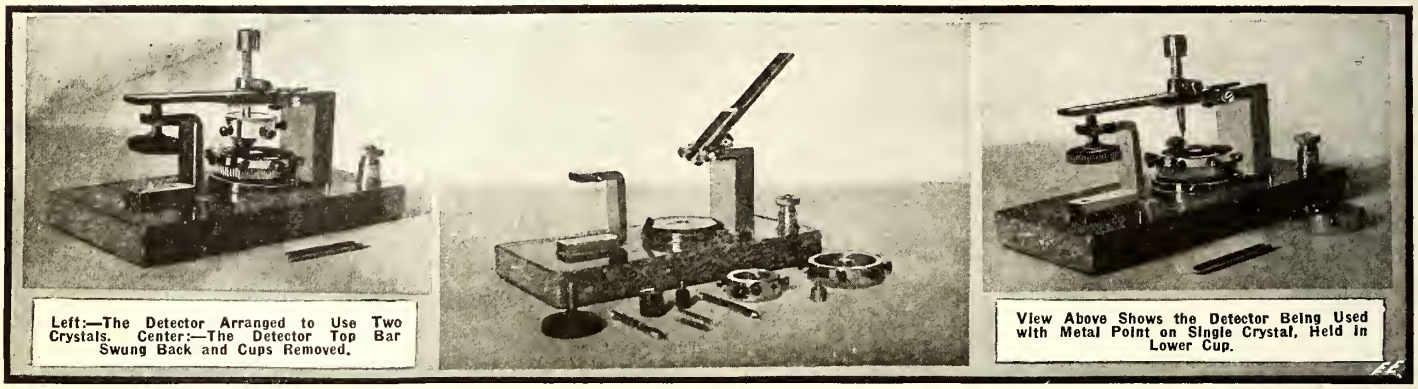
(*Continued on page* 588)

www.americanradiohistory.com

An Efficient Radio Crystal Detector

By ROBERT F. GOWEN, Radio Engineer

THE Multi-crystal Detector Mounting here illustrated is the result of an extended study by the author of many different forms of crystal detectors both commercial and home-made. It was built to provide a detector having the following characteristics: (1) Maximum sensitiveness; (2) Maximum robustness or power to hold its adjustment; (3) Maximum flexibility in its use.



Left:—The Detector Arranged to Use Two Crystals. Center:—The Detector Top Bar Swung Back and Cups Removed.

View Above Shows the Detector Being Used with Metal Point on Single Crystal, Held in Lower Cup.

Fig. 1 (at left) shows the mounting used to hold a pair of crystals or a crystal couple such as Zincite-Chalcopyrite or Zincite-Bornite. The electrodes are made eccentric to each other so that any point in the lower cup may be made to intersect with any point in the upper cup. The crystals are mounted in small brass thimbles by means of Wood's metal, Hugonium, or a similar soft solder and are held fast in the cups by means of the set screws.

By removing the upper cup a phosphor-bronze point is exposed which is used in connection with *Silicon*. When using *Carborundum*, the pin cup is unscrewed and the pin reversed to obtain a contact having a comparatively large area. When *Galena* is used, a pin shown in front of the instrument and having a very fine contact wire, takes the place of the pin shown in use. The lower cup is made large enough to hold several crystals at once so that in the case of one burning out, another may be immediately substituted by simply rotating the cup on its pedestal.

Rotating the cups also provides an easy method of determining the most sensitive crystal surfaces. It is only necessary to connect the detector in circuit with a test-buzzer and rotate the cups and thimbles until the head receivers show that the most sensitive crystal faces are in contact.

A good method of comparing the sensitiveness of different crystals is also a feature. This is accomplisht by inserting the several types of crystals in the large cup and bringing one after the other in contact with the pin while an observation for each is made with some type of receiver shunt. In this manner, the crystals may be separated into groups of varying sensitiveness for future use.

In order to change the cups it is simply necessary to throw the lever back against the spring as shown in Fig. 2 (at center). This cut shows the detector unassembled.

The large hole shown in the pedestal provides a bearing for the small shoulder shown in front of the large cup, into which it is screwed when in use; or if preferred, the large cup may be screwed on to the pin in the lever arm.

The small hole shown directly in front of the larger one is threaded to take an 8-32 machine screw which may be used to hold in place a small acid container for an electrolytic detector. In this case a third pin is used, to the end of which is soldered the fine Wollaston wire.

The adjustment screw on the front of the detector is provided with a very fine thread, thus assuring a very sensitive adjustment. The spiral spring shown in the unassembled view is slipt over the contact pin to allow of an easy adjustment while pushing the pin down in place, after which the pin is clamped in place by means of the set screw with its hard-rubber handle

The lever arm holding the pin moves in adjustable conical bearings in the fork mounted on the back piece and is held under tension by means of a flat, steel spring, the end of which may be seen directly over the bearings.

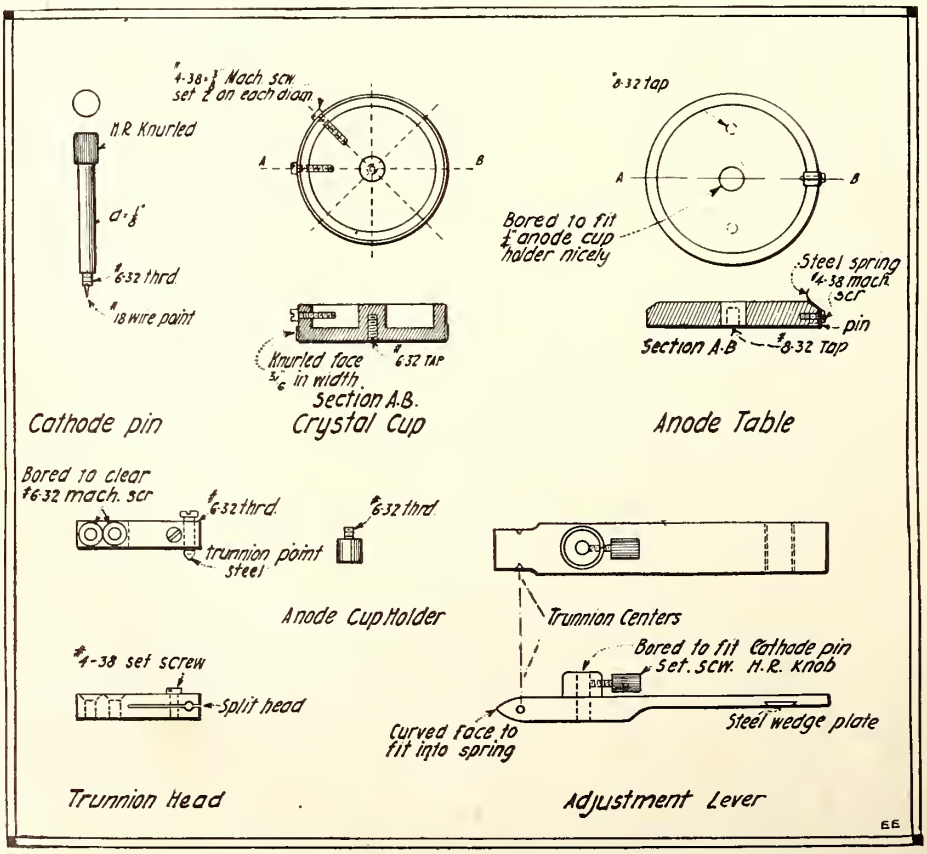
Experience has shown that for the experimenter the detector fulfills a long felt want in that the parts are entirely interchangeable and accessible. It may be used as a detector of any of the well known crystal types or as an electrolytic detector of the "whisker-point" type. By replacing the contact point with a small glass tube containing a fine platinum wire, a "Dip-point" electrolytic detector is provided.

To change from one detector to another it is simply necessary to throw back the lever arm and take out the cups. This action requires a very small time period to perform.

In order to adjust the detector the large cup is turned so that the crystal to be used is underneath the pin or upper crystal holder, whereupon the pin is pushed down against the spiral spring until contact is made, after which it is clamped in place by means of the set screw. The lower cup is then turned slightly until a good point of contact is obtained, whereupon the detector is brought into final adjustment by means of the sensitive adjusting screw at its front.

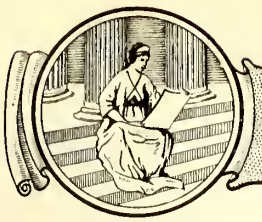
The author has found this type of detector to retain its adjustment for several weeks at a time and believes this is due to the use of a rigid marble base and the stiff, non-vibrating spring. For the base a special marble is used having a very high insulation value.

(*Cont. on page* 584)

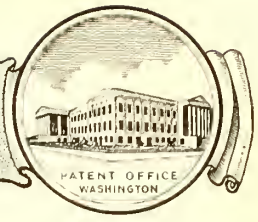


Detail Drawings of Parts Used in Making Universal, Single or Multiple Crystal Detector.

www.americanradiohistory.com



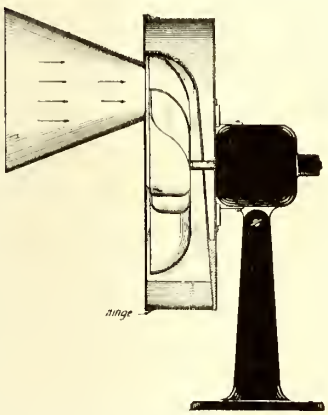
LATEST PATENTS



Electric Fly-Catcher.

(No. 1,311,281, issued to Maik Kurka.)

Of all the thousands of inven-

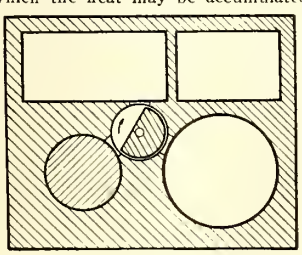


tions made monthly and yearly in this country, perhaps there is nothing at this time of the year which interests us more than a fly-catcher—and especially an electric fly-catcher, for by its very cognomen it must be good. This electric fan device for catching flies provides a specially designed blade which acts when rotating at a high speed to produce a suction thru the horn or tunnel, and the flies are whirled around inside the fan casing into the blind vault, where they conveniently die a most horrible death.

Electric Heat Storer.

(No. 1,311,464 issued to Oskar Sælid.)

An electric heat storing device, in which the heat may be accumulated

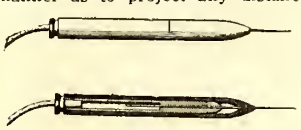


from an electric heating member or grid in a storing body placed in a chamber formed in a secure body of sealed "heat insulating" material. This is designed particularly to apply to electric heat-storing kitchen ranges. The heat generated electrically may be transferred thru special channels and a multiple heat valve to various heat-storing chambers. The heat may be conducted by metal members or by air-filled channels, as provided by the movement of the valve.

Electro-Surgical Needle.

(No. 1,311,494, issued to Ervin M. Camp.)

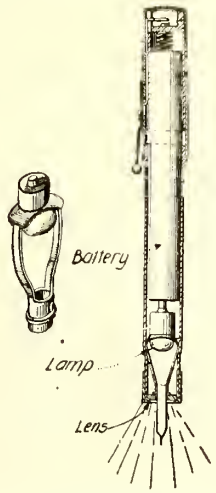
This electro-surgical needle is intended to provide a device of this kind, in which the electrically operated needle is provided with a grip chuck arranged to hold it positively in any desired position or adjustment. Further, the surgical needle is longitudinally adjustable in the gripping chuck, in such a manner as to project any distance.



Illuminated Pen or Pencil.

(No. 1,310,476, issued to Louis F. Hart.)

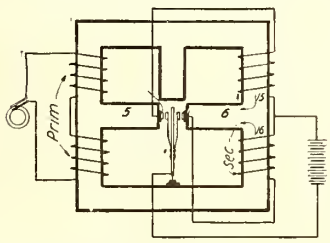
A novel writing instrument is here illustrated which may he in the form of a fountain pen or pencil. It is very cleverly designed, and incorporates a small incandescent electric lamp similar to a flash-light bulb, together with a small reflector lens and a tubular dry battery. There is also a clever cap switch for opening or closing the lamp circuit. The lamp bulb proper is mounted a short distance above the writing point in a special form of tripod as shown in the illustration; the light from the bulb flashing downward thru the lens having a hole thru its center to accommodate the pen or pencil point.



Vibrating Rectifier.

(No. 1,311,490, issued to Quincy A. Brackett.)

In the ordinary A.C. to D.C. vibrating rectifier, several of which have been on the market for an appreciable period of time, it is usual to provide two co-acting magnetic fluxes; one of these is uni-directional and the other alternating, the uni-directional flux being invariably supplied by a permanent magnet or from coils excited by auxiliary direct current. In the present design the inventor very cleverly arranges a special circuit for the rectifier, whereby he obtains both of these magnetic fluxes in a simple and yet effective manner, without the use of any windings except those of the ordinary transformer commonly employed with rectifiers, and

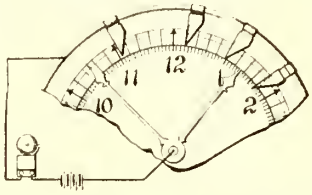


further without the use of a separate direct current exciting source. The alternate pulses of current in the two halves of the secondary winding will set up waves of magnetic flux, as indicated by the arrows 15 and 16, and these waves will consolidate to form a uni-directional magnetic flux thru the pole pieces 5 and 6, as becomes apparent. The vibrating reed will thus oscillate at synchronous speed and co-act with the uni-directional poles 5 and 6.

Electric Clock Alarm

(No. 1,311,424, issued to Benjamin H. M. Spargo.)

This electric clock alarm is devised with a number of adjustable contact

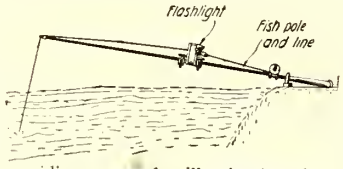


members, which may be arranged around the dial at any hour or fraction of an hour desired. One side of a bell and battery circuit is connected to the hands, while the other side connects to a metal member on which the contacts may be snapt into place. It is at once seen that the alarm may be arranged to ring as many times in the course of a day, as desired. This is often required in schools, offices, factories, etc.

Electric Fishing Signal.

(No. 1,309,365, issued to John E. Monighan.)

This invention comprises something which is of interest particularly to sportsmen and Nature-lovers during the warm months of the year. It comprises nothing else than the fisherman's rod, which supports a flashlight electric alarm for night fishing, so that the instant the fish bites on the hook and starts to unreel the line, the movement of the line thru a special trigger switch device on the flashlight holder, closes the circuit and the lamp flashes. Full details of the device are given in the patent and the action of the switch is simple and ingenious, permitting a line to be run out or wound up on the reel, without being interfered with in any way by the device, and yet

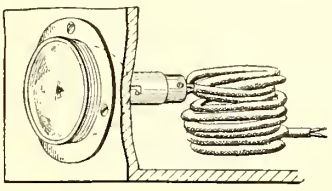


providing means for illuminating the flashlight whenever a fish bites.

Tonneau and Trouble Lamp.

(No. 1,311,295, issued to Jason C. Stearns.)

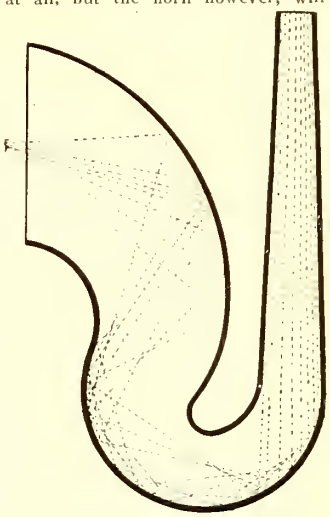
A useful and practical development in auto accessories, comprising an electric tonneau and trouble lamp, so constructed as to be capable of use in an efficient and convenient manner. The design of this lamp is carried out in such a manner that the lamp proper and its holder can be readily removed or replaced in its stationary receptacle on the auto dash or on the wall of a tonneau, etc. In order to do this, the inventor has provided a clever bayonet joint, by which the lamp is held rigidly in position when desired, or also easily and quickly removed, and when used as a portable trouble light, current is supplied to lamp thru a flexible duplex wire, which is normally coiled up in back of the lamp as the drawing shows.



Amplifying Horn.

(No. 1,311,478, issued to Russell A. Willson.)

A specially designed amplifying horn for use on phonographs and other similar instruments. The inventor claims that to give a clear-cut sound reproduction of a record, the horn must be so designed that each tone will be conveyed thru the horn so as to reach a certain focal point, after having travelled over approximately the "same distance" thru the horn, as have been travelled by other accompanying tones. In other words, the inventor states that the length of the sound waves or vibrations in the horn is the same. We do not agree with his theory at all, but the horn however, will

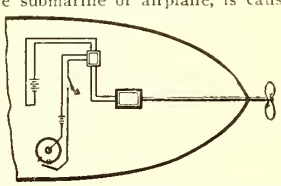


work in the usual manner in spite of it, if so we may express our idea of the matter. The inventor also mentions that the horn is designed rectangular in cross-section with diverging walls, while the outlet end of the amplifying portion is provided with parallel walls. Sound waves when conveyed thru a horn like this have a tendency to swirl or travel in a spiral direction giving inferior tone reproduction; the rectangular construction overcomes this by providing dead air spaces along the corners of the horn.

Submarine Signaling.

(No. 1,311,157, issued to Reginald A. Fessenden.)

This invention by Prof. Fessenden, relates to signaling by sound in a fluid media, such as water or air. It is also applicable to airplane signaling, and should prove particularly efficacious in sending out signals at night. The secret of this invention lies in the fact that either by means of automatic or key-operated electric switches, the electric circuit for driving the propeller on the submarine or airplane, is caused



to fluctuate a slight amount in its rotation. This need not be sufficient to cause the propeller to stop, but simply to cause a slight change in the humming note projected from the spinning propeller. The inventor states that he has tested this idea out under practical working conditions, and that slight variations in the notes are readily detected.

www.americanradiohistory.com

WITH the AMATEURS

Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light-toned ones. We pay $5.00 each month for the best photo or photos and $2.00 to each "Honorable Mention." Address the Editor, "With the Amateurs" Dept.

"Amateur Electrical Laboratory" Contest

THIS MONTH'S $5.00 PRIZE WINNER— EDWARD H. COX

I PRESENT herewith four flashlight photos of my "Experimental Laboratory." In the first photo may be seen my electrical test-board, all controlled from the small switch-board observed in the upper left-hand corner of photo. This switch-board is so wired that I can obtain 1½ volts; 24 volts A. C. or 120 volts A. C. thru a rheostat of my own design. Also 1½; 24 or 120 volts D. C. thru a rheostat, all from the plug shown on bottom of the fiber switch-board panel. There is also shown my submarine chaser model which is undergoing repairs at present. In front of this is a small brass steam engine constructed entirely without any lathe work. On the right-hand side of photo may be seen my electric furnace and high frequency set. In the upper centre is shown a safe operated entirely by electricity.

One photo shows my "Chemical Laboratory," while a third photo shows my wireless set and "Yours Truly." I have a wood-turning lathe and jig-saw which are not shown.—Edward H. Cox, 9 Pierce Avenue, Hamburg, N. Y.

HONORABLE MENTION— ARMAND DE PICHON $2.00 PRIZE PAID EACH "HONORABLE MENTION"

AFTER seeing numerous photos of Amateur "Labs" publisht, I at last decided to send some photos of my own. In my chemical "Lab." I have Florence and Erlemeyer flasks, a retort, pestle and mortar, test tubes, microscope and other apparata. My radio receiving set consists of a loose coupler, two detectors, two sets of receivers, a 43-plate variable condenser, switch, fixt condenser and a test buzzer. I also have quite a number of transmitting instruments, including a helix, transformer, key, spark coil, spark gap, D.P.D.T. switch for sending and receiving, and a fuse block switch. Some of my apparata is home-made, and I intend to put up my sending set sometime in the future, or as soon as the ban on transmitting sets is lifted by Uncle Sam.

I am now fixing up a switch-board in my electrical "Lab.", and I will send you some more photos of it when completed.

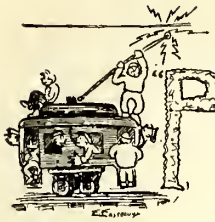
I find much useful and interesting information in your magazine, which I read constantly. Armand de Pichon, 1100 Morton Street, Alameda, Calif.



www.americanradiohistory.com

Science in Slang

By EMERSON EASTERLING



"POWER'S off," remarked a passenger as our trolley car came to a dead stop in absolute darkness.

"While we are so conditioned," I remarked, "would you mind spilling us a little anointment in the line of electro-propelled vehicles and the like, and so forth?"

"Yes," he replied. "I was just dying to slip you the oil, anyhow."

"Yes," spoke up a stranger from Missouri, "let us all in on it. I have a brother that knows a street car conductor in Vancouver, Washington. He works for the North Coast Power Company on the car that walks out to the Standifer Steel Ship Yards."

"Well," commenced Jazz, lighting up a cigar—and also the entire car. Over in one corner a man and a woman—but that is another story. "It all started way back in 1835——"

"Say, partner," reproved the rather aged man with the ditto woman in the corner, "you don't need to insinuate."

"As I was saying," continued Stokes, "a bird by the name of Tom Davenport invented——"

"A couch!" broke in a furniture dealer absent-mindedly.

"A Yankee by the name of Davenport invented an apparatus, contraption, or contrivance that was able to live up to the name of primeval surface jolter.

"About the same time a Scotch Highlander (or Lowlander), Bobbie Davidson —no relation to Harley as far as known— tried out a trolley in the 'auld' country.

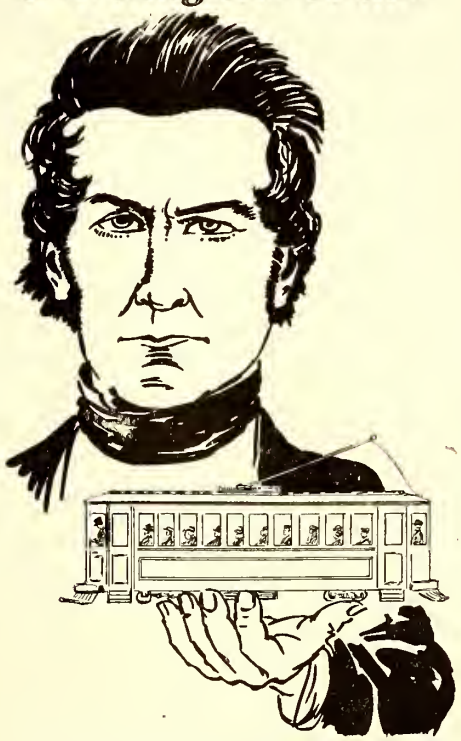
"In Washington, D. C., Prof. C. I. Page gave the public the sensation of seeing a real (almost) street car. That was way back in 1850.

"Moses G. Farmer stuck onto the public the first electro-bus with reduction gears from the motor—in spite of his name.

"But it was in Berlin that a couple of guys combined efforts and gave the grasping—or should I say yawning or reaching —world the pleasure of witnessing the first practical working model of life size—of the 'juice jerked' juggernaut. These ducks were Siemens and Halske. The same Siemens that is guilty for the early dynamos and motors that bear his John Hancock. No, not the one that met the pieman!

"From 1880 to 1883 Steve Fields and Tom Edison had a spat over patent rights, but finally they came to a settlement by forming a League of Notions; that is, they consolidated in the traffic jamming project. At the 'Chi' Railway Exhibition they showed off their first performance of their product and in a few years the people over the country were cautiously entering the moving houses and gripping to their seats and praying while the motorman did his best to 'keep things going' up in front.

Trucking the Traffic



A Yank by the Name of Tommie Davenport Invented an Apparatus, Contraption, or Contrivance, that was Able to Live Up to the Name of Primeval Surface Jolter.

"Kansas City was the first 'burg' to install an electric railway of any note. That was in '84. I don't know why that 'burg' should be first in the line any more than I know why it is one of the toughest towns in the States.

"The first line had the juice entering one rail and leaving the other. Then along come another model having the juice from double overhead trolleys, as in Kansas City. Another bird figgers out the third rail, and another the stunt of using the trolley and track, while still others carried the batteries aboard the municipal boxcar. Edison had a pretty fair example of the battery car.

"The original—and a lot of the subsequent—cars were put out with about the same horsepower as the present-day motorcycles. Think of it! They grew up to twenty horsepower, and then they *doubled* the power by furnishing both trucks with motors. The larger electrical interurban railways have ten times—and in some cases more than that—the power of the street cars."

"How do these strings of cars that snake thru the ways work?" asked a voice next to me. "They have only one engineer on the front car."

"They employ what we call the multiple unit system of control. The cars are connected together by connections at the ends of each car. The motorman at the head car in controlling his own car operates the other ones automatically. The—but if I would explain the workings of a single unit you would probably get me better.

"On the simple or single unit the juice is handled by resistance and varied connections at the control panel that the motorman operates. On starting the resistance and all the separate (the field coils are arranged so as to be connected series or multiple, or both—that is, some series and others multiple) field coils are in series with each other, the resistance and the armature. To increase the speed the resistance is first thrown out, then the field is changed from series to series and multiple and then to multiple; then the armature is connected multiple, making the motor shunt wound instead of series. If you should look out the window at this point you find yourself jazzing right along under ideal conditions.

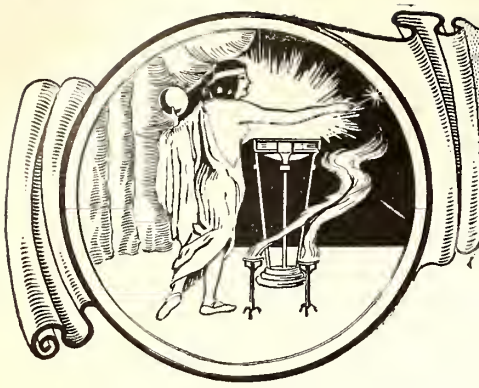
"To get back home without turning the car around the motorman straddles thru the car to the other end and jams his crank down on the controller and when the conductor gets one trolley arm down and the other up—or the same one yanked around —the connections are now so arranged that the armature is in a different relation with the field; that is, the different judicial flow renders the magnetic jerk on the armature around to another field pole instead of the one that it did before—the result: 'reversed motion.' Also there is a separate control in each end that makes it possible for the street car to be backed up without going thru the above actions. This makes it nice in the 'traffic jams,' as it avoids the necessity of the passengers getting out and pushing said car back to let the auto truck, go-cart, bicycle, ice wagon, widow with pack-

(*Continued on page* 558)



Herr Werner von Siemens of Berlin Gave the World the Pleasure of Witnessing the First Practical Working Model of a Life-Size "Juice Jerked" Juggernaut. Von Siemens, as Will Be Seen, Is at the Helm. The Dope, Elektrische-Eisenbahn, Means Electrical Railway. And Pipe the 1880 Style of Clothes and Lids.

www.americanradiohistory.com



THE ORACLE

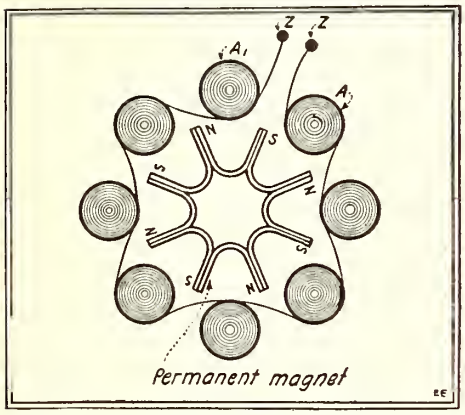
The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be publisht. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered. Your correct name and address must be signed.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addrest to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

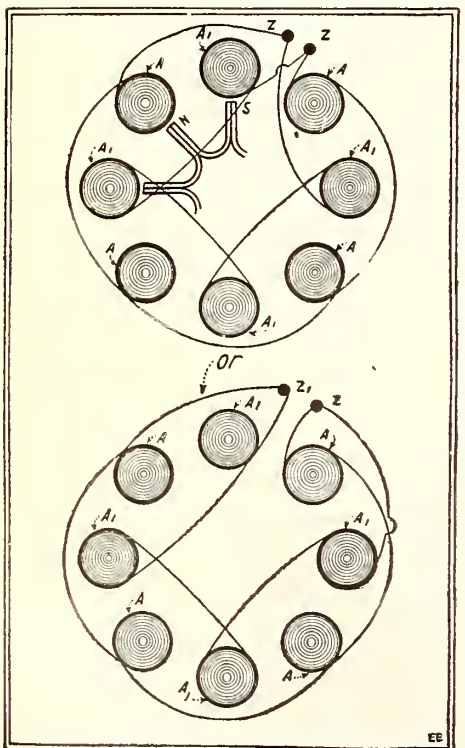
CHANGING THE FORD MAGNETO FROM A. C. TO D. C.

(1023) Rev. V. F. M., North Dakota, asks the "Oracle" several questions relative to converting the Ford auto magneto from A. C. to D. C.

A. 1. We have examined your diagram



Original Connections of Ford Magneto and Arrangement of Rotating Steel Magnets to Produce "Alternating" Current.



Two Proposed Re-connection Schemes for Ford Magnetos, in Order to Derive "Direct" Current. The Reason it Will Not Work as Anticipated Is Explained in the Accompanying Text.

and proposal for converting a Ford A. C. fly-wheel type magneto to a D. C. generator. We have looked over your diagrams carefully, but do not see that you will gain any such result by simply changing the connections and the coils, for the following reason. If you will take, for example, one of your diagrams where you have changed the windings so as to have two series of four poles each, and select a given pole, let us say, A, and note that the revolving steel magnets having alternate north and south poles, of course you will see that this coil will, for example, first be acted upon by a moving *north* pole—and then successively by a moving *south* pole, then by a *north* pole, etc., etc. This will mean, of course, that an *alternating current* will be set up in that particular coil, and in all the other coils so situated and acted upon in that circuit.

Your suggestion prompts the following discussion: Your idea would seem to be the same as trying to get direct current from a revolving field type of alternating current generator, without using a commutator. And here the same reasoning as just set forth comes into force, i. e., you must not forget that in any such case as this the *north* and *south* field magnet poles act alternately on each winding coil, pole or unit, many times per minute. Therefore you will get, as we always do get from a revolving field type of alternator, an *alternating current.* The simplest solution of the whole problem would appear to be to either rig up a commutator on the machine or else to use a D. C. dynamo, and this can be purchased for about $10.00. The Ford magneto, which is an A. C. type of course, owing to its fundamental design, is very rugged, simple and efficient, all things considered, as it only operates the lamps, and in some cases an electric siren, the A. C. current does the work in a thoroly efficient manner. Where a self-starter is fitted to a Ford, which is very exceptional in the Editor's observations, a storage battery is used for operating the starting motor, and this *same* motor is utilized as a charging dynamo by a simple relay arrangement, which changes the circuits for either requirements. The Ford A. C. magneto operates all right as a generator, but it would certainly work very poorly as a motor under any consideration.

TRAIN-DISPATCHING SELECTOR.

(1024) H. H. Gowan, Peterboro, Ont., Canada, writes:—

Q. 1. What book or manual is there available on the subject of train-dispatching selectors?

A. 1. Regarding the details of the "Selector" used on the Western Electric Railroad telephone dispatching system, would say that, so far as the Editor knows, there is no special book on the subject, but the best thing to do, as he has found, is to obtain copies of some of their patents which explain the matter fully. One of these patents which proves very interesting is U. S. Patent No. 1,244,544, which we can supply for 10c.

SPINTHARISCOPE.

(1025) Paul S. Howard, Okmulgee, Okla., asks:—

Q. 1. About construction of a home-made spinthariscope?

A. 1. The microscope by itself cannot be used as a radium spinthariscope. It is necessary to have radium or some radio-active material at one end of your magnifying tube in order to have a spinthariscope. The radio-active substance must be mixed with zinc sulfid or arranged just above a disc covered with the zinc sulfid. The alpha particles shooting off from the radium and colliding with the zinc sulfid is what gives the effect of the "shooting stars." This radio-active material may be secured from radium supply companies.

WANTED!!!

"ODD PHOTOS" AT $1.00 EACH.

Here's what we want! What have you got?

ELECTRICAL PHOTOS—
New photos of Lightning; new and unusual Electrical Apparatus and Machinery; Electric Signs; Electric Autos; Electric Clocks.

SCIENTIFIC PHOTOS—
New Scientific Apparatus; Results; Effects; Motion Pictures; Stunts.

OPTICAL PHOTOS—
Peculiar stunts obtained with various lens arrangements; odd film effects caused by unusual conditions; novel micro-photographic subjects.

ASTRONOMICAL PHOTOS—
New eclipse photos; star and moon effects caught by the camera; comets; shooting stars; progressive moon studies; moon and star photos.

FREAK PHOTOS—
Odd double and triple exposure effects; novel and striking effects due to unusual exposures.

MECHANICAL PHOTOS—
Electrical and Mechanical apparatus of unusual news interest.

RADIO PHOTOS—
New stations, both commercial, government, and private. Owners of private or amateur stations will find a special contest for these photos on another page of this issue.

And don't send us plate or film "negatives"; send unmounted or mounted "prints", preferably a light and dark one. Enclose stamps if photos are to be returned and place a piece of cardboard in the envelope with them to prevent mutilation.

Address photos to—Editor "Odd Photos", Electrical Experimenter, 233 Fulton Street, New York City.

www.americanradiohistory.com

Why Electrical Workers Are Needed.



Consider for a moment what part electricity plays in every-day life, in the comfort, convenience, pleasure and even health of the whole civilized world.

Think of having to ride in horse cars again—

of writing a letter every time you now phone—

of waiting days for what the telegraph does in a few minutes—

of no automobiles or moving picture shows—

Electricity takes millions to and from work. Without it the automobile and airplane would be impossible—the telephone and telegraph would be useless. All the civilized world relies on it for light, heat, transportation and communication. In a thousand ways electricity is used in factories, offices and in the homes.

Electricity is almost as essential as the air we breathe. Business would be almost at a standstill if deprived of its energy.

To say that electricity is still in its infancy is no exaggeration. Every day brings into practical use some new method of controlling it, some new device or appliance for using it. In industrial work there are still scores of operations where electricity will be utilized sooner or later. The day is coming when the railroads will entirely replace steam with electricity. Doctors, dentists and scientists are only beginning to realize the possibilities af electrical energy.

These facts merely touch the high spots, yet they prove beyond a doubt that electricity plays a vital part in business, in our individual lives, and that there is unlimited scope for those who make electricity their life work.

The electrical worker provides other men light to work by, the telephone and telegraph to convey their orders, the power to run their machines and transport their goods. He supplies power in the homes to operate washing machines, vacuum cleaners; for ironing, heating and ventilating. In short, it is the electrical worker who makes it possible for the world to live more comfortably, to enjoy more pleasures and to do a bigger, more profitable business.

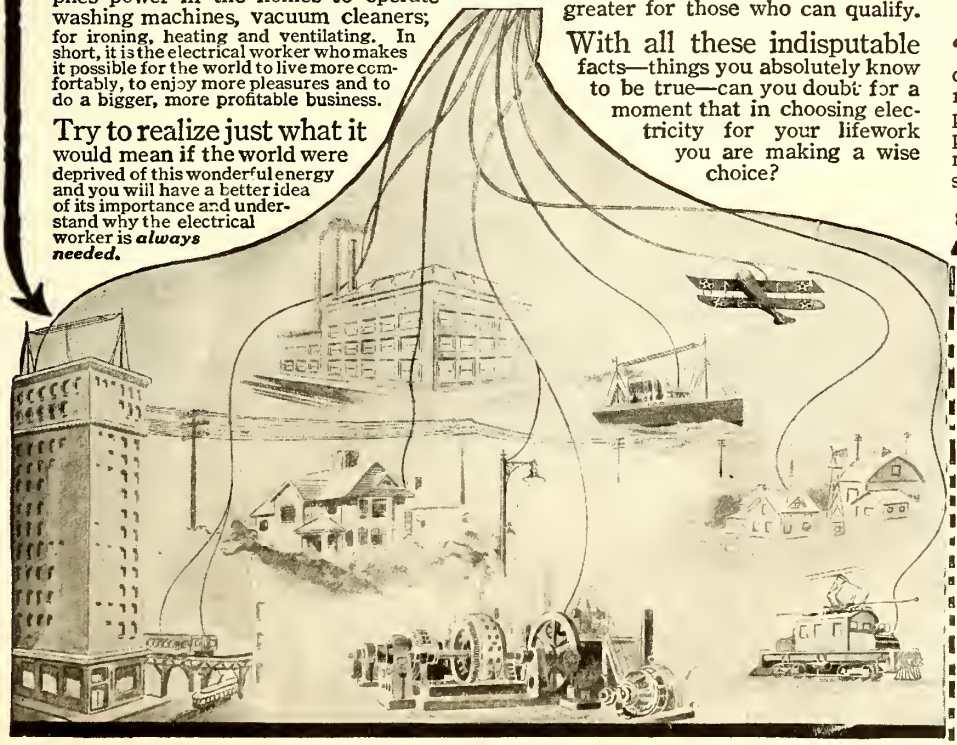
Try to realize just what it would mean if the world were deprived of this wonderful energy and you will have a better idea of its importance and understand why the electrical worker is ***always needed.***

What Electricity Offers You

Once you have mastered the A-B-C of electricity you are confronted with unlimited opportunities for advancement. You can specialize in extending and perfecting the wonders already accomplished in the field. You may take up those branches of electrical and mechanical work which cover the design and manufacture of electrical apparatus or start in to qualify for a well-paid position in the designing, construction, operating or consulting branches of the electrical engineering profession, and to fit yourself eventually for a position as Distribution, Operating, Testing, Erecting or Designing Engineer.

In the automobile, airplane, telephone and telegraph lines there is also great scope for the trained electrician. Many wonders of electricity have yet to be unfolded—its uses multiplied—and opportunities still greater for those who can qualify.

With all these indisputable facts—things you absolutely know to be true—can you doubt for a moment that in choosing electricity for your lifework you are making a wise choice?



How You Can Qualify

You don't have to interfere with your present work while qualifying for a good electrical position. The American School can give you just the training you need in your SPARE TIME. Our electrical courses have been specially prepared for home study—are written so you can understand everything quickly—and from your first lesson until you get your Diploma expert instructors coach you. Our training will enable you to get into the game RIGHT.

Read This Guarantee —Then Act

"We guarantee at any time during the first year of your enrollment to refund the entire amount paid if, immediately upon the completion of ten examinations, you notify the School that you are not satisfied with your course."

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. G267 CHICAGO

TRAINING—THE KEY TO SUCCESS

Please send me booklet and tell me how I can fit myself for the position marked X

..Electrical Engineer	..Automobile Repairman
..Electric Light and Power Superintendent	..Airplane Mechanic
	..High School Course
..Hydroelectric Engineer	..Architect
..Wireless Operator	..Building Contractor
..Mechanical Engineer	..Lawyer
..Heating and Ventilating Engineer	..Business Manager
	..Certified Pub. Acc'nt.
..Sanitary Engineer	..Accountant and Auditor
..Master Plumber	..Bookkeeper
..Civil Engineer	..Gen'l Education Course
..Structural Engineer	..Com. School Branches
..Western Union Course	..Fire Insurance Adjuster
..Telephone Engineer	..Shop Superintendent
..Draftsman and Designer	..Steam Engineer
..Automobile Engineer	..Stenographer

Name.....

Address.....

.....

www.americanradiohistory.com



One pupil says, "It's the best money I ever invested. The lessons would be cheap at double the price."

Who wants to learn boxing?

Would you like to know how to protect yourself against a bully? To be able to outbox someone bigger than you? To know the eight most effective blows to use, and the best guards against violent attack, not only against blows, but kicks and wrestling holds? Do you know that you can learn these things easily and quickly by the new "shorthand" system of boxing instruction, the Marshall Stillman Method, making your daily exercise interesting as well as beneficial?

Marshall Stillman teaches boxing by science. By this new method he has taught a novice in 15 minutes the difficult scientific left hand lead. It often takes 20 lessons to learn it by the old method. In 40 minutes Marshall Stillman taught 46 new members of the New York State Guard the principles of the hit, guard, and duck. Boxing professors in the Army say that it took them weeks to teach a group those fundamentals by the old method.

This system is so simple that it is taught by mail. You learn the fundamentals right in front of your own mirror. When you face your first opponent, you know how to hit him, what to expect in return, and how to guard against it. Two weeks after receiving it pupils have been able to outbox bigger and stronger opponents. Even boys of 15 have learned to hit and to protect themselves. Men of 50 and 60 have taken it, not only to learn boxing, but for the interesting and beneficial daily exercise.

The new complete Home Study Edition is only $5—less than you would pay for a few lessons by the old method. Besides the 5 "shorthand" lessons on the hit, guard, duck, feinting and clinching and footwork with 25 illustrations, it includes one lesson on daily exercise, 8 illustrations; 3 rounds of shadow boxing, 8 bone-breaking holds and releases (Jiu Jitsu) and 8 holds in standing wrestling, with 69 illustrations; and a complimentary copy, specially bound for home study, of Mike Donovan's famous book "The Science of Boxing," including 70 illustrations.

Send no money

Frankly, you don't believe boxing can be taught by mail, do you? All right, we'll take you on your own ground—we will mail the complete course to you on 5-day approval. Use the coupon below.

Marshall Stillman Association, Suite E-10, No. 461 Fourth Ave., New York.

You may send me on free 5-day approval your new complete Home Study Course in Boxing, including 5 "Shorthand" or Sub-conscious Boxing Lessons, one lesson for daily exercise, 3 rounds of shadow boxing, 8 bone-breaking holds and releases, 8 holds in standing wrestling, and a complimentary copy of Mike Donovan's Book, "The Science of Boxing." I will either return the course or remit $5 in full payment within 5 days after its arrival.

Name.....

Address.....

BE AN EXPERT



Auto and Tractor Mechanic Earn $100 to $400 a Month

Young man, are you mechanically inclined? Come to the Sweeney School. Learn to be an expert. I teach with tools not books. Do the work yourself, that's the secret of the

SWEENEY SYSTEM

of practical training by which 5,000 soldiers were trained for U. S. Government and over 20,000 expert mechanics. Learn in a few weeks; no previous experience necessary.

FREE Write today for illustrated free catalog showing hundreds of pictures men working in new Million Dollar Trade School.

LEARN A TRADE Sweeney

SCHOOL OF AUTO-TRACTOR-AVIATION
66 SWEENEY BLDG. KANSAS CITY, MO.



INSYDE TYRES Inner Armor for Auto Tires. Double mileage, prevent blow-outs and punctures. Easily applied in any tire. Thousands sold. Details free. Agents wanted. Amer. Accessories Co., Dept. 53, Cincinnati

"Piped Cold" — Prof. Bell Has It

(*Continued from page* 517)

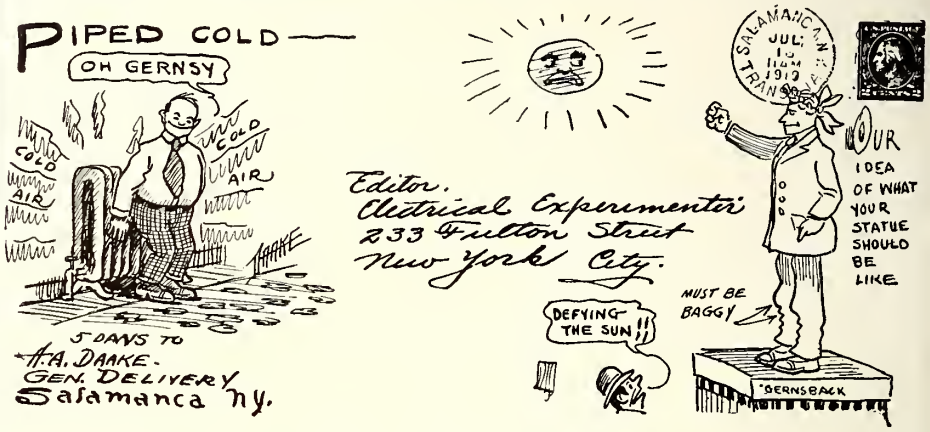
our radiators and pipes. But we prefer not only to let our babies and our feeble old folk die unnecessarily every summer, but we actually lose untold millions of dollars thru non-production when the "dog-days" are upon us. No one can work at his best when the mercury climbs to dizzy heights. Production, whether mental or physical, slows down anywhere between forty and eighty per cent. Statistics prove it. Factories as well as offices slow down and just barely creep along. Think of this enormous, incalculable loss alone, not to mention all the physical suffering due to the heat.

Ah, yes, we *do* have our brave fans—which, however, do not cool at all, but only remind us how hot our bodies are the minute we are not in the immediate vicinity of one of these spinning monuments to our stupidity.

For our dear fans only stir up the hot air *and* the dust. Our skin, wet or moist from perspiration, meets this stirred up air and due to a well-known physical phenomenon, *surface evaporation*, we experience a *sense of coolness*, but the air itself is *not* cooled. It is true that surface evaporation produces cold, but in order to have it, it is necessary to let the fans blow upon us, or nearly so, and everyone knows this is far from healthy, frequently producing severe colds. Besides, as soon as we leave the fan our suffering from the heat is all the more acute.

Where is the practical genius who will "study up" on refrigeration and sell us a cheap refrigerating machine which we can connect to our already existing steam or hot water radiators? For the same money which we now spend on fans we ought to be able to buy the machine. And for the money it costs to run the fans we can run the refrigerator, too.

Hundreds of refrigerators have been invented, but the simplest and best no doubt for our purpose is the *cold-air process*. It is based on the principle that the compression of air generates heat and in its subsequent expansion absorbs heat. The air is first comprest, is then past thru a cooler under pressure, after which it is expanded in a cylinder. No chemicals are used with this system and it possesses the very distinct advantage that extremely low temperatures are readily obtainable.



What H. A. Daake, of Salamanca, N. Y., Thought of Mr. Gernsback's Editorial "Piped Cold."

My Inventions

By Nikola Tesla

(*Continued from page* 508)

receiver. The higher the terminal and the greater the space encompast by the wires, the more pronounced is the effect, but it must be understood that it is purely local and has little to do with the real trouble. In 1900, while perfecting my wireless system, one form of apparatus comprised four antennae. These were carefully calibrated to the same frequency and connected in multiple with the object of magnifying the action, in receiving from any direction. When I desired to ascertain the origin of the transmitted impulses, each diagonally situated pair was put in series with a primary coil energizing the detector circuit. In the former case the sound was loud in the telephone; in the latter it ceased, as expected, the two antennae neutralizing each other, but the true statics manifested themselves in both instances and I had to devise special preventives embodying different principles.

The Remedy for Static.

By employing receivers connected to two points of the ground, as suggested by me long ago, this trouble caused by the charged air, which is very serious in the structures as now built, is nullified and besides, the liability of all kinds of interference is reduced to about one-half, because of the directional character of the circuit. This was perfectly self-evident, but came as a revelation to some simple-minded wireless folks whose experience was confined to forms of apparatus that could have been improved with an axe, and they have been disposing of the bear's skin before killing him. If it were true that strays performed such antics, it would be easy to get rid of them by receiving without aerials. But, as a matter of fact, a wire buried in the ground which, conforming to this view, should be absolutely immune, is more susceptible to certain extraneous impulses than one placed vertically in the air. To state it fairly, a slight progress has been made, but not by virtue of any particular

(*Continued on page* 552)

www.americanradiohistory.com



Be a Draftsman

Raise Your Income

Get into this paying profession and have positions opened to you by manufacturers, architects, railroads, contractors—by every kind of a corporation where mechanical design and construction are carried out. Draftsmanship puts you in the class of specialists, raises you above the crowd of job hunters, makes you a man whose services are needed.

You have the same opportunity to get the training that other men had who took the Chicago "Tech" Course in Draftsmanship and are now drawing large salaries and holding important, responsible positions. You also can learn how to earn

$25 to $100 a Week

Not enough really skilled draftsmen are available to fill the places open now. All you need is training to be prepared to answer the call that will mean more money for you. Begin your training without delay. Don't waste time waiting. The Chicago "Tech" experts are ready today to give you the thorough, practical instruction which will enable you to step into the drafting room of some big organization prepared to do the kind of work that earns high salaries and leads to advancement. At least write. Mail the coupon below or a letter stating which branch specially interests you.

Drawing Outfit

(No Extra Charge)

Every student of the Chicago "Tech" Home Study Course in Draftsmanship receives this drawing outfit—set of instruments in case, drawing board, T square, triangles, scale, curve, drawing paper, pencils, etc. or a cash credit in case he already has an outfit. These instruments are of the same make and sizes as used by high salaried experts in drafting rooms of factories, shops, railroads, etc. You use them while learning — then take them right into your practical work.



Come to Chicago "Tech" OR TRAIN AT HOME

Chicago "Tech" has its students everywhere. If you can't come to Chicago, take the Home Study course. The same professors who direct the resident courses will teach you by mail. You will have their personal direction, you will learn the most modern methods—all this while holding your present job. We train hundreds of ambitious men—and see them quickly rise to success. You therefore need not be denied this technical education. Sign and mail the coupon.

Get Practical Training from Practical Men

NO TIME PUT IN ON NEEDLESS STUDIES

Enrollment with Chicago "Tech" means getting direct personal instruction from men who for years have planned and directed big architectural and engineering work in leading cities. They have weeded out useless theories and needless studies and will give you the kind of instruction which will enable you to work beside the most experienced men.

That is one reason why you can get a complete, thorough technical training here in such a short time. Also the reason why Chicago "Tech" men are in such great demand. They go into work prepared to give the kind of service wanted.

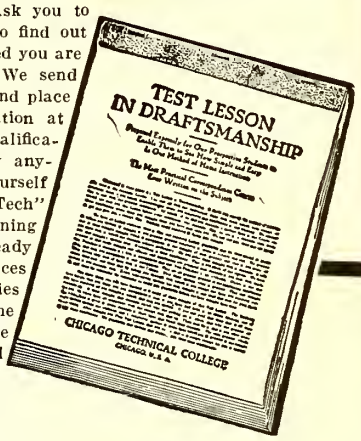
This is the training you are offered either at the college or by mail. And this is the time to enroll when there is such a pressing need for highly trained draftsmen. Use your spare hours to fit yourself for a bigger salary—a more important position. Chicago "Tech" offers you the opportunity. **WRITE.**

EASY PAYMENTS

Low tuition fees and easy terms of payment. Pay as you go along. Get training which will soon repay in extra earnings all the cost of the course. You know the salaries received by skilled technical men today. Get information on the opportunities which are opened wide to you by Chicago "Tech". We will give you all this information about fees, terms, etc., and send testimonials from Chicago "Tech" graduates on how they have profited from our instruction, if you will send the coupon.

FREE TEST LESSON

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything. And see for yourself just what Chicago "Tech" offers you in training which will bring a ready market for your services and open opportunities which are closed to the untrained man. The coupon will bring all the facts about the course, the small fee, and the easy terms.



Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Learn all about Principles of the Automobile, all about Gas Engines, Power Plants, Transmissions Lubrication, Cooling, Batteries, Starting and Lighting Systems, etc.

KNOW HOW TO FIX TROUBLES

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men.

Aeronautics

Complete, practical instruction in Aeronautic Engineering. Every principle made clear. Construction of every type of machine fully explained. This course equips you for expert work. Get the catalog and information. Send coupon.

WRITE

Below we list our principal courses in Drafting and several others. Just mark X in the [ ] to show which course interests you and we will send catalog and information about that particular subject. If in doubt about yourself, tell us your ambitions and we will advise you. Sending this coupon may mark a turning point in your career. May lead to a larger measure of success than you have expected. We can train you as we have trained others. Send the coupon today.

CHICAGO TECHNICAL COLLEGE
1045 Chicago "Tech" Building, Chicago

CHICAGO TECHNICAL COLLEGE
1045 Chicago "Tech" Building, Chicago

Without obligation upon me, send your Catalog on subject indicated below. Also FREE Lesson **If inquiry is on Drafting or Plan Reading.**

Mark X opposite work in which you are especially interested.

[ ] Architectural Drafting	[ ] Plan-Reading—Buildings
[ ] Machine Drafting	[ ] Plan-Reading—Shop Men
[ ] Electrical Drafting	[ ] Estimating
[ ] Structural Drafting	[ ] Surveying
[ ] Sheet Metal Drafting	[ ] **Autos and Gas Engines**
[ ] Builders' Course	[ ] **Aeronautics**

Name.....

Address.....

City.....State.....

College or Home Study? State which.....

www.americanradiohistory.com



Boys! Win an Auto-Wheel

In This Interesting Contest

TO THE BOY who can think of the most interesting uses for the popular AUTO-WHEEL COASTER, for earning money and for play, we shall award one of our large models absolutely FREE. It's a mighty generous prize for a few minutes' work. And the following eleven valuable prizes will be given to those sending in the next best uses: **Camera, Camping Tent, Mess Kit, Scout Knife, Fleetwing Steering Sled, Compass, Ingersoll Watch, Axe, Bank, Electric Flashlight, Poncho.**

INFORMATION ABOUT CONTEST

1. Any boy or girl not over 15 years may compete.
2. Contest will be judged by three men well-known in the Boy Scout organization.
3. Write to Business Idea Dept., Buffalo Sled Co., for pamphlet explaining the Contest, and colored catalog telling all about Auto-Wheel.
4. At end of letter write names of three Coaster Wagon Dealers in your town. If any carry the Auto-Wheel put an "x" after name.

YOU CAN DO IT. Any live boy who knows how to get fun and earn money out of a good, strong coaster wagon, has a fine chance to get the Auto-Wheel as a prize. **Here are a few pointers:** The Auto-Wheel is a wagon for work or play. It's built for strength and speed. Has roller bearings, steel axles and tires, body white ash, maple gear.

If there's an Auto-Wheel dealer near you, he'll gladly let you see the Auto-Wheel Coaster in his store, and he'll give you some good ideas for your letter. CONTEST CLOSES NOVEMBER 30, 1919.

HERE'S YOUR CHANCE. GET BUSY.

Buffalo Sled Co.,
163 Schenck Street,
N. Tonawanda, N. Y.

In Canada:
Preston,
Ontario.



ONLY $5.00
A MONTH PAYS FOR THIS SPLENDID DIAMOND RING

SPECIAL VALUE

SWEET'S Cluster; 7 fine Diamonds set in Platinum. Looks like $225 Solitaire.

Seven perfectly matched, blue-white Diamonds, skilfully mounted in Platinum to resemble one magnificent Solitaire. The Diamonds were selected for their perfect cut, their blue-white color, their superior quality and wonderful brilliancy, by one of our most skilful Diamond experts; together they look like one large, single stone. A most handsome and showy ring for the least amount of money.

SEND NO MONEY—we will send the ring, all charges prepaid—you are sure to be pleased. Pay only $12.50 on delivery—the balance in ten months: $5.00 EACH MONTH, until entire price, $62.50 has been paid.

OUR PROFIT-SHARING PLAN

Our customers have the benefit of a 7½% increased re-purchase value. Write for particulars—know the House of Sweet.

FREE DE LUXE CATALOG. Learn of our great values—our easy terms of payment—our big variety. Ask for catalog **No. 579R** and be sure to address **Dept. 579R, Liberty Bonds accepted at face value.**

THE HOUSE OF QUALITY
L.W. SWEET & CO. INC.
2-4 MAIDEN LANE, NEW YORK

Build Your Own PHONOGRAPH

It's Easy With Our Help

A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fine profit building phonographs for your friends.

Write Today for Our Free Blue Print Offer. Agents wanted for our ready built Choraleons.

Choraleon Phonograph Co.
710 Monger Bldg., Elkhart, Ind.



SAVE OVER HALF

My Inventions

By Nikola Tesla

(*Continued from page* 550)

method or device. It was achieved simply by discarding the enormous structures, which are bad enough for transmission but wholly unsuitable for reception, and adopting a more appropriate type of receiver. As I pointed out in a previous article, to dispose of this difficulty for good, a radical change must be made in the system, and the sooner this is done the better.

Radio Government Control Not Wanted.

It would be calamitous, indeed, if at this time when the art is in its infancy and the vast majority, not excepting even experts, have no conception of its ultimate possibilities, a measure would be rushed through the legislature making it a government monopoly. This was proposed a few weeks ago by Secretary Daniels, and no doubt that distinguished official has made his appeal to the Senate and House of Representatives with sincere conviction. But universal evidence unmistakably shows that the best results are always obtained in healthful commercial competition. There are, however, exceptional reasons why wireless should be given the fullest freedom of development. In the first place it offers prospects immeasurably greater and more vital to betterment of human life than any other invention or discovery in the history of man. Then again, it must be understood that this wonderful art has been, in its entirety, evolved here and can be called "American" with more right and propriety than the telephone, the incandescent lamp or the aeroplane. Enterprising press agents and stock jobbers have been so successful in spreading misinformation that even so excellent a periodical as the *Scientific American* accords the chief credit to a foreign country. The Germans, of course, gave us the Hertz-waves and the Russian, English, French and Italian experts were quick in using them for signaling purposes. It was an obvious application of the new agent and accomplished with the old classical and unimproved induction coil—scarcely anything more than another kind of heliography. The radius of transmission was very limited, the results attained of little value, and the Hertz oscillations, as a means for conveying intelligence, could have been advantageously replaced by sound-waves, which I advocated in 1891. Moreover, all of these attempts were made three years after the basic principles of the wireless system, which is universally employed to-day, and its potent instrumentalities had been clearly described and developed in America. No trace of those Hertzian appliances and methods remains today. We have proceeded in the very opposite direction and what has been done is the product of the brains and efforts of citizens of this country. The fundamental patents have expired and the opportunities are open to all. The chief argument of the Secretary is based on interference. According to his statement, reported in the New York *Herald* of July 29th, signals from a powerful station can be intercepted in every village of the world. In view of this fact, which was demonstrated in my experiments of 1900, it would be of little use to impose restrictions in the United States.

America First.

As throwing light on this point, I may mention that only recently an odd looking gentleman called on me with the object of enlisting my services in the construction of world transmitters in some distant land. "We have no money," he said, "but carloads of solid gold and we will give you a liberal amount." I told him that I wanted to see first what will be done with my inventions in America, and this ended the interview. But I am satisfied that some dark forces are at work, and as time goes on the maintenance of continuous communication will be rendered more difficult. The only remedy is a system immune against interruption. It has been perfected, it exists, and all that is necessary is to put it in operation.

The terrible conflict is still uppermost in the minds and perhaps the greatest importance will be attached to the Magnifying Transmitter as a machine for attack and defense, more particularly in connection with *Telautomatics*. This invention is a logical outcome of observations begun in my boyhood and continued thruout my life. When the first results were publisht the *Electrical Review* stated editorially that it would become one of the "most potent factors in the advance and civilization of mankind." The time is not distant when this prediction will be fulfilled. In 1898 and 1900 it was offered to the Government and might have been adopted were I one of those who would go to Alexander's shepherd when they want a favor from Alexander. At that time I really thought that it would abolish war, because of its unlimited destructiveness and exclusion of the personal element of combat. But while I have not lost faith in its potentialities, my views have changed since.

The Road to Permanent Peace.

War can not be avoided until the physical cause for its recurrence is removed and this, in the last analysis, is the vast extent of the planet on which we live. Only thru annihilation of distance in every respect as, the conveyance of intelligence, transport of passengers and supplies and transmission of energy will conditions be brought about some day, insuring permanency of friendly relations. What we now want most is closer contact and better understanding between individuals and communities all over the earth, and the elimination of that fanatic devotion to exalted ideals of national egoism and pride which is always prone to plunge the world into primeval barbarism and strife. No league or parliamentary act of any kind will ever prevent such a calamity. These are only new devices for putting the weak at the mercy of the strong. I have exprest myself in this regard fourteen years ago, when a combination of a few leading governments—a sort of Holy Alliance—was advocated by the late Andrew Carnegie, who may be fairly considered as the father of this idea, having given to it more publicity and impetus than anybody else prior to the efforts of the President. While it can not be denied that such a pact might be of material advantage to some less fortunate peoples, it can not attain the chief object sought. Peace can only come as a natural consequence of universal enlightenment and merging of races, and we are still far from this blissful realization. As I view the world of today, in the light of the gigantic struggle we have witnest, I am filled with conviction that the interests of humanity would be best served if the United States remained true to its traditions and kept out of "entangling alliances." Situated as it is, geographically, remote from the theaters of impending conflicts, without incentive to territorial aggrandizement, with inexhaustible resources and immense population thoroly imbued with the spirit of liberty and right, this country is placed in a unique and privileged position. It is thus able to exert, independently, its colossal strength and moral force to the benefit of all, more judiciously and effectively, than as member of a league.

(*Continued on page* 554)

www.americanradiohistory.com



"The Job is Yours— on One Condition!"

"For a long time I watched the new men who came into this business. Some stood still—stayed right where they started. Others climbed—made each job a stepping stone to something better.

"Now, what was the difference? Well, I investigated and found out. The men who were getting ahead had been devoting part of their spare time to study along the line of their work. Our treasurer used to be a bookkeeper. The factory superintendent was working at a bench in the shop a few years ago. The sales manager started in a branch office up state. The chief designer rose from the bottom in the drafting room.

"All of these men won their advancements through spare time study with the International Correspondence Schools. Today they are earning four or five times—yes, some of them *ten* times as much money as when they came with us.

"So out of this experience we have formed a policy. We are looking for men who care enough about their future not only to do their present work well, but to devote part of their spare time to preparation for advancement.

"And I'll give you this job on one condition—that you take up a course of special training along the line of your work. Let the I. C. S. help you for one hour after supper each night and your future in this business will take care of itself."

Employers are begging for men with ambition, men who really want to get ahead in the world and are willing to prove it by training themselves in spare time to do some one thing well.

Prove that you are that kind of a man! The International Correspondence Schools are ready and anxious to help you prepare for advancement in the work of your choice, whatever it may be. More than two million men and women in the last 28 years have taken the I. C. S. route to more money. Over 100,000 others are getting ready in the same way right now. Surely the least you can do is to find out what there is in this proposition for *you*. Here is all we ask: Without cost, without obligating yourself in any way, simply mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6202, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ ELECTRICAL ENGINEER
- ☐ Electrician
- ☐ Electric Wiring
- ☐ Electric Lighting
- ☐ Electric Car Running
- ☐ Heavy Electric Traction
- ☐ Electrical Draftsman
- ☐ Electric Machine Designer
- ☐ Telegraph Expert
- ☐ Practical Telephony
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Toolmaker
- ☐ Machine Shop Practice
- ☐ Gas Engineer
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MINE FOREMAN OR ENGINEER
- ☐ ARCHITECT
- ☐ Architectural Draftsman
- ☐ PLUMBING AND HEATING
- ☐ Sheet Metal Worker
- ☐ Ship Draftsman
- ☐ CHEMICAL ENGINEER
- ☐ SALESMANSHIP
- ☐ ADVERTISING MAN
- ☐ Show Card Writer
- ☐ Outdoor Sign Painter
- ☐ RAILROADER
- ☐ ILLUSTRATOR
- ☐ DESIGNER
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Public Accountant
- ☐ Traffic Management
- ☐ Commercial Law
- ☐ GOOD ENGLISH
- ☐ Common School Subjects
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ STATIONARY ENGINEER
- ☐ Textile Overseer or Supt.
- ☐ AGRICULTURE
- ☐ Navigator
- ☐ Poultry Raising
- ☐ AUTOMOBILES
- ☐ Spanish
- ☐ French
- ☐ Italian

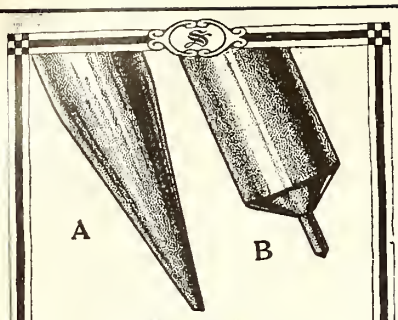
Name _____

Occupation & Employer _____

Street and No. _____

City _____ State _____

www.americanradiohistory.com



Make your records last longer and play better!

AFTER an ordinary steel needle plays one record the needle point is worn off. (Illustration A.) After playing one record there is no perceptible wear if you use (Illustration B.)

THE INSTRUMENT OF QUALITY
Sonora
CLEAR AS A BELL

Semi-Permanent Silvered PHONOGRAPH NEEDLES

These Sonora Needles *play 50 to 100 times*, are more economical, more convenient, save constant needle changing and mellow the tone. These needles give the maximum of satisfaction and are the most economical ultimately.

FREE! A sample needle will be given FREE so that you can prove its merit for yourself. Write for yours today.

Three Grades
Loud, Medium, Soft.
30c per card of 5. In Canada 40c

Sonora Phonograph Sales Company, Inc.
GEORGE E. BRIGHTSON, President
279 Broadway, *Dept. G*, New York
Toronto: Ryrie Bldg.

CAUTION! Beware of similarly constructed needles of inferior quality

$446 BUYS THIS "PRESTO-UP" Bolt-Together House



The Wonder Buildings of the Age

GUARANTEED

Purchased after most rigid inspection by some of the largest Steel, Coal and Industrial Corporations in the United States. You are not experimenting. "PRESTO-UP" Bolt-Together Houses are patented, manufactured exclusively by us and sold at money saving prices.
Seven different types of walls to choose from. Wind and weather proof. Invisible joints inside and out. Extremely simple to bolt together. Wonderful strength. Better construction than regularly constructed houses. Exceptionally good lumber. Cement coated nails. Fifteen Year Guaranteed Slate Coated Roofing. Well painted, and best of all, neat in appearance and so simple to bolt together that it is a pleasure to do the work.

Send for **CATALOG FX-412 TODAY**

Houses—Garages—Barns—Out Buildings, etc. Also Harris Fresh Air Canvas Houses

HARRIS BROTHERS CO., Chicago

My Inventions

By Nikola Tesla

(*Continued from page* 552)

The Mechanistic Theory of Life.

In one of these biographical sketches, published in the ELECTRICAL EXPERIMENTER, I have dwelt on the circumstances of my early life and told of an affliction which compelled me to unremitting exercise of imagination and self-observation. This mental activity, at first involuntary under the pressure of illness and suffering, gradually became second nature and led me finally to recognize that I was but an automaton devoid of free will in thought and action and merely responsive to the forces of the environment. Our bodies are of such complexity of structure, the motions we perform are so numerous and involved, and the external impressions on our sense organs to such a degree delicate and elusive that it is hard for the average person to grasp this fact. And yet nothing is more convincing to the trained investigator than the mechanistic theory of life which had been, in a measure, understood and propounded by Descartes three hundred years ago. But in his time many important functions of our organism were unknown and, especially with respect to the nature of light and the construction and operation of the eye, philosophers were in the dark. In recent years the progress of scientific research in these fields has been such as to leave no room for a doubt in regard to this view on which many works have been published. One of its ablest and most eloquent exponents is, perhaps, Felix Le Dantec, formerly assistant of Pasteur. Prof. Jacques Loeb has performed remarkable experiments in heliotropism, clearly establishing the controlling power of light in lower forms of organisms, and his latest book, "Forced Movements," is revelatory. But while men of science accept this theory simply as any other that is recognized, to me it is a truth which I hourly demonstrate by every act and thought of mine. The consciousness of the external impression prompting me to any kind of exertion, physical or mental, is ever present in my mind. Only on very rare occasions, when I was in a state of exceptional concentration, have I found difficulty in locating the original impulses.

Lack of Observation a Form of Ignorance.

The by far greater number of human beings are never aware of what is passing around and within them, and millions fall victims of disease and die prematurely just on this account. The commonest, every-day occurrences appear to them mysterious and inexplicable. One may feel a sudden wave of sadness and rake his brain for an explanation when he might have noticed that it was caused by a cloud cutting off the rays of the sun. He may see the image of a friend dear to him under conditions which he construes as very peculiar, when only shortly before he has passed him in the street or seen his photograph somewhere. When he loses a collar button he fusses and swears for an hour, being unable to visualize his previous actions and locate the object directly. Deficient observation is merely a form of ignorance and responsible for the many morbid notions and foolish ideas prevailing. There is not more than one out of every ten persons who does not believe in telepathy and other psychic manifestations, spiritualism and communion with the dead, and who would refuse to listen to willing or unwilling deceivers. Just to illustrate how deeply rooted this tendency has become even among the clear-headed American population, I may mention a comical incident.

Psychic Phenomena in the Manufacture of Flivvers.

Shortly before the war, when the exhibition of my turbines in this city elicited widespread comment in the technical papers, I anticipated that there would be a scramble among manufacturers to get hold of the invention, and I had particular designs on that man from Detroit who has an uncanny faculty for accumulating millions. So confident was I that he would turn up some day, that I declared this as certain to my secretary and assistants. Sure enough, one fine morning a body of engineers from the Ford Motor Company presented themselves with the request of discussing with me an important project. "Didn't I tell you?" I remarked triumphantly to my employees, and one of them said, "You are amazing, Mr. Tesla; everything comes out exactly as you predict." As soon as these hard-headed men were seated I, of course, immediately began to extol the wonderful features of my turbine, when the spokesmen interrupted me and said, "We know all about this, but we are on a special errand. We have formed a psychological society for the investigation of psychic phenomena and we want you to join us in this undertaking." I suppose those engineers never knew how near they came to being fired out of my office.

Confuting Spiritism.

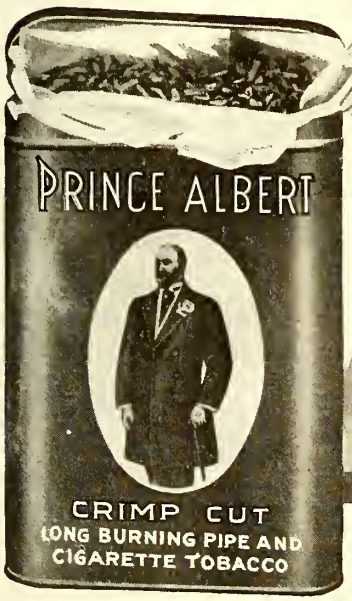
Ever since I was told by some of the greatest men of the time, leaders in science whose names are immortal, that I am possesst of an unusual mind, I bent all my thinking faculties on the solution of great problems regardless of sacrifice. For many years I endeavored to solve the enigma of death, and watched eagerly for every kind of spiritual indication. But only once in the course of my existence have I had an experience which momentarily impressed me as supernatural. It was at the time of my mother's death. I had become completely exhausted by pain and long vigilance, and one night was carried to a building about two blocks from our home. As I lay helpless there, I thought that if my mother died while I was away from her bedside she would surely give me a sign. Two or three months before I was in London in company with my late friend, Sir William Crookes, when spiritualism was discussed, and I was under the full sway of these thoughts. I might not have paid attention to other men, but was susceptible to his arguments as it was his epochal work on radiant matter, which I had read as a student, that made me embrace the electrical career. I reflected that the conditions for a look into the beyond were most favorable, for my mother was a woman of genius and particularly excelling in the powers of intuition. During the whole night every fiber in my brain was strained in expectancy, but nothing happened until early in the morning, when I fell in a sleep, or perhaps a swoon, and saw a cloud carrying angelic figures of marvelous beauty, one of whom gazed upon me lovingly and gradually assumed the features of my mother. The appearance slowly floated across the room and vanished, and I was awakened by an indescribably sweet song of many voices. In that instant a certitude, which no words can express, came upon me that my mother had just died. And that was true. I was unable to understand the tremendous weight of the painful knowledge I received in advance, and wrote a letter to Sir William Crookes while still under the domination of these impressions and in poor bodily health. When I recovered I sought for a long time the ex-

(*Continued on page* 556)

www.americanradiohistory.com

PRINCE ALBERT

the national joy smoke



TOPPY red bags, tidy red tins, handsome pound and half-pound tin humidors—and—that classy, practical pound crystal glass humidor with sponge moistener top that keeps the tobacco in such perfect condition.

R. J. Reynolds Tobacco Co.
Winston-Salem, N. C.

Copyright 1919 by
R. J. Reynolds Tobacco Co.

NO use arguing about it, or making chin-music in a minor key! If you've got the jimmy-pipe-notion or cigarette rolling 'em idea cornered in your smokeappetite, slip in a few liberal loads of Prince Albert! *And*, you'll sign the longest lease you can hook up to on about the cheerfulest brand of in-and-out-door sport that ever did ramble up Broadway or down Lost Creek trail!

Boiled down to regular old between-us-man-talk, *Prince Albert kicks the "pip" right out of a pipe!* Puts pipe pleasure into the 24-hours-a-day joy'us class! Gives smokers more fun to the square inch than they, *or you*, ever dug out of a pipe before!

Prince Albert makes a pipe or cigarette a peace party at both ends and the middle! Just hums and hums the soothingest symphony of smoke content that ever sifted its happy way into a man's system! P. A. is so fragrant, so fascinating in flavor, so refreshing!

And, you run plumb-fair against the astounding fact that Prince Albert can't bite your tongue or parch your throat! Because, our exclusive patented process cuts out bite and parch! Why, you can't get orders in fast enough to try to buy up the supply for a long, long spell!

www.americanradiohistory.com

DETROIT

the Automobile Center of the World is the Logical Place to

LEARN AUTOMOBILE ELECTRICS



Training for Head and Hand

Auto Electricians are in big demand everywhere. Interesting work—big salaries—exceptional opportunities for advancement. Every garage, factory and service station needs one or more good men. Also splendid opportunities to open electrical service stations and make big money. Cars need constant attention. Nearly all the trouble is electrical. Six million cars now in use—a million and a half new ones will be put in service this year. That means thousands of trained men will be needed. Men trained in Detroit get the preference.

NOT A "ONE MAN SCHOOL"

The M. S. A. S. embodies the best ideas in the Auto Industry. No other school offers such an advantage as this school here in Detroit. School open all the year, enter classes any day.

KING MOTOR CAR COMPANY

BUILDERS OF KING CARS — DETROIT, U.S.A.

Replying to a recent letter addressed to Mr. Artemas Ward making inquiry as to the reputation of the Michigan State Auto School, will say that as far as we know all Detroit Automobile manufacturers endorse the work they are doing.

It is managed very efficiently and they have been turning out some pretty good men for the automobile industry, and cannot see any reason why you should hesitate about taking a course with this Institution.

Yours very truly,
KING MOTOR CAR COMPANY

MONEY-BACK GUARANTEE

We guarantee to qualify you for a position as chauffeur, repair man, tester, demonstrator, auto electrician, garage man, automobile dealer, Aeroplane motor mechanic or tractor mechanic and operator, paying from $100 to $400 monthly or refund your money.

Be An Auto Electrician
Earn $200 to $500 Monthly

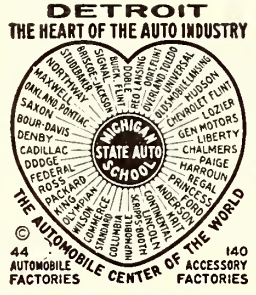
If you are electrically inclined this is your best opportunity. Our complete Auto Course trains you thoroughly in Auto Electrics. You can hold down **any** job or run a business of your own. You make more money because you can locate trouble quickly, without waste of time. All your time is spent repairing the trouble—not looking for it. Our successful graduates are in every part of the world.

Auto Factories Heartily Endorse Our School

They not only endorse the M. S. A. S. but they also give us hearty co-operation. They employ our students while taking course and after they graduate. We have the latest model chassis for students to work on. In this way our students get best possible training in most practical manner.

"School News" and 176 Page Catalog FREE

Just off the press. Gives complete information. Quotes dozens of letters from students who have actually done what you would like to do. What better proof do you want that YOU can do it? You CAN! — but get busy. "Jump" a train and come to Detroit. Hundreds have done it and made good. Will help you get a job if necessary to pay expenses while taking our course. Get action NOW.



Michigan State Auto School The Old Reliable School
670 Auto Bldg. Detroit, Mich. U. S. A. A. G. ZELLER, Pres.

CARNOTITE

(Radium Mineral.) The American Pitchblende found in Colorado, from which *Radium* is extracted.

A generous piece, enough to conduct experiments, such as affecting photographic plates thru opaque material (similar to X-Ray pictures), first made by Sir W. Crookes and Mme. Curie, is furnished in neat, wooden box. **URANIUM ORE** (*Radio-Active*)

Containing about 35% of pure Uranium; also Radium and Vanadium. One of the most rare and interesting minerals. Twenty milligrams are furnished in glass vial protected by lead cover.

One box of *Carnotite* and one vial of *Uranium Ore* as described above 50c sent prepaid.

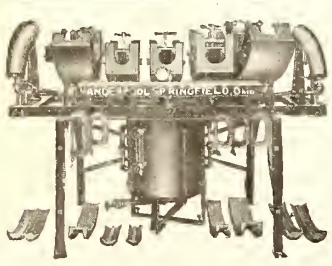
FORMULAS

Luminous Paint—Silver Plating Powder—Liquid Court Plaster—Soap Bubble Liquid—Straw Hat Bleach—Collapsible Tube Tooth Paste—Resilvering Mirror Liquid—Polish for Tan Shoes—Dressing for Tan Shoes—Paint to make Oil Cloth.

These Ten Recipes in sealed envelope for 50c. Sent prepaid.

SIDNEY SPECIALTY CO., 233 Fulton Street New York City

Enormous Income from Insignificant Investment



Open a tire Repairing Shop—business pours in. Vanderpool Vulcanizer (5 Cavity Model) has capacity of $100 worth of work a day. We are the pioneer manufacturers of the Dry Cure Vulcanizer — the only vulcanizer that guarantees absolutely PERFECT work. We send you FREE TIRE REPAIRING MANUAL and give you free instruction. Write today for full particulars.

In answering address Dept. X-15

WM. VANDERPOOL CO. **Springfield, O.**

MODEL AIRPLANE SUPPLIES

Build and fly Model Airplanes ~



Send 5¢ for catalog of complete and knocked-down scale models of new machines, parts, fittings, and supplies.

Wading River Mfg. Co. 672 Broadway, Brooklyn, N.Y.

My Inventions

By Nikola Tesla

(*Continued from page* 554)

ternal cause of this strange manifestation and, to my great relief, I succeeded after many months of fruitless effort. I had seen the painting of a celebrated artist, representing allegorically one of the seasons in the form of a cloud with a group of angels which seemed to actually float in the air, and this had struck me forcefully. It was exactly the same that appeared in my dream, with the exception of my mother's likeness. The music came from the choir in the church nearby at the early mass of Easter morning, explaining everything satisfactorily in conformity with scientific facts.

This occurred long ago, and I have never had the faintest reason since to change my views on psychical and spiritual phenomena, for which there is absolutely no foundation. The belief in these is the natural outgrowth of intellectual development. Religious dogmas are no longer accepted in their orthodox meaning, but every individual clings to faith in a supreme power of some kind. We all must have an ideal to govern our conduct and insure contentment, but it is immaterial whether it be one of creed, art, science or anything else, so long as it fulfills the function of a dematerializing force. It is essential to the peaceful existence of humanity as a whole that one common conception should prevail.

Tesla's Astounding Discovery.

While I have failed to obtain any evidence in support of the contentions of psychologists and spiritualists, I have proved to my complete satisfaction the automatism of life, not only through continuous observations of individual actions, but even more conclusively through certain generalizations. These amount to a discovery which I consider of the greatest moment to human society, and on which I shall briefly dwell. I got the first inkling of this astounding truth when I was still a very young man, but for many years I interpreted what I noted simply as coincidences. Namely, whenever either myself or a person to whom I was attached, or a cause to which I was devoted, was hurt by others in a particular way, which might be best popularly characterized as the most unfair imaginable, I experienced a singular and undefinable pain which, for want of a better term, I have qualified as "cosmic," and shortly thereafter, and invariably, those who had inflicted it came to grief. After many such cases I confided this to a number of friends, who had the opportunity to convince themselves of the truth of the theory which I have gradually formulated and which may be stated in the following few words:

Our bodies are of similar construction and exposed to the same external influences. This results in likeness of response and concordance of the general activities on which all our social and other rules and laws are based. We are automata entirely controlled by the forces of the medium, being tossed about like corks on the surface of the water, but mistaking the resultant of the impulses from the outside for free will. The movements and other actions we perform are always life preservative and tho seemingly quite independent from one another, we are connected by invisible links. So long as the organism is in perfect order it responds accurately to the agents that prompt it, but the moment that there is some derangement in any individual, his self-preservative power is impaired. Everybody understands, of course, that if one becomes deaf, has his eyesight weakened, or his limbs injured, the chances for his continued existence are lessened. But

(*Continued on page* 600)

www.americanradiohistory.com



Which Job Do You Want?

NOT one of these jobs is beyond your reach. You can have any one you want. The big pay that goes with it is yours, too. A little ambition and some training that you give yourself at home is all you need. You don't have to serve an apprenticeship. You don't have to go to school. American Technical Society Home Study Books and a little spare time will quickly fit you to hold any kind of job. If you haven't the necessary "know how" to put you in the big pay class, make up your mind to get it right now. Pick out the job you want and send the coupon for the books that will fit you to hold it.

Some of the greatest experts in the world prepared these books just for you—to help you get ahead. They are written in plain, everyday, good old U.S. language, just like you and I talk. No big technical terms—no trouble to understand them. Hundreds of pictures and diagrams in each set help to make difficult things as simple as A. B. C.

Examine Any Books Free

Carpentry and Contracting, 5 volumes, 2138 pages, 1000 pictures. Was $25.00. Now...$17.80

Civil Engineering, 9 volumes, 3900 pages, 3000 pictures. Was $45.00. Now..... 29.80

Fire Prevention and Insurance. 4 volumes, 1500 pages, 600 pictures. Was $20.00. Now 15.80

Electrical Engineering, 8 volumes, 3800 pages, 2600 pictures. Was $40.00. Now..... 24.80

Automobile Engineering, 6 volumes, 3000 pages, 2000 pictures. Was $30.00. Now..... 19.80

Machine Shop Practice, 6 volumes, 2300 pages, 2000 pictures. Was $30.00. Now 19.80

Steam and Gas Engineering, 7 volumes, 3300 pages, 2500 pictures. Was $35.00. Now...$21.80

Law and Practice (with reading course) 13 vols, 6000 pages, illustrated. Was $72.00. Now 39.80

Telephony and Telegraphy, 4 volumes, 1728 pages, 2000 pictures. Was $20.00. Now... 12.80

Sanitation, Heating and Ventilating, 4 volumes, 1454 pages, 1400 pictures. Was $20.00. Now 13.80

Practical Accounting, 4 volumes, 1840 pages, 800 pictures, etc. Was 20.00. Now..... 12.80

Drawing, 4 volumes, 1578 pages, 1000 pictures, blueprints, etc. Was $20.00. Now..... 14.80

Don't Send Money

The coupon alone, properly filled out brings any books you select by express collect. No money to pay in advance and no obligation to buy.

Only 50c a Week

Use the books as you please for a week and send them back at our expense if you want to. If you decide to keep the books to help you make more money like thousands of other men have done, send us only $2.00 each month. This is only 50 cents a week.

Extra Special FREE OFFER

Those who send the coupon promptly will be enrolled as a consulting member of our Society for one year. This gives you the privilege of consulting our engineers and experts on any problem connected with your work—**Free of any charge.**

Go after one of these big jobs now. This is the time. Trained men were never more needed than they are today. This coupon is your start on the road to real success. **MAIL IT NOW.**

American Technical Society
Department X-257 Chicago

REDUCED PRICE COUPON

American Technical Society, Dept. X-257, Chicago

Please send me set of ..... for 7 days' examination, shipping charges collect. I will examine the books thoroughly and if satisfied, will send $2 within 7 days and $2 each month until I have paid the special price of ..... If I decide not to keep the books, I will return them by express at your expense. Title not to pass to me until the set is fully paid for.

Name .....

Address .....

Reference .....

www.americanradiohistory.com



Treat Yourself At Home

Here is a partial list of ailments treated successfully, with the Violetta, Violet-Ray Machine.

Asthma
Barbers' Itch
Boils
Blackheads
Bunions
Callous
Catarrh
Chilblains
Colds
Corns
Constipation
Dandruff
Deafness
Earache
Eczema
Eye Diseaso
Falling Hair
Hay Fever
Headache
Goitre
Insomnia
Lumbago
Nervousness
Neuralgia
Neuritis
Obesity
Pains
Paralysis
Piles
Pimples
Pyorrhea
Rheumatism
Skin Diseases
Sore Throat
Sprains
Tonsilitis
Whooping Cough

VIOLET RAYS Remove Pain As If By Magic!

Try This for Health and Beautify—10 Days Free

The magic of Violet Rays now brought to your home. Most famous electrical health and beauty device yours for 1 cent per treatment. Relieves pain almost instantly from neuritis, rheumatism, lumbago. Rid yourself of headaches, catarrh, constipation, insomnia, nervousness. Beautify hair and skin. Double your vigor, energy, and vitality.

VIOLETTA VIOLET RAY MACHINE

Not a vibrator. No shock. No pain. Wonderful even for infants. Soothes and relieves while vitalizing every cell and every tissue. Write today for free book and 10 days' trial offer. Read amazing story of Violet Ray. High Frequency Current. The VIOLETTA is sold direct to you from our own laboratories. Mail coupon or postal right now.



Bleadon-Dun Company

Dept. 21 11 S. Desplaines Street, Chicago, Illinois

BLEADON-DUN COMPANY,
Dept. 21,
11 S. Desplaines St.
Chicago, Illinois.

Please send me your free book and 10 Days' Trial offer on VIOLETTA Violet-Ray Machine.

Name.....

Address.....

Science in Slang

By Emerson Easterling

(*Continued from page* 547)

ages, baby buggy, and other objects ahead untangle and get on their way. And it always looks more graceful to see the cars running under their own power, too."

"How about the lights and heat in the cars?" spoke up a stranger. Then, after apparent thought, "Oh, of course it comes in like the power."

"Of course," replied Jazz.

Just then the power came on. The lights flashed up again. We were lighted as well



Here We Have Tommy Edison Running His First Model of the Electrical Railway Somewhere Over the Jersey Flats, And Believe Us, It Worked.

as enlightened. (How do you get that way.)

Somehow I couldn't help looking around at the couple in the corner. They were gone. But some rice was left in the seat. I don't know whether they will have rice or eggs for breakfast, tho.

"Does it make much difference whether they use direct or alternating current for the cars?" I asked of Stokes.

"Not much," he answered back as he spit out of the window of the car, now in motion.

EDISON VS. SPRAGUE ON ELECTRIC RAILWAYS

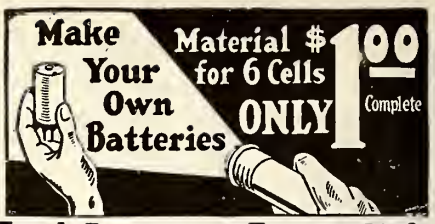
To the Editor of the New York Sun.

SIR: I have noticed in your paper of August 27, 1919, a communication from Frank J. Sprague in which he takes me to task for claiming in a recently published article the invention of the trolley car.

Mr. Sprague's principal contribution to the trolley car was the mechanical suspension of the electric motor to the truck. The motor itself was the modern reversible, low resistance, high efficiency, dynamo-motor devised and developed by me in working out the incandescent electric light system. This was already invented and at hand for Mr. Sprague to adopt to the conditions of a railway car truck. Neither he nor Siemens nor any one else could have succeeded in making a trolley system commercially practicable without this development.

A trolley car does not constitute a trolley system. A central current generation and distributing station and a complete system of conductors are absolute necessities. I had already spent years in their development for the incandescent electric light system and they were available to Mr. Sprague.

Mr. Sprague states also that he had great financial difficulties in introducing the trolley system into Richmond and carried it out largely by his personal credit. Perhaps he has forgotten that when his com-



Fresh Batteries—Easy to Make

In about 2 minutes you can make a better, fresher flashlight battery than you can buy—and you get full life of chemicals. Stronger light, 25% cheaper—400% more service in Make-UR-Own batteries. Fit 1½ x 6½ in. tubular flashlight case. Enough in outfit to last a year of ordinary use. Don't buy "dead" batteries—make your own. Satisfaction, or money-back guarantee.

Renewal Outfit—Parts and chemicals to make 6 cells complete.... $1.00

Marvel Flashlight Outfit—Flashlight case of fibre heavily nickel trimmed, Mazda lamp, complete with 6-cell Make-UR-Own battery outfit $2.35



In ordering give name and full address plainly written; mention amount enclosed and which outfit is desired.

AGENTS WANTED

PROTECTO EXPLOSION AUTOMOBILE WHISTLE



A pleasing, effective warning signal—clear, loud tone. Gets the right-of-way in dense traffic—prevents accidents. Replaces priming cup, or furnished with attachment for spark plug. Cannot get out of order—no wiring. Attach it yourself in a few minutes. Specify make of car. Order today. $2.50 complete.

$2.50 Complete AGENTS WANTED

The Marvel Co. Dept. E1E
333 S. Dearborn Street, CHICAGO, ILL.

Make Your Phonograph



Build a high-grade talking machine with Acmephone motor, turn table, tone arm, reproducer, hinges, knobs—everything complete at only $11.85. Plays all records. Blueprints free with instructions. A $100 machine can be produced using these parts.

Blueprints only, 25c each.
Full set of working parts with instructions complete at only.. $11.85

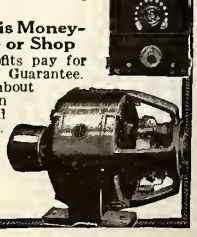
Acme Mfg. Co. Dept. E1E
333 South Dearborn Street, - CHICAGO, ILL.

PROFITS for YOU — Charging Batteries — Making Electric Lights

The HB Lighting and Battery Charging Set makes your electric lights for as low as 2c per KW. and at the same time brings profits of $100 to $150 per month charging batteries. Sturdy, dependable, economical to operate from line-shaft or engine. No electrical experience required.

Small Payment Puts This Money-Maker In Your Garage or Shop

Balance on easy terms. Profits pay for outfit. Absolute Money-Back Guarantee. Ask our Service Department about proper size for your needs. Pin this ad to your letterhead and write TODAY for information.



HOBART BROTHERS COMPANY
Box 105E, Troy, Ohio
Successful Manufacturers Since 1893

CLEARTONE PHONOGRAPHS

$4.00 to $200.00 Retail



Needles 45c per thousand in lots of 500,000 Motors $1.35 to $14.75 each. Tone Arms and Reproducers $1.30 to $5.75 per set. Main Springs 20c to 90c each. Records, Needles, Sapphire Points and Parts at reasonable prices.

Write for our 84 page catalogue, the only one of its kind in America, illustrating 33 different styles of Talking Machines and over 500 different Phonographic Parts.

LUCKY 13 PHONOGRAPH COMPANY
Export Dept. 46B E. 12th St., N. Y., U.S.A.

www.americanradiohistory.com

pany was without funds and the Richmond project was in a serious situation, due to too much mathematics on the part of Mr. Sprague, I came forward and trusted his company for over $100,000 worth of apparatus and the aid of my men to pull the scheme thru.

What Mr. Sprague can really claim is that by his persistence and electrical knowledge he was the first one to start the trolley car system commercially. This is what I have always thought and publicly stated.

THOMAS A. EDISON.

Orange, N. J., September 3.

Treasure Ships Located Electrically

(*Continued from page* 512)

simple matter to locate the wreck. All the commander of his submarine will have to do is to cruise back and forth near the spot where the sunken vessel is supposed to lie. Sooner or later the faithful induction balance will find the wreck.

In our illustration it will be seen that the balances can be raised or lowered by means of winches on board the submarine. This is necessary because the submarine floats at a certain level. The depth of the ocean naturally varies more or less; if a deeper strata is encountered, the induction balances must be lowered further than in cruising in shallow water. Not only will the induction balance give us the exact spot where the ship is located, but it will also give us the exact location if the ship should be entirely covered with sand or silt.

The cost of an outfit of this kind is negligible, as such an under-water Hughes balance can be constructed for less than $100.

MEASUREMENTS OF WAVE-LENGTHS IN THE SPECTRUM OF NEON.

The lines in the neon spectrum are very sharp, a quality which recommends this gas as a standard source wherever the lines have sufficient strength. The ultra-violet group between 3369A and 3520A may be used for standards, and there are a few good infra-red lines, but the strength and distribution of the lines in the region 5852A to 7438A make the neon spectrum particularly useful as a comparison in this region, says the *Bureau of Standards* Bulletin.

The wave-lengths of fifty-five lines in the neon spectrum have been measured by means of the interferometer. These lines lie in the region of 3369A to 8495A. The strong lines in the visible region of the spectrum have been observed with great accuracy, the probable error being one part in several millions, or less than one-tenth the width of the line. These strong lines were observed by means of three different pairs of interferometer plates, which were each used on several interferometers. The ultra-violet lines and all the strong lines in the visible were compared directly with the fundamental standards 6438A. Some of the deep red and infra-red lines were compared with well-determined lines in the visible neon spectrum.

One hundred and eighty-nine faint lines in the visible and infra-red neon spectrum have been measured by means of a concave grating. The probable error of these grating measurements is one or two hundredths angstrom. The region covered by the grating observations extends from 5343A to 8783A.

The constant differences discovered by Watson are found to hold with remarkable exactness in the case of lines which are strong enough to be measured with the highest accuracy. In fact, the differences are exactly constant within the limits set by the accuracy of the wave-lengths.

Do Germs and Climate Cause CATARRH, Coughs and Colds?

By R. L. ALSAKER, M.D.



R. L. ALSAKER, M.D.

NOTE.—Dr. Alsaker is a successful practicing physician in one of the largest cities of the U. S.

Doctor Alsaker: I have had catarrh since boyhood, and now my two children have it. During the winter months my wife suffers with bad colds.

We have taken treatment from local physicians, using the medicines prescribed; we have used sprays and salves, but have derived no lasting benefit.

We live well, eating and drinking whatever we want, but we do not dissipate in any way. Our family physician tells us that catarrh is caused by germs. Another doctor told us to blame it on the climate. If germs and the climate are the cause of catarrh, I don't see how it can be prevented or even cured. What have you to say on the subject? J. B. W.

THIS family is no exception. The majority have catarrh, either chronic or acute. Catarrh of the head is annoying—and filthy. In the throat it causes irritating coughs. When it is seated in the chest it is called bronchitis. If allowed to continue, the bronchitis becomes chronic and robs the individual of refreshing sleep, comfort and health. It weakens the lungs and paves the way for pneumonia and consumption.

Catarrh of the stomach and intestines points toward indigestion. So does catarrh of the liver, which produces various ills, such as jaundice and gall-stones, often ending in disagreeable and painful liver colic.

Catarrh sometimes causes earache, headache and other forms of pain, and it lays the foundation for many diseases.

This gentleman says that he lives well, but no one lives well who is ill. That is poor living. He can continue to eat what he likes, and grow healthy, if he will only learn how.

He thinks that germs and the climate are to blame, and as germs and climate are everywhere, we are helpless. It is a tragic fate, or would be, if it were true, for we can't escape the omnipresent germs and climate.

But neither germs nor the climate causes catarrh. Catarrh is due to improper eating—so are coughs and colds—and these conditions can be prevented and cured through right eating. And here is how it happens:

When people eat as they should *not*, they get indigestion, which fills the stomach and bowels with acids, gases and poisons; a part of these abnormal products are absorbed into the blood, which becomes very impure and the whole body gets acid. The blood tries to purify itself, and a lot of the waste attempts to escape by way of the mucous membrane. This causes irritation, and the result is colds and catarrhs.

The right kind of food, properly eaten, makes pure blood and produces health, vigor and strength. The right kind of food builds a sound body, puts catarrh, pimples and blotches to flight, and paints roses on the cheeks and makes life worth living.

Catarrh can be conquered quickly, surely and permanently. It has been done in thousands of cases. *If you have catarrh you have eaten your way to it.* You can cure yourself—you can eat your way out of catarrh into health, and while you are losing your catarrh you will rid yourself of other physical ills: The dirty tongue, that tired feeling, the bad taste in the mouth in the morning, the gas in the stomach and bowels, the headache and other aches, pains and disabilities will clear up and vanish. It is marvelous what proper eating will do, when other means fail. Don't take my word for it, but prove it in your own case and on your own person.

Catarrh is a luxury, not a necessity. Those who get it, can keep it indefinitely. They can also get rid of it and stay rid of it. Those who have catarrh should not complain about it, for they can easily get the knowledge that will show them how to get rid of catarrh and back to health.

Realizing the universal need of clearly defined instruction on the cause and cure of catarrh, coughs and colds, I have outlined in a small volume an attractive plan of living that has proved successful in curing and preventing these troublesome conditions. My instructions are easy to understand and pleasant to follow.

The plan shows how to live so as to have health at all times. It tells you in plain English the true cause of catarrh, and it gives you the true cure—a cure that works. There is nothing mysterious about it. You need not go to health resorts. You need not take drugs. It is simple, good, workable common sense that you can apply without expense *right in your own home.* The title of this book is, "CURING CATARRH, COUGHS AND COLDS." Its price is considerably less than the usual charge for prescribing treatment—less than the usual charge for a patent "cure all" *that doesn't cure*—less than it would cost you to lose a day's pay on account of sickness—less than the cost of an evening at the theatre. In fact, its real value to you cannot be measured in dollars and cents.

Send only two dollars and ten cents to my publisher, Frank E. Morrison, Dept. 312, 1133 Broadway, New York, and get your copy of this book of instructions. Follow my complete plan of treatment for the cure of Catarrh and the prevention of colds, for one month; then if you are not entirely satisfied with the improvement in your health, return the book and your money will be refunded to you.

Remember this: If you want to free yourself of Catarrh you can do so. You have your choice of living right or living wrong. This book teaches you the truth and nothing but the truth. Get it.—

(*Continued on page* 560)

PUBLISHER'S ANNOUNCEMENT: R. L. Alsaker, M.D., is an eminent authority on the subject discussed in the above article. He has a large and constantly growing practice; his patients come from all corners of the globe and they learn from him how to get well and stay well. He has put the net results of his many years of professional experience with sick people into his writings and it is a real pleasure for me to recommend them, because I know from personal experience and observation that good results *always* follow an observance of his simple instructions. Don't risk another day's sickness. Send $2.10 for "Curing Catarrh, Coughs and Colds" and learn quickly how you can get back to health and happiness. Money returned if you follow instructions for one month and are not entirely satisfied with your improvement in health. FRANK E. MORRISON (Estab. 1889), PUBLISHER, Dept. 312, 1133 Broadway, New York.

www.americanradiohistory.com

(*Continued from page* 559)

The Alsaker Way

The most remarkable cures known to man have been produced without the use of drugs in any form. Don't continue wasting money for pills, powders and potions. Stop trying to live, or make a living in violation of natural laws. Send $2.10 for any one of the following guides to health and learn how to feel well and vigorous all the time.

Book 1. "Curing Catarrh, Coughs, and Colds."

Dr. Alsaker tells you in simple English the true cause of Catarrh, and he gives you a true cure—a cure that works. He does not prescribe salves, sprays, drugs, nor medicines of any kind. This book costs no more than a single visit to your doctor, and less than you have paid for medicine that has not cured your trouble.

Book 2. "Getting Rid of Rheumatism."

You need not take drugs nor waters, nor have your teeth extracted to cure Rheumatism. Learn from this book the true cause of Rheumatism, and then follow instructions for the correct use of the foods you like, and you will get rid of your rheumatic pains and aches.

Book 3. "Dieting Diabetes and Bright's Disease."

Dr. Alsaker explains in this book the many causes of Diabetes and Bright's Disease, and tells how, when, and what to eat to regain health. He shows how a cure may be effected if a cure is possible, and how to prolong the life of those who cannot regain full health. This book would be cheap at $50.00.

Book 4. "Curing Constipation and Appendicitis."

Medicines will not cure Constipation. Constipation and Appendicitis are due to the wrong use of foods. Indigestion is generally the first stage, then Constipation, then Appendicitis. The cause and cure are fully explained in this book. Learn from it what to eat to overcome Constipation, and to prevent Indigestion and Appendicitis.

Book 5. "Conquering Consumption."

In this book Dr. Alsaker has explained the true cause of the disease, and how to overcome it in its early stages—without drugs, serums, or sanitariums. A complete, satisfactory, and successful treatment is given in this book. Sufferers have paid thousands of dollars for less valuable advice.

Book 6. "Curing Disease of Heart and Arteries."

It is generally believed that arteriosclerosis, high blood-pressure, apoplexy, and chronic heart disease cannot be cured. This is far from the truth. This book explains how those who suffer from these diseases can be made safe, and how many of them can make complete recovery even after they have been given up as incurable.

Book 7. "How to Cure Headaches."

A headache is an indication that something is wrong somewhere. There must be a cause, and that cause must be found and removed before permanent relief can be got. This book explains how to find the true cause, and how to prevent and cure headaches of all kinds.

Book 8. "How to Live on 3 Meals a Day."

This is a book of food facts, showing in a common sense way how to reduce the cost of good foods and increase the pleasure and profit of eating. It contains scores of balanced menus for the whole family.

Publisher's Personal Guarantee of Satisfaction or Money Refunded.

An investment in any of these books will pay **daily** dividends in health and happiness as long as you live. It will enable you to save many dollars that might otherwise be wasted on worthless and harmful "cure alls"—and that's the truth!

As soon as you receive your book, read every page thoughtfully. Then put its teachings into daily practice. Give **The Alsaker Way** an honest trial for 30 days. The plan is pleasant and practical to follow and you are sure to be satisfied with **results**. You take no chances in sending your money **today**, because if you are not satisfied after a 30 day trial you may return the book and I will refund your money. So send me $2.10 today for the book **you** need, and I will mail it, postpaid, the day your order is received.

Frank E. Morrison (Estab. 1889), Publisher,
Dept. 313, 1133 Broadway, New York.

The Submarine's Underwater Radio

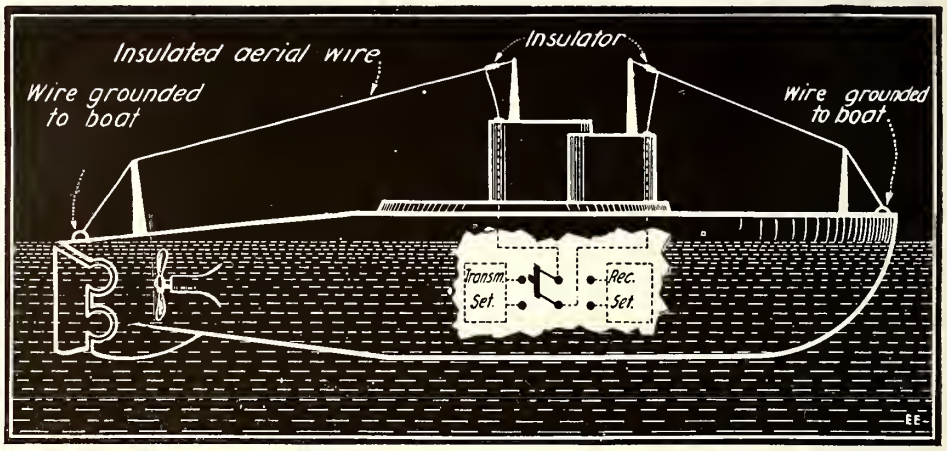
(*Continued from page* 539)

"Messrs. Willoughby and Lowell, of the Bureau of Standards, working for the Navy Department, have completed a series of experiments in transmitting and receiving radio signals on board submarines. Their results from using a single turn "loop" are very promising and incorporate the most complete data ever obtained in receiving and sending radio signals on board submarines."

Signals Received 6,000 Miles.

We are glad to have the opportunity of presenting herewith official report on the work in "Submarine Radio" conducted by Messrs. Willoughby and Lowell, of the Bureau of Standards, in coöperation with the Navy Department, at the submarine base at New London, Conn. In the tabulated results below we find one of the most remarkable wireless tests ever conducted—a submarine under water receiving signals from Nauen, Germany, *a distance of* 6,000 *miles*. The submarine was submerged eight feet during this particular test. We are indebted for this information to Dr.

(*Continued on page* 584)



The New Submarine Loop Antenna as Installed by the Radio Engineers Who Made the Tests Here Cited. The Receiving Record—6000 Miles.

"RECEPTION" RESULTS, ON BOARD SUBMARINE

Date 1918	Wave length in meters	Distance in miles	Power	Depths at which readable signals could be heard, measured from top of loop to surface of water
June 10	6000	200	100 k. w. undamped (Arlington)	16 ft.
June 11	9600	100	150 k. w. undamped (N. Brunswick)	21 ft.
June 11	9600	100	150 k. w. undamped (Tuckerton)	21 ft.
June 21	10000	3000	250 k. w. undamped (San Diego)	8 ft.
June 21	13000	6000	? undamped (Nauen, Germany)	8 ft.
June 21	2500	200	Arlington's Spar's	8 ft.

"TRANSMISSION" RESULTS, ON BOARD SUBMARINE

Date	Wave Length in Meters	Actual Distance in Miles	Estimated Maximum Distance in Miles	Current in Amperes	Remarks
1918 Sept. 12	540	50	150	12	Submarines running full speed on surface in heavy sea.
Sept. 12	600	50	150	11	Submarines running full speed on surface in heavy sea.
Sept. 12	756	50	100	10	Submarines running full speed on surface in heavy sea.
Sept. 12	952	50	80	8	Submarines running full speed on surface in heavy sea.
Sept. 16	540	97	150	12	Submarine tied up at dock.

			Current in Amperes		
			Surface	Submerged	
Sept. 9	952	12	12	6	Submarine submerged running full speed with top of loop near surface.
Sept. 16	952	9	12	6	Submarine submerged and balanced so that top of loop was submerged a few inches.
Sept. 16	952	3	12	6	Submarine submerged and balanced with top of loop submerged 9 feet.

www.americanradiohistory.com



18 cents a package

Camels are sold everywhere in scientifically sealed packages of 20 cigarettes; or ten packages (200 cigarettes) in a glassine-paper-covered carton. We strongly recommend this carton for the home or office supply or when you travel.

Camel CIGARETTES

YOU'LL prefer Camel Cigarettes expert blend of choice Turkish and choice Domestic tobaccos to either kind smoked straight. *Your taste will prove that!*

Camels are so exceptional in flavor, in fragrance and in mellowness that you quickly realize their remarkable quality. It will be your constant delight to find Camels so *full bodied* though so mild and smooth. You may gratify your keenest desires to smoke liberally. Camels *will not* tire your taste.

Your enjoyment increases as you get to know Camels better. They return such generous cigarette satisfaction. Camels *certainly fit your taste* exactly as if they had *been made for it.*

Camels are unlike any cigarette you ever smoked. For instance, they leave no unpleasant cigaretty aftertaste or cigaretty odor. In fact Camels are in a class by themselves! That's why we ask you to *compare Camels with any cigarette in the world at any price!* You will not look for or expect premiums, coupons or gifts. *You'll prefer Camel quality!*

R. J. REYNOLDS TOBACCO COMPANY, Winston-Salem, N. C.

www.americanradiohistory.com

Telephone Men Use These a WEEK FREE

ACCEPT this **free** offer and use these great up-to-date books on the telephone in your own home or shop a whole week free.

We will send you all four volumes bound in genuine red morocco leather, 1728 pages and 2000 pictures, without one cent in advance.

Cyclopedia of TELEPHONY AND TELEGRAPHY

Everything about the telephone is explained in them in simple and plain language—theory—practice—operation—from the first experimental line to the modern equipment and complicated switchboards. Not one detail has been overlooked. Every vital fact that you need to make you an expert is in them.

Free Consulting Service

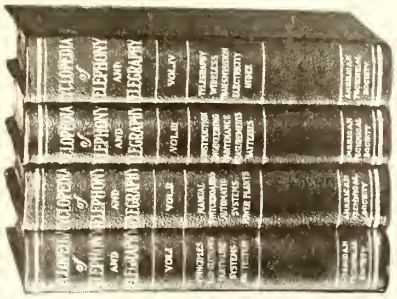
If you wish to keep the books on our easy terms of $2.00 a month, we will include FREE a year's Consulting Membership in the American Technical Society, and you can have the services of our engineers and experts for one year as often as you wish to write in—ask for their help on any subject within the scope of books.

Send the Coupon Now

Don't send any money. Just mail the coupon properly filled out and the books will come to you at once by express collect. Keep them a whole week and use them as if they were your own. Send them back to us if you want to, but give them a trial anyway, and if you keep them send us only $2.00. You can send the balance of the special $12.80 price the same way—$2.00 each month.

Give yourself a chance to make some real money—right now. Send the coupon before you turn this page.

American Technical Society
Dept. T 257 **Chicago, U. S. A**



American Technical Society, Dept T 257, Chicago

Please send me a set of Telephony and Telegraphy in 4 volumes, express collect. I will send you $2.00 in 7 days and $2.00 each month until I have paid $12.80. If I don't want to keep the books I will return them to you in one week and will owe you nothing.

Name.....

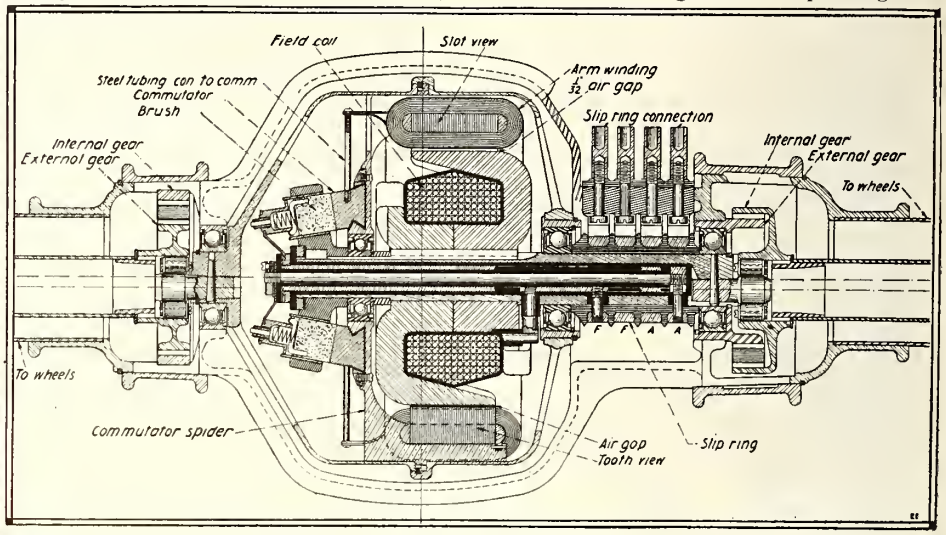
Address.....

Reference.....

A New Era Electric Auto

(*Continued from page* 523)

charge. On this basis, for every pound weight saved in mechanical construction an additional pound can be saved in the battery weight; thus it can be truly said that "one pound saved is two pounds earned." The total weight of the rear axle, which includes the entire power plant, is approximately 100 pounds; which is several hundred pounds lighter than any other known to the writer; air springs will save 50 pounds; the wood frame with truss rods accounts for another 75 pounds. These savings are all duplicated in the battery weight, and are only a few of the many savings thruout the car that enables it to be produced at such record light weight, considering its size; but lightness begets lightness, and that is the whole secret.



Sectional View of the New "Dey" Electric Automobile Motor Which Has a Revolving Field as Well as Revolving Armature. This Motor Fits on the Rear Axle, Each Revolving Unit Driving One Wheel. No Differential Gear Is Necessary.

The inventor has largely increased the future field for his car by designing a *portable charging plant*, weighing only about 100 pounds, to be carried under the bonnet of the car. It comprises an exceptionally neat four-cylinder, four-cycle air-cooled engine, minus its flywheel; it is direct connected to the ring armature of a dynamo very similar in design to the motor; its field, however, is stationary. The cylinders of the engine are made of steel tubing, the cooling flanges of which are machined on by rotating the cylinders before a gang of milling cutters that cuts all in one operation. The flanges being formed in this manner permits doubling or tripling the radiating surface, as compared with cast cylinders. There are a number of other special features about the cooling arrangements that should produce an exceptionally well cooled engine, even if we did not consider the small size; for it requires less than two horsepower to meet the power consumption requirements on the road. With this combination the mileage per gallon will be at least *twice that of a gas car;* due to the engine always running at its maximum efficiency load, while a gas car does not average one-tenth of its rating; making its efficiency very low, probably not one-tenth of its best. The experimental car, which weighed 400 pounds more than the commercial vehicle, will *consume less than two electrical horsepower when running at 23 miles per hour* on level dirt roads. Hills will not appreciably change the figures for an average, for there are as many downs as ups in a round trip, and unless a grade is steep enough to make a demand upon the brakes the excess force of gravity will be stored in the form of momentum; and in the Dey Electric the motor converts its braking power into electricity that is stored in the battery; so there is very little loss due to hills, regardless of how steep their grades.

This plant will charge the battery at any time, while the car is running or standing. An automatic device stops the engine and opens the charging connection whenever the battery becomes fully charged. The dynamo acts as a starter when charging is desired. If short runs are the rule, *the plant can be removed from the car and used as a stationary charging plant for both the car and a stationary battery for house lighting.* It is a simple matter to replace at any time for long-distance touring. With the generating outfit aboard one-half of the battery equipment can be dispensed with, thus making a net saving in the weight of the car exceeding 100 pounds. The cost of the plant will also be largely cancelled for the same reason. When ladies drive it will probably be mainly as a plain electric; there is nothing, however, to prevent them using the engine, for the turn of a switch will set it going with a pep not equaled by any self-starter. The operation will be as quiet as any automobile engine.

$1000.00 Reward! For a Single Word

Can you create the one word which will best denote the United States and all parts of Britannia? If so, you will be paid at the rate of $1,000 a word. The World Trade Club of San Francisco has offered $1,000.00 to the person who suggests the word which, in the judgment of the club's Metric Campaign Committee, is best adapted to world-wide use.

The competition is open to all humankind. The money will be paid to the winner at noon on the 15th of May, 1920, by a committee appointed by President W. H. Hammer of the World Trade Club.

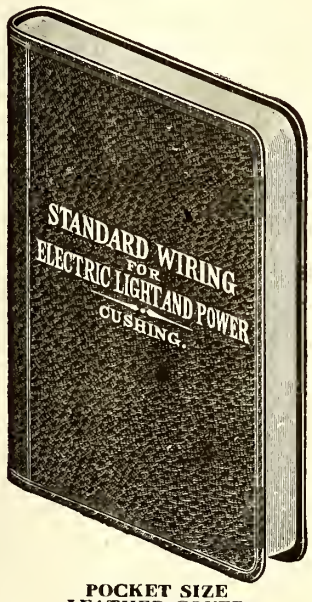
"Brit-Am," "Ambria," Ambrittica," "Brit-Am," "Sam-Bull" are some words thus far suggested. New names are constantly coming. The World Trade Club is offering this award because in carrying on its present compaign for the adoption of metric units by all English-speaking people—the United States, the British Isles, Canada, Australia, New Zealand, Tasmania, United South Africa, and so on—it was hampered by the lack of a single short word which would express all these.

The metric units of weight and measure are now used by all the world except "Brit-Am" or "Ambrittica," or "Sam-Bull."

www.americanradiohistory.com

LEARN WIRING

Earn $30.00 to $60.00 a Week



POCKET SIZE
LEATHER COVER

This Latest Edition of "STANDARD WIRING" *Will Make You An Expert Wireman*

GENERATORS—How to install them, care for them and operate them; all their troubles and how to prevent and cure them; all diagrams showing connections for compound, series and shunt wound machines. How to operate them in parallel or in series. How to protect them and wire them in accordance with the underwriters' requirements.

MOTORS—How to install them, how to protect and operate them. The required amperes, volts or horse power when any two factors are known. How to take care of hot boxes, sparking commutators and other troubles. How to change the direction of rotation when desired. How to start and stop any kind of motor in any class of service. All diagrams of motor wiring. How to find the proper size of wire for any motor for direct current or for A. C. single, two or three-phase.

OUTSIDE WIRING—Pole line construction, line wires, service wires, roof structures, poles and their dimensions and weights, and how to erect and protect them and wires they carry. Insulators, guard arms, guy anchors. Tree wiring, splicing, service and entrance wiring. How to install Lightning arresters. Transformers with diagrams and instructions.

INSIDE WIRING—when and where to use rubber covered, slow burning and weatherproof wire. How to find the proper size of wire to use for lamps, motors or heating devices for any current, voltage and drop, either by formula or by the many tables that are given in this section of the book. How to wire for two-wire or three-wire systems. Direct current, two-phase and three-phase with formulae and tables, with examples worked out for each system and in a simple manner that anyone can understand and use. How to run wires on walls, ceilings, floors, through partitions and walls and in concealed places, damp places and where dangerous surroundings exist. When and where to install Switches, Cut-outs and Circuit Breakers and just how to do it. How to wire for high and low voltage systems and the precautions to be taken. The proper way to install Knife and Snap Switches, Cabinets and Cut-out Boxes, Outlet, Junction and Switch Boxes, Panel Boards, Wooden and Metal Raceways. How to install complete interior conduit jobs either for rigid metal, flexible metal or flexible non-metallic conduit. Concealed knob and tube work or armored cable. How and where to install and wire electric and combination lighting fixtures. How and where to use flexible cord and where not to use it. How to install arc lamps and gas filled lamps and the fixtures and rules required.

LIGHT AND ILLUMINATION—What is meant by proper and efficient illumination, the latest data on Mazda and gas filled lamps of every candle power and wattage. Direct, indirect and semi-indirect illumination and where each should be used. Illumination required for various classes of service from show window lighting to public halls and from factories to small residences.

TABLES—Fifty-two tables giving every dimension, carrying capacity, resistance, weight and strength of every size of wire and cable of copper, steel and iron.

All the necessary dimensions, capacities, weights, and other data on conduits, fuses, insulators, lamps, sockets, motor efficiencies, current per horse power of motors.

Electrical units and their equivalents. Proper size of wire for all classes of power, light and heating installations. The proper symbols to use to indicate on plans just what is wanted from a motor to a small snap switch with all necessary diagrams.

APPARATUS AND SUPPLIES—A classified list of the leading manufacturers of officially approved wires and wiring devices. Engines, generators, motors, appliances, fixtures, and all supplies necessary for any complete installation from a Central Station to a small cottage.

The most complete and accurate Book on Wiring and Construction published

350 PAGES - LEATHER COVER - POCKET SIZE, $1.50

Sent Postpaid to Any Address on Receipt of Price by

H. C. CUSHING, Jr., 8 West 40th St., New York

Every Electrical Inspector in the United States will approve your work if done in accordance with the simple rules given in "Standard Wiring"

www.americanradiohistory.com

Don't Belong to the Great Unfit



STRONGFORT
The Perfect Man

You see them on every side—men who don't count—men who are losing every chance of happiness and success in life, some because chronic ailments are wasting away their energy; others through loss of their vitality through early excesses and dissipations.

Has Constipation, Indigestion, Biliousness, or any other chronic ailment got a grip on YOU? Do you feel that you are not as good a man as you used to be; that your former pep and punch and energy is ebbing away? Are YOU slipping gradually into that great army of hopeless, useless, broken-down humanity? If so, **take hold of yourself at once, act quick, and**

Fight Your Way Out

You can do it, if you will only WILL to do it. You can free yourself of your handicapping ailments and build yourself up. You can turn the watery fluid in your veins into rich, red blood, develop your muscles, strengthen all your vital organs, get back the power—THE MANHOOD—you have lost, and have every chance in the world of becoming a big, strong, successful MAN, if you ACT NOW and go about it the right way.

STRONGFORTISM

Strongfortism is the one way out for weak, anaemic, ailing men. It is Nature's way, and Nature is the greatest Builder Up the world has ever known. Put the machine that Nature gave you in shape to do its work; live life as Nature meant it to be lived, and health, strength, happiness—everything worth while in the world—is the inevitable result.

I KNOW. Thousands of my pupils, many of them discouraged, broken-down wrecks when they took up Strongfortism, are walking the streets today, strong, vigorous, healthy, able MEN.

I GUARANTEE to improve you 100 per cent. if you will follow my directions for a few months. It doesn't make any difference what your present condition is or what brought you to it, I can and will do what I claim, and without patent medicines or drugs of any kind.

Send for My FREE BOOK

I have put the results of my life's work, Building Up Men, into **"PROMOTION AND CONSERVATION OF HEALTH, STRENGTH AND MENTAL ENERGY."** It tells you all about Strongfortism. It will show you how YOU can rid yourself of your ailments, build yourself up, make yourself a well, strong, energetic man again, in **Nature's way.** Send for it today. IT'S FREE—but it's worth good money to any man who wants to be strong and virile. Don't wait. Only send three 2c stamps to cover packing and postage, and I'll mail you a copy at once.

LIONEL STRONGFORT
Physical and Health Specialist
1069 Strongfort Institute NEWARK, N. J.

DIAMONDS WATCHES ON CREDIT

SEND FOR FREE CATALOG

There are over 2,000 photographic illustrations of Diamond Rings, Diamond La Vallieres, Diamond Ear Screws, Diamond Scarf Pins, Diamond Studs, Watches, Wrist Watches; also our wonderful showy assembled Solitaire Diamond Clusters.



Diamonds Win Hearts Cased in Handsome Ring Box



Loftis Perfection Diamond Rings

Each Diamond is specially selected by our diamond experts and is skillfully mounted in our famous Loftis "Perfection" 14-karat solid gold 6-prong ring, possessing every line of delicate grace and beauty

$10 Down, $5 a Month, buys a $50 Ring.
$20 Down, $10 a Month, buys a $100 Ring,
$25 Down, $12.50 a Month, buys a $125 Ring.

Every Article in Our Large Jewelry Catalog is specially selected and priced **unusually low.** Whatever you select will be sent prepaid by us. **You see and examine the article right in your own hands.** If satisfied, pay one-fifth of purchase price and keep it; balance divided into eight equal amounts, payable monthly. Standard world-renowned watches on credit terms as low as $2.50 a month. Send for Catalog. **LIBERTY BONDS ACCEPTED.**

LOFTIS BROS & CO. EST'D 1858
The National Credit Jewelers
Dept. E-22. 108 N. State St.
CHICAGO, ILL.
STORES IN LEADING CITIES

MUSIC TAUGHT FREE



In Your Home. Write today for our booklet. It tells how to learn to play Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced pupils.
American School of Music, 57 Lakeside Bldg., Chicago

Legless -- He Drives Auto Skilfully

(*Continued from page* 530)

both sides of the car are electric chime bells, which may be rung from conveniently placed push buttons, and the car is thoroly equipt with electric lights, both inside and out. Moreover, not only is this car used for pleasure purposes, but it is also used to economize on the High Cost of Living. The car is equipt with two small stoves on which the cooking is done, the fuel for the same amounting to about 10 cents per week. All cooking utensils are placed in a very tidy position, as neat as any housewife would care to have them. There is a collapsible bed, which can be stretched out and slept in with ease and comfort. This, too, is so arranged that a small tent, which is always carried, may be pitched in some open field on the road from here to "somewhere West," and the bed removed from the car and made use of in the tent. And talk about other comforts, you'll find the machine fitted with an electric fan and dozens of smaller items too numerous to mention, such as a clothes rack, medicine chest—in fact, anything which a small modern home can make use of. According to Mr. Hammel, the only thing that is lacking is a "wife."

Perseverence is the thing that counted. Mr. Hammel has obtained his chauffeur's license after being placed under the most excruciating quizzes which the State License Bureau could possibly give. So cheer up, all you individuals without the use of limbs. This device has been patented and placed on the market, so you will have no difficulty in mastering the science of automobiling, tho legless, and may enjoy your rides without the expense of a chauffeur.

WAR IDEAS SENT U. S. FROM ALL OVER WORLD.

The latest war secret to leak out is how friendly inventors from all over the world gave to the United States their ideas for death-dealing machines for the destruction of Germany.

A companion secret is how all these ideas were kept from the enemy by the "seven serious sphinxes" of the Patent Office. This was a board of seven men, of unquestioned loyalty and sworn to secrecy, empowered to examine and withhold patents on war machines until the war was over and meanwhile turn ideas of promise over to the Government.

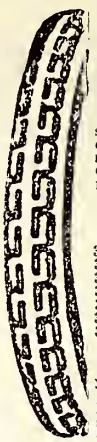
Among the spectacular inventions were the depth bomb, submarine signals, and devices for air photography. The committee approved a patent for the special leather for trench shoes, designed to resist the mud and water. It also approved a patent for special alloys for use in steel tools to turn out shells. Patents for wireless and aiming machine guns from airplanes were past upon.

More than 2,000 devices which it was thought might be of value to the United States or the Allies were past upon and 200 were important enough to get before military authorities. Some of them, it is said, helped win the war.

The ideas came from England, France, Switzerland, Hawaii, New Zealand, Australia, Mexico, Spain, Italy, Russia, Poland —*and one from Germany!* Of course, a larger number came from within the United States. Now that the war is over, the patents are being allowed.

Patent Commissioner Newton's committee included five who were West Point or Annapolis graduates, being Sidney Smith, A. E. Glascock, J. H. Colwell, F. W. Holt and F. C. Skinner. They were assisted by A. C. Lewers, chemist, and William J. Rich, metallurgist.

GET MORE MILEAGE at 1/4 the Price



Guaranteed for 4500 Miles
STANDARD GUARANTEE

Good-Wear Double Tread Tires are reconstructed by our skilled mechanics, made of double the amount of fabric than any ordinary tire. Free from punctures or blow outs. Our customers receive from 4,000 to 10,000 miles of service. Reliner Free.

Order today at these low prices:

Size	Price Tire	Tubes	Size	Price Tire	Tubes
30x3	$5.50	$1.60	34x4	$8.75	$2.60
30x3½	6.50	1.75	34x4½	$10.00	3 00
31x3½	6.75	1.85	35x4½	11 00	3.15
32x3½	7.00	2.00	36x4½	11 50	3.40
31x4	8.00	2.25	35x5	12.50	3.50
32x4	8.25	2.40	36x5	12.75	3.65
33x4	8.50	2.50	37x5	12.75	3.75

Send $2.00 deposit for each tire ordered, balance C. O. D. Tires shipped subject to your examination. State whether S S or Cl, plain or non-skid is desired. All same price. By sending full amount of order you can save 5 per cent—our special cash with order discount.

GOOD-WEAR TIRE & TUBE CO.
2307 Indiana Ave. Dept. 38 Chicago, Ill.

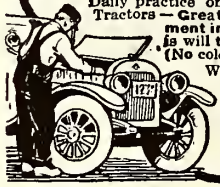
Start a Garage

Make $100 to $400 a Month

Right in your own neighborhood. Be a **Rahe Trained** Motor Mechanic and get into a good paying business at once 30 000 small towns and rural communities without a Garage of any kind.

Learn in 6 to 8 Weeks

Daily practice on Automobiles, Trucks, Tractors—**Greatest Training Equipment in America.** All you need is will to **"Learn By Doing."** (No colored applications).



Write for 7-Day Trial Offer and Big Book **FREE**

RAHE AUTO AND TRACTOR SCHOOL
Dept. 2470
Kansas City, Missouri

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 180 Big Pages, 500 illustrations, 300 instruments and apparatus, etc. Big **"Treatise on Wireless Telegraphy."** 20 **FREE** coupons for our 160-page **FREE** Wireless Course in 20 lessons. **FREE** Cyclopedia No. 20 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.

WIRELESS

Send 6 cents in stamps or coin for which we will send our latest Cyclopedia Catalog No. 20 as described.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

EARN REAL PHONOGRAPH



Beautifully finished, nickel winding crank, spring motor, speed regulator, stop lever. New improved sound box with mica diaphragm—makes perfect reproductions of all kinds of music. A marvelous machine in every way. Delighted thousands of homes.

SEND NO MONEY

Just your name, and we will send you 24 of our Art Pictures to dispose of on special offer at 25c each. Send us the $6 you collect and we will send this new improved E. D. L. Phonograph and a selection of 6 records free.

E. D. LIFE, Dept. T82 CHICAGO

HANDY BINDER
for the Electrical Experimenter

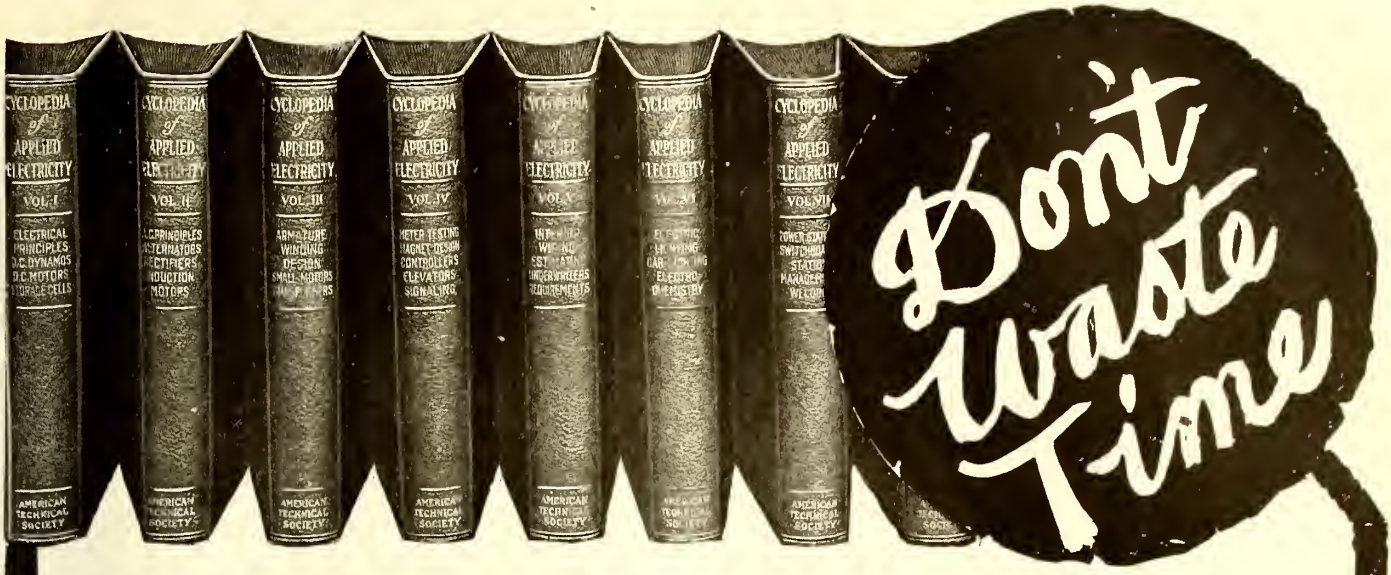
Holds and preserves 12 issues, each of which can be inserted or removed at will, without tools. Will keep your magazines perfectly for all time or just preserve them like new till you bind them permanently. Made of heavy material, extra strongly reinforced at the back and covered with handsome green cloth, suitably lettered in gold.

65c

Add postage for 2 lbs.

Experimenter Pub Co., Inc. Book Department 233 Fulton St., N. Y

www.americanradiohistory.com



Learn Electricity —the New Way

IT'S no longer necessary to go to school or serve an apprenticeship to learn electricity. With this new library of APPLIED PRACTICAL ELECTRICITY you learn right at home—in your spare time without interfering with your present work.

Any big job that you want in the electrical field is yours if you will train yourself to fill it. It only takes an hour or two a day with these books.

This is the 1920 edition—new from cover to cover—chuck full of the latest methods and most recent discoveries in this fascinating field. Everything is written in plain, good old U. S. language by 27 of the greatest experts in the business. The eight volumes with 3800 pages make up a complete course in electrical engineering. It's a home study course for the beginner and a handy reference guide for the expert combined.

Big Pay for Trained Men Jobs paying $1500.00 to $5000.00 a year are waiting for men who can qualify as Electrical Engineers—Substation Operators—Troublemen—Switchboard Operators—Dynamo Tenders—Electricians. Electricity is the greatest force in the world and it is growing bigger and bigger every day. More and more men are needed all the time. Why don't you get into this big paying field now?

Good Jobs Are Waiting If you are trained in some branch of electricity you will never have to look for a job. The job and the big pay will be looking for you. You can't dodge a good job if you have the "know how" under your hat. Let these 27 great engineers help you to the best kind of job with their books.

Send the coupon below and get them for FREE examination. See our free offer below.

What the Books Teach Elements of Electricity—Electrical Measurements—Electric Wiring—Underwriter's Electrical Requirements—Theory, Calculation, Design and Construction of Direct Current Generators and Motors—Types of Generators and Motors—Management of Electrical Machinery—Electric Lighting—Alternating Current Machinery—Power Transmission—Electric Railways—Self-Propelled Railway Cars—Trackless Trolley—Power Stations—Switchboards and Switching—Storage Batteries—Applied Electro-chemistry—Electric Elevators—Electric Welding and Heating—Wireless Telegraphy and Telephony—Land and Submarine Telegraphy.

Free Service With every set of these great electrical books we give a one year membership in this society. This entitles you to consult our engineers and experts on any electrical problem. Write as often as you like. Ask as many question as you like for one year.

The World's Greatest Electrical Books LOANED to YOU FREE

We will lend you this wonderful library to use in your own home or shop a whole week FREE. It won't cost you one cent. DON'T SEND ANY MONEY. Just fill out and mail the coupon today and the set of eight volumes will come to you by express collect. You be the judge and find out for yourself what the books will do for you. Use them as you please. Show them to your friends and get their opinion. Then if you have any doubt as to their value send them back at our expense and you won't owe us anything.

Only 7 Cents a Day

If you like the books after a week's examination you pay us only $2.00 and the same amount each month until $24.80 is paid. This is only 50 cents a week—7 cents a day. You can't afford to pass up a better job on these easy terms. MAIL THE COUPON NOW.

American Technical Society
Dept. E 257, CHICAGO

Coupon is All You Need— Send it Now

American Technical Society
Dept. E 257
Chicago, U. S. A.

Please send me the 8-volume set of Electrical Engineering for 7 days' examination, shipping charges collect. If I decide to buy I will send $2.00 within 7 days and balance at the rate of $2.00 a month until $24.80 has been paid. Then you will send me a receipt showing that the set of books and the Consulting Membership are mine and fully paid for. If I want to get along without the books, I will return them, after 7 days, at your expense.

Name.....

Address.....

Reference.....

www.americanradiohistory.com

Become An Electrical Engineer



A wide open field of opportunity. Present and future demand for trained men unlimited.

B. S. Degree in 3 Years

from the College of Electrical Engineering will start you right in pursuing your electrical career. Over forty experts in science engineering and mathematics form our faculty. The laboratories, shops recitation and drafting rooms where you work are splendidly equipped, furnished with every modern type of apparatus supplies for the most thorough instruction.

NEW FALL TERM
October 1st

No time to lose. Don't delay your start. "Earn While You Learn" if you like. Full provisions for securing deficient high school credits.

Clip the coupon *now* for a copy of the "Photo Story" and the latest bulletin.

SCHOOL OF ENGINEERING OF MILWAUKEE
College of Electrical Engineering
373 Broadway Milwaukee, Wis.

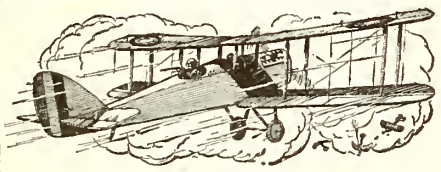
CLIP HERE

School of Engineering of Milwaukee
Milwaukee, Wis.

Gentlemen:—Without obligation, send me catalog, Photo-Story book and particulars concerning your 3-Year Electrical Engineering Course with B.S. Degree.

Name .....
Address .....
City .....State.....
Age .....Education.....

SCHOOL OF ENGINEERING OF MILWAUKEE
116-373 Broadway, Milwaukee, Wis.



Send 5c for this Model Aeroplane Book

Be an Amateur Aviator! This 48-page book tells how you can build and fly "IDEAL" Model Aeroplanes that are true copies—actual, reduced-scale duplicates—of famous Aeroplanes such as the De HAVILLAND Battle Plane, the famous NC-4 Transatlantic Seaplane; and many other well-known and historic machines. They look like the real Aeroplanes and will rise from the ground or water by their own power and fly in the air. You can build one and learn the principles of construction, operation and control. We furnish Complete Construction Outfits containing all parts and full instructions. You put the parts together and build your own Model Aeroplane.

PLANS FOR MODEL AEROPLANES

NC-4, 50c; De Haviland Battle Plane, 35c; Curtiss Military Tractor, Bleriot Monoplane, Nieuport Monoplane, Taube Monoplane, Cecil Peoli Racer—25c each. Send for Plans or Book at once.



IDEAL AIRPLANE & SUPPLY COMPANY

ESTABLISHED 1911
159-161 Wooster Street
New York City
Cor. West Houston St.

SPIDERS TIE UP CABLES.

Spiderwebs are working havoc with cable communication between the United States and Argentina, Brazil, and parts of Chile, as well as paralyzing interior telegraphic routes. The ground spider spins a heavy web which the wind sometimes wraps around the wires. These masses become very damp during a humid spell and short circuits are thus caused.

Large forces of linemen have to follow the wires across the Pampas and the mountains, removing the accumulations.—[When you meet spiders 9 to 10 inches in diameter and weighing a pound or two, you may expect "trouble" somewhere.—ED.]

PHOTO COURTESY CORRECTION.

We wish to make a correction in giving courtesy for the article entitled "NC Planes Had Electric Self Starters," which appeared on page 411 of the September issue, and which was credited to The Westinghouse Electric and Mfg. Co., in error. This credit should have been given to the General Electric Co., and the makers of the Liberty motor electric starter used on the NC planes in the trans-Atlantic flight to Europe, was the Bijur Motor Appliance Co.

Investigating "Psychical Phenomena With Scientific Instruments"

(*Continued from page* 521)

convinced of the reality of these phenomena,—was busy devising an instrument which would register and direct *psychic power* liberated from the body of a physical medium when in trance.

Dr. Imoda, the assistant of Professor Mosso, has also conducted a number of experiments in the discharge of an electroscope, by means of "rays" issuing from the medium's body. It was found that, if the medium held her fingers at a distance of an inch or so from the knob of the electroscope, some form of energy, apparently *radio-active* in character, issued from her fingers, and *gradually discharged the electroscope*. This is the "radiation" or "emanation" issuing from the body, which has been studied extensively by students of the occult. Dr. Imoda concluded—as the results of his experiments—that *"the radiations of radium, the cathode radiations of the Crookes' tube, and mediumistic radiations are fundamentally the same."*

Some other very interesting facts have been observed, by means of the electroscope. For example, Dr. W. J. Crawford (D.Sc.), in his experiments, noted that:—

". . . In séance rooms where tables are moved without physical contact, I found that after a sitting was well started, I was always *unable* to charge an electroscope, even tho I tried to do so in the corner of the chamber farthest from the medium. In order to charge it I had to take it outside the room. I asked the 'operators' (intelligences 'running things,' apparently, in the séance-room) if there was any 'power' in the séance-room so far away from the medium, and they answered in raps that there *was*. By 'power' I understand them to mean particles of matter taken from the medium . . ."

Again, in his "Reality of Psychic Phenomena," he says:—

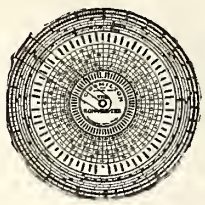
"I took the electroscope to the table in the corner; then placed it in the circle near the medium. I asked the operators to touch the disc of the instrument very gently. They did this almost at once, the 'touching' consisting of a metallic scraping upon the brass disc, quite audible, similar in type to the imitation of the floor being rubbed with sand paper, a phenomenon I quite often observed. (*Continued on page* 571)

SELENIUM CELLS

Made by entirely new process. Highly sensitive and quick-acting. Suitable for all experiments. From $5 up.

Write for Catalog

Selenium Laboratories
Good Ground, Long Island, N. Y.



SPECIAL KON-VER-TER SLIDE RULE

The Hamilton KON-VER-TER slide rule has over 8000 gradoations and over 1800 characters on it, will handle anything in Arithmetic, Algebra, Geometry or Trig. This slide rule is in use in all parts of the world and is much simpler to operate than others of similar lines. Does not require a wizard to use it.

Eventually you will get this rule, get it now and save the extra bother and expense. Utility rules $1.00. Special De Luxe, white ivory celluloid $2.50, instructions free. Leatherette case 50c extra.

J. C. HAMILTON & CO.,
Dept. B 7 Water St., Boston, U.S.A.



Says the Master Mechanic. The Greb Automatic Grip Puller is a One-Man Puller—Quick-acting, strong and simple in the extreme. May be locked in any desired position. A combination of two or three arms. Heavy Duty Size capacity 1" to 18"—Junior size capacity 1" to 7". Two sets of jaws furnished with each size.

Ten Days' Trial If your dealer or jobber does not have them we will send you one. Try it ten days. If not satisfactory, return to us and we will refund your money. We also make the GREB RIM PULL.

THE GREB CO., 230 State Street, BOSTON



FINLAY Engineering College
Kansas City, Missouri
Only School of the Kind In the West
Specialties: Electricity, Steam, Gas, Armature Winding, A. C., D. C. Auto. Intensive training, courses, six weeks, three and five months, year, day and night. Enroll any time.
Write for Catalogue W.



Handsome TELESCOPE for selling 25 art and religious pictures at 10c each. Also other valuable presents, watches, air rifles, cameras, talking machines, typewriters, etc. Send no money. We trust you.
SPENCER PUB. CO. Dept. 304 Chicago

STAMPS

50 diff. Belgium (large bi-color), China, Jamaica, Portugal, Venezuela, etc., 10c; 100 diff., nice packet, 20c; 1,000 well mixed, 40c; 100 war, U. S., 50c; 1,000 hinges, 10c; Agts. wanted, 50%. List free. I buy stamps. L. B. Dover, Overland, Mo.

Be an Artist

Comics, Cartoons, Commercial, Newspaper and Magazine illustrating. Pastel, Crayon portraits, Poster and Fashions **Earn Big Money.** *Taught by Mail or* Local Classes. Write for illustrated booklet, terms and list of successful pupils
ASSOCIATED ART STUDIOS, 13A Flatiron Bldg., N. Y.

TRICKS, PUZZLES, JOKES, TOYS,

games, novelties, doll and cane racks, plays, wigs, stage supplies, escapes and illusions. Large 1919 catalogue free.
OAKS MAGICAL CO.
Dept. 549 Oshkosh, Wis.

KNOW COSTS ACCOUNTANCY

Be a Cost Expert. Earn $3,000 to $10000 yearly. C.P.A's teach you thoroughly in a few months by our New Home study system-Low Cost-FREE BOOK
International Accountants Society, Dept. 39K 2626 S. Michigan Ave. Chicago



EARN MONEY

Stamping Names on Key Tags. $50
Either sex. Spare time. Some make
Send 25c for Tag with your name on and instructions. Returned if required. Exp. Key Tag Co., Cohoes, N.Y.



158 Genuine Foreign Stamps—Mexican War Issues, Venezuela, Salvador and India Service, Guatemala, China, etc., only 10c. 100 all diff., fine, 15c; 200 all diff., 25c. FINEST APPROVAL SHEETS 60% to 80%. AGENTS WANTED. Big 72-page Lists FREE! We Buy Stamps. Est. 25 years. C. E. HUSSMAN STAMP CO. Dept. 67 ST. LOUIS, MO.

STAMMERER

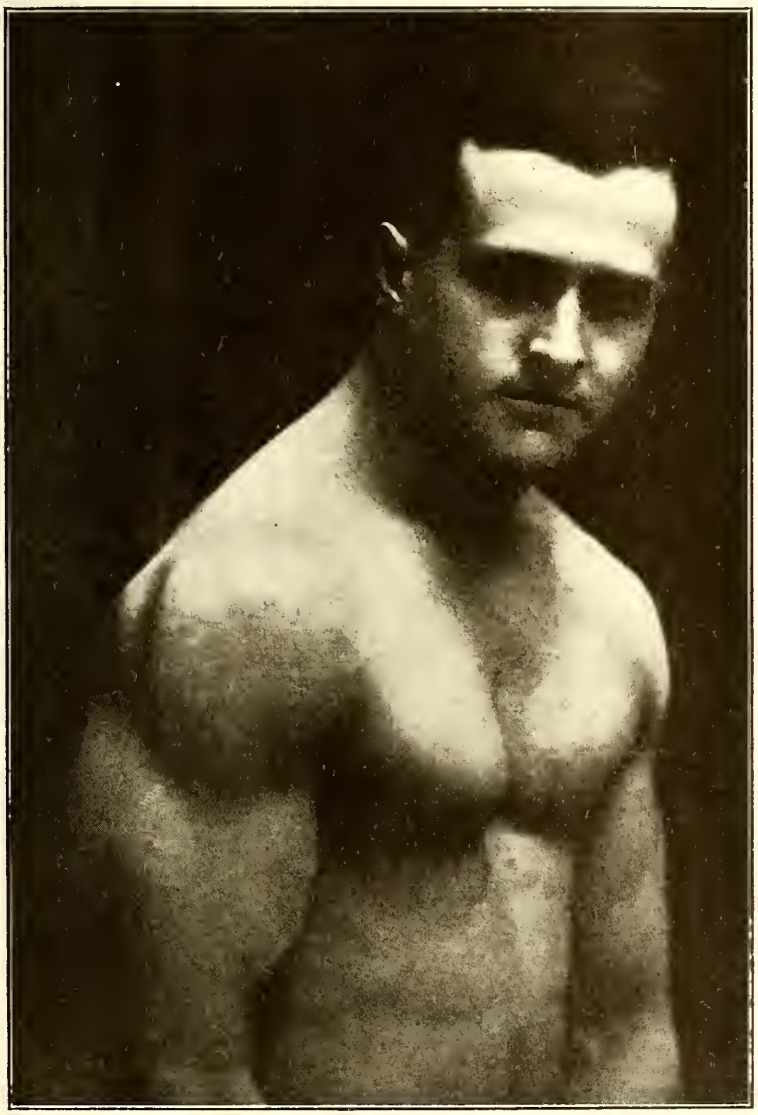


Send 10 cents for my remarkable book, "How To Stop Stammering." Kill the fear of stammering. Re education the key.
The Hatfield Institute, 109 N. Dearborn St., Chicago, Ill.

www.americanradiohistory.com

YOU CAN BE A SUPER-MAN!

YOU can take your place as a real leader and advance yourself in business and social life. Why drift along aimlessly with the crowd—merely existing? You do not know what life really means unless you have ROBUST HEALTH, GREAT STRENGTH and a HIGHLY DEVELOPED MIND AND BODY. Pull yourself together—shake off that sloth and indifference that is pulling you down. Brace up—be a real man. Fill yourself with vitality. Be strong and stay strong—assume that commanding appearance that shows success.



EARLE E. LIEDERMAN
the Acme of Physical Perfection

I can help you. I can show you the short cut to health and strength. I have found the way to develop these qualities in the shortest possible time. I have done it for thousands of others and can do it for you. My system will make a new man of you in a quicker time than you imagine. I begin where others leave off. Just remember that—it is the secret of my success.

I Have Trained Some of the World's Strongest Men

Many of the most noted strong men of today owe their wonderful physique to my method. I have taken hold of weaklings—mere physical wrecks—and made powerful athletes of them. This alone shows the superiority of my system. My own development and strength are more convincing proofs. If an instructor can first show results of his teachings on his own person, it speaks well for his ability to train others.

My New Book, "MUSCULAR DEVELOPMENT"

Tells how I can help you. It is handsomely illustrated with 20 full page photographs of myself and some of the finest developed athletes whom I have trained. I will send this valuable book to you by return mail on receipt of only 10c, stamps or coin, to cover cost of wrapping and mailing. This book also contains full particulars of my splendid offer to you.

Don't pass this by. Don't miss a single day on the way to health, success and happiness. Sit right down now and fill in the coupon and mail it to me. Do it now, this minute, before you forget it. The sooner you get the coupon off to me, the sooner you will receive the book.

EARLE E. LIEDERMAN

203 Broadway **Dept. 213** **New York City**

EARLE E. LIEDERMAN,
Dept. 213,
203 B'way, New York

Dear Sir:—I enclose herewith 10c for which you are to send me, without any obligation on my part whatever, a copy of your latest book "Muscular Development." (Please write or print plainly.)

Name .....

Address .....

City..... State.....

El. Exp. 10-19

www.americanradiohistory.com

THAT SOFT, ROSY, VELVETY COMPLEXION

BLEMISHES REMOVED QUICKLY AND PERMANENTLY

Your Complexion Makes or Mars Your Appearance



Miss Pearl La Sage, former actress

You too—can have that Soft, Rosy, Velvety Complexion. This great beauty marvel has instantly produced a sensation. Stubborn cases have been cured that baffled physicians for years. You have never in all your life used anything like it. Makes muddy complexion, red spots, pimples, blackheads, eruptions vanish almost like magic, No cream, lotion, enamel, salve, plaster, bandage, mask, massage, diet or apparatus, nothing to swallow. It doesn't matter whether or not your complexion is a "fright," whether your face is full of mudoy spots, peppery blackheads, embarrassing pimples and eruptions, or whether your skin is rough and "porey," and you've tried almost everything under the sun to get rid of the blemishes. This wonderful treatment in just ten days, positively removes every blemish and beautifies your skin in a marvelous way. You look years younger. It gives the skin the bloom and tint of purity of a freshly-blown rose. In 10 days you can be the subject of wild admiration by all your friends, no matter what your age or condition of health, **All methods now known are cast aside.** Your face, even arms, hands, shoulders are beautified beyond your fondest dreams All this I will absolutely prove to you before your own eyes in your mirror in ten days. This treatment is very pleasant to use. A few minutes every day does it.

Let me tell you about this really astounding treatment free. You take no risk—send no money—just your name and address on coupon below and I will give you full particulars by next mail—Free.

FREE COUPON

PEARL LA SAGE, SUITE 793
4325 Drexel Blvd., Chicago, Ill.

Please tell me how to clear my complexion in ten days; also send me Pearl La Sage Beauty Book, all FREE.

Name .....

Street .....

City ..... State .....

USE HB BALL BEARING ELECTRIC MOTORS

BETTER POWER AT LESS COST

HB Ball-Bearing Motors substantially save on operating costs, giving more economical, dependable, and better power than a gas engine. Trouble proof, absolutely reliable. Built for heavy service. Ideal for factory, garage, and machine shop, and lower power bills.

$20 Brings You Any HB Motor. Balance on Easy Terms.



Sizes 1 to 15 h.p. A Size to SUIT Your Needs,

Write our Service Department your requirements Get their advice—FREE—simply state what machinery you wish to run and the type of current available. We plan your power system for best results at least cost. Attach this ad to your letterhead and mail TODAY for full information. Ask also about HB Battery Chargers, Generators, etc.

HOBART BROTHERS COMPANY
Box 104E Troy, Ohio
Successful Manufacturers Since 1893

Send To-day for the

"Electrical Worker's Friend"

An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting A.C. motors. Special at **$3.50**

Or write for full particulars of this valuable book.

SMITH & SMITH PUBLISHING CO.
1524 LOWRIE ST., N.S., PITTSBURGH, PA.

Making a Machine for Telegraphing Pictures

By Leroy J. Leishman

(Continued from page 533)

or wires which are in turn connected with the shaft. E is a narrow piece of metal also connected with the shaft. F is a metal band much wider than E which extends around the cylinder from one side of E to the other, but does not touch E, as E and F must be insulated from each other. G, H, I, J and K are brushes. J touches both E and F as the cylinder revolves, but K touches F only. L and M are binding posts to which the wires are attached that come from the distant machine. N and O are the binding posts of the particular picture *transmitting* machine to which the synchronizer is attached. H and I are connected to two solenoids into which the horns of an iron rocker arm protrude. There is sufficient friction in the pivot of this rocker arm to keep it from turning excepting when the solenoids are energized. U is a rheostat with which a brush on the rocker arm makes contact. V is also a rheostat, and W is resistance in series with the motor. T represents the electro-magnets of a gravity relay, the arm of which rests against the stationary contact Z until T is energized, after which it rests against the contact Q. R, S, P is a two-way battery switch. X is a motor that is geared down to operate the picture transmission machine proper. The electrical connections are all shown in the diagram.

If this type of synchronizer is to be used, one must be made for both machines. The particular advantage of this type over all others which require no additional line wires lies in the fact that the cylinders are permitted to revolve continuously and are not stopt momentarily each time a revolution is made.

Now let us see how this synchronizer operates. With the arm of relay T against Q, we adjust the rheostat V so that the motors X of the sending and receiving machines run as nearly as possible in synchronism when the contact of the rocker arm is in the center of U. The synchronizer is now ready to operate.

Of course, we have not yet explained how a picture is prepared or transmitted, but you know that the needles on the carriage arms must be in contact with the cylinders. Until the machines are running in synchronism, we therefore do not let the needles rest on the pictures, as everything transmitted before synchronism is establisht would be distorted beyond recognition.

On the sending outfit put the arm of the gravity relay against Q, and put the two-way battery switch on S. The motor of the sending machine is now started, and by studying the diagram you will see that a circuit is completed every time B and E come in contact with G and J, respectively, causing an impulse to be sent over the wire once every revolution. Start the motor of the receiving machine with the relay arm against Z, and throw the battery switch to R. This motor is now going slightly slower than that of the other machine, because it is in series with the resistance W. The motor of the sender is not in series with its resistance, as its relay is against Q instead of Z. On account of the slower motion of the receiving cylinder, the brushes are on a different part of the circumference of the drum A each time the once-every-revolution impulse comes from the sending machine. The brushes H and I are therefore finally on C and D when this synchronizing impulse comes. This causes the current to go thru the solenoids and the relay T, the arm of which

LEARN LANGUAGES
AT THE
BERLITZ SCHOOL
28-30 WEST 34th STREET
Brooklyn, 218-230 Livingston Street

Washington, Boston, Philadelphia, Detroit, Chicago, Baltimore, Orange, Havana, Rio de Janeiro, Buenos Aires, Sao Paola, Cordoba, Paris, London, Madrid, Rome, etc., etc.

FRENCH, GERMAN, SPANISH, ITALIAN, &c., &c.

By the Berlitz Method students learn not only to read and write, but especially to understand and to speak the foreign language.
TRIAL LESSONS FREE

The Seneca MOTOR CAR **Built for the Owner** **$1085.00**



Simple, Sturdy construction. Low cost of up-keep and operation. Cantilever springs in rear. **Comfortable E-Z riding**

4 cyl. - 27 H. P. 108 in. wheel base

Dealers Wanted Immediate deliveries. Fifth successful year. Increased output. Liberal newspaper advertising in dealers' territory. Wonderful opportunities. **Write or Wire NOW.**

THE SENECA MOTORCAR CO., 50 Seneca Factory, FOSTORIA, OHIO

UMAKEM

Airplane Workchest, containing aircraft work table with mitre cutting board and length gauge, steel drill, steel hammer, Model Maker's steel square, screwdriver, sandpaper block, 10" scroll saw, together with finest quality reed and bass wood, aluminum, silk, para rubber, full set of blueprints, directions, and all fittings for building one 36" Bleriot Model flying Monoplane. Price $10.00. Other UmakeM Outfits 50c to $50.

W. R. PRICE, Inc.
No. 2 UmakeM Building, 127 Fifth Avenue, New York

A NEW AND EASY WAY TO PAINT
SIGNS and SHOW CARDS
OUR PATTERNS DO THE WORK

No experience required. Anyone can paint all kinds of signs, banners, cards, etc., on any surface with our new and easy system of lettering. Complete outfit containing eight alphabets of letters, assorted styles and sizes from two to twelve inches high, also four sets of figures, etc., not printed but life size patterns cut out of durable tag board which can be used over and over again for years, also brushes, colors and book of instructions. Satisfaction guaranteed. PREPAID ------ **$7.50**

ACME SALES CO., Empire Bldg., Denver, Colo.

POPULARITY FOLLOWS THE
UKULELE

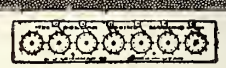


... you play quaint, dreamy Hawaiian music or latest songs on the Ukulele you will be wanted everywhere. We teach by mail 20 simple lessons; give you free a genuine Hawaiian Ukulele, music, everything—no extras. Ask us to send the story of Hawaiian music. You will love it. No obligation—absolutely free.



The Hawaiian Institute of Music
1400 Broadway, Dept. 6 J, New York

DOLLAR ADDING MACHINE $1



Adds and multiplies with speed of expensive machines. Seven columns capacity. Remarkably simple in construction. Nothing to get out of order. Weight one ounce. Made of metal and celluloid. The ideal pocket, desk or home machine. Order today. The best way not to forget is to do it now.

L. J. LEISHMAN CO., Dept. 142, Ogden, Utah

LEARN WATCH REPAIRING



You can learn by our modern and original system of instruction every part of the Watch Repairing Trade at home as good or better than at a shop. You can earn money while learning and secure a well paying position or start in business after completing our course of instruction. Good watch repairers are always in demand and earn from $20 to $35 per week. For particulars apply to the

Milwaukee School of Watchmaking 166 Mason St., Milwaukee, Wis.

Red or Black "Vulcan" Ink Pencils



Two Sizes— 4¼ and 5½ inches. Extra Size—8 inches (black only) $1.75. Your name in gold inlay—$ 35. FREE—Liberal supply of ink with retail orders.

The ONLY perfect, non-leakable ink pencil sat moderate prices Order today. **$1.50**

Agents wanted. Big profits.

J. R. ULLRICH & CO., 27 Thames St. New York

HEAD ACHES NEU-RAL-GIA
AK
FLU WOMEN'S ACHES
ASK FOR A-K TABLETS

www.americanradiohistory.com

is pulled from Z to Q, thereby cutting out the motor resistance so that the motor will of its own accord run at the approximate speed of the motor on the sending apparatus.

The accurate synchronizing now goes on automatically. You will remember that the current to the resistance pieces C and D comes from metal strips on opposite sides. When the synchronizing impulse comes in, when H and I are in the exact centers of C and D, the currents in H and I are therefore equal. The solenoids also receive equal current and keep the rocker arm in the center of U, supplying the motor with a uniform amperage. If the receiving machine gets slightly behind or ahead of the sending machine, the brushes H and I will be slightly above or below center, and one brush will be nearer the metal strip which supplies the current to the resistance, and the other brush will be further away. One brush, therefore, carries more current than the other, and one solenoid will pull harder than its companion, causing the rocker arm to change its position on the rheostat U, thereby correcting the speed of the motor. The function of E, F and K is to distribute the current alternately to the synchronizer and the picture machine proper.

If this synchronizer seems too difficult or costly to make, the other synchronizer may be used or else the rod connection employed. In the latter case, your picture transmitting set will have been very easily and inexpensively constructed, and the degree of excellence of the received pictures will not be lessened in the least.

The machines are now ready to be adjusted. When sending, the needle in the carriage arm may have a play of as much as a quarter inch. It must at all times touch the cylinder, and should there be any sort of bulge in the rolled transmitting plate, this much play is necessary so that the bulge will not raise the needle beyond its play and throw the half nut on the bottom of the carriage out of mesh with the threads on the shaft. For receiving, the needle must be very delicately adjusted. It must rest on the cylinder when the magnets are not energized, and when raised up, it should be just high enough to clear the cylinder at all points on its circumference. The less upward and downward motion the needle has the faster it will operate and the better the pictures will be.

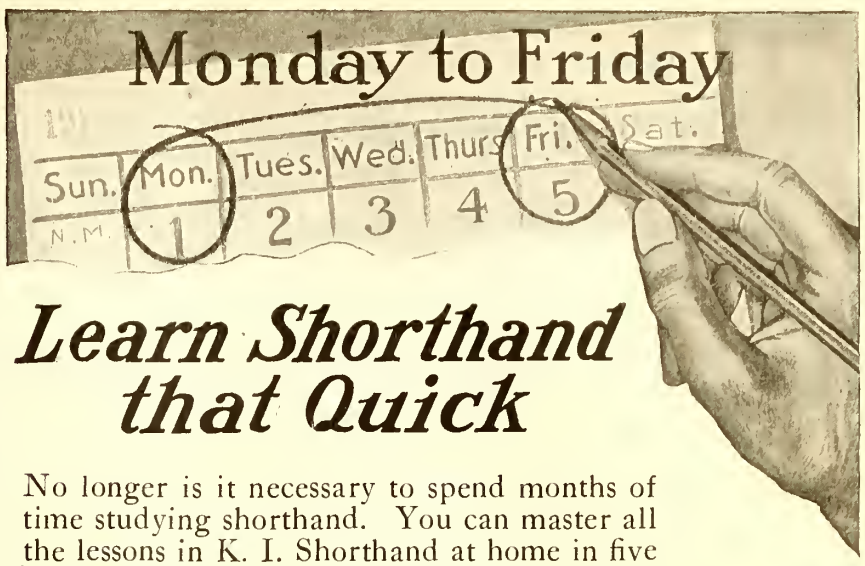
Extend a wire from one of the binding posts of one instrument to one of the binding posts of the other. The remaining posts must be connected to the batteries—preferably two dry cells. If the last explained synchronizer is used, these wiring directions may be considered to apply to the synchronizer binding posts instead.

TRANSMITTING PICTURES

Before transmitting *half-tones*, you can write or draw with shellac upon a thin metal plate and transmit this. After the shellac is dry, roll the plate into a cylinder and slip it over the cylinder of the machine you are going to use for transmitting. Place the edges at the top of the cylinder with the overlapping part of the cylinder toward the carriage, and if the plate is put on as explained the overlapping edge will not strike the needle and cause trouble. Put heavy rubber bands around the ends of the plate to hold it firmly against the cylinder.

RECEIVING THE PICTURES

To receive the picture, you will need a sheet of ordinary white paper and a piece of pen carbon paper. The carbon sheet goes on the cylinder face down around the white paper. If the rod connection or the first explained electric synchronizer is being used, be sure that the edges of the paper are placed at the top. If you are using the synchronizer which requires the extra cylinder or drum, the edges of the paper when placed on the picture cylinder should be in a straight line with the resistance pieces and the copper strip. This also



Learn Shorthand that Quick

No longer is it necessary to spend months of time studying shorthand. You can master all the lessons in K. I. Shorthand at home in five evenings. Don't doubt this amazing truth! Send for free lessons—also convincing proof that this is the simplest, most practical, lowest-cost course in stenography by *personal correspondence instruction.*

K. I. Shorthand

The Universal Speed-Script

Undoubtedly you have heard of this new and wonderful shorthand system—the *simplest and most practical in the world.* Used in the Army and Navy and in numerous other governmental places. Used by court officials, by doctors, business-men, teachers, clergymen, lawyers, reporters—and those in hundreds of other occupations.

It is the *universal speed-script—the easy-to-learn, never-forgetable, lightning writing.*

K. I. is Shorthand acquired with wonderful speed and ease—but it is so standardized as to make for *perfect legibility* and *absolute accuracy.* Notes years old may be read as easily as when fresh.

How Quickly Can YOU Learn This?

Here's p and, this is a Write the two together, and you have pa Here's th To make path you simply write and with these two easy movements of your pencil, you have made a word that needs 16 pencil movements when written in longhand. Here's t so it is easy to write at, tap and pat.

Already you have learned four K.I. Shorthand signs you won't forget. With the other signs and easy directions you can learn to indicate every word in the dictionary in quarter to twentieth of the time required in ordinary writing, as rapidly as words are spoken!

On 30 Days' Approval

For instance! E. A. Fulton says: "Four months ago I knew absolutely nothing of the first rudiments of shorthand. *To-day, I am holding a position as stenographer in the office of Inspector of Buildings,* where the terms apply almost wholly to building construction."

Henry Dranke writes: "Already I can write 50 or more words per minute and it took only about a *quarter hour each day for ten days.*"

A. Tompkins, journalist, writes: "Your system is excellent, being *simple,* yet *comprehensive.* I find it fascinating in my work as a press correspondent.

The above are but a few of legions of testimonials which we are ready to give you with full addresses.

Free Lessons—Send no Money

K. I. Shorthand is offered on the most liberal terms right now. Do not miss this opportunity. *Send immediately for the first two lessons free.* You may then continue the entire course on a month's approval. We give you a positive guarantee that *you can learn for no cost to you.* King Institute is incorporated in New York State. $100,000 capital.

KING INSTITUTE, Inc.

EM 300, Station F, New York, N. Y.

8 S. Wabash Avenue, EM-300. Chicago, Ill.



"Go ahead! I am getting it in K. I. Shorthand."

Please send me your FREE lessons in K. I. Shorthand, also full information.

Name .....

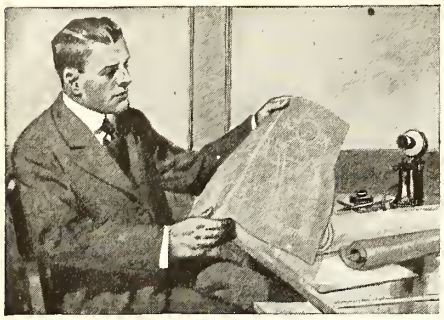
Address EM-300



"Talk as fast as you like. I am taking it down in K. I. Shorthand."

www.americanradiohistory.com

Mechanical Engineering



Learn at Home!

Employers everywhere are looking for men with mechanical ability. Splendid salaries and rapid advancement are offered.

There is an easy, delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving men and women just the training they need for success in mechanical engineering and more than 200 other subjects. Hundreds of thousands have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6203 SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

☐ ELECTRICAL ENGINEER	☐ CHEMICAL ENGINEER
☐ Electrician	☐ SALESMANSHIP
☐ Electric Wiring	☐ ADVERTISING MAN
☐ Electric Lighting	☐ Window Trimmer
☐ Electric Car Running	☐ Show Card Writer
☐ Heavy Electric Traction	☐ Outdoor Sign Painter
☐ Electrical Draftsman	☐ RAILROADER
☐ Electric Machine Designer	☐ ILLUSTRATOR
☐ Telegraph Expert	☐ DESIGNER
☐ Practical Telephony	☐ BOOKKEEPER
☐ MECHANICAL ENGINEER	☐ Stenographer and Typist
☐ Mechanical Draftsman	☐ Cert. Pub. Accountant
☐ Ship Draftsman	☐ Traffic Management
☐ Machine Shop Practice	☐ Commercial Law
☐ Toolmaker	☐ GOOD ENGLISH
☐ Gas Engineer	☐ STATIONARY ENGINEER
☐ CIVIL ENGINEER	☐ CIVIL SERVICE
☐ Surveying and Mapping	☐ Railway Mail Clerk
☐ MINE FOREM'N OR ENG'R	☐ Textile Overseer or Supt.
☐ ARCHITECT	☐ AGRICULTURE
☐ Architectural Draftsman	☐ Navigator ☐ Spanish
☐ PLUMBING AND HEATING	☐ Poultry Raising ☐ French
☐ Sheet Metal Worker	☐ Automobiles ☐ Italian

Name_____

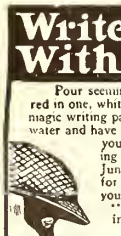
Present Occupation_____

Street and No._____

City_____ State_____

Write Secret Letters With Invisible Ink

Pour seemingly plain water into three glasses and have it turn red in one, white in another and blue in the third! Make your own magic writing paper, and blue ink or ink powder. Write with plain water and have the writing turn blue. You can surprise and puzzle your friends with these and more mysterious and amusing Chemical tricks, if you have "CHEMCRAFT" Junior—the boys' miniature chemical outfit. Send 25c for your outfit right now, it's the greatest fun-maker you ever had. Send at once and get a Free copy of "The Chemcraft Chemist," an interesting magazine for boys.



Amateur Chemist's Catalogue and Hand Book
containing much valuable information for Boy Chemists and listing many useful chemicals and apparatus, sent postpaid for 10c. None free. Regular "CHEMCRAFT" Chemical Outfits $1.50, $2.00 and $5.00.

CHEMCRAFT JUNIOR
25¢
POSTPAID

THE PORTER CHEMICAL CO.
Hagerstown, Maryland

FREE PRINTING PRESS, for printing cards, circulars, fully guaranteed, with type, ink, cards, etc., all ready for use, also other valuable presents, cameras, air rifles, talking machines, telescopes, typewriters, etc., given absolutely free for selling our art and religious pictures at 10c. Send for 25, when sold send money and select premium. SPENCER PUB. CO., Dept. 306 Chicago

applies to the copper sending cylinder. Overlap the ends of the paper toward the carriage, the same as you did with the plate. If you should carelessly overlap it the other way, the needle will catch the edge of the paper and tear it off. Be sure that the carbon sheet fits *tightly* against the white paper. Secure these to the cylinder with rubber bands.

Put the carriage at one end of the cylinders with the needle in contact with the same. Now place the switch on your sending instrument at the right and on your receiver at the left. Start your motors, or else turn the cylinders with a crank. As before mentioned, the speed should be about one revolution in three seconds.

By the time your carriages have advanced to the other side of the cylinders the picture is finished. As long as the needle of the transmitting instrument is on bare copper, the current flows, energizing the electric magnets of the receiving carriage and causing the needle to be raised out of contact with the carbon paper. Whenever the shellac comes under the needle the current is broken and the spring holds the receiving needle against the carbon paper, thereby making a mark. In this way the transmitting of the entire picture is accomplisht.

In the inexpensive sets that I mentioned having designed for the market, half-tone pictures are supplied already prepared on copper for transmission; but there is some satisfaction in having them prepared yourself. Any photo-engraver can do it. You should have a photograph without too much detail and with considerable contrast—that is, black and white. Better results are possible if the photograph has a glazed finish. Obtain a sheet of thin polished copper of a size that will roll to fit the cylinders. Tell the engraver that you want him to proceed as if he were going to make a half-tone on this copper plate, but that he must stop after he has cooked his gelatine to a dark chocolate color. *It must not be etched.* Tell him you want the screen to be no finer than 25 or 30. He undoubtedly will have no screen this coarse, so instruct him to make a small zinc half-tone cut of 40 or 65 screen, and to make a print from this. Then have him make an enlargement of this print, *without his screen,* until he has the 25 or 30 mesh which you desire.

This plate is rolled and the picture transmitted just the same as the shellac drawing.

Pictures do not have necessarily to be received with carbon paper. Your apparatus will permit the use of a few other methods. Smoked paper or wax-coated paper will do. If the former is used, however, the received picture will be a negative unless a negative is used for transmitting. Various other plans of receiving may be experimented with and will be found very interesting to the experimenter.

Pictures may be received without any carbon paper by turning the switch of the receiving machine to the right or sending position and utilizing a sheet of paper soaked in a solution of the following proportions:

Nitrate of ammonia, 4 pounds; ferricyanid of potassium, 1 ounce; gum tragacanth, 4 ounces; glycerine, 4 ounces; water, 1 gallon.

The paper should be kept moist while the picture is being received. Like the smoked paper, this produces a negative when a positive is being used for transmission, and a positive when a negative is being sent. These visible ways of recording make a much more interesting demonstration, altho the picture is not as good.

Of course, there are ways to telegraph pictures which are radically different from those explained here, but only the simpler ways are given so that the apparatus can be constructed easily and cheaply.

The experimenter will find telephotography a very interesting, instructive and fascinating field.

BOYS! Make Things AT HOME

1. The Study of Electricity for Beginners.
2. Dry Batteries. How to Make Them.
3. Electrical Circuits and Diagrams. Part 1.
4. Electric Bells, Annunciators and Alarms.
5. Modern Primary Batteries.
6. Experimenting with Induction Coils.
7. Electric Gas Igniting Apparatus.
8. Small Accumulators. How to Make and Use.
9. Model Steam Engine Design.
10. Practical Electrics.
11. Inventions. How to Protect and Sell Them.
12. Woodwork Joints. How to Make and Use.
13. The Fireman's Guide to the Care of Boilers.
14. The Slide Valve Simply Explained.
15. The Magneto Telephone.
16. The Corliss Engine and Its Management.
17. Making Wireless Outfits.
18. Wireless Telephone Construction.
19. The Wimshurst Machine. How to Make It.
20. Simple Experiments in Static Electricity.
21. Small Electrical Measuring Instruments.
22. Electrical Circuits and Diagrams. Part 2.
23. Induction Coils. How to Make Them.
24. Model Vaudeville Theatres.
25. Alternating Currents. Simply Explained.
26. How to Build a 20-Foot Bi-plane Glider.
27. A B C of the Steam Engine.
28. Simple Soldering. Hard and Soft.
29. Telegraphy for Beginners.
30. Low Voltage Lighting with Storage Batteries.
31. Lieckfeld Gas and Oil Engines.
33. House Wiring for Electric Light.
34. Magnets and Magnetism.
36. Small Windmills and How to Make Them.
37. Collin's Wireless Plans. Part 1.
38. Collin's Wireless Plans. Part 2.

Price 25 cents each, postpaid

SPON & CHAMBERLAIN
120 G Liberty Street, New York

Is Your Blood Hungry for Iron?

Iron Is The Red Blood Food That Gives You Strength, Energy and Power—How To Make The Test That Tells

Actual blood tests show that a tremendously large number of people who are weak and ill lack iron in their blood and that they are ill for no other reason than lack of iron. Iron deficiency paralyzes healthy, forceful action, pulls down the whole organism and weakens the entire system. A pale face, a nervous irritable disposition, a lack of strength and endurance and the inability to cope with the strong vigorous folks in the race of life—these are the sort of warning signals that Nature gives when the blood is getting thin, pale, watery and literally starving for want of iron. If you are not sure of your condition, go to your doctor and have him take your blood count and see where you stand or else make the following test yourself: See how long you can work or how far you can walk without becoming tired; next take two five-grain tablets of Nuxated Iron three times per day after meals for two weeks. Then test your strength again and see how much you have gained. By enriching the blood and creating new red blood cells, Nuxated Iron strengthens the nerves, rebuilds the weakened tissues and helps to instill renewed energy and power into the whole system.

Unlike the older inorganic iron products Nuxated Iron is easily assimilated, does not injure the teeth, make them black nor upset the stomach. The manufacturers guarantee successful and entirely satisfactory results to every purchaser or they will refund your money. It is dispensed by all good druggists.

Send Only 12c

(Stamps or Coin)

And I will send you a copy of my valuable booklet.

"Hints to Music Loving Owners of Talking Machines"

Tells you how to take care of your machine and records, preserve the life of both, and gives many pointers to improve the tone of your instrument and increase your enjoyment of it. Instructs on the care of the motor, cleaning, speed adjustment, care of the needles—in fact every thing you should know. Send 12c today and the booklet will come by return mail.

J. H. ELLIS, Box 882, Milwaukee, Wis.
Patentee & Manufacturer. Ellis Harmonious Reproducer

www.americanradiohistory.com

Investigating "Psychical Phenomena"

By Hereward Carrington, Ph. D.

(*Continued from page* 566)

"*Result:*—On examination, the electroscope was found to be completely *discharged!*

"I took the electroscope to the table in the corner of the room and tried to recharge it, but found I was unable to do so even after repeated trials. Accordingly I asked the 'operators' to put back into the body of the medium the matter they had taken out (for the production of the sledge-hammer blows) and to give a few raps when they had done so. In a minute or two some *very light raps* were given, and when I asked if the process was complete I received *no raps in reply at all,* which seemed to indicate to me that all the matter used for rapping had been returned to the medium. At any rate, I found that I could now charge the electroscope; which done, I placed it on the floor as before within the circle, and asked that the disc should be touched lightly. After a little time, there was the metallic scraping as before, and on examination the electroscope was found to be completely *discharged.*"

It will be at once apparent to the reader that two problems confront the investigator, when once he is called upon to solve such problems as the above: (1) the *physical miracle* itself; and (2) the nature of the *intelligence,* lying behind and directing or controlling the manifestations. This latter is called a *psychological* question, which, immensely important as it is intrinsically, does not enter into the *physical* problem. It need only be said that this is *the* baffling question in psychical investigation, and the most puzzling. Whether it be an independent "spirit," as it claims to be; or the subconsciousness of the medium; or whether it is a sort of compound consciousness, made up of the collected minds of those forming the circle at the time; or whether still other interpretation is open to us—this is all a moot question, which is referred to here, merely to draw the reader's attention to the fact of its existence.

It will be at once apparent to the reader, also, that physical and electrical apparatus has played an important part in such investigations, in the past, and is certainly destined to occupy a far more important place in the future. These curious phenomena—like all others in our world—depend upon invisible forces or energies for their production. Those interested in electricity should realize, more than all others, the power of the invisible; and the fact that *the invisible is the real.* Anything that we see consists merely in a bundle of "phenomena"—of *effects.* The real cause is always behind, and is always invisible. Thus, there is an old saying that "No man hath seen God." But it is equally true that "No man hath seen man." We see his clothes; these can be changed. We see his face and features; even these can at times be camouflaged! But the real man, the Self, the Ego, is something within,—invisible, intangible,—the directing and guiding power, which in life we know as the "Person."

There is nothing inherently absurd or impossible, therefore, in these odd manifestations,—however bizarre and unusual they appear to us at first sight. An unusual combination of circumstances might bring them about. Stones do not ordinarily fall out of the air; yet at times they *do* (meteors). Water does not usually rise above its own level, yet it can be made to do so. The curious freaks of lightning are well known. There is nothing inherently impossible, therefore, in supposing that a

Learn Mechanical Drafting

Earn $35 to $100 a Week

"Get into the profession of big pay and Rapid Advancement with the help of the school that has started hundreds on the Road to Success. I am ready to help you." Roy C. Claflin, President, Columbia School of Drafting.



Learn At Home In Spare Time

You don't have to stop work or leave home in order to become a trained Draftsman. Through our practical home study Training we will teach you Right in Your Own Home so that you will soon be able to qualify for a good position at Big Pay. We will continue to instruct and help you until we know you have the knowledge necessary to succeed.

No Previous Training Necessary

Right now—TODAY—there are openings for thousands of Draftsmen in the Government Departments, industrial concerns, and the big engineering offices. One department alone recently called for 1,800 draftsmen. With this tremendous demand has come a big increase in salaries.

Draftsmen Are Getting $35 to $100 a Week

with big chances for even better pay as the demand grows. By enrolling NOW for our practical Home Study Course in Drafting you can quickly qualify for a position as Draftsman and by properly applying the principles we teach.

You Have a Chance to Become a Chief Draftsman

and get to the very top in this fascinating profession. Our course will give you just the knowledge you need to make good as chief draftsman when your chance comes.

Industrial Activity Demands Draftsmen

With the problems of reconstruction facing the nation the demand for draftsmen is Greater Than Ever Before in American History. All big engineering, construction and manufacturing projects must first go through the drafting room before the workmen can commence. You can help in the work of reconstruction and secure a Big Salary with excellent opportunities for advancement. Many Big men in industry got to the top through Drafting.

We Will Help You Secure a Position

as soon as you complete our course. We have already placed hundreds of our graduates in good paying positions and are constantly in touch with vacancies for which Draftsmen are Urgently Needed. Government Departments and Private Concerns are continually calling upon us for our graduates because they know that our instruction produces draftsmen of the caliber they need.

Men Needed Right Now

Drawing Outfit FREE

As soon as you enroll you will be sent our special drawing outfit FREE so that you will be sure to have it to work with while taking the course. This set will be yours to keep. You are not asked to return it after completing the course.

Illustrated Book of Particulars Sent Free

Fill in the coupon below—send it to us and we will send you FREE a copy of our illustrated book telling all about our practical Home Study Course and how you may secure our instruction at once on Easy Terms so as to quickly qualify for one of the Big Positions Now Open.

Mail This Coupon To-day

Columbia School of Drafting
Dept. 1057, 14th and T Sts., N. W.
Washington, D. C.

Without obligation to me, please send me your illustrated book telling how I can secure your complete Home Study Course, the FREE DRAWING OUTFIT, and your help in securing a position as Draftsman.

Name .....

Address .....

City .....State .....

www.americanradiohistory.com



Finish This Picture

Fill in the missing lines. See how close you come to the original drawing. The above picture was drawn by Student Wynn Holcomb. We have a great number of students and graduates whose work appears in magazines and newspapers all over the country.

Can You Draw?

If you like to draw write for our book. Read about our new method Home Study Course in cartooning, illustrating, designing. Learn at home, by mail, in spare time.

Become an Artist

Illustrators, Cartoonists, Commercial Artists make big money. You can earn $25 to $100 a week and more. Learn under personal direction of Wilt H. Chandlee, famous newspaper, magazine, advertising artist of 30 years' successful experience.

Book and Outfit Free

Complete outfit free to new students. Write for handsome book, "How to Become an Artist." Tells what Course includes, shows many drawings made by Director Chandlee and many students.

Write Postal NOW

Don't miss our book. Even if you have no previous knowledge of drawing, our Course will enable you to become a successful cartoonist or illustrator. Many students earn money while they are learning. If you are ambitious to get ahead, to earn more money, write for our free book and special offer now. You can do as well as our other successful students! Write now for free book, "How to Become an Artist." Mail letter or postal.

WASHINGTON SCHOOL OF ART, Inc.
1442 H Street, N. W. Washington, D. C.

table can be "levitated" into the air, under unusual conditions; it is simply the manifestation of an unknown energy—of which, doubtless, there are many. We can manipulate and control the electric current; but we do not know yet precisely what it *is*. Similarly, we can study the effects of many of these curious biological forces, without understanding their true nature. Above all, it behooves us to keep an open mind, and not to cry "impossible," just because we have never seen such facts, or because they appear to us innately improbable.

Here, as elsewhere, we depend upon hidden and unknown energies. Could we but find *an energy common to the two worlds*—the spiritual world and the material world—we should have here a means of direct communication, possibly by instrumental means. *Delicate physical and electrical apparatus may be the means, after all, by which such communication will ultimately be established!* At all events, when subtle causes and forces are in operation (as they doubtless are during a séance) it is only natural to suppose that instruments, *far more delicate than our senses*, should be the logical method of detecting them, and, as yet, such experiments have rarely been attempted.

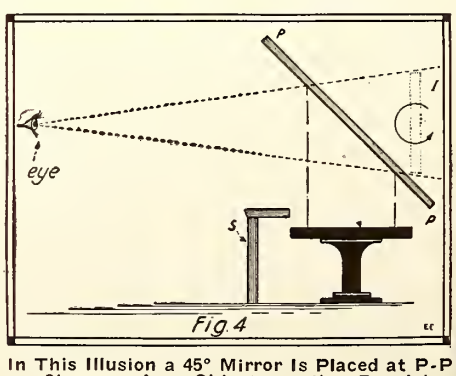
When we take into consideration finally the electrical theory of the nature of matter; when we remember the many striking analogies between electricity and the life-force; when we remember that the science of electricity is yet in its infancy, it should hold out to us the hope that, *here*, we may find a solution of many of these obscure problems, and that further investigations in the field of electricity may serve to explain to us many of these unknown and mysterious secrets of our inner nature, and the still more mysterious secrets of the séance-room. No more interesting and profitable researches could be attempted than those which endeavor to establish a connection between known and unknown phenomena; between physical and electrical manifestations, on the one hand, and these curious "psychical" phenomena, on the other. I hope that a number of readers of this article may see their way clear to try experiments in this direction, and to publish their results.

Experiments in Physics

By John J. Furia, A.M.

(*Continued from page* 531)

After the performer has stept into the cage and the door is closed, he pulls in the mirrors as in B. When the door is opened again he is hidden behind the mirrors, while the *mirrors reflect the sides of the cage* out to the audience, giving the illusion that *the back of the cage* is seen. On pushing the mirrors back into place again while the door is shut the performer again comes into the view of the audience when the door is opened.



In This Illusion a 45° Mirror Is Placed at P-P as Shown. Any Object on the Revolving Table "T" Appears to Be Rotating in Mid-air at a Point in Space "I".

Telegraphy Pays BIG MONEY

RADIO TOO

We teach you in two to four months In Your Own Home or at our Institute

The demand for telegraphers is enormous and increasing; there are ten positions for every man or woman available; the pay is high; advancement rapid; the hours are short—it's pleasant work and it's worth while. Write for catalog—learn how quickly you can qualify for positions paying

$125.00 to $350.00 Per Month

Our scientific system of teaching telegraphy, perfected by a corps of practical experts, makes you fully competent in 2 to 4 months—railroad 2 months—commercial 3 months and brokerage 4 months. Our new **phonographic system of instruction** is making expert telegraphers of hundreds without leaving their homes or interfering with present business. Easy to learn in spare time. Hundreds of graduates now profitably employed in railroad offices, banks, brokerage offices, etc.

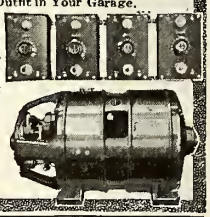
Our course is short, the cost is low—and the result is certain. We put you in touch with the position you want. Write today for catalog. It explains all fully. Endorsed and recognized by U.S. Gov't Depts., R. R. Officials, etc.

CHICAGO TELEGRAPH INSTITUTE
America's Finest School—Land Wire and Wireless
3402 Michigan Avenue, Chicago

Big Profits in Battery Charging with the HB 32-Battery Charger

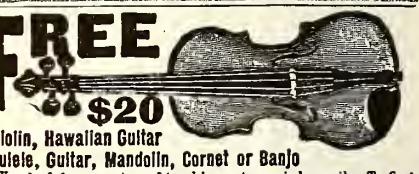
Buy Ample Capacity to Handle Big Business This Fall. This fall brings bigger business in battery charging—and BIGGER PROFITS—than ever before. More cars driven, more batteries to charge. If *you* don't get those profits some other garage will. Get equipped NOW.

Small Cash Payment Puts This HB Outfit in Your Garage. Balance on easy monthly terms. Recharges 1 to 32 6 volt batteries at once, or equivalent in 12 or 24-volt batteries. Costs 10c. to 15c. each, customer pays 75c. to $1.50. No repairs, no expensive renewals, no mechanical skill needed to install or operate. Absolute Money-Back Guarantee. Do you want these BIG PROFITS? Tear out this ad and mail TODAY for information.



HOBART BROTHERS COMPANY
Box 103 E, Troy, Ohio
Successful Manufacturers Since 1893

FREE



$20
Violin, Hawaiian Guitar
Ukulele, Guitar, Mandolin, Cornet or Banjo

Wonderful new system of teaching note music by mail. To first pupils in each locality, we'll give a $20 superb Violin, Mandolin, Ukulele, Guitar, Hawaiian Guitar, Cornet or Banjo absolutely free. Very small charge for lessons only expense. We guarantee success or no charge. Complete outfit free. Write at once—no obligation.

SLINGERLAND SCHOOL OF MUSIC, Dept. 422, CHICAGO, ILL.

BRANCH MANAGER WANTED

by old established Chicago Concern. We furnish full stock of goods, advertising matter, and equip store completely, in good location, all at our expense. We allow you to draw out $175 a month and will also pay you liberal share of the profits your store earns. Work may be started in spare time. No investment or previous experience necessary. If you are a hustler and want an opportunity to make $5,000 a year, we want you, and will pay you well from the start. Send your application today.

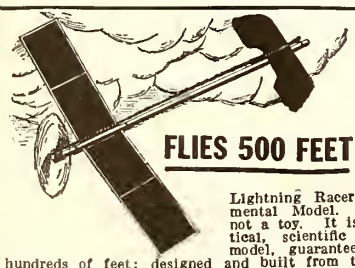
S. LEVY, Manager Dept. 784
—329 S. Franklin Street Chicago, Ill.

Telegraph Pictures
BY ELECTRICITY



Complete sets of two machines of this marvelous equipment at ridiculously low prices. Instructive, mystifying and useful. This picture of President Wilson was telegraphed by these machines. Will transmit pictures, maps, drawings and hand writing. Picture telegraphing is the coming science. Write today.

J. LEISHMAN CO., Dept. T Ogden, Utah



FLIES 500 FEET

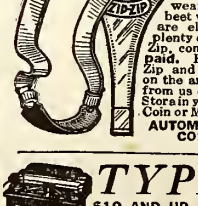
Lightning Racer Experimental Model. This is not a toy. It is a practical, scientific flying model, guaranteed to fly hundreds of feet; designed and built from the finest selected materials, by Model Experts. This machine and our famous "Montauk Flyer" are the only Complete Model Aeroplanes guaranteed to fly 500 ft. selling for less than $5.00. This model, shipped with monoplanes detached, ready and guaranteed to fly, $3.75 prepaid. Send stamps for circular describing this wonderful model.

Blueprints of the following models 1-2 actual size 50 cents postpaid in U. S.

Bleriot Racer, flies 600 ft. Manhattan Racer, flies 2000 ft. Montauk Flyer, flies 500 ft. 3 ft. Curtiss or De Haviland Biplane, 75 cents each, postpaid.

HEC Flying Boat guaranteed to rise from the water and fly 500 ft. Two sheets blueprint $1.00 postpaid U. S.

HEC AEROPLANE CO., 300 E. 49th St. N. Y. C.



ZIP-ZIP Patented Sept. 3rd, 1918

The Greatest 50 Ct. Article on the Market. Shipped right from the factory the same day we receive your order. The Prong is made of beautiful metal; never break or wear out; scientifically made and best workmanship. The rubbers are elastic and lasting, with plenty of pep and force. Zip-Zip, complete, only **50c prepaid.** Be sure the name Zip-Zip and our address appear on the article you buy. Order from us or any Sporting Goods Store in your city. Send Stamps, Coin or Money Order.

AUTOMATIC RUBBER CO. COLUMBIA, S. C.



TYPEWRITERS

$10 AND UP. ALL MAKES. SAVE $25 TO $50 on rebuilt at the factory by the well known "Yntng Process." Sold for low cash—installment or rented. Rental applies on purchase price. Write for full details and guarantee. Free trial. **YOUNG TYPEWRITER CO., Dept. 823, Chicago**

www.americanradiohistory.com

So far the illusions described have been of the *virtual image* class. The audience has seen an *unreal* image. The real image class is not used as extensively. The following is an illustration of this type. A fragrant odor meets the nose, a beautiful bouquet is seen in a handsome vase. One gets nearer and nearer to the vase and the bouquet has—disappeared! Figure 6-C

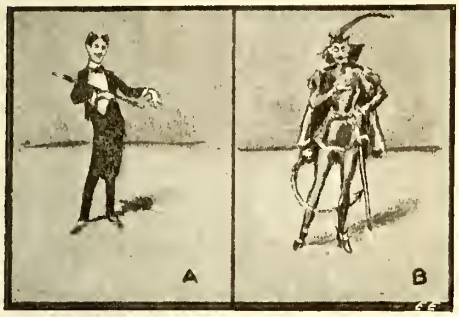


Fig. 3. The Performer Mystically Changes from His Evening Clothes to a Devil's Costume Before Your Very Eyes—Thanks to the Lighting Stunt and Glass Screen Shown in Figures 1 and 2.

tells the story. An empty vase A is placed on a hollow box. Inside the hollow box hangs a bouquet unside down. A concave mirror M, directly in front of the eye, is concealed by its dark surroundings. The mirror forms a *real image* of the bouquet, and by moving the mirror to the proper distance and tilting it to the proper angle this image can be formed just at the right point on the vase as to give the appearance of the bouquet being actually in the vase. As one moves out of the line of the vase and mirror, the image is no longer seen and the flowers have disappeared.

The subject of illusions is a vast one, and in a short article of this kind one can only "hit the high spots." In detecting illusions always look for mirrors and polished surfaces.

(To be continued)

To Europe In Three Hours

By H. Winfield Secor

(*Continued from page* 514)

what a difference the body and its organs have to accustom themselves to in this short time, and it is small wonder that the pilot can hardly stand the rapid atmospheric changes occurring. Ascending to an altitude of 40,809 feet in another official test which the weather bureau has conducted, and utilizing a pilot balloon with scientific instruments attached for recording the atmospheric constants, we find the air pressure here dropt to the low figure of 2.69 pounds per square inch. At 60,000 feet elevation above sea level, the official figures show but 1.17 pounds per square inch. At 88,000 feet, 16.7 miles above sea level, the recorded air pressure is .3146 pounds per square inch, or approximately 5 ounces. Let us now jump to a real high altitude—100,000 feet, or 18.9 miles above good old terra firma at sea level, where we find but a fraction of a pound, or 3.05 ounces (.91 lb.) per square inch, atmospheric pressure. Even a flea could not live up there, we will wager, except that it is in a vacuum bottle, and a strong one at that. The highest figure to which a test balloon carrying recording instruments has flown is 126,800 feet, or 24 miles above sea level. The pressure at this dizzy altitude is but a fraction of an ounce.

The various degrees of cold found in recent tests, most of which were carried on during the summer months, are tabulated

DOUBLE YOUR STRENGTH

For Vital Strength **IMPROVE YOUR HEALTH AND LENGTHEN YOUR LIFE**





Resistance on abdomen increases automatically

THE SUCCESS OF YOUR LIFE — your business, your position, your happiness, all depend upon YOUR HEALTH and STRENGTH.

I guarantee that my system of CONDENSED EXERCISE with my patented

AUTOMATIC EXERCISER



Overhead exercise for straightening and strengthening spine and shoulders

will more than double your constitutional and muscular strength in from two to three months. My many pupils all over the country will testify that the Automatic Exerciser will do this.

Ten Minutes Daily on the Automatic Exerciser will build for you a degree of fundamental, physical strength that will make life and work a pleasure.



Wrist and upper arm



Massages and exercises the small of the back

IT WILL GIVE YOU
A Clear Brain
A Powerful Heart
Massive Chest
Strong Lungs, A Fine Back
Broad Powerful Shoulders
Strong and Well Shaped Legs
A Wrist and Arm of Steel

Detachable Hollow Ball in 2 Pieces

The **AUTOMATIC EXERCISER** will fortify the entire area of the abdominal walls throughout all its layers.

Its influential effect on the digestion eliminates the special diet question. It will strengthen the entire organism and insure immunity from the many ills the "busy" man knows so well.

It will instantly relieve that brain and body fag. It will make nervousness and complications therefrom a thing of the past.

You quickly outgrow any mail course.

Their results are only temporary.

You Cannot Outgrow the "AUTOMATIC EXERCISER." It does not "use up" your vital energy. It generates MORE VITAL ENERGY.

Like the heart, which has a rest between each beat, so in my system there is a resting pause between each contraction of the muscle brought into action with the "Automatic Exerciser." This enables you to develop a superior physique without undergoing the strenuous and exhaustive training which the ordinary gymnasium methods require.

The patented mechanism of the Automatic Exerciser induces complete relaxation in the nerves and muscles and develops great strength and flexibility in the joints. It will cure any case of "muscle bound" condition in a short time.

The attachments for different parts of the body are hooked to the chain at any point desired.

The resistance increases automatically with each pull and the numbers on the bar REGISTER the increase at each pull as the lever bar moves ahead one cog each time.

The resistance and increase is POSITIVE and UNIFORM and can be adjusted less than a pound or several pounds to suit the requirements of the different parts of the body.

WHAT OTHERS SAY

"I am well pleased with the AUTOMATIC EXERCISER. Before taking exercise on your machine my blood and liver were slow and sluggish—but now! what a difference—I am full of energy.

"It is worth a hundred times the price I paid for it."
Wichita, Kansas. EARL PINNEY.

"The Automatic Health Exerciser is a wonder. It has done more for my health and strength in two months than all the exercises and apparatus put together which I have tried in years." MAURICE DALY, JR.
Daly Billiard Academy, N. Y. City

Mr. Anton Hromatka, City Infirmary, St. Louis, Mo., sends records of his results, which he secured with my machine and instructions in four months.

Strength of	First Record	Second Record	Strength Gained
Thighs	754 lbs.	2,000 lbs.	1,246 lbs.
Knees	754 lbs.	1,800 lbs.	1,046 lbs.
Calves and Ankles	410 lbs.	892 lbs.	482 lbs.
Back	508 lbs.	1,382 lbs.	874 lbs.
Shoulders and Arms	356 lbs.	641 lbs.	285 lbs.
Neck	185 lbs.	375 lbs.	190 lbs.
Biceps	87 lbs.	280 lbs.	193 lbs.

His fingers show an average gain in strength of 100%.

Records of one month's results by Mr. Thomas Waring, Hamilton, Ont., Can.

First Record	Second Record
159 lbs.	411 lbs.
134 lbs.	461 lbs.
.....	.....
54 lbs	88 lbs.
41 lbs.	86 lbs.
20 lbs.	54 lbs.
.....	.....
Abdomen	
46 lbs.	102 lbs.

With the Automatic Exerciser you can acquire more Resisting Power and Vim than you ever had.

If you want to double your strength and consequently acquire a SUPERIOR DEGREE OF HEALTH send for my 32-page booklet

IF YOU ARE BATTLING WITH FUNCTIONAL WEAKNESS IN ANY FORM, SEND FOR..... ☞ **LIFE'S BACKBONE**

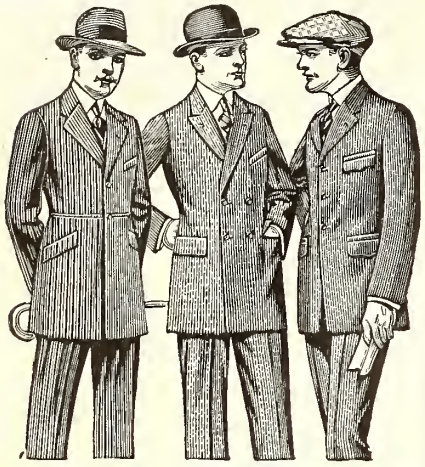
Prof. ADRIAN P. SCHMIDT
1951 Broadway, New York City
(Near 66th St. Subway Station)

which gives a full description of the Automatic Exerciser, how it works, what it will do, etc. *Don't judge my machine until you have read this booklet.* I will send it on receipt of 4o postage.

www.americanradiohistory.com

SAVE 40% ON CLOTHING

A money-saving opportunity that you should investigate at once. We make and sell the finest made-to-measure clothes direct to wearer at a guaranteed saving of from 25% to 40%. We cut out all middlemen, save all unnecessary expenses and unnecessary profits, and give you the benefit.



All Orders On Approval

We make every suit to your exact measure and individual specifications, send it to you delivery charges prepaid, let you try it, and inspect it carefully. Unless you are perfectly satisfied you will not be under the slightest obligation to keep it and your trial order will not cost you one cent.

LOOK AT THESE LOW PRICES
(A Few Of Our Bargains)

Kind of Cloth	Usual R't'l Price	Our Wh'le Price
Fine Blue Worsted	$35.00	$22.00
Gray Cassimere	32.00	20.00
Fine Blue Serge	50.00	35.00
Brown Check Worsted	40.00	29.50
Steel Gray Worsted	45.00	32.50

And Sixty-five Other Wonderful Bargains.

STYLE BOOK AND CLOTH SAMPLES *FREE*

Write at once for copy of our new style book showing the latest New York and Chicago fashions with a beautiful variety of large cloth samples of the season's most popular fabrics, directions for taking measures, etc. Everything free and postpaid and no obligations to you. Bell Tailoring is unsurpassed in quality, fit, and style. Nothing better made and remember we guarantee a saving of 25% to 40%. No matter where you live, write at once for your copy of our new book,

THE BELL TAILORS
Adams at Green Sts. Dept. 106 Chicago, Illinois

Study Chemistry

with the aid of one of our chemical and apparatus sets. They contain all the chemicals and apparatus necessary to perform practically every experiment found in any text book.

All Chemicals are Contained in Glass Bottles

Chemical Set No. 1—$13.50
Apparatus Set No. 1— 11.75
Chemical Set No. 2— 20.50
Apparatus Set No. 2— 31.25
Chemical Set No. 3— 54.25
Apparatus Set No. 3— 55.00

Write for particulars which state quantities, etc., of chemicals and apparatus supplied.

Junior Set No. 00

For those who do not wish so elaborate a set at first, we have put out a Junior Set, consisting of 48 chemicals in glass bottles and 16 pieces of apparatus.

PRICE $5.00

Ziegler Experimental Laboratory
47 Judson St. ROCHESTER, N. Y.



FREE Sterling Silver INITIAL CRYSTAL WATER SET, each piece stamped sterling, any initial, also other valuable presents, cameras, air rifles, talking machines, telescopes, typewriters, etc., given absolutely free for selling our art and religious pictures at 10c. Send for 25, when sold send money and receive premium.

SPENCER PUB. CO., Dept. 305 Chicago

in the accompanying illustration, and these exert a very severe effect on the pilot indeed, covering his glasses with frost, so that it is impossible to see the instruments and steer the plane, even at altitudes of 25,000 feet and less; causing the engine to misfire, and in fact to stop in many instances. Electric self-starters which are now being fitted to most of the sea and land planes help the pilot out of many difficulties such as this, which may otherwise end disastrously for him.

To Europe in Half a Day by Airplane.

If we have an airplane which can go over 200 miles an hour, such as the "Christmas" Bullet plane, and ascending to an elevation let us say of between 30,000 and 40,000 feet, where we had an air current traveling Europeward at 200 miles an hour, then our net speed upon reaching this strata would total 400 miles an hour. With a "vacuum bottle" cab fitted to the airplane, together with oxygen tanks and atmospheric compressors for the carburetor system of the engine as well as for the cabin, it would then become possible to fly the 3,000 miles separating New York and London in approximately *one-half day or seven and one-half hours.* Possibly in flights of the future, when aircraft will abound in large numbers, there will be a strict classification of the air strata, such as shown in the accompanying drawing; the lower strata being assigned to the slow-going and shorter trip airships—the middle strata to the speedier open-cabin planes or dirigibles; and finally, the upper highly rarefied, rapidly moving air strata to the specially protected aircraft engaged in negotiating long distances, such as trans-oceanic and trans-continental trips, where speeds of 400 to 600 miles will be not only frequent, but common. The passengers will hardly realize that they are traveling at such prodigious speeds, owing to the fact that one of the principal components of their relative velocity to the earth will be the air current in which they are moving. If the plane had to tear its way thru the air, so that air currents had to rush by the edges and surfaces of the machine at a velocity of 400 to 500 miles an hour, the terrific air friction would probably injure the craft speedily; however, when the plane is actually cutting thru the air at 200 miles an hour, and the air current with which it travels is going at an equal speed, then no abnormal air friction will be encountered.

Around the Earth in 24 Hours by Airplane.

If we can devise an aircraft with large enough wings to support itself, sufficiently large multi-bladed propellers, compensated engines and proper crew housing arrangements to survive the extremely rarefied atmosphere at an altitude of forty to fifty miles (which is in the region of the limit of the earth's atmosphere, as our scientists tell us), then it is possible that the aviator would meet with air currents of such high velocity that he would be able to practically shut off his power and travel 25,000 miles (generally speaking) in 24 hours. Why is this so? Due to the fact that it is known from kite and balloon sounding tests in the upper atmospheric air strata, that many miles above the surface of the earth there are air currents moving eastward, and probably some of them westward with the rotation of the globe, or 1,000 miles per hour. Prof. McAdie, a noted American meteorologist, Harvard University, has estimated that such high velocity air currents may be encountered at even 50,000 feet. Considering that such a high velocity air current is found at 50,000 feet, then he considers that above this there may be a *westward-moving* air stratum, and still higher another *eastward-moving* air stratum. These phenomena were attested very markedly by the high altitude flight of Major R. W. Schroeder, of the American



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle massage. Can be used with or without electric current.

All users of the Lek-Tro-Shav speak well of it

A barber says—"Have shaved for years and have never used any shaving device near its equal."
A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."
No. 1 Made for use from Light Socket.
No. 2 Made for use from Dry Battery.
Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.

VIBRATING ELECTRIC RAZOR CO.
Dept. 122. Omaha, Nebr.

FUN



Noiseless Target Practice
Fit your .22 with a Maxim Silencer and get no end of fun this winter practicing in your backyard and basement.

MAXIM SILENCER
MAKES YOU A BETTER MARKSMAN

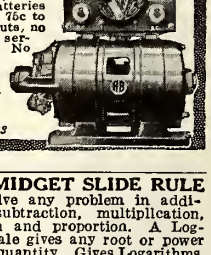
It eliminates recoil and all noise of the report, and steadies your aim. Direct from Dealer or Factory $5.00. Write for Free Book of Stories.

FREE BOOK

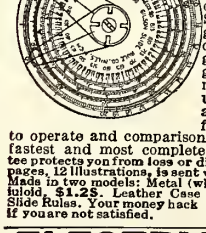
MAXIM SILENCER CO.
89 Homestead Ave., Hartford, Conn.

Big Profits Every Month in Battery Charging

These Garages Use HB Chargers—Note Their Profits
Keifer Auto Supply Co., Keifer, Okla. (pop. 1,200)—"My average income per month is $165.00. The charge is O.K." Hamilton Battery Co., Hamilton, O. (pop. 38,000)—"Income per month $200.00 to $240.00. Cost per month, $15 to $30. The most complete and best machines ons can buy. Not a moment's trouble.
YOU Can Do as Well with This HB 5c0 Watt Charger.
Small cash payment, balance on easy monthly payments. HB Absolute Money-Back Guarantee. Recharges 1 to 86-volt batteries for 10c to 15c each, customer pays 75c to $1.50. BIG PROFITS. No burn-outs, no expensive renewals, steady reliable service. Easy to install and operate. No electrical knowledge required. Pin this ad to your letterhead and mail TODAY for information.



HOBART BROTHERS COMPANY
Box 102E Troy, Ohio
Successful Manufacturers Since 1893



THE MIDGET SLIDE RULE will solve any problem in addition, subtraction, multiplication, division and proportion. A Log-Log Scale gives any root or power of any quantity. Gives Logarithms, Sines, Tangents, Cosines, Cotangents and the decimal equivalents of fractions to six figures. It is grease and water proof and will give years of service. This rule is not to be compared with the paper utility rules which sell for $1.00 and are put together with paper fasteners. It is accurate, simple to operate and comparison shows that it is undoubtedly the fastest and most complete rule made. Our refund guarantee protects you from loss or disappointment. An instruction book 16 pages, 12 illustrations, is sent with each rule. Diameter of rule 4 in. Made in two models: Metal (white coated steel), **$1.00**; White Celluloid, **$1.25**. Leather Case **50c** extra. Send for catalogue of Slide Rules. Your money back if you are not satisfied.

Gilson Slide Rule Co., Niles, Mich.

ELECTRICAL training again open to civilians. Over 3000 men trained for electrical industries in experience of more than a quarter of a century. For men of ambition and limited time. Condensed course in Electrical

ENGINEERING enables graduates to secure good positions and promotions. Theoretical and Practical Electricity, Mathematics, Steam and Gas Engines Mechanical Drawing. Students construct dynamos, install wiring and test electrical machinery. Course with diploma, complete.

IN ONE YEAR



Thoroughly equipped fireproof dormitories, dining hall, laboratories, shops.
Write for catalog. 27th year opens October 1, 1919.

BLISS ELECTRICAL SCHOOL
260 TAKOMA AVENUE, WASHINGTON, D.C.

www.americanradiohistory.com

Flying Corps, who found himself carried 200 miles *east* of the location from which he had ascended; and not only this, but with his plane traveling *west* at 100 miles an hour, the great eastward moving air current must have had a velocity of more than 300 miles an hour, or it would not have carried him 200 miles *eastward* from where he ascended. Thus do we learn more and more daily of the uncharted wonders of the great translucent envelope surrounding our earthly habitation, which we call the "atmosphere."

High Altitude Flying Machines.

What type and form of aircraft will the high altitude machine be? This question was answered in part by the above discussion, where it was mentioned that the machine intended to fly at altitudes of 40,000 feet or over would be necessarily equipt with wings of much greater sustaining surface or else a triplane or quadplane could be employed. Also in order to "get hold" on the thin rarefied air of the higher strata, longer propellers would be necessary, and preferably also an increase in the propeller speed. It should be remembered that while the air has become lighter and less dense at these high altitudes that the weight of the plane and aviator has remained practically the same, the slight loss in weight due to the change in gravity pull, occasioned by going away from the earth's surface, being very small and having no practical bearing on the matter. Balloons have ascended with passengers as high as 38,000 feet. The heat of the sun rapidly expands the gas in balloons, and they also expand markedly at such altitudes, due to the reduced air pressure. At a height of 70,000 to 80,000 feet a pilot test balloon (no passengers) *will expand to about four times its normal size.* The air pressure acting on the balloon bag has fallen decidedly; so the hydrogen gas with which it is filled pushes outward on the envelope to a proportionate extent. Many times these weather bureau pilot balloons burst before they have reached the altitude intended for these reasons—heat and rarefication of the atmosphere. The large passenger-carrying dirigibles, containing gas to make them buoyant, such as the R-34, which recently crost the Atlantic ocean and return, have special compensating valves which release some of the gas at intervals as the airship ascends—losing about 1/30 of its volume of gas for every thousand feet of "climb."

What does this demonstrate? Simply this: that what gas is lost by heat and rarefication expansion by ascending cannot be recovered. Therefore the balloon must carry sufficient gas to permit its remaining buoyant when it descends again to a denser or lower atmospheric strata. A certain amount of expansion in a non-rigid or even in a rigid balloon or dirigible is permissible and desirable, as this increases the surface area exposed to the atmosphere; therefore the lifting power is maintained, within certain limits, in the less buoyant and highly rarefied air. It is conceivable, therefore, that as the rarefaction of the air increases very rapidly as we rise to greater altitudes than 40,000 feet above sea level we shall probably find our dirigible altitude airmen confined to air strata below 40,000 feet. This seems logical, for the reason that to ascend much above this air level a very considerable amount of gas would have to be liberated to prevent the balloon expanding to the bursting point, and therefore the gas so lost would apparently soon reach the limiting point where no more gas could be liberated, or else the dirigible would not retain a sufficient volume of gas to give it the necessary buoyancy to hold the weight of the crew, cabins, engines and fuel. A pilot balloon as used by the Weather Bureau for testing purposes is a simple spherical and easily expansible af-

(*Continued on page* 596)

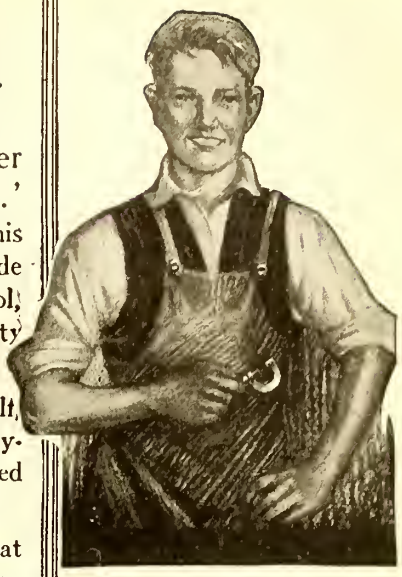
The apprentice says:

"Almost the first tool I ever heard of was a Starrett 'mike.' Somebody pinched Dad's out of his jumper pocket and the fuss he made showed he thought it was *some* tool, even if he had had it close on twenty years.

"When I got into the shop myself, I noticed the toolmakers and everybody who had 'fussy' jobs preferred Starrett Tools.

"There's something about 'em that the fellows like. Yeh! They're accurate and they're convenient, but I guess the fact that the men who make 'em are pretty good mechanics themselves, has something to do with it.

"What? Sure I'm getting me a set of Starrett Tools—I need 'em every day. Yes, I got me one of those seventy-five cent Starrett Apprentice Books, too. It saves me asking the foreman a question every five minutes. Now, when I want to know how to do something, I can look in the book and study it out myself."



Starrett Tools



The L. S. STARRETT COMPANY
THE WORLD'S GREATEST TOOLMAKERS
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

For thirty-nine years Starrett Tools have measured the accuracy of the world's work. Catalogue No. 21 "L.E." free upon request.

42-972

HOME BATTERY CHARGING

means Vitality, and Long Life to your battery and anyone can do it with the

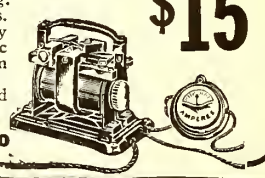
NEW F-F BANTAM BATTERY BOOSTER

which will charge any 6 volt storage battery eF-Ficiently from 100 to 130 volt 60 cycle alternating current lamp socket at a cost about equal to burning an electric lamp for a few hours.

This is a new size of F-F Rectifier and similar to our standard F-F Magnetic Rectifiers which have been on the market for over 3 years. Thousands in use giving satisfactory service. Simple, safe, sure acting. Copper and carbon electrodes rectify the current. Capacity 8 amperes. Shipping weight 10 pounds. Price complete with Ammeter and Battery Clips $15. Also F-F Rectifiers of larger capacities for private or public garages as well as Battery Charging Rheostats that operate from Farm Lighting Plants and Direct Current Service.

Send check for prompt shipment via express or if via parcel post add sufficient for postage and insurance. Bulletin 12 on request.

$15



THE FRANCE MANUFACTURING CO., Cleveland, Ohio

AMAZING OPPORTUNITIES in the Airplane Industry

Right now is your opportunity to get into the greatest industry the World has ever known. Thousands of new positions opening up everywhere in this attractive new field. Never before have ambitious men had such a glorious chance. Send Coupon at once—find out how our wonderful Course in Practical Aeronautics will give you the knowledge to enter this new field. Learn at home by mail during your spare time.

Prepare NOW for these positions
Aeronautical Engineer
Aeronautical Instructor
Aeronautical Contractor
Aeroplane Repairman
Aeroplane Mechanic
Aeroplane Inspector
Aeroplane Salesman
Aeroplane Assembler
Aeroplane Builder

Enormous Demand for Men—Big Pay
If you know Practical Aeronautics, some big Airplane Corporation will want you. Unheard of Salaries are being paid trained men. Act at once. The pioneers are going to reap the big rewards. Automobile history, railroad history, movie history will repeat itself in Aviation

Special Offer NOW—Send Coupon
Send the Coupon at once for full particulars of our remarkable offer open to you now. We will also send you our big new book "Opportunities in the Airplane Industry." No obligation. Be sure to tear off and mail coupon today.

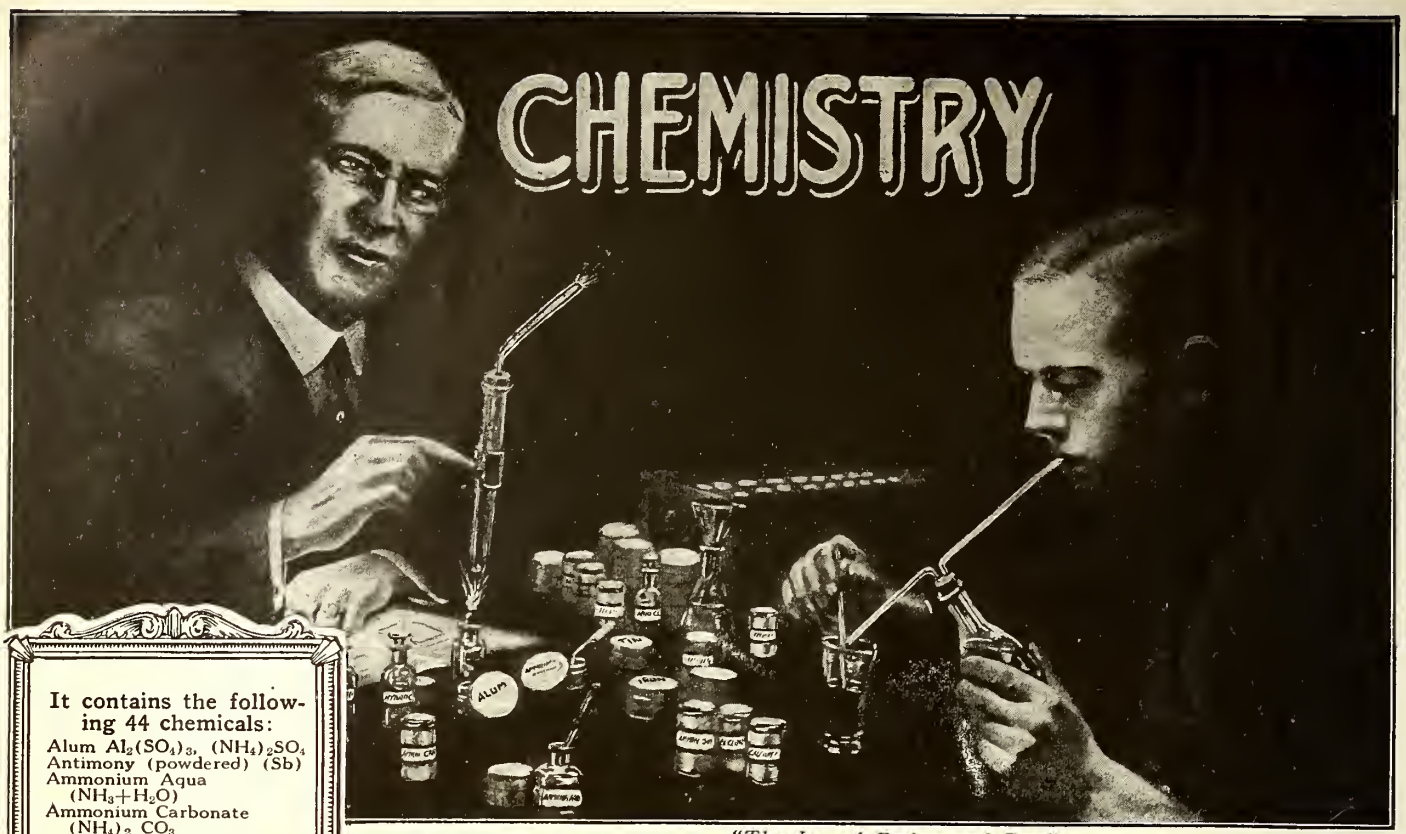
AMERICAN SCHOOL OF AVIATION
431 S. Dearborn St. Dept. 7748 Chicago

FREE BOOK COUPON

American School of Aviation
431 S. Dearborn St., Chicago
Dept. 7748
Gentlemen: Please send me full particulars of your remarkable offer, also your new big book "Opportunities in the Airplane Industry." I assume no obligation.

Name.....
Address.....

www.americanradiohistory.com



"The Joy of Father and Boy."

Chemical Laboratory

We present herewith to our friends our new **E. I. Co. Chemical Laboratory** which contains **real** chemicals and apparata to perform **real** chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a **Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.**

It contains the following 44 chemicals:

Alum $Al_2(SO_4)_3$, $(NH_4)_2SO_4$
Antimony (powdered) (Sb)
Ammonium Aqua (NH_3+H_2O)
Ammonium Carbonate $(NH_4)_2\ CO_3$
Ammonium Chloride (NH_4Cl)
Ammonium Sulphate $(NH_4)_2\ SO_4$
Barium Chloride $(BaCl_2)$
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride $(CaCl_2)$
Calcium Oxide (CaO)
Calcium Sulphate $(CaSO_4 2H_2O)$
Charcoal (Carbon) (C)
Chloride of Zinc $(ZnCl_2)$
Copper Sulphate $(CuSO_4)$
Ferrous Sulphate $(FeSO_4)$
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5(OH)_3$
Hydrochloric Acid (HCl)
Iodine (I)
Iron Chloride $(FeCl_2)$
Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
Magnesium Carbonate $(MgCO_3)$
Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
Nickel Chloride $(NiCl_2)$
Oxalic Acid $(H_2C_2O_4)$
Sodium Bicarbonate $(NaHCO_3)$
Sodium Borate $(NaBO_2)$
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate $(NaNO_3)$
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride $(SnCl_2)$
Sulphate of Nickel $(NiSO_4)$
Sulphate of Zinc $(ZnSO_4)$
Sulphuric Acid (H_2SO_4)
Tin (Granulated) (Sn)
Zinc (Metal) (Zn)
Zinc Carbonate $(ZnCO_3)$

The following apparata are furnished:

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube
Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure
Glass Tubing
One book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

DESCRIPTION OF THE OUTFIT:

The outfit consists of forty-four (44) Chemicals all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) enough to make dozens of experiments with each. See list of Chemicals herewith.

The apparata furnished are all of the best obtainable make and of standard laboratory size and shape. A list of the 17 pieces of apparata furnished with this outfit is printed also herewith.

The Instruction book is a real **Chemistry Course for the Beginner.** Some of the Contents are: **Division of Matter:** This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. **Chemical Nomenclature:** This explains in simple language the derivation of the chemical names of the Elements and their compounds. There is a chapter on **Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms,** etc.

A good part of the book is devoted to Weights and Measures. The Metric System, the English system and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights, Volume, Capacity and Length; Per Cent solutions; Conversion of Measure expressed in parts; Poisons and their antidotes; Technical and common name of chemical substances; Formulas for Cleaning various substances, etc., etc.

Among the **100 Experiments** are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to Make Chlorine Gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

The price is still $5.00. Shipping Weight 10 lbs. (Can be shipped by Express only.)

TRADE MARK **THE ELECTRO IMPORTING CO., Mfrs.** **TRADE MARK**
231 FULTON STREET NEW YORK CITY

"THE LIVIEST CATALOG IN AMERICA"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 176 Big Pages, 400 illustrations. 300 instruments and apparatus, etc. Big **"Treatise on Wireless Telegraphy."** 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 20 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

I enclose herewith 6 cents in stamps or coin, to cover postage, for which please send me your latest Cyclopedia Catalog No. 20 as described.

NAME .....
ADDRESS .....
STATE.....E. E. 10-19

www.americanradiohistory.com



In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries addrest to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are publisht here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

Combination Salt and Pepper Shaker.

(340) Messrs. Frank B. Martin and G. L. Pastor, Braddock, Pa., submit what they call a combination salt and pepper shaker. The idea is to use the two vessels side by side, and then by having a sliding member with holes, either salt or pepper may be shaken out from either vessel as desired. Our advice is asked on the invention.

A. This is a capital idea and should prove a success. We are certain that a patent can be obtained upon it, and that the article when made properly will prove a good seller.

Multiple Phonograph Record.

(341) Jackson Lloyd, Long Beach, Calif., would like to know whether a patent can be obtained on a phonograph record which has four pieces on it, two on each side. The idea is to use a double track, similar to a double thread on a bolt. This would require the record to be twelve inches in diameter to hold the same amount, or the same length, of music as on a ten-inch record. The starting operation would be accomplisht by placing the needle in a groove, which would have to extend out into the smooth rim while the machine was not in operation. It is then started going.

A. There is nothing new about this device, and no advantage is gained because each piece would take up a certain amount of the record, and you might just as well have the second piece after the first was played. This is the present mode of doing it, and is perhaps more satisfactory than the suggested manner, which has been tried out in the past and found unsatisfactory.

Electric Shutter Trip.

(342) Lewis H. McCarrow, San Diego, Calif., would like to have our advice on an electric shutter trip for cameras to be used as a cable release operated shutter. Drawings accompany the request.

A. Nothing fundamentally new is shown in this device, and while no doubt it will work, there is nothing new contained in it that would warrant our correspondent to obtain a patent.

Pliers.

(343) B. F. Freese, Williamsburg, Pa., submits description and illustration of a combination electrician's pliers. Several new improvements are shown, where the jaws of the pliers have several different sizes of openings, which are used to remove insulation from different gage wires. Our opinion is asked as to patentability, etc.

A. We can offer no encouragement to our correspondent on this idea. Nothing fundamentally new is shown, and we doubt very much whether a patent could be obtained.

Shuttle Alarm.

(344) G. L. Busse, Cedar, Minn., has conceived an idea to use an electric contact arrangement which gives an alarm when the thread on the sewing-machine bobbin becomes depleted. It is well known that many pieces of material are spoiled or have to be run over because the thread has run out from the shuttle bobbin when the person operating the machine was not aware that the thread supply had run low. Our advice is asked as to patentability and usefulness of this improvement.

A. This is a very good idea, and we think a patent can be obtained on the device. How practical it will be and how the women folks will take to it, is impossible to say. One advantage of the device is that it can be manufactured for a few cents and is readily attached to any machine. All that is required is a battery and a buzzer, and the whole outfit can be put on the market for $2.00. What success there would be in marketing the device, however, is problematical.

Cold from Electricity.

(345) Mr. Ernest F. Prucha, Howells, Nebr., submits an idea showing a net-work of bismuth and antimony bars, which are crost and soldered together in the form of a Peltier's cross. This is to be used to cool a room, etc.

A. There is nothing fundamentally new shown, and the principle is well known and quite old. No patent could be obtained, in our opinion.

Spark Plug.

(346) Frederick L. Umbach, Troy, N. Y., writes: "I have a small invention and would like to know if it is on the market. It is a low-tension make-and-break spark plug. No coil or magneto is used. All that is needed is a dry-cell battery to make the plug throw a large spark. I have tried this plug on gasoline engines, motorcycle and automobile engines, and it has worked with success. I have made a few and sold them to different men who have cars, and they have had good results with this plug, so that the carbon from the engine could not stop the sparking. I would like to know whether this could be patented, and wish to hear from you as soon as possible."

A. Not having more details on the invention, it is quite impossible for us to give any information on the subject.

Hat Covering.

(347) Alex. Yenyo, Johnstown, Pa., writes: "I would like to submit a plan for a rubber covering for a hat, which is to be made of thin soft rubber overlapping a quarter of an inch at the brim. It is shaped exactly like the hat so that it fits snugly over it, to protect it from the rain. When not in use, it can be slipt into the pocket or a case made to hold it. I would like to know if this idea can be patented, or if there is any such idea out."

A. It is quite an old idea and any United States army or navy officer will be glad to show you one of the coverings which he uses to cover his cap. Such rubber coverings are for sale in stores selling headwear to officers.

Talking Film.

(348) Donald Hucke, Sheldon, Iowa, writes as follows: "I have read so much of the impossibility up to the present time to obtain perfect synchronism between the motion picture machine and the phonograph. In the February, 1918, issue of the ELECTRICAL EXPERIMENTER, on the first page, the vibrations of the voice was recorded on a celluloid film. Couldn't this be applied to the edge of a regular picture film. If heat was needed for the talking record, it could easily be localized so as not to affect the film. Altho this would have to be recorded on each individual film sent out, this also could be easily done from the original. The difficulties of talking would be few. A phonograph recording attachment and a few sensitive microphones would be all. I have thought this over from every point and I can't see any objection to it that could not easily be remedied. Will you please put this on your "Patent Advice" columns of the E. E. and tell me whether it works or not.

U.S. PATENTS



Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

LANCASTER & ALLWINE

255 OURAY BLDG.,
WASHINGTON, D. C.

PATENTS

TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
164 Owen Building, Washington, D. C.
2276-8 Woolworth Bldg., New York City

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE ON CONCEPTION." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention we will give our opinion as to its patentable nature.

Our illustrated Guide Book, "HOW TO OBTAIN A PATENT," sent Free on request.

Electrical Cases a Specialty Highest References Prompt Attention Reasonable Terms

FREE COUPON VICTOR J. EVANS & CO., Patent Attorneys

New York Offices: 1001 to 1007 Woolworth Bldg. Pittsburgh Offices: 514 Empire Bldg. Philadelphia Offices: 135 S. Broad St.
Main Offices: 779 Ninth Street, N. W., Washington, D. C.

Name..... Address.....

www.americanradiohistory.com

PATENTS

LACEY & LACEY

Attorneys-at-Law—Patent Practice Exclusively
Solicitors of

U. S. and Foreign Patents
Trade-Marks, Copyrights
659 F St., N. W., Washington, D. C.
Write Us for Our Free Inventors' Book
PATENT-SENSE
Established 1869

PATENTS

INVENTORS: Send us sketches or a model of your invention and a description of the device for advice in regard to the best way of obtaining patent protection. Our practical experience covers a period of twenty years. Our hand-book on patents is sent free on request. All communications strictly confidential. Write us today.

TALBERT & TALBERT
Patent Lawyers
4287 Talbert Bldg. Washington, D. C.

? HOW TO MAKE

MONEY WITH YOUR PATENT
HOW TO SELL
HOW TO KEEP CONTROL
HOW TO ORGANIZE
HOW TO RAISE MONEY

These and hundreds of other vital questions the inventor must know to make his invention a financial success, fully answered in

The Inventors' Manual of Valuable Information
$1.50 per copy, postpaid

If you have a patent or are thinking of taking out one, protect yourself by getting all the information this valuable book contains.

Write for free circular and table of contents.

G. E. Perry Company, Publishers, 1324 Broadway N. Y.

PATENTS

If you have an invention and desire to secure a patent, send for our Free Guide Book, HOW TO GET YOUR PATENT. Tells our Terms, Methods, etc. Send model or sketch and description for our opinion of its patentable nature.

RANDOLPH & CO.
Dept. 172 Washington, D. C.

Patents Promptly Procured

Send sketch or model for actual search of U. S. Patents. Highest references. Personal service. Moderate fees. Write for Free Patent Book.

GEORGE P. KIMMEL, Patent Lawyer
99-Y Loan & Trust Bldg. Washington, D. C.

PATENTS

C. L. PARKER
Formerly Member Examining Corps. U. S. Patent Office.
PATENT LAWYER
McGill Bldg.
Washington, D. C.

Patents, Trade Marks, Copyrights, Patent Litigation

Handbook for Inventors, "Protecting, Exploiting and Selling Inventions," sent upon request.

PATENTS

Hand Books on Patents, Trade Marks, etc., sent free. Our 70 years of experience, efficient service, and fair dealing, assure fullest value and protection to the applicant. The Scientific American should be read by all inventors.

MUNN & CO., 622 Woolworth Bldg., N. Y.
Washington Office, 622 F St., Washington, D. C.

A. This magazine has publisht quite a good deal about talking films in the past, and while the fundamental idea seems to be right so far, we have never seen the device work out in practise, presumably for the reason that the investigators have struck a snag. As to our correspondent's idea to put the phonograph record alongside of the perforation of the film, this would not constitute a patentable idea, nor would there be enough room for the voice, as far as we are able to ascertain.

Automatic Talker.

(349) A. B. W., Chicago, Ill., says as follows: Could you please advise me through the ELECTRICAL EXPERIMENTER whether or not I would be able to secure a patent on the following apparatus. The apparatus is an instrument which will automatically answer a telephone; that is, when the party being called is not at home; tell the party calling that there is no one at home and asking if there is any message which they would desire to leave, which, if there is, it will take it and reserve for the party being called. Upon the return of the party being called the same machine which talked to the incoming calling party will play off the message which has been received. The instrument is only set at times desired.

Here is an example of the machine having been connected. Machine answering phone: "Hello—Drexel 4368." "There is no one at home just at present. Is there any message which you wish to leave?" The party calling: "Yes. Please tell Mr. Jones that I would like very much for him to call Mr. Smith at Eng. 5346." When the calling party hangs up the machine automatically comes to a stop. Upon the return of the party being called they play off the record which has been made by the call.

The machine is connected in the home and is started by the incoming call.

A. There is nothing new to this device, it having been described a number of times in the ELECTRICAL EXPERIMENTER, as well as other magazines. The device is not impossible, altho we believe it is impractical, as, first of all, few people would go to the trouble of installing it, and the device would be unduly complicated in case two or three more people would call up in succession.

Electrical apparatus for tapping trees, which can be left without attention for months, has been invented.

For mines using electric haulage, a door opening motor and safety signal, operated by the drivers of mine locomotives, has been invented.

Practical Chemical Experiments

By Albert W. Wilsdon

(*Continued from page* 532)

Experiment No. 5. Since the acid potassium malate exists in the stalks of the common rhubarb, the juice that is exprest from this may be filtered and tested for malic acid by the method in Experiment No. 4.

Citric acid occurs in the juice of lemons, currants, unripe tomatoes, gooseberries, etc. It is made on a large scale from lime or lemon juice, by saturating the juice with chalk; the precipitat of calcium citrat is decomposed by an equivalent quantity of sulfuric acid and filtered from the calcium sulfate. Evaporate the filtrat and crystallize out most of the calcium sulfate, and from the mother liquor allow the citric acid to crystallize.

Experiment No. 6. Make citric acid from the juice of at least two lemons, as above described.

Experiment No. 7. Add a moderate quantity of calcium chlorid to a concentrated solution of citric acid, and then add sodium hydroxid till the solution is nearly neutral. Calcium citrat will be formed.

Experiment No. 8. Try the above test with a concentrated and filtered sample of lemon juice, and note the formation of the precipitat of calcium citrat.

Tartaric acid is found in many fruits, particularly ripe grapes, as acid potassium tartrate. When the "must" ferments the "cream of tartar" precipitates as the alcohol increases, and this precipitat is known as crude tartar. It is frequently much contaminated with calcium sulfate, which is used in "plastering" the wine. To make

Competent Patent Service
By a Former Examining Official of the U. S. Patent Office
NORMAN T. WHITAKER
Lawyer and Engineer
480 Whitaker Bldg. Washington, D. C.
Branch Office, 87 Nassau St., New York City.
INQUIRIES INVITED

PROTECT YOUR RIGHTS TO INVENTION

Write today for "Record of Invention," which contains forms to establish evidence of conception. Prompt personal service. Preliminary advice without charge.

J. REANEY KELLY
732-P Woodward Bldg. Washington, D. C.

PATENTS
TRADE MARKS COPYRIGHTS

Our facilities for securing patents enable us to give prompt and reliable service at reasonable rates. Send sketch for preliminary examination. Inquiries invited.

A. M. BUCK & CO.
205 Second Natl. Bk. Bldg., Wash., D. C.

PATENTS

Inventors Invited to Write for Information and Particulars
Highest References. Best Results.
Promptness Assured.
WATSON E. COLEMAN
Patent Lawyer
624 F Street N. W. Washington, D. C.

AMATEURS — INVENTORS
ELECTRICAL APPARATUS MADE TO ORDER
COSTS NO MORE THAN READY MADE
and allows you to
WORK UP YOUR OWN IDEAS
KAUFMAN MACHINE COMPANY
1357 Odell St. New York City
Engineers Expert Instrument-Makers Designers



Swing 4 in., 11 in. between centers, 17 in. total length. Shipping weight 13 lbs. Bed of lathe is machined. Workmanship first-class. Equipped with wood turning chuck. Can be fitted with 3 in. face plate and drill chuck as special equipment. Order one today Price $5.00 cash with order. SYPHER MFG. CO., DEPT. C TOLEDO, OHIO



SMALL ENGINES

Perfected Gasoline Engines—½, 1 and 1½ h. p.—for Farm and Shop use. Price, $27.50 and up. Also,
WASHING MACHINES
We ship on trial. Send for Booklet and Special Offer.
SIEVERKROPP ENGINE CO.
1401—19th St., Racine, Wis.
STARTER for FORD CARS

MARKO
STORAGE BATTERIES
ARE GOOD—TRY ONE
Paul M. Marko & Co., Inc.
1402-1412 Atlantic Ave.
Brooklyn, N. Y.

Electricians Get up-to date in HOUSE WIRING! Save TIME, MONEY, LABOR and MATERIAL by using our 98 GENUINE BLUE PRINT DRAWINGS, containing all the latest diagrams and connections known in house wiring—every diagram and connection up-to-the-minute as used by first class electricians for wiring BELLS, BURGLAR ALARMS, LIGHTS, ANNUNCIATORS, FIRE ALARMS and ELECTRIC GAS LIGHTING. These drawings are bound in the form of a flexible book (9 x 12) for convenience in using on the job. Send for them, and if they don't make you more efficient as a wireman and save you many times their cost as a contractor, return them and money will be refunded—you can't afford to be without them. ONE DOLLAR postpaid. Send for circulars on other sets of drawings.
PATENT SPECIALTY COMPANY
P. O. Box No. 583 San Francisco, Cal.

www.americanradiohistory.com

½ SAVED
GET OUR BIG BOOK

Do Your Own Plumbing and Heating at low cost

Send for our big instructive 256 page well-bound Handy-Man Book Catalog. Every Home Owner, Contractor, Electrician, Farmer, Factory Manager, etc., needs it. Shows over 10,000 Fixtures and Supplies in plumbing and heating at wholesale. Shows how to save skilled labor, hard work and unnecessary material by

OUR NEW
Cut-to-fit Method

This wonderful book helps you select and install the proper Plumbing, Water Supply System, Hot Air, Water or Steam Plant. Besides being our Wholesale Catalog it has many practical plans, diagrams, sketches, elevations, etc., showing how to do the work this newer, cut-to-fit way. Any handy man with a few tools can easily do his own installing with the aid of this

Big Handy-Man Book

We have spared no effort and have gone to a great expense to compile this valuable book. With economy still a national necessity, it would be unpatriotic to send this expensive book broadcast to non-interested parties. Therefore, we request a temporary deposit for each copy of 25c which we refund on first order, or we send our Bargain Bulletin Free. Address Today

HARDIN-LAVIN COMPANY
40 Years At
4510-20 Cottage Grove Ave., Chicago
$500,000 plants behind our guarantee

35 Miles per hour
Is Record of this Car

Boys, Build This Car. This nifty little car driven by gasoline motor, can be built by any boy. Parts are furnished by us and are very cheap. Send 26c for building plans and price list of parts showing how to build this lad's car.

SYPHER MFG. CO.
156 Warren Street
TOLEDO, OHIO.

SUBMIT YOUR SONG-POEMS ON ANY SUBJECT FOR OUR ADVICE. WE REVISE POEMS, COMPOSE MUSIC OF ANY DESCRIPTION, SECURE COPYRIGHT AND EMPLOY ORIGINAL METHODS FOR FACILITATING FREE PUBLICATION OR OUTRIGHT SALE OF SONGS UNDER THIS SUCCESSFUL CONCERN'S GUARANTEE OF SATISFACTION.

SONG WRITERS' MANUAL & GUIDE SENT FREE

IT CONTAINS VALUABLE INSTRUCTIONS TO BEGINNERS AND TELLS THE TRUTH CONCERNING EVERY BRANCH OF THIS ESSENTIAL AND FACINATING PROFESSION. THE GREAT WORK ACCOMPLISHED BY THE POPULAR SONG IN WINNING THE WAR IS ONLY AN INDEX TO THE MUCH WIDER SCOPE AND GREATER OPPORTUNITIES AFFORDED BY PEACE.

KNICKERBOCKER STUDIOS 211 Gaiety Bldg., N.Y.C.

GENUINE TYPEWRITER

fully guaranteed, also other valuable presents, cameras, air rifles, talking machines, telescopes, typewriters, etc., given absolutely free for selling our art and religious pictures at 10c. Send for 25, when sold send money and select premium.

SPENCER PUB. CO. Dept. 307 Chicago

"BOW LEGS and KNOCK-KNEES" UNSIGHTLY

Send for booklet showing photos of men with and without THE PERFECT LEG FORMS.

PERFECT SALES CO.
140 N. Mayfield Ave., Dept. 50 Chicago, Ill.

FREE BOOK ON AVIATION

Learn of the great opportunities in this new $1,000,000,000 industry. Thousands of men needed. Learn by mail—free book tells how. Write at once
Nat. Aero Inst., Dept. 744Z, 916 S. Mich. Av., Chic.

WIRELESS TELEGRAPHY

Make your own "Wireless," also Dynamos, Batteries, Motors, Telegraph, Telephone, Lights, Bells, Alarms, Coils, Current Reverser, Electric Engines, etc. Book with 75 Illustrations; by experts so anyone can understand it. With Catalog. All 10c, 3 for 25c pp

J. C. Dorn, 705 S. Michigan St., Dept. 22, Chicago, Ills.

tartaric acid from this, the solution of the argols (crude tartar) is treated with milk of lime to form the calcium tartrat, and the latter salt is suspended in water and treated with an equivalent of sulfuric acid, and the calcium sulfate so formed is filtered off, and the tartaric acid is obtained in crystals by concentration of the filtrate.

Experiment No. 9. Add to a concentrated solution of tartaric acid a concentrated solution of potassium chlorid, when a precipitat of potassium tartrat will be formed on shaking and allowing to stand at ordinary temperature. The test is more delicate if the solution is nearly neutralized with sodium carbonat before the potassium chlorid is added.

Experiment No. 10. Make a similar experiment with filtered grape juice, which may conveniently be obtained from canned grapes. A more delicate test is made by adding to 100 cc. of the fruit juice a few drops of concentrated acctic acid, a few drops of concentrated potassium acetate solution, and 15 g. of pure, finely ground potassium chlorid; dissolve the latter salt by shaking and add 20 per cent of 95 per cent alcohol. Stir and shake vigorously to assist in the crystallization of the acid potassium tartrat.

Cultivation has changed the character of many fruits, and has much improved their flavor, so that many luscious fruits have been developed from disagreeable, or, to say the least, very medium stock. Cooking improves many fruits by softening the cellulose and converting the gums and allied bodies into a gelatinous form. Sucrose is inverted and pectin bodies converted into soluble forms. If there is starch remaining, this is made more digestible by cooking. There are many fruits that in the raw state are not suitable to use as food for persons with dyspeptic tendencies. They are, however, very satisfactory and useful when suitably cooked. Apples, pears, quinces, and cranberries belong to this class. It should also be noted that a jelly made from the fruit juice is usually more acceptable to an invalid and less irritating in its action than the raw fruit or the jam. This is especially true of raspberries, blackberries, and currants, on account of the numerous fine seeds that are present in the jam.

(*To be continued*)

Experimental Mechanics

By Samuel D. Cohen

(*Continued from page* 536)

Practically all brass fixture parts are threaded in the lathe.

One of the commonest methods of tapping the part, where it is not too large, is to grip it in the large chuck on the *live* spindle of the lathe. The tap may then be held by its square head in a monkey wrench or tap wrench, in such a way that the center hole in the top of the tap rests on the tail center of the lathe. The wrench holding the tap from turning rests against the lathe bed. The belt on the lathe or the gearing is shifted so as to give a slow rotative speed to the lathe chuck supporting the part to be threaded. When the material is thus rotating slowly, the tailstock center is slowly advanced, thus causing the tap to start cutting. A taper or plug tap is invariably used in this case, and where the hole does not pass entirely thru the material a bottoming tap may be employed to cut the threads of full pitch and diameter clear to the bottom of the drill hole. Where much tapping is done in the lathe, it becomes a very simple matter to lubricate the tap by placing a can contain-

(*Continued on page* 595)

DRAWING
Big Pay—Easy Pleasant Work

Draftsman earn $150.00 to $300.00 a month. The work is pleasant and the hours are short.
You can get this big pay too. All you need is the new 1919 edition of the Cyclopedia of Drawing and a little of your spare time. The cost is only 7 cents a day, and we give a year's consulting service free. See the FREE examination offer below.

Cyclopedia of DRAWING
4 big volumes each 6½x8¼ in., bound in genuine American Morocco and trimmed in gold 1578 pages and more than 1000 illustrations plates, diagrams and blue prints.

The only books that thoroughly cover Mechanical, Structural and Architectural Drafting in a non-technical way. You don't have to know anything about the subject to understand them. They begin at the beginning and tell you everything about Blue print Reading—Mechanical Drawing—Machine Design—Machine Drawing—Structural Drafting—Architectural Drawing and Lettering—Shades and Shadows—Perspective Drawing—Freehand Drawing—Pen and Ink Rendering—Typographical Drafting—Drawing Instruments and Their Uses and hundreds of other things connected with the work.

Use One WEEK FREE!

You can have these books for a whole week free without sending one cent. Just send the coupon below and all 4 volumes will come to you at once by express collect. Use them as if they were your own—go through them thoroughly and send them back at our expense if you don't want to keep them. If you do keep the books send us only $2.00. You can send the balance of our special introductory price—only $13.80 the same way—$2.00 each month.
Remember you don't take any chances. The risk is all ours and the benefits will all be yours—Send the coupon today

American Technical Society
Dept. D 257 CHICAGO, U. S. A.



American Technical Society
Dept. D 257
CHICAGO, U. S. A.
Please send me the 4-volume Cyclopedia of Drawing for 7 days' Free Examination, shipping charges collect. I will send you $2.00 in 7 days and $2.00 each month until the special price of 13.80 is paid, and you will send me a receipt showing the books are mine. If I decide not to buy I will return the books in 7 days

Name.....
Address.....
References.....

Turn a Valve and Cook or Heat



The Oliver Oil-Gas Burner makes any cooking or heating stove a gas stove. Burns coaloil (kerosene). Cooks, bakes better, cleaner. Keeps home warmer. You regulate flame. No fires to start, no dirt. Simple, safe, easily put in or taken out. No damage to stove. Lasts a lifetime. MONEY-BACK GUARANTEE. Free literature tells how two gals. kerosene equals 97 lbs. of coal.
AGENTS WANTED
Oliver Oil-Gas Burner & Machine Co., 1345 N. 7th St., St. Louis, Mo.
Western Shipments From Frisco.

Do away with coal and wood



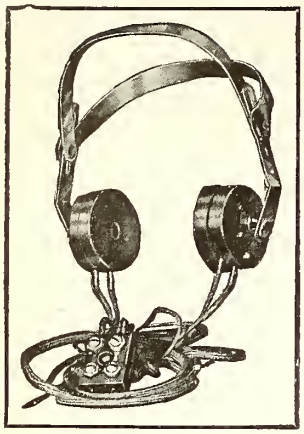
MAIL CLERKS
WANTED
$1100 FIRST YEAR
Fall Examinations likely Everywhere
Common education sufficient
Boys 18 or over
Life Job

Franklin Institute,
Dept. K-101
Rochester, N. Y.

COUPON
Sirs:—Send me at once, free of charge, sample of Railway Mail Examination questions, list of other U. S. Government positions now open and free book describing them.
Name.....
Address.....

www.americanradiohistory.com

MURDOCK No. 55 RADIO RECEIVERS



The Truth

is what we all want to know about something we are going to buy. Advertising nowadays is comparatively reliable—yet we are apt to be anxious about articles bought from printed description. We must see them and try them before we can be sure that they are up to the mark.

MURDOCK advertising has always held fast to the truth, and has been devoted to an attempt to get those who may have need of our product, to buy and try.

So, with regard to our No. 55 'phones we simply say: — we believe that we are offering the best value in the world. If you will try them, we think that you will find this statement the truth.

PRICES

Effective September 1, 1919

2000 ohm complete double set $4.50
3000 ohm complete double set 5.50

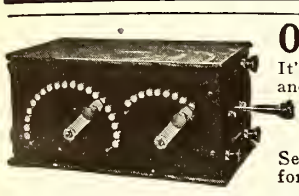
Order a set TODAY. Test them as you will. If you do not find them satisfactory in every detail, return them and get your money.

Bulletin 19A, showing the complete line of really good MURDOCK apparatus, is yours for the asking.

WM. J. MURDOCK CO.

55 Carter Street
CHELSEA, MASS.

221 Second St., San Francisco



Only $10.50

It's extensively used and highly praised throughout the United States. Order one now. Send 2-cent stamp for bulletin.

COLBY'S TELEGRAPH SCHOOL, AUBURN, N. Y.

NEW-ORLEANS
WIRELESS SUPPLIES AND MINERALS OF ALL DESCRIPTIONS
L. A. ROSE
4323 MAGNOLIA STREET
NEW ORLEANS, LA.

WHY "FLUNK"?

In Latin, students? "CAESAR"-FIRST 8 BOOKS-"CICERO", OR "VIRGIL"-and others-, translated, word for word into ENGLISH. Complete, clothbound, $1.25 each, postpaid.
MONONGAHELA NOVELTY CO., BOX 565 MONONGAHELA, PA.

Building and Testing Small Transformers

(*Continued from page* 534)

spools and bring the end out, marking it P. Commencing about ⅛" from the end of the spool, wind the small wire on evenly, stopping about ⅛" from the opposite end. Cover the layer with paper and proceed in like manner until you have twelve layers on. Now fasten the wire so that it cannot unwind, remove the spool from the block and insert the core pieces from alternate sides. Do not cut the wire, but scrape a small bit of the insulation off and connect the primary coil to the 110 volt A.C. circuit with a 25-watt Tungsten lamp in series. Leave the secondary coil open. If the lamp lights up brightly, you have not enough wire on the primary. Cover the bare spot on the wire with a small piece of paper or silk and wind on two more layers and test again. Now if the lamp does not glow at all, you have enough wire on, but if it still glows a dull red, wind on another layer. When you have sufficient wire on the coil the lamp should show no color at all. Now short-circuit the outside ends of the secondary coil and if the transformer is working properly the lamp will light up quite brightly. Make the terminal at this end of the coil in the same manner as at the beginning and cover the coil with paper or Empire cloth.

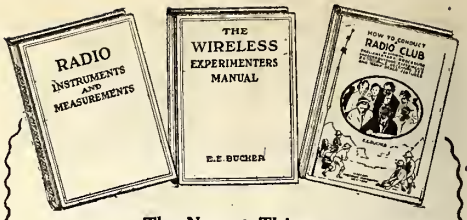
MOUNTING THE TRANSFORMER.

There are several ways of mounting the transformer, but probably the best way is to drill a hole thru each end of the core piece. Do this after the transformer is all assembled. If you place a block of wood under the ends and another over them, clamping the blocks together with screws, you can drill thru the laminations without any trouble. It can now be mounted on a board.

Now as to varying the size and output of a transformer. By keeping the same proportions thruout in making the core pieces, having a difference of eight or ten sizes between the primary and secondary wires and testing as above, you can get almost any voltage you desire. For example, if you wished to make a simple bell-ringing transformer, make the center tongue of the core about ¾" x ⅝" and the other sizes in proportion. Use four layers of No. 26 wire for the secondary and ten or twelve layers of No. 34 wire for the primary. If you wish to make one larger than the one given, make the center tongue 1⅝" x 1⅛", use five layers of No. 16 wire on the secondary and fourteen or sixteen layers of No. 26 wire for the primary.

TWO TRANSFORMERS GIVE GREAT FLEXIBILITY.

A very nice arrangement for the experimenter who desires to have a large range of voltages is to make two transformers like the one given in detail. Make one with no taps off the secondary and the other as described. Mount them on one board and wire up according to the diagram shown in Fig. 7. This will give a range of from 1 to 35 or 40 volts and the system is very flexible. The two primaries are in multiple, and may be used together or separately. The secondaries may be used separately, in series or multiple. The four steps in transformer No. 1 give you four different voltages; in series with No. 2 you get four more; in multiple, four more. Now if you cut in the 25-watt lamp on No. 1 circuit, you will get four still different voltages, and if you replace the tungsten lamp with a 16-candle-power carbon lamp, you will get four lower voltages still, so that you have at your command almost any voltage you wish within the limits of the maximum power of the two transformers.



The Newest Things
IN WIRELESS
Are in These Three Books

Just Off The Press

RADIO INSTRUMENTS AND MEASUREMENTS
Every amateur should have this book as it answers the questions you want to ask and covers all phases of the subject matter indicated by its title.
Cloth Bound, 320 Pages. Price $1.25

THE WIRELESS EXPERIMENTERS' MANUAL
By E. E. Bucher
Mr. Bucher's latest book. The only one that comprehensively covers all phases of wireless work, including the latest practices in both Radio Telegraphy and Telephony. Most complete text book on these subjects yet published.
Cloth Bound, Approximately 300 Pages. Price $1.75

HOW TO CONDUCT A RADIO CLUB
By E. E. Bucher
One of the most popular wireless books ever published. Covers parliamentary procedure, indoor and outdoor experiments, 5,000-mile receiving sets, use of vacuum tubes and many other subjects.
Paper Cover, 148 Pages. Price 50o

THE WIRELESS AGE
A monthly magazine that will keep you posted on the up-to-the-minute things in wireless communication. Official organ of the National Amateur Wireless Association.

Price Per Year $2.00
SPECIAL COMBINATION PRICE
All Four for Only $4.50

WIRELESS PRESS
1850 Woolworth Building, New York

INVARIABLY

Four-months-for-a-dollar subscribers renew their orders for

THE PHOTO PLAY WORLD

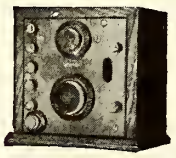
because they find this high class publication indispensable for their library every month.

If you are not a regular reader, a dollar will bring you the next four numbers, each bigger and better than ever. When your subscription has expired you'll want the Photo Play World regularly.

The yearly subscription is $3.50—35 cents on newsstands.

Sample copy on request.

THE DOWNS PUBLISHING COMPANY
Bulletin Building Philadelphia, Pa.



VACUUM TUBE CONTROL PANEL

Most efficient and neatest panel manufactured.

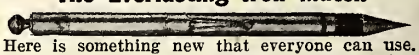
Bakelite panel, graduated dials, mounted in oak cabinet. Variable grid condenser, rheostat, and tube receptacle mounted back of panel.

May be used in any circuit.

PRICE—less Bulb (with V. T. Base)—$13.25
(with Audiotron mounting)—$12.00
For full information write

DAYNOR RADIO ELECTRIC COMPANY
Box 105 Wilkinsburg, Pa.

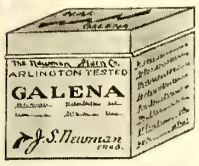
The Everlasting Iron Match



Here is something new that everyone can use. This lighter embodies two constant necessities, pencil at one end and lighter at the other end. Its convenience appeals to all—no larger than an ordinary pencil or fountain pen—finished in highly polished nickel—just the thing you and your friends have been longing for—an ideal birthday present—price within reach of all—handy to operate—saves matches, time, money and temper. Order one for each member of the family. Their practicability was thoroughly demonstrated by their unlimited use by our soldiers abroad during the world war. Sent anywhere for one dollar,—don't hesitate, enclose one dollar and enjoy the wonderful benefits of this lighter.
Paragon Electric Co. - 329 E. 5th St., N. Y.

www.americanradiohistory.com

GET THE BEST OUT OF WIRELESS!
BUY THESE FOUR Newman-Stern PRODUCTS
Ready now for immediate delivery. Order today to avoid disappointment



THAT VITAL SPOT IN YOUR RECEIVING SET—you can make it fool-proof by using
N. S. ARLINGTON TESTED MINERALS

Why buy minerals on a gamble? Be *SURE* of results—*GOOD* results! *KNOW* when you put a crystal in your detector that it is absolutely and *EXTREMELY SENSITIVE!*

You *can* be sure if you use our Arlington tested Minerals. They cost more, of course. We discard a very large percentage of our tested minerals. You buy only *one* crystal at a reasonable price—but you *KNOW* the quality of that crystal. It has been selected and re-selected, and finally tested by experts for distant stations. It *MUST* come up to our high standard. Every Arlington Tested crystal must receive messages from far distant stations before you get it. It must "come in" loud and perfect. It must show performance—extraordinary performance.

If, when you buy our Arlington Minerals, they are not exactly as we state, we will replace any crystal returned to us within one week. Remember, that after all, even Arlington Tested Minerals are not expensive—so why buy quantity when quality is the only thing that counts?

Genuine Arlington Tested Minerals have been on the market for five years. They are individually packed in neat lithographed tin containers. Each genuine package bears the signature of J. S. Newman, the originator of tested minerals. Look for his signature when you buy NAA minerals. Reputable dealers carry them in stock.

NAA GALENA, per guaranteed crystal, prepaid..... $0.25
NAA SILICON, per guaranteed crystal, prepaid..... .25
NAA ZINCITE COUPLE, per guaranteed set, prepaid..... .25

The World Famous Newman-Stern
"Red-Head" Receivers
The New Standard in High Resistance Phones



"Red Head" Receivers are so well known by this time that little need be said here in again introducing these splendid phones to the radio world. That Red Head Receivers have made good is indicated by the unprecedented number of orders that have come in to us since the lifting of the wireless ban. The public has handsomely appreciated our effort to market the finest possible high resistance receivers at a moderate price.

"Red Head" Receivers are now standard in their field. We boldly claim that no instruments selling at less than double the price of "Red Heads" can compare in sensitiveness or appearance.

Description and Specifications

The receivers are built after the most approved design. The backs are made of aluminum. Each receiver is wound to 1000 ohms (2000 ohms per pair) with electrolytic copper wire of the highest grade. The best magnet steel obtainable is used in the construction of Red Head 'Phones—and plenty of it. The interior parts of each receiver are highly nickled and polished. The diaphragms are extra thin.

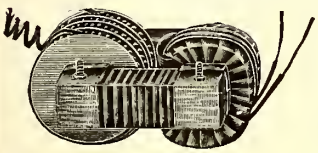
Special attention is given to the shape of the genuine Bakalite ear caps. They are comfortable. They properly concentrate sound. They fit closely.

Every part that goes into the manufacture of Electro-set "Red Head" Receivers is machined to a nicety. The pole pieces and shells are ground to the thousandth part of an inch. The windings and magnets are examined and tested by experts. The sizes and weights of parts are calculated mathematically for efficiency. The finish even of the interior parts, is as high grade as that in a good watch.

Split phosphor-bronze head band, fully adjustable; 5 foot double cord.

No. 2020 "RED HEAD" RECEIVERS, per pair, complete with head band and cord, 2000 ohms.....$6.50
(Shipping weight 2 pounds)

EXPERIMENTERS! RADIO MEN! SCHOOLS!
Here's Your Ideal Source of High Tension Current OUR NEW 1918 MODEL
1-6 KILOWATT High Tension TRANSFORMER



Five years ago, in order to meet the demand for a smaller size, high frequency transformer of real quality, we introduced our now famous 1/6 K.W. model.

Our 1/6 K.W. Transformer enables you to enjoy all the advantages of transformer operation at a lower cost than ever before.

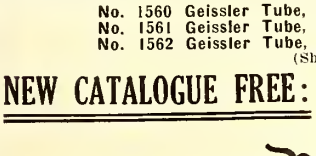
This famous instrument represents the best buy possible for the experimenter at anywhere near the price. It compares with the best ¼ K.W. instrument on the market, and will transmit further than many of them.

Thirty-five mile transmission is common with our transformer. 400 miles has been successfully transmitted but, of course, only under "freak conditions."

Specifications: Core built up of high grade silicon transformer sheets. Windings taped and shellaced. Insulation tested at every stage of manufacture. Core laminations are bolted between heavy fibre frame strips to prevent buckling or dissembling. By a new process, the windings are vacuum impregnated and baked to stone hardness. Overall size 8x9x4 inches.

No. A-1000 1/6 K.W. Transformer, as described, shipping weight 10 pounds.....$10.50

N. S. GEISSLER TUBES Made in U. S. A.



Geissler Tubes are now very scarce and difficult to procure. The large bulk of tubes used in America were of German manufacture and, of course, are now practically extinct in this market. We are one of the very few American concerns who have attempted their manufacture.

The Geissler, or Vacuum Tube, is simply an exhausted glass container, provided with suitable electrodes for passing a high tension current thru the residual gases. The discharge is accompanied by a beautiful colored glow, ranging from greenish blue to orange, pink and red, depending on the degree of vacuum and the structure of the residual gas contents. Many beautiful and interesting experiments may be performed with Geissler Tubes.

In radio work they are widely used as indicators in place of the more expensive hot wire meters. A tube is connected in series with the antenna. The circuits are then adjusted until maximum glow is observed at which point the circuits are properly tuned.

No. 1560 Geissler Tube, 4 inches long..... $0.45
No. 1561 Geissler Tube, 6 inches long..... 0.55
No. 1562 Geissler Tube, 7 inches long..... 0.75
(Shipping weight, any size, 8 ounces)

NEW CATALOGUE FREE: Our New Catalogue will be ready for distribution by the time this magazine is in circulation. Every experimenter will want this book of instruments, parts and raw materials. Just write for Catalogue D-4. It's yours for the asking.

The Newman-Stern Co
CLEVELAND, OHIO

Use this Order Blank Now

The Newman-Stern Co.,
Cleveland, Ohio.

Gentlemen:

Kindly ship to the undersigned the materials specified. Enclosed please find $..... in payment. I understand that I may return any item after 3 days' examination if same is unsatisfactory.

Quantity	Number	Item	Price

Note: Add Sufficient for Parcel Post Charges.

Name .....

Address .....

Town & State.....

www.americanradiohistory.com



TWO STEP AMPLIFIER

TYPE TRIODE B

This amplifier is a compact unit of the regenerative low frequency type, and provides a maximum of amplification.

Its compactness, simplicity and efficiency render it an attractive investment to the progressive radio experimenter.

IMMEDIATE DELIVERY

Particulars and price on application.

THE EATON OSCILLATOR

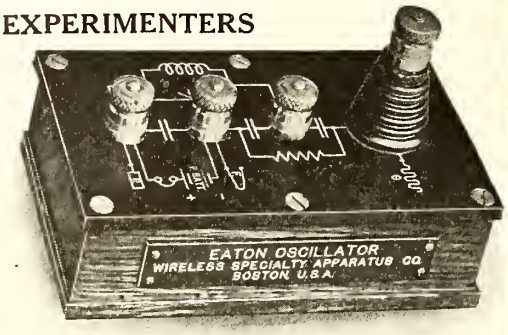
FOR EXPERIMENTERS

Designed to transform receiving circuits to receive arc and other undamped signals.

It will oscillate over a wave length range of 250—25,000 meters.

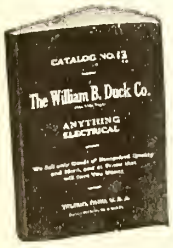
Requires no adjustments of any kind. Only one variable, the tuning condenser, is required.

The simplest and cheapest way of receiving undamped signals.



PRICE $14.90 Immediate Delivery

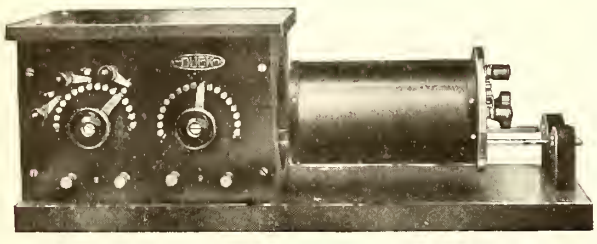
WIRELESS SPECIALTY APPARATUS CO.
ENGINEERS, DESIGNERS, MANUFACTURERS
Boston, Mass., U. S. A.



DUCK'S New Big 264-Page Wireless and Electrical Catalog Just Out—Now Ready

It is mailed for 12c in stamps or coin which may be deducted on first order of $1.00. Catalog not sent otherwise.

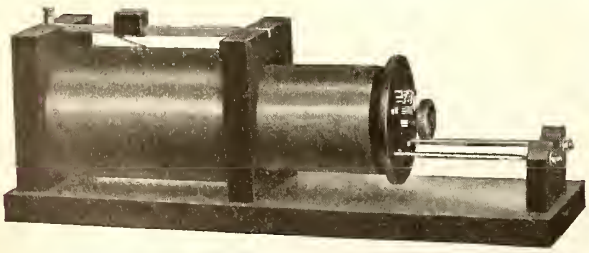
We regard this catalog as our greatest effort. It embraces everything in wireless worth while. 172 pages with no waste space devoted exclusively to wireless instruments. Your amateur friend will tell you that there never has been any wireless catalog to take the place of catalog of this company and above all that you can absolutely depend on our goods. There is no need for any other catalog when you have this big catalog.



NEW MODEL 5BB. NAVY TYPE RECEIVING TRANSFORMER

A big improvement over our former model. Primary divided into two sections, with three dead end switches, greatly improving selectivity.

Secondary divided into three sections, with two dead end switches, eliminating harmonics. By changing the construction of the end piece, there is also greater loose coupling. It is a wonderful improvement over our old model both in performance and appearance. Only $23.50.



OUR IMPROVED ARLINGTON RECEIVING TRANSFORMER

The secondary on our new type Arlington is divided into three sections with two dead end switches, eliminating dead end effect and harmonic and giving greater selectivity. The end support similar to that on our Navy type permitting of greater loose coupling. It is a beautifully finished instrument and will be sold by us at the same price as the old model. $9.00.

THE WILLIAM B. DUCK CO., 230-232 Superior St., Toledo, Ohio

Latest Amateur Radio Receiving Apparatus

(*Continued from page* 542)

with some of the standard type vacuum tubes and having such constants as will give best and most efficient results. A series resistance is inserted in the filament circuits, in such position as to give a negative charge on the grid, thereby eliminating the use of external means of producing this effect necessary in proper amplification work. These resistances are mounted on the vacuum tube holders.

Three jacks are mounted on the lower part of the panel and so connected that with the aid of the jack plug connected to the telephone receiver as shown, it is possible to quickly interchange from the vacuum type receiver circuit to the first or second stage amplifiers as desired simply by inserting this plug in the respective jacks. The jack to the left is used to connect the telephone directly across the vacuum tube detector. The middle jack connects to the first stage amplifier, and the jack to the right connects the second stage amplifier to the telephone. The jacks are so constructed that when the first stage is connected in series the second stage is kept open, thereby eliminating the unnecessary flow of current to the second stage, and when the plug is thrown in the second stage jack the first stage jack is automatically closed, thereby permitting the first and second stage amplifiers to be used simultaneously.

The binding posts to the left are the *input* side to the amplifier and are connected to the telephone side of the vacuum tube receiver. The two lower binding posts to the right are connected to the filament battery, the two center binding posts are connected to the plate battery, while the two upper binding posts to the right are connected directly across the second stage of the amplifier and are used in connection with a loud-talking telephone.

Each vacuum tube has its individual filament rheostat and this is mounted on the outside of the box (as shown in Fig. 3). Two holes, closed by Bakelite covers on top of the box, permit the operator to insert or remove the vacuum tubes from their respective sockets whenever desired.

All of the instruments are of standard height, and each set of binding posts on each respective instrument is so arranged that by means of metallic straps it is possible to connect the receiver, the vacuum tube detector and the amplifier as a complete receiving equipment.

NEW YORK ELECTRICAL SHOW TO BE RESUMED.

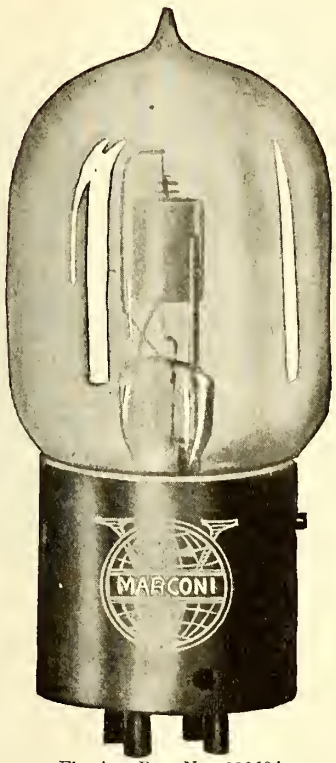
The electrical exposition and motor show is to be resumed this year, opening at the Grand Central Palace on September 24th. This will be the first show since 1917, last year's display having been omitted because of the war.

In announcing the resumption, Arthur Williams, President of The Electric Show Company, said that while there had been some uncertainty as to the time and place of the exposition, there had never been any doubt that the first year of peace would see the exposition back in its accustomed place. In fact the show plans began to take form soon after the armistice was signed.

The Grand Central Palace was used during the war as a debarkation hospital. An indication of the importance with which the electrical industry regards this show is seen in the fact that 40 per cent of the space had been assigned to exhibitors before the date of the exposition had been finally settled upon.

www.americanradiohistory.com

THE HEART OF THE WIRELESS



Fleming Pat. No. 803684
De Forest Pat. Nos. 841387-879532

An Amateur Station Without a Vacuum Tube is Years Behind the Times

MARCONI V.T.

$7.00 each

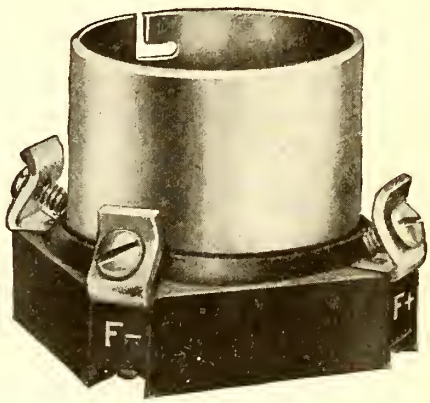
Under agreements recently effected the Marconi V. T. is the only vacuum tube, or audion, which may be sold to amateurs, laboratories, schools of instruction and experimenters.

The approximate operating life of the MARCONI V. T. is 1,500 hours.

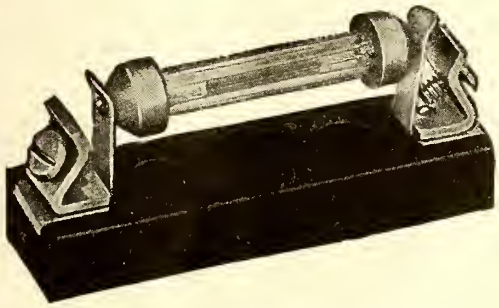
Class I.—Designed for use as a detector; operates with plate potential of 20 to 60 volts.

Class II.—Designed for use as an amplifier; plate potentials from 60 to 110 volts may be applied.

Tubes in either class may be used for detection or amplification, but those of Class I are best as detectors, and Class II tubes are superior as amplifiers.



Standardized Socket $1.50 additional



Standard Resistance, Complete $1.00

The Marconi Resistance, connected in the circuit between the grid and the filament of the Marconi V. T., is made in the following standard sizes:

½ megohm, 1 megohm, 2 megohms, 4 megohms, 6 megohms.

Resistances of any special fractional values up to 6 megohms can be supplied.

Send all remittances with order to COMMERCIAL DEPARTMENT

MARCONI WIRELESS TELEGRAPH CO. OF AMERICA

Woolworth Building,
235 BROADWAY, NEW YORK

Sole Distributors for De Forest Radio Telephone & Telegraph Co.

BRANCH OFFICES:

Schofield Bldg., Cleveland, Ohio
American Bldg., Baltimore, Md.
Insurance Exch. Bldg., San Francisco, Cal.
136 Federal St., Boston, Mass.
301 Commercial Bank Annex, New Orleans, La.
109 South 2nd St., Philadelphia, Pa.

www.americanradiohistory.com

BUILD THAT COUPLER NOW!
PAPER TUBES
AT ATTRACTIVE PRICES

Specially made, smooth, round, seamless, gray cardboard tubing in selected sizes for constructing loose couplers, variometers, loading coils, etc.

FOR 3500 METER COUPLER

Primary 3¾" outside dia. 7" long—25c
Secondary 3¼" outside dia. 6" long—20c

FOR VARIOMETERS

Primary 4¾" outside dia. 2½" long, 12c
Secondary 3¾" outside dia. 2" long—10c

FOR LOADING COILS

3¾" Outside Dia. 14" long—40c
4¾" Outside Dia. 14" long—50c

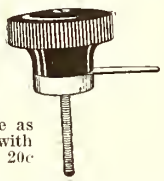
Special Lengths Cut to Order

To 15" long 3¼" dia.—4c per in.
3¾" dia.—5c per in.; 4¾" dia.—6c per in.
All tubes have ⅛" wall.
Immediate shipments, POSTPAID.

THE TAYLOR CO. BOX 1043 LOWELL, MASS.



WIRELESS!



KNOB AND SWITCH LEVER—Mounted on brass bearing and shaft, threaded 6-32, two inches long. Lever securely fastened to knob. Each 40 cents, postage 4 cents.

KNOBS as illustrated above as used on switch 1¼x¾ with hole for mounting, each 20c postpaid.

Consolidated Radio Call Book, postpaid, $1.00
CONTACT POINTS 7/32x7/32 Brass with screw for mounting. Postpaid 25c per doz.

Bakelite-Dilecto panels, about
9½ x 19 x ¼ Black XX.....$4.00
19 x 19 x ¼ Black XX..... 8.00
9½ x 19 x 3/16 Black XX..... 3.00
19 x 19 x 3/16 Black XX..... 6.00

Send 5 cents in stamps for our catalog and get on our mailing list for future bulletins.

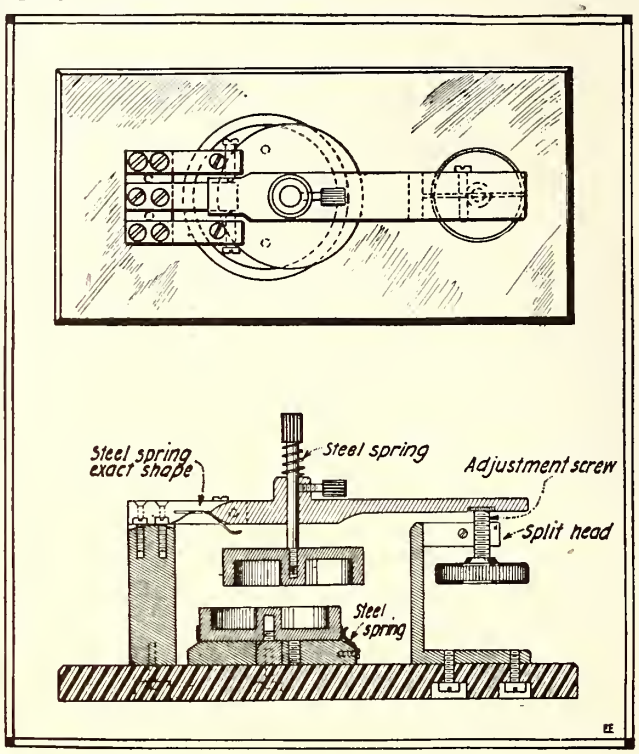
A. H. CORWIN & CO.
924 Kinney Building Newark, N. J.

An Efficient Radio Crystal Detector

By Robert F. Gowen

(*Continued from page* 544)

In conclusion a few remarks regarding the operation of crystal detectors in general may be in order. It is best, of course, to cover over any crystal detector with a glass bell or cup so as to keep it free from dust and the dampness of the atmosphere, which tend to corrode the surface of the metal parts and the crystals, thus impairing the efficiency of the instrument. Another very good thing to watch out for in operating crystal detectors is vibration.



Sectional and Top Views of Crystal Detector.

CORE WIRE

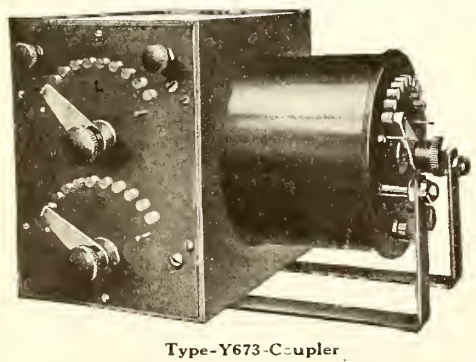
At Pre-war Prices, 20cts. lb.

We have been fortunate in securing thru auction several tons of guaranteed pure, double annealed **Norway Iron Core Wire** and are selling this wire to "Experimenter" readers at 20c lb. This wire is just the thing for spark coils, transformers, etc., and it is, of course, a very much more superior product than the usual iron wire. We have only one size left:

24 INCHES LONG. Thickness about No. 21 B and S

If this size should be too long we advise cutting the wire down yourself by means of shears. As long as the supply lasts we offer this wire as described above to our customers at the very low price of 20c a pound. Add postage or we will ship express collect. Order at once.

ELECTRO IMPORTING CO., 231 Fulton Street, New York City



Type-Y673-Coupler

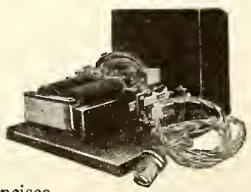
TYPE Y673 Coupler
200 to 3000 meters
Price $12.00

Camb. Rectifier, for storage battery charging
Price $22.00

Three-cent stamp brings bulletins of both these instruments

CLAPP EASTHAM CO.
131 Main Street, Cambridge, Mass.

Pacific coast representatives: Remler Radio Mfg. Co., San Francisco
Canadian representatives: Radio & Electric Supply Co., Montreal



Rectifier

The Submarine's Under-water Radio

(*Continued from page* 560)

E. B. Rosa, Acting Director, U. S. Bureau of Standards.

SUBMARINE RADIO.

During the past summer (1918) a series of experiments have been carried out by J. A. Willoughby and P. D. Lowell, of the Bureau of Standards, at the submarine base, New London, Conn., with the view of improving, if possible, the present methods of radio communication with submarines. The experiments have shown that communication at sea can be carried on under all conditions, more efficiently with an insulated closed loop than with an ordinary antenna now in general use. The loop is of simple construction, requires no mast and therefore does not interfere with submergence. Under storm conditions or during a submergence where the ordinary antenna is useless, communication by means of the closed loop is perfectly practicable. The following are among the most important results obtained:

A. When the submarine is submerged, any North American or European station can be received as distinctly as when it is on the surface; the maximum depth of submergence, however, is determined by the wave length of the transmitting station. To receive short wave lengths it is necessary that the top of the loop be near the surface of the water, whereas a wave length of 10,000 meters can be received when the top of the loop is submerged twenty-one feet. Still longer wave lengths can presumably be received at still greater depths.

B. Recognition signals can be exchanged (using the standard 952 meter wave length) at a distance of ten or twelve miles when the submarine is completely submerged, the maximum distance being obtained when the top of the loop is practically at the surface, decreasing to two or three miles when the top of the loop is eight or nine feet below the surface.

C. Submergence of the submarine during reception or transmission of message does not alter the wave length, though if the maximum depth for the wave length in question is exceeded, communication of course is interrupted.

D. When the submarine is running awash or on the surface, signals can be transmitted (with a 1-KW. spark set) a distance of at least a hundred miles even under very stormy conditions; grounds or short circuits caused by heavy seas, which render the ordinary antenna useless in stormy weather, do not affect the closed loop.

E. The closed loop can also be used as a direction finder, either on the surface or submerged, the maximum strength of signal being obtained when the long axis of the loop (of submarine) is pointing toward the transmitting station and the minimum signal when it is at right angles to the stations.

(*Continued on page* 590)

www.americanradiohistory.com

What the Entire Amateur Radio-World Has Been Awaiting



A WIRELESS TELEPHONE

that plugs into a lamp socket, at a price you can afford. A genuine DE FOREST UNDAMPED WAVE RADIOPHONE (and telegraph) OPERATING DIRECT FROM YOUR 60 CYCLE 110 VOLT HOUSE CURRENT. NO MOTOR GENERATOR REQUIRED. *JUST PLUG IN AND TALK—SIMPLICITY ITSELF.*

A greater invention than wireless telegraphy. Absolutely silent in operation. Trouble-proof, foolproof and *only one adjustment required* after which the instrument "stays right." Couldn't possibly be simpler to operate. Practically simultaneous transmission and reception by means of electrically operated relay transfer switch. Marvellous, snappy clear speech. Voice quality superior to that over a wire. Absolutely stable in operation. Utmost selectivity. No decrement. The panel is divided into three divisions—rectifier, filter and oscillator. The rectifier employs two bulbs thus taking advantage of both halves of the cycle. The filter of inductances and capacities smooths out the ripple, freeing the speech from distortion. The oscillator of four tubes comprises a new circuit of high efficiency both in power output and modulation.

Tested Ranges { **Telephone 10 to 20 miles** / **Telegraph 50 to 75 miles** } **Depending upon aerial height and terrain.**

Our actual experience with this set indicates that these ranges can be greatly exceeded.

PRICE COMPLETE INCLUDING BULBS, $200.00
SPECIAL RATES FOR RADIO CLUBS

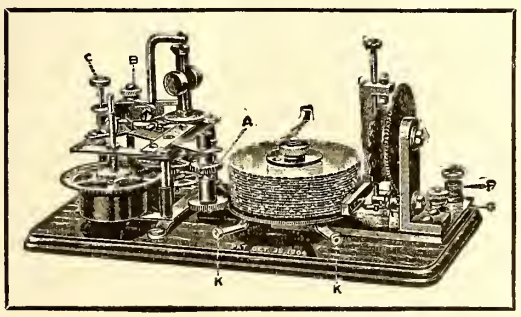
You will eventually use this type of transmitter, now recognized as the most efficient of all low-power systems—so why not now? Order immediately to insure early delivery.

DE FOREST RADIO TELEPHONE & TELEGRAPH COMPANY
1415 SEDGWICK AVENUE, NEW YORK CITY

LEARN THE CODE WITH THE OMNIGRAPH

The Omnigraph Automatic Transmitter

will teach you both the Wireless and the Morse Codes, *at home, in half the usual time,* and at the least possible expense. The *Omnigraph* connected with your Buzzer, or with Buzzer and Head Phones, or with Sounder, will send you unlimited Wireless or Morse Code messages by the hour, and at any speed you desire.



We offer the *Omnigraph* as a positive success and with the strongest of endorsements. It is used by the U. S. Gov't. in testing all applicants applying for a Radio license. It is also in general use by a large number of the leading Universities, Colleges and Telegraph Schools throughout the Country.

If you are a beginner, it will make you an operator in the shortest possible time.

If you are already an operator, the Omnigraph will make you a better one.

Send for free catalog describing 3 different models—$9.00 to $23.00—or order direct through your electrical dealer. We sell the *Omnigraph* with the guarantee that you must be satisfied or your money back for the asking.

THE OMNIGRAPH MFG. CO., 39L Cortlandt St., New York

How did you learn to talk? By listening. **JUST LISTEN,—THE OMNIGRAPH WILL DO THE TEACHING**

www.americanradiohistory.com

THE BEST

Yes, the best and only the best is cheapest in the end. Then why not apply this rule when taking a course in wireless? Our correspondence course is simple, easy to master, up to date and consists of 15 lesson books prepared by our expert theory instructors. All practice and transmitting apparatus for mastering the code is furnished free.

We Operate the One Big

radio school of the world, and this correspondence course is an extension of our activities, a Post Graduate Course in our Washington School being given you free, if you desire. You see we are not *A RADIO SCHOOL*, but actually and absolutely *THE RADIO SCHOOL*—the top one, the biggest one—the one that *HAS BEEN* and *IS* turning out the *WINNERS* every week. You can't compare us with any other school, because we are head and shoulders above all—the very top. You get the idea? You can't get a better or higher course, we are the final—the finish. Act now. Get a grip on yourself—take the big important step. Settle your career today. Our new catalogue, just out of press, will tell you how. Send for it.

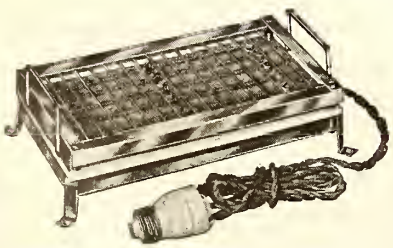
SERVICE RADIO SCHOOL

Dept. E, 900-2 Pa. Ave. Washington, D. C.

A $5.00 Electric Toaster-Stove for $2.50 Postpaid

A SPLENDID GIFT

TOASTS, FRIES, BOILS



Toasts bread as fast as you can Eat It. Attach to your lighting circuit and it is ready for use.

We furnish the parts. You do the assembling and save $2.50. Nothing complicated, anyone can assemble it in 15 minutes. No knowledge of electricity required.

Frame made of Steel, Nickel plated and highly polished. Size 10" long, 6" wide and 3¾" high. Furnished with 6-foot cord and plug.

EMPIRE ELECTRIC SPECIALTIES CO., Not Inc., 2212 Sedgwick St., Chicago, Ill.

IS THE BIBLE TRUE ?

You **must** read the book that has been suppressed for over **100 years!** Sent by mail prepaid for only **50c.** If you don't think it is worth **ten times** 50c we will refund your money. **Know the truth!** You will be **startled.** Order at once. **Truth Pub. Co., Dept. A.E., 1400 Broadway, New York.**

Government Radio Control—Once More

(*Continued from page* 541)

cient to maintain contact under all circumstances with American military and naval forces abroad. This was done successfully and as one result this department has had a wide experience in transocean radio communication.

No one thing indicates more clearly the closeness of contact that is surely coming in the world than the fact that it is now quite within the practical to erect a radio station so effectively that its signals can be intercepted in every village in the world. Such an instrumentality can be of incalculable value in bringing the world together and furthering common understandings. The same instrumentality, however, gripped by evil-minded government or private enterprise, is just as available for selfish and dissentious purposes. Yet the risk must not be overlooked and such control must be provided as will lead to its use for social and not antisocial purposes. From the very character of radio its development and control must be considered from a world viewpoint. Messages in the air recognize no boundaries. The full utilization of radio requires world organization and coordination.

From an American commercial point of view, it is evident that the permanent extension of American foreign trade is largely conditioned upon cable and radio communication. Orders are placed and ship movements are directed largely by cable and radio. If other countries have better communication services with lower rates, their nationals have a distinct trade advantage. Further, it has become clear that if the American reader is to have full news reports from all parts of the world, and if American news—the publication of which has very definite commercial and political advantages—is to be printed throughout the world, America must have a highly efficient communication contact with all parts of the world.

As high-power radio is going to play an important part in future commercial development, it is incumbent upon the United States to give immediate consideration to this fact. It would be very detrimental to the interests of the United States were the ultimate control of high-power radio to become lodged in a foreign corporation or in any foreign country or if the United States lagged behind in the utilization of radio.

The Navy Department is required, for purposes of communicating with its ships at long distances and with its outlying bases, to maintain and operate high-power radio stations. These stations are a naval necessity for purposes of national defense. In normal times it is inconceivable that all the available time of these stations will be utilized for Government messages. It seems a comon-sense view that the spare time of these stations should be utilized for the benefit of the American people by handling personal, commercial, and press messages.

Whether the Government should own and operate all transocean radio stations is a subject on which the department, on the basis of its experience, has decided views. Especial considerations enter into radio communication between the United States proper and American possessions. Naval operations and assurance of uninterrupted communication with outlying possessions make essential the further development of these facilities and the maintenance of stations and personnel at highest efficiency. Radio communication at low rates will go far toward linking our outlying possessions to this country. Certainly under no circumstances should such radio communication be allowed to pass into the control—direct or indirect—of foreign corporations or countries.

The immediate problems in connection with transocean radio are: (1) To make available to American commerce and press the present Government-owned stations; and (2) to further the development of transocean radio for the benefit of this country.

Since the Government must have a high-power radio system for its control of the fleet and for other Government business, which includes communication with Army transports, Coast Guard vessels, aircraft, lighthouse tenders, lightships, weather reports, storm warnings, time signal service, hydrographic information and safety of life at sea, it is a needless duplication of capital and effort to permit private stations to operate where they might interefere with each other and with the military and other Government work of stations, and where the Government stations can easily handle commercial work in times of peace; one control only can efficiently manage the variety of communications required.

Radio communication should be considered not alone from the point of view of Government ownership of utilities, but chiefly from the point of view of the best interests of the United States in its international relations. The governments of many of the great powers control wireless either directly or indirectly. The Marconi Wireless Telegraph Co., a British organization, has endeavored to establish a British-controlled wireless circuit of the globe. The high-power Marconi stations in the United States and Hawaii form a part of this system. The high-power stations at Sayville and Tuckerton, as well as those in certain parts of South America, were constructed by German corporations.

The Navy Department is the principal user and

www.americanradiohistory.com

the most extensive buyer of radio apparatus in the United States. It has had the strongest influence in developing apparatus since the early days of the use of radiotelegraphy in this country. It has gained large experience concerning the operative features of radio apparatus, and it is convinced that Government operation and control of all transocean and ship-to-shore stations used for commercial purposes, is necessary on account of present interference between stations, and for other reasons given below:

(*a*) To permit the greatest amount of business, Government and commercial, being done through consistent changes in apparatus, through systematic apportionment of any prompt and frequent changes of wave lengths, and through standardized methods of operating, one management is necessary.

(*b*) Radiotelegraphy has been looked upon as a natural Government monopoly. Since only by the closest regulation can the best use of this art be obtained, not only for commercial and safety at sea, but for military purposes, radiotelegraphy is a strict Government monopoly with the larger number of foreign nations; and, in those countries where commercial stations are permitted, the Government control is generally so strong as to amount to monopoly.

It seems therefore admitted that:

(*a*) Efficient radio communication for military (naval) and other Government purposes is a necessity.

(*b*) Efficient radio communication requires effective control; effective control requires a monopoly and the Government should exercise that control.

(*c*) Military (naval) necessity demands not only efficient and rapid communication, including effective control, but protection of the radio stations from destruction.

(*d*) During periods of strained relations, as well as during war, direct Government control and operation would be the only safe and effective control and operation, as the personnel would be subject at all times to Government supervision and discipline.

(*e*) The commercial interests of the Nation will be served best by having its radio communication facilities under a control that is non-partisan, and one which precludes the possibility of foreign domination or of private domestic monopoly, with consequent liability to preferential treatment by such agencies, of the interests controlling them.

(*f*) The dissemination of news to all countries can be accomplished best and mutual international understandings can be arrived at with more facility through national control of radio.

Radio traffic is very much congested at present; but on account of the centralized control by the Navy at the large ports, there is more traffic being handled than ever before. To turn to the old method of separate control by competing private companies would be disastrous to the merchant marine and the general public.

One central control facilities the coordination of the various systems, i. e., coastal, aircraft, medium power and high power. It enables the proper concentration of radio as an aid to navigation and other radio developments designed to render the life of the mariner more safe.

High-power radio is international in character because it causes interference thruout the world. It is much easier for the Government to regulate international interference than it is for private companies to do so. Most of the countries of the world already own all radio stations within their boundaries, and it is more or less a simple matter for the United States Government to come to an agreement with foreign administrations regarding technical details.

Also, as the art advances and new apparatus is constructed, that will lessen the amount of interference, the international conventions will be modified accordingly. A private radio communication company might not be able, on account of financial reasons, to adopt the more modern apparatus. This might result in complications with foreign countries, and further handicapping of the radio service for the general public might ensue.

In certain localities there are several high-power stations within a small area. When they operate independently the business of all is seriously handicapped. But, on the other hand, when they are operating from a central control, business is expedited, and the general public is able to file more messages. In this connection, it might be said that a station running at full load and handling a maximum amount of traffic is able to give cheaper rates to the general public than those stations which are not running at full capacity on account of interference. The only way to handle transocean radio traffic efficiently is to control all the stations from a central point. A few radio stations controlled in this way will handle more traffic than several cables.

In the above I have endeavored to advance proper arguments which would seem to show the desirability of Government ownership of all radiotelegraph stations which are engaged in ship-to-shore work or long-distance transocean work, and particularly that these should be under the jurisdiction of the Navy Department, which Government department alone has the means and facilities to carry on this work efficiently.

This question of national and international communication by means of radiotelegraphy is particularly prominent at this time, when on ratification of the peace treaty, all restrictions on the use of this art will be removed and many interests will be attracted to this form of investment. It is conceived and shown that ship to shore and transocean radiotelegraphy can only be efficiently carried on under a monopolistic control, and this department contends this should be a Government monopoly, and requests congressional authority to assume this ownership and control. At this time this depart-

"ASK ANYONE WHO HAS USED IT"

Submarined Three Times and Still In Use

Said an Englishman: "I've been submarined three times—and put my Brandes headset in my pocket each time. You bet I saved it. I wouldn't have any other make." (Name on Request.) Think of the help to wireless operators, that the perfect sensitiveness and dependability of Brandes Headsets provided during the war. Life or death depended upon *hearing correctly*. They are made today just the same, and give the same quality of service.

BRANDES WIRELESS HEADESTS

CLEAR TONE
LIGHT WEIGHT
DEPENDABLE SERVICE



"Superior" Set, 2000 ohms, $6

Score 100% efficiency in actual use. Sharp, Unblurred, Readable Signals assured by

"BRANDES MATCHED TONE"—

Exactly matching the tone of both receivers in each set and thus eliminating all confusion due to unmatched harmonics.

TRIAL OFFER

Brandes Wireless Headset sent to you on trial for 10 days. If, for any reason, you are dissatisfied, your money back without a question. Test it,—compare with others,—for sensitiveness, clearness, distance. Prove for yourself the fine quality, the "matched tone." The two diaphrams, toned exactly alike, strengthen the signals and prevent blurring. Used by many U. S. Gov't experts, and experts abroad; by colleges and technical schools; and by professionals and amateurs everywhere.

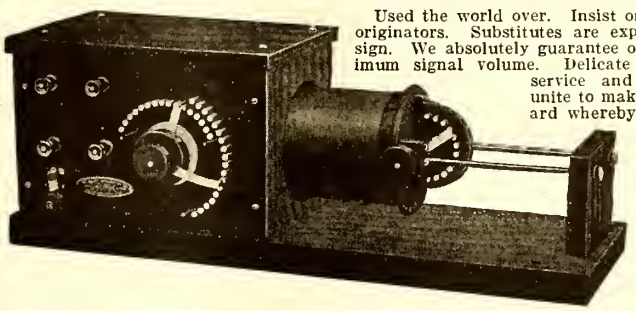
SEND 4c FOR CATALOGUE E.

C. BRANDES, Inc.
Room 814
32 Union Square
New York City, U. S. A.

WIRELESS RECEIVER SPECIALISTS

Complete Line of Brandes Receivers for those in Canada. Send stamp for Pamphlet "E"
Radio Electrical Supply Co., 43 McGill College Avenue, Montreal, P. Q., Can.

TRACO QUALITY
RECEIVING TRANSFORMERS



Used the world over. Insist on the genuine, built by its originators. Substitutes are expensive, irrespective of design. We absolutely guarantee our tuners to give the maximum signal volume. Delicate refinement, uninterrupted service and high class workmanship unite to make TRACO tuners the standard whereby all others are judged. If your Dealer does not handle them, order direct from us.

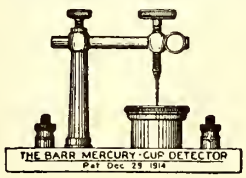
LIBERTY DETECTOR VALVES. RADIO AMPLIFYING PHONES, type used by the **UNITED STATES, BRITISH** and **FRENCH GOVERNMENTS,** now in stock, for sale.

Send stamps for bulletins.

The Famous 5A and 5C Models

THE RADIO APPARATUS CO., Pottstown, Penna., U. S. A.

THE BARR
Mercury-Cup Wireless Detector



The most efficient Detector on the market. Tested by the United States Government and Marconi Wireless Telegraph Co.

Increases the efficiency of every wireless receiving set by making the signals clear, sharp and distinct.

Instantly adjustable at a constant pressure.

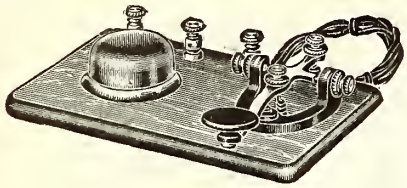
For full information and price—write

The Barr Mercury-Cup Detector, Dept. A, The Wyoming, Washington, D. C.

www.americanradiohistory.com

Wireless Receiving Ban Raised

MESCO WIRELESS PRACTICE SET



The Practice Set comprises a regular telegraph key, without circuit breaker, a special high pitch buzzer, one cell Red Seal Dry Battery, and four feet of green silk covered flexible cord.

The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes.

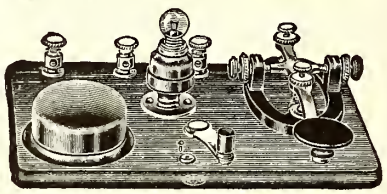
List No. Price

342 Telegraph Practice Set, with Battery and Cord $3.24

Weighs 4 lbs. packed.
Price does not include postage.

MESCO Combination Practice Set for Learning the Morse and Continental Visual and Audible Codes

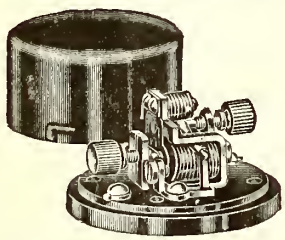
This outfit is the only reliable instrument which will enable students to become proficient operators in the U. S. Naval Service, because it is equipped with a buzzer and miniature lamp enabling the user to master both the visual and audible signals quickly.



List No. 52—Practice Set with Red Seal Battery and Cord $4.05

Weighs 4 lbs. packed. Price does not include postage.

MESCO RADIO BUZZER



This buzzer maintains a constant note and is recommended as an exciter for checking wavemeters where pure note and ample energy are required.

It consists of practically a closed circuit field of low reluctance, having a steel armature to which is riveted a strap supporting a movable contact. The armature tension is adjustable by means of a screw with a milled head large enough to be easily and permanently adjusted with the fingers. The stationary contact is adjusted by means of a similar screw. The magnet coils are connected in series with a total D. C. resistance of 3.9 ohms. Shunted across these coils is a resistance having a D. C. value of 3 ohms. This shunt eliminates all sparking such as occurs at the break on ordinary radio buzzers and the energy saved thereby is transferred into any oscillating circuit connected to it, the result being that this buzzer as constructed radiates five times more energy than any other existing type. All connecting wires liable to be broken are eliminated. Contacts are of genuine platinum, which is essential in order to maintain a constant note. The parts are mounted on a Condensate base to insure constancy in operation.

Diameter 2 in., height 1¼ in. The cap is attached to the base by a bayonet joint.

List No. Price

55 Mesco Radio Buzzer $2.05

We carry a Large and Complete Line of Standard Wireless Material Recognized by Experts as such with Competent Experienced Wireless Attendants in Charge

Send for the New Edition of Our Catalog W28

It is pocket size, contains 264 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Wireless Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

Manhattan Electrical Supply Co., Inc.

17 Park Place, New York, N. Y.

CHICAGO
114 S. Wells St.

ST. LOUIS
1106 Pine St.

SAN FRANCISCO OFFICE: 604 Mission St.

SPECIAL SALE!





Reduced Photograph of Transmitter showing nickel plated case and Hard Rubber Mouthpiece

$1.00 ONLY

Postage extra.

Ship. Weight, 2 lbs.

Diameter, 3¼ ins.

We have on hand 2,000 Carbon Grain Transmitters as per photograph. They are first-class instruments and may be used for all kind of experiments, especially for wireless telephone sets, where a heavy current is to be passed through. Slightly used, but in perfect working order. Money refunded if not satisfied. A real bargain. Order one or more today.

THE ELECTRO IMPORTING CO., 231 Fulton St., NEW YORK

ment is confronted with conditions which make it imperative to ask for this monopoly.

Obviously the United States can not own radio stations in other countries. These countries fall into certain groups: (1) Those in which the Government itself maintains a radio monopoly; (2) those in which the Government permits its own nationals, but not foreigners, to own and operate stations; (3) those in which any authorized individual or corporation can erect s ations.

Obviously every encouragement should be given American companies to manufacture and sell radio equipment abroad and to own and operate stations abroad. The American Government-owned stations should exchange traffic with such stations and assist them in any legitimate way. Especially should any patents or improvement controlled by the Government be made available to such American companies under proper safeguards and guaranties.

In conclusion this department recommends that Congress immediately enact legislation regarding radio communication along the following lines:

(1) Either by a committee of Congress or by special designated commission, authorize a comprehensive study of the problems in connection with radio within the United States. This, however, is not of immediate concern to this department. Of course, the department stands ready to give the benefits of its experience and technical knowledge.

(2) Authorization to the President to set aside by proclamation certain bands of wave lengths for ship-to-shore work, for shore to aircraft, and for transocean services in accordance with international conventions and demonstrated needs from time to time.

(3) Constituting ship-to-shore radio service a Government monopoly under the Navy.

(4) Constituting transocean and international radio service a Government monopoly under the Navy.

(5) Authorization for Navy Department to utilize immediately all Navy radio stations for commercial and press business.

(6) Authorize the Navy and other departments to assist American enterprise in the sale of radio apparatus and the development of American-owned radio stations abroad, and especially to authorize the Secretary of the Navy to authorize the use by American companies under proper conditions of Government-owned patents and improvements, to be paid for either in exchange of patent rights or in other suitable ways.

Sincerely, yours,

JOSEPHUS DANIELS.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

Radio Problems in Aviation

By Edward Rice Doyle

(*Continued from page* 543)

factors of capacity on an airplane, since he is used to the high building and tower aërials and the solid capacity of Mother Earth. But the airplane must give its capacity effects with little more than the engine and tank metals for counterpoise. And to build up any additional capacity with lengthened aërial means increased weight and lowered flying efficiency. These considerations have therefor held the aviation radio sets to wave lengths of 300 meters or less. And if any radio engineer was asked to design a transmitting set with a minimum range of 500 miles with 300 meters to work with he would think you had asked the impossible.

It is not so difficult to use loading coils to permit of reception by the radio set in an airplane of longer wave lengths than 300 meters, but the added resistance is always undesirable and for transmission it is impracticable.

And in addition to the head resistance and structural limitations on the radio sets for airplanes we have a number of other complications peculiar to aviation radio, to wit:

The engine noises are always present during flight and make accurate message reading difficult even with "noise-proof" receivers. The army practically never attempted to require aviators to receive messages in the air. All signals to the airplane were visual.

The engine magneto sets up a field which has a marked effect in reducing the transmitting range of the airplane set ahead.

Effective power generation for transmitting means a sacrifice of speed. If coupled

www.americanradiohistory.com

to the engine it means a loss of power and if fan-driven generator is used it must greatly increase head resistance. Storage batteries of sufficient capacity are too heavy.

On account of the narrow range of wave lengths available for airplane radio sets, the possibility of interference is greatly increased.

Since a minimum weight in coils and condensers used in the set itself is necessary, broad tuning is generally used, and this means further difficulty from interference.

Changes of altitude which affect condenser capacity are liable to make prearranged wave length communication difficult where close tuning is required.

Cloud effects are apt to reduce the efficiency of transmission and reception, while static can effect airplane radio communication as disastrously as a land station.

The higher the voltage used on the airplane set the higher the fire hazard. Many precautions against sparks which could be observed in a roomy land station are impossible in the small limits of an airplane cockpit.

Difficulties in controlling the frequency of the generator, especially if fan-driven, involve wave length difficulties not encountered on land.

If in spite of these difficulties some radio engineer can evolve a system that will even partly afford effective radio communication with the airplane, he will find ample rewards awaiting him.

Aside from the structural difficulties presented by the airplane toward experimental work, there is always the actual difficulty of "flying" itself. You can plot an audibility chart for a land station with accuracy, but the airplane is constantly moving while in the air and at every moment it is operating under different conditions. To efficiently experiment, the airplane must proceed thru a given maneuver at a given point several times and the possibilities for error are magnified with speed and distance.

The solution of those problems seems to lie in larger planes. With greater wing spans and greater counterpoise capacity the airplane can attain certain advantages. A plane with a double fuselage, for example, ought to give the best structural advantages both in efficient flying (not to be considered here) and in maximum radio control. (See Fig. 3.)

Note that to obtain directional effect in any point of the compass a maximum change of direction of flight required would be but 45 degrees at most. This is certainly not a serious handicap. Also note the absence of trailing wires.

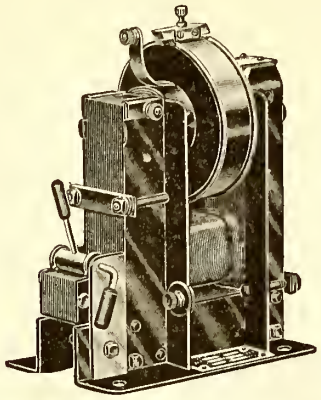
For ideal results, the set would be operated by a storage battery of large capacity, charged by a generator actuated by either of the engines. Thus if the airplane were at rest on the water or land, the set could still be used and any variation of speed or wind would not affect wave length or power input.

Four or five stage amplifications could be used to obtain increased sensitivity of the set to calls, and close tuning would be possible with finely graduated fixt air pressure or oil condensers.

Permanent aërial supports would be built into the airplane by the manufacturer.

DR. GOLDSMITH DIRECTOR OF RESEARCH FOR AMERICAN MARCONI COMPANY.

Dr. Alfred N. Goldsmith, professor in charge of electrical engineering at the College of the City of New York, has been appointed Director of Research of the Marconi Wireless Telegraph Company of America. Dr. Goldsmith is Editor of Publications for the Institute of Radio Engineers, and has recently written an important book on the subject of Radio-telephony.

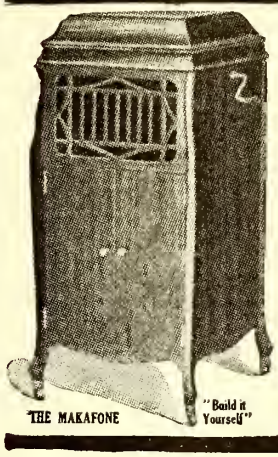


RADIO AMATEURS

Do you want your radio station listed among the "long distance" amateurs? Our new type "R" 1 K. V. A. 25,000 volt Wireless Transformer will make your station efficient for "long distance" relay work. Write for our catalog 20 T describing complete transmitting apparatus.

Thordarson Electric Mfg. Co.
501 S. Jefferson St. Chicago, Ill.

YOU can BUILD this PHONOGRAPH *easily!*
TREMENDOUS SAVING IN COST



You don't need to be a cabinet maker. We have made it an easy and a pleasant job with

Our Simplified Plans We furnish blue prints, diagrams, ready-built horn, cabinet pieces, motor, and all metal parts complete. You do the assembling. 6 models to choose from. A few hours' work, and you will have as fine a type of phonograph as any produced, and at a price away below what you would pay in a store.

Keep the Savings in Your Pocket

Machines play all records, will have a wonderful tonal quality, excelled by none. No need now for any family to be without a phonograph because of the cost. THE MAKAFONE solves the problem. BUILD IT YOURSELF AT LESS THAN ONE-FOURTH REGULAR COST, but equal to the high priced cabinet machines. Free Records with each outfit. SEND TODAY FOR FREE CATALOG and full particulars of our wonderful offer. *Many a manufacturer got his start in this way. Why not you? Build machines and sell to your friends. Ask us about this.*

AGENTS ATTENTION
You can make and sell this machine from our plans at a profit of $50 to $75 each. Others are selling two and three a week. Here is your opportunity to make big money and become independent. Pleasant and profitable work. START TODAY.

MODERN PHONOGRAPH SUPPLY CO.
111 Springer Bldg.313.So. Clinton St.,Chicago,Ill.

WRITE TODAY!
MODERN PHONOGRAPH SUPPLY CO.
111 Springer Bldg., 313 So. Clinton St., Chicago, Ill.
Gentlemen: Please send me full particulars of your Makafone proposition, without obligation to me.
Name.....
Street Address.....
City or Town.....

New Method Makes Music Amazingly Easy to Learn

Learn to Play or Sing—Every Step Made Simple as A B C.

TRY IT ON APPROVAL

Entire Cost Only Few Cents a Lesson—and Nothing Unless Satisfied.

How often have you wished that you knew how to play the violin or piano—or whatever your favorite instrument may be—or that you could take part in singing?



How many an evening's pleasure has been utterly spoiled and ruined by the admission "I can't sing," or "No, I am sorry, but I can't play."

And now — at last—this pleasure and satisfaction that you have so often wished for can easily be added to your daily life.

No need to join a class. No need to pay a dollar or more per lesson to a private teacher. Neither the question of time nor expense is any longer a bar—every one of the obstacles that have been confining your enjoyment to mere listening have now been removed.

My method of teaching music by mail—in your spare time at home, with no strangers around to embarrass you—make it amazingly easy to learn to sing by note or to play any instrument.

You don't need to know the first thing about music to begin—don't need to know one note from another. My method takes out all the hard part—overcomes all the difficulties—makes your progress easy, rapid and sure.

Whether for an advanced pupil or a beginner, my method is a revolutionary improvement over the old methods used by private teachers. The lessons I send you explain every point and show every step in simple Print-and-Picture form that you can't go wrong on—every step is made as clear as A B C. My method makes each step so easy to understand and practice that even children only 7 to 10 years old have quickly become accomplished players or singers under my direction by mail. Also thousands of men and women 50 to 70 years old—including many who had never before tried to.

My method is as thorough as it is easy. I teach you the only right way—teach you to play or sing by note. No "trick" music, no "numbers," no makeshifts of any kind.

I call my method "new"—simply because it is so radically different from the old and hard-to-understand ways of teaching music. But my method is thoroughly time tried and proven. Over 225,000 successful pupils from boys and girls of 7 to 8 to men and women of 70—are the proof. Largely through the recommendations of satisfied pupils, I have built up the largest school of music in the world.

For Beginners or Advanced Pupils

Piano	Harmony and Composition
Organ	Sight Singing
Violin	Guitar
Viola	Ukulele
Banjo	Harp
Mandolin	Cornet
Clarinet	Piccolo
Flute	Trombone
Saxophone	
Cello	

To prove what I say, you can take any course on trial—singing or any instrument you prefer—and judge entirely by your own progress. If for any reason you are not satisfied with the course or with what you learn from it, then it won't cost you a single penny. I guarantee satisfaction. On the other hand, if you are pleased with the course, the total cost amounts to only a few cents a lesson, with your music and everything also included.

When learning to play or sing is so easy, why continue to confine your enjoyment of music to mere listening? Why not at least let me send you my free book that tells you all about my methods? I know you will find this book absorbingly interesting, simply because it shows you how easy it is to turn your wish to play or sing into an actual fact. Just now I am making a special short-time offer that cuts the cost per lesson in two—send your name now, before this special offer is withdrawn. No obligation—simply use the coupon or send your name and address in a letter or on a postcard.

Mr. David F. Kemp
President
U. S. School of Music,
13310 Brunswick Bldg.
New York City.

Please send me your free book, "Music Lessons in Your Own Home" and particulars of your Special Offer.

U. S. School of Music
13310 Brunswick Building
New York

Name.....
Address.....
City..... State.....

www.americanradiohistory.com

AMPLIFY YOUR RADIO SIGNALS

With the new DETECTAGRAPH-TRANSMITTER, the amateur can amplify radio signals to such an intensity that he can hear the signals about his station without the need of the telephone head set.

By the addition of a loud talking telephone he is able to hear the messages many feet away from the instrument.

The super-sensitive DETECTAGRAPH-TRANSMITTER herewith shown is two and three-eighths inches in diameter, five-eighths of an inch thick and weighs less than three ounces. It is the most sensitive sound detecting device ever brought before the public.

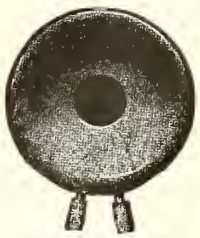
The manner in which the amplifying process is attained is by attaching with tape the DETECTAGRAPH-TRANSMITTER to the regular wireless receiver.

Not only is this instrument applicable for amplifying radio signals, but it can be used with equal satisfaction for magnifying other sounds. Phonograph music can be transmitted from one place to another by means of this instrument, and those who are afflicted with deafness will find enormous benefit by using this transmitter. It is the greatest device for building your own loud talking telephone, detectagraph and other devices. Can be used for any purpose where a sensitive detecting instrument is required.

SUPER-SENSITIVE Detectagraph MICROPHONE DEVICES



Our Super-Sensitive Detectagraph Transmitter. Price, $7.00 Complete



Our Special No. 25 Loud Talking Receiver. Price, $4.00 Complete



Detectagraph Rheostat, especially made for amplifying circuits. Price, $2.00 Complete



Super-Sensitive No. 40 Receivers to be used in connection with Detectagraph-Transmitters, $10.00



The Detectagraph Junior Deaf-Phone $15

Equal to any $35 instrument made. Outfit consists of Super-Sensitive Transmitter with cord connector; Super-Sensitive Ear Piece with small black cord; Black Single Headband; Black Case and Two Batteries.



Model "B" Horn, with Loud Talking Receiver, Cord Plugs and Desk Stand Base. Price, $10.00 Complete

Model "C" Horn, with loud talking Receiver, Cord Plugs and Wall Base. Price, $10.00 Complete





Detectagraph $15

This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord, Receiver, Headband, Case and Battery.

Order direct from ad.

Or write for free descriptive circular.

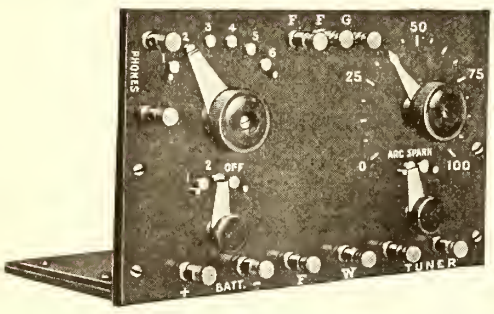
G. BOISSONNAULT COMPANY

26 CORTLANDT STREET NEW YORK CITY

Makers of Super-Sensitive Microphone Devices

AUDIOTRON VACUUM TUBE PANELS

PARTS AND ACCESSORIES



Panel full XX Grade Continental Bakelite Dielecto Steel cut and whitened engraving. All metal parts heavily nickeled. Switches for double filament tubes and arc or spark reception. New type Back mounted smooth running rheostat. Panel also furnished in maple with imitation black bakelite finish.

No. 8B.	Full Bakelite panel assembled.....	$15.00
No. 8BP.	Complete set of parts.....	12.00
No. 8W.	Wood panel complete	12.50
No. 8WP.	Complete set of parts.....	10.00

Send for free bulletins on panels, couplers, detectors, parts, etc.

Send cash with order and save all delivery charges. Dealers: write for proposition.

AUDIOTRON SALES CO., 311 Lick Bldg., San Francisco

LEARN WIRELESS TELEGRAPHY

Fascinating and Educational Work—Big Salaries—Prepare Now

The United States Shipping Board is making heavy demands upon us for **Dodge-trained** wireless operators. Travel all over the world, secure, free, unsurpassed living accommodations and earn a big salary.

We Also Teach Morse (Wire) Telegraphy and Railway Accounting

School established 45 years. Endorsed by wireless, railway and telegraph officials. Low rates. Students can earn living expenses while attending school. **Catalog Free. Write Today.**

Dodge's Telegraph and Wireless Institute 22nd St. Valparaiso, Indiana

The Submarine's Under-Water Radio

(Continued from page 584)

The design and specification of the closed loop are given below:

DETAILS OF SUBMARINE LOOP ANTENNAE.

The loop antenna consists of two insulated wires *grounded* at the extreme ends of hull carried over suitable supports to the bridges, and thence thru radio lead-ins to the apparatus.

(1) *Wire.*—Seven strands of No. 14 B. & S. phosphor bronze wire, covered with 40 per cent Para rubber, to a total outside diameter of ½".

(2) *Supports.*—Two substantial masts, triangular or oval in cross-section, 3 feet high with insulators at the top, erected at either end of the boat and braced to withstand considerable strain.

(3) *Stanchions.*—Two stanchions insulated at the top placed high enough to support the wire at least 1 foot above the bridge.

(4) *Radio Insulators.*—An extra radio insulator similar to the one already installed, placed in the space now occupied by the antenna mast (or in any convenient place at least 3 feet away from the other insulator), and extended vertically thru the hull.

(5) *Water-tight Sleeves.*—(To prevent the sea water from working up under insulation on wire.) Brass stock 3" long bored to outside dimensions of insulated wire for 2¾" and drilled dimensions of bare wire for ¼". The wire is stript of insulation for a few inches and is slipt thru the sleeve, the insulated portion being smeared with white lead and the stript portion being soldered to the brass.

(6) *Grounded Connections.*—Lugs on end of wire grounded to hull by bolts.

(7) *Lead-in Joints.*—Junction of insulated wire and radio conductor is made water-tight by marine glue poured in a cylindrical mold.

(8) *Wire-tightening Device.*—(*a*) Turnbuckles may be placed at the end of each wire next to ground connections; or (*b*) in order to take up slack on both wires equally it is preferable if construction of boat permits to place one insulated turnbuckle between stanchions on bridge.

(9) *Receiving Apparatus.*—Tuner capable of receiving wave lengths of 300 to 16,000 meters, and oscillation audion detector and three-stage resistance type amplifier of French design. (The Navy standard audion control box type SE 1,000 two-step amplifier cannot be used unless placed in a noise-proof and inductive-proof compartment.)

(10) *Transmission Apparatus.*—Regular quenched spark set, preferably the 1 KW. size. Terminals of loop antenna are connected to the antenna and ground connections, respectively, with a .0005 microfarad condenser in series with the loop. The ground connection on the set being removed.

SENATOR MARCONI A PEACE DELEGATE.

The new Italian Ministry has selected Senator Marconi as one of the Italian peace delegates. The illustrious scientist was appointed a Senator by the King of Italy in 1915 and seems to be entering more and more into the public life of his country. It is surely most fitting that he, whose genius has so greatly contributed to the preservation of human life and the promotion of international communication, should now receive the signal honor of being made a peacemaker. He is shortly to visit America on the subject of the peace treaty and other matters.

www.americanradiohistory.com



RADIO FREQUENCY AMMETER

4 inch Face

0 to 3, 0 to 5 or 0 to 10 Amperes. Specify Reading Required.

$11.00 Net

The Jewell Electrical Instrument Co. is prepared to fill the instrument needs of the amateur experimenter in radio and general electrical work, as well as those who desire more precise and accurate measurements of electrical quantities.

We show above our high frequency ammeter, of the thermo couple type, especially desirable for medium sized installations.

For receiving panels, we are supplying small D. C. instruments for plate voltage and filament current, at a very reasonable price.

Write for our special radio instrument bulletin.

JEWELL ELECTRICAL INSTRUMENT CO.
1640 Walnut St. Chicago

Audion Control Panel



Type P-100 —combining in a single compact set the **Peerless De Forest Audion Detector, oscillator and audion amplifier,** built for the audion as only the makers of the audion can build it. No other set like it has ever been built to sell for less than $150.00. Our Price without the bulb $65.00. Descriptions of lower priced models sent on application.



The latest in Amplifier design sufficient to give amplifications up to 20,000 times. **Panel quickly removable making all parts accessible, and the replacing of the new type en block "B" batteries but a moment's work.** Workmanship of the highest grade. Price without the bulbs $69.50.

DeForest Radio Telephone & Telegraph Co.
1415 Sedgwick Avenue
New York City

Can Radio Ignite Balloons?

(*Continued from page* 516)

WHAT NIKOLA TESLA SAYS

Probably no other living electrician could be found today who can more authoritatively state just what effect can be produced at a distance by radio currents, than Dr. Nikola Tesla. He has produced and measured the greatest electrical discharges ever developed by man—sparks 70 to 100 feet in length, which manifested their influence 12 miles and more distant. In a special interview with the ELECTRICAL EXPERIMENTER representative, Dr. Tesla said in regard to the present blimp disaster:

"Referring to electrical or radio wave action at a distance, I know from experience that if proper precautions are not taken, fires of all kinds and explosions can be produced by wireless transmitters. In my experiments in Colorado, when the plant was powerfully excited, the lightning arresters for *twelve miles around* were bridged with continuous arcs, much stronger and more persistent than those which ordinarily took place during an electric storm. I have excited loops (coil aerials) and lighted incandescent lamps at a considerable distance from the laboratory without even using more than five or ten per cent of the capacity of the transmitter. When the oscillator was excited to about 4,000,000 volts and an incandescent lamp was held in the hand about *fifty or sixty feet from the laboratory,* the filament was often broken by the vibration set up, giving some idea of the magnitude of the electromotive forces generated in the space. The accompanying illustration shows one of my experiments in which I lighted several lamps at a distance of 100 feet from the laboratory, purely by wireless energy. Such induced currents might easily fire a gas balloon under the proper conditions. When the large transmitter coil, 51 feet in diameter, which I had in the center of the laboratory, was powerfully energized, butterflies were carried around in a circle as in a hurricane and could not get out, no matter how they tried. I was unable to satisfactorily explain the gyrations in the circle, altho I can well understand that the charged coil might, by repulsion, keep them in the center. Perhaps the most remarkable of all the observations was the production of sparks in the sand when one walked at some distance from the building. At night a continuous stream of tiny sparks could be seen between the heels and the earth and between the grains of sand. Another most curious effect was the action on horses, which shows how very sensitive they are to electric shock. When I operated with undamped waves, the oscillator being perfectly silent (no streamers whatever), a horse at a distance of perhaps *one-half a mile,* would become scared and gallop away the instant the switch was thrown on. I suppose the capacity of the body was sufficiently great to derive a rather strong current thru the legs which would frighten the animal. When using damped waves the roar was so strong that it could be plainly heard ten miles away and despite all precautions, such as using cotton in the ears, one would get a singular sensation in the head as if something was bursting, similar to that I observed with Röntgen Rays in 1896 or '97, when I was operating with a powerful apparatus designed for their production.

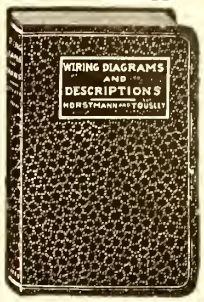
"In my experiments in New York in the laboratories at 35 South Fifth Avenue and at Houston Street, I have exhibited to thousands of people effects of loops or coil antennae. In one experiment, for instance, I would tune a coil about 30 inches in diameter with which I would collect at

Fit Yourself for the Big Job

Don't hesitate any longer. There is a greater demand for trained men now than ever before — greater opportunities — bigger pay — more rapid advancement. It's training that counts now—accurate knowledge—a complete grasp of your trade.

Drake's Practical Mechanical Books

For Home Study

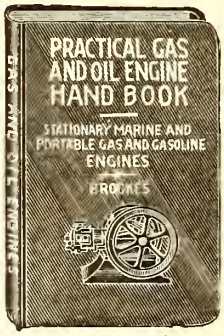


Pave the way to the fat pay envelope. Written in non-technical language that any man can grasp. Send the price of any book listed below. We will send the books postpaid—you keep them five days—if not entirely satisfied return the books and your money will be refunded in full. Order direct from this page. Use the Coupon.

Electrical Books

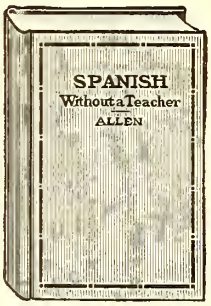
Electric Motor Control Systems and Methods. Leatherette.....$1.50
Electrical Tables and Engineering Data. Leatherette 1.50
Motion Picture Operation. Leatherette.. 1.50
Alternating Current. Leatherette..... 1.50
Wiring Diagrams and Descriptions. Leatherette 1.50
Armature and Magnet Winding. Leatherette 1.50
Modern Electric Illumination. Leatherette 1.50
Modern Electrical Construction. Leatherette 1.50
Electricians' Operating and Testing Manual. Leatherette..... 1.50
Drake's Electrical Dictionary. Leatherette 1.50
Electric Motors, D and A. Leatherette.. 1.50
Electrical Measurements and Meter Testing. Leatherette..... 1.50
Drake's Telephone Handbook. Leatherette 1.50

Automobile Books



Automobile Ignition. Leatherette, $2.00.
Brookes' Automobile Handbook. Leatherette ..$2.00
Automobile Starting and Lighting. Leatherette ..$1.50
Ford Motor Car, Truck and Tractor Attachments. Cloth, $1.00
Ford Motor Car, Truck and Tractor Attachments. Leatherette ..$1.50
Automobile Catechism and Repair Manual. Leatherette.....$1.25
Gas and Oil Engine Handbook. Cloth... 1.00
Gas and Oil Engine Handbook. Leatherette 1.50

Modern Language Courses



FRENCH
SPANISH
GERMAN
} Without a Teacher

By Professor Philip Schuyler Allen, University of Chicago. An entirely new home series of modern foreign languages. Simplest, easiest - to - master language method ever devised. French, Spanish or German. Pocket size.

Each $1.25

Drake books are for sale at all leading book stores. Do not accept Substitutes.

Mail the Coupon NOW

Order on our five day money back plan.

FREDERICK J. DRAKE & CO.,
1009 Michigan Ave., Chicago, Ill.

Enclosed find ($.....), for which please send me prepaid the books checked in this adv. (or list attached). It is agreed that I may return same in 5 days if not entirely satisfied, and money will be refunded in full.

Name.....

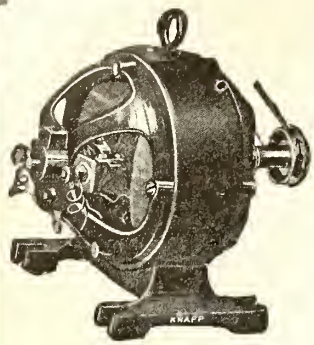
Address.....

www.americanradiohistory.com

DEPENDABLE KNAPP ELECTRIC SPECIALTIES

Motors and Electrical Specialties Are Best

Knapp Goods have stood the test for 29 years. No detail in construction has been spared to make them the best that money can buy. The complete Knapp line includes Toy and Power Motors, Generators and Dynamos. Specialties and Novelties that amuse and instruct. Fans, Rheostats, Compasses, etc. And Knapp prices are always lowest. Always insist on Knapp Goods.



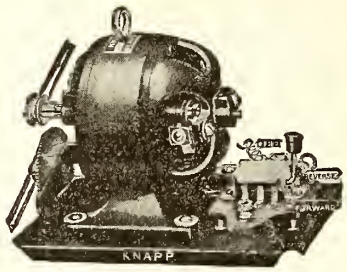
KNAPP DYNAMO MOTOR

Will electroplate, charge storage batteries, run lamps, motors, train of cars, induction coils,—in fact, the number of experiments it can be used for is unlimited. Runs on 4 to 6 Volts or can be connected to run on 110 Volts through a transformer.

Price, Complete, $8.00

KNAPP "LEADER"

An efficient and reliable motor that greatly resembles the big motors of real power plants. Drives from either pulley. Two speeds and reverse. A motor that you will be proud to own and one that will give you unlimited service.

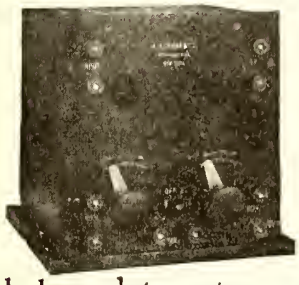


Price, Complete, $4.00

Order to-day. Or your dealer can secure them for you. DESCRIPTIVE CIRCULAR and CATALOG of celebrated **KNAPP MOTORS** *and Electrical Specialties from 10c up mailed FREE on request.*

KNAPP ELECTRIC & NOVELTY CO., 523 West 51st Street, New York City

ARE YOU GETTING THE MOST OUT OF YOUR RECEIVER?



The ether is full of signals these days, some easy to hear and some inaudible. Inaudible because the proper apparatus is not being used.

It is to make those inaudible signals audible that the Grebe RORB two-stage audio-frequency amplifier has been designed. Here is a properly balanced two-stage amplifier, which gets the most out of available vacuum tubes without distortion. A telephone cam switch with auxiliary contactors accomplishes the change from the "off" position to either one or two stages without necessitating any other manipulations. The filaments, as well as the stage circuits, are controlled by this cam switch. This is a feature not found in other amplifiers available at present. Send for bulletin R-108.

TYPE RORB, TWO STAGE AMPLIFIER, PRICE, $45.00

A. H. GREBE & CO.

RICHMOND HILL **NEW YORK**

Boys! You Can Make Your Own Electrical Apparatus with the aid of these wonderful books

Home-made Electrical Apparatus

By A. M. Powell



Three wonderful big books, chuck full of just the sort of information you have been looking for and at a price within reach of your pocket book. Each volume is printed on heavy paper, contains **75 pages and over 60 illustrations, complete working drawings for making every sort of electrical apparatus.** Written so you can understand them. **The price is only 30 cents per copy**—practically the cost of publication. See partial table of contents below and order now. The supply is limited.

Vol. I Contains *working drawings* and directions for making all sorts of Static Machines, Static Apparatus, Home-made Batteries, Storage Cells, Transformers, Rectifiers, etc.

Vol. II contains *working drawings* and directions for all sorts of Voltmeters, Ammeters, Galvanometers, Switches, Rheostats, Telegraph Keys, Sounders, Telephones, Shocking Coils, Spark Coils, Experiments, etc., etc.

Vol. III contains *working drawings* and directions for making all sorts of Dynamos, Motors, Electric Engines, Miniature Lighting Plants, Wireless Telegraph Apparatus, Tesla Coils, Wireless Telephone, Electroplating, Experiments, etc., etc.

Any one of these wonderful books will be sent to you *postpaid* for **30 cents.**

COLE & MORGAN, Inc., *Publishers and Booksellers*

P. O. Box 473, C. H. Sta., New York City

Arnold **Loose Couplers**

Combination Loose Coupler Parts and accessories.

Send 3c stamp for literature which is sure to interest you.

J. F. ARNOLD **2082 Lexington Av. N.Y. Established 1910**

ADVANCED EXPERIMENTERS

Our specialty is to serve you. We build high-grade apparatus or models to specifications, furnish standard apparatus, parts, materials and supplies and do special machine work. Tell us your needs.

JUNIOR EXPERIMENTERS

We are getting out a line of electrical and wireless apparatus especially for you. Each article is well made, practical and instructive as well as inexpensive. Cat. E and code sent for 3c stamp.

THE WILCOX LABORATORIES, Lansing, Mich.

any place in a large hall, *nearly three-quarters of a horsepower,* lighting incandescent lamps, producing long discharges, streamers, etc. One of my exhibits, which was particularly appreciated, was a coil carried on the head which, when resonantly excited, would develop streamers several feet long.

"As regards that deplorable accident to the blimp in Chicago, of course a powerful wireless plant is capable of setting up, at a few hundred feet distance, electro-motive forces of such magnitude that if there is even moderate rise thru resonance, long sparks may result. *In Colorado I drew 1-inch sparks between my body and an iron pipe buried in the ground about 100 feet from the laboratory.* I think it perfectly practicable to produce an explosion by wireless designedly at a considerable distance from a wireless transmitter, and I look upon the accident as very likely having been due to some such cause. By taking proper precautions, however, it is possible to entirely eliminate this danger and I have devoted much thought to the subject, having early recognized the peril to such bags filled with hydrogen. According to my ideas, the accident is not so much chargeable to the plant as to the neglect of proper precautions on the aërial vessel itself. Such a vessel has a considerable span and the guy wires, gondola and other metallic parts constitute a considerable capacity, so that an appreciable amount of energy can be deprived from a wireless plant at a great distance, as it is well shown in the ease with which messages are transmitted to, and received from, aërial vessels.

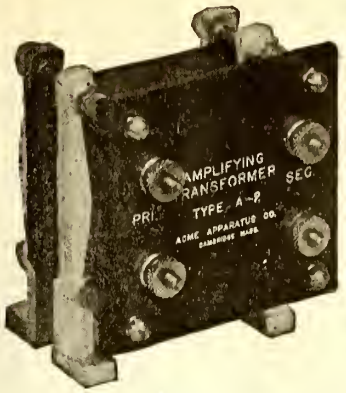
"Why do the naval and other authorities allow such forms of aircraft to use an explosive gas like *hydrogen?* A short time ago the press was filled with the wondrous stories of how the U. S. Government experts had perfected the manufacture of the new and non-inflammable balloon gas—*helium,* to such an extent that it was very cheap and readily obtainable in quantities. Funny, how these "new" inventions require so long a time to reach the public and those who need them. Helium, extracted from illuminating gas, is not new or wonderful at all. My friend, Sir James Dewar, showed me experiments with it over 20 years ago."

How radio waves, even at distances of several miles, can cause sparks to occur among bales of cotton, baled with wire hoops, etc., is shown in one of the accompanying illustrations. The cotton bale wires have currents induced in them every time a radio message is sent from the ship or in its vicinity. This induced current is practically never strong enough to heat up the wire, but should one of these wires break and form a spark gap, then very often the induced current will cause a spark to jump the gap. That is enough to start a fire. Where wired bales are packed close together in the hold of a steamer, in trains, or warehouses, here also radio waves are liable to cause fairly strong electrical oscillations to be set up by resonance in adjacent loops on the bales, as the diagram shows. Result, a spark occurs, and another fire of "unknown origin" has started.

M. George A. Leroy, a French chemist, in his municipal laboratory at Rouen, France, very ably demonstrated that wireless waves could without doubt cause fires at a distance. His apparatus is shown schematically herewith.

Mr. Leroy's apparatus has been christened by him the "Igniting Resonator." The apparatus he used consists of a glass bulb having four apertures; one at either side and one at the top and bottom, respectively. The substance to be tested with this igniter resonator can be placed in the airtight glass compartment and the two electrodes very accurately adjusted by micrometer screws fitted to them. The transmitter comprises a spark coil giving a 15-to-20-

www.americanradiohistory.com



BUY THE BEST

The Audion or V T Detector has been vastly improved in recent years. To keep pace with this improvement we have developed the Amplifying Transformer to a degree hitherto unapproached.

These Instruments are carefully made of the best materials obtainable.

Ratio of Turns 4 to 1.

Ratio of Amplification about 25 to 1 per step.

Peak Amplification Approx. 1000 Cycles.

Price $10.00 Mounted. $7.50 Unmounted.

If your Dealer cannot Supply you, immediate delivery can be made direct from the factory.

ACME APPARATUS CO.
28 WINDSOR ST., CAMBRIDGE, MASS.

NEW catalog just off the press. Seventy-six pages of new apparatus for the Radio Experimenter. Send 4c for this complete catalog.

Haller, Cunningham Electric Co.,

428 Market Street, San Francisco, Cal.

Get Our Prices

on the Wireless Apparatus you need, before buying.

We handle new and second hand instruments on which we can save you money.

All Second Hand Instruments guaranteed to be in perfect working order.

WHAT DO U NEED?

Send us your list now

Radio Equipment Co.

630X Washington St. Boston, Mass.

NATIONAL TRADE DENTAL SCHOOL

506 S. Wabash Ave., Chicago, Ill.

LEARN MECHANICAL DENTISTRY—DEMAND UNLIMITED

A paying professional trade: You will be a trained dental mechanic and receive our diploma when competent. Students given advantage of thoroughly up to date laboratory, and services of graduate Dental Surgeons on practical cases. No effort spared to place graduates advantageously. No age limit. Day or Evening. Individual instruction. No educational requirements. No book or home study. Easy terms. Highest references. Especially attractive proposition to those who write at once for catalog H.

inch spark, which was connected with a spark gap, glass plate and tin-foil condenser and a loop antenna or spiral comprising a few turns of heavy wire, about 2 feet in diameter. Several yards distant, Mr. Leroy placed his receiving coil or igniting resonator, which included a loop or heavy copper conductor about three feet in diameter. The action on the device was similar to that of the Hertzian resonator, i. e., whenever the spark coil or transmitting helix were excited, allowing a spark to jump the gap, electromagnetic waves were set up in the intervening ether, causing corresponding currents to be induced or set up in the receiving loop. As in the historic experiments of Hertz, this loop will gather sufficient energy from the etheric waves to cause a small spark to jump a gap connected across the terminals of the loop, as the accompanying diagram clearly shows.

Mr. Leroy carried out many different experiments with his apparatus, placing the glass spark chamber of the igniting resonator in a bath of oil or vaseline, which can be heated when desired by incandescent lamps, etc.

One of the most interesting experiments carried out by Mr. Leroy was that with miniature bales of cotton, which were enclosed in jute wrappers and provided with iron wire bands, in the way cotton is usually packed for shipment. "Spontaneous combustions in cotton warehouses and in shipholds loaded with cotton or similar material, are not always what they seem," says Mr. Leroy, in describing his experiments and results with the radio igniter. One of the hoops encircling the bale of raw cotton may break or become loose under the action of shock or from some other cause, and the gap created by the breaking of the wire, forms a miniature Hertzian resonator. When a wireless station situated in the immediate vicinity, or perhaps at some quite distant point, starts in to transmit (and the more powerful the station the more pronounced the effect and danger from fire of course), currents will be induced in the iron wire around the bales or other packages, and sparks may pass between the various metal members. Especially will they be inclined to jump small gaps in the wire which occur in the immediate loop. We may say right here, that to a layman all of this phenomena may seem somewhat far-fetched, and not within the realm of everyday possibilities, but anyone who has experimented with high frequency currents, as generated from even a small size oscillator, will at once be convinced that these effects can and do take place under most unbelievable conditions. Of course, one objection that the average electrical and radio reader will probably think of, is that if the cotton bales, et cetera, are placed in a steel vessel, that this metallic hull will act as a screen, and that the bales will not have any current induced in their wire loops, but while this may be partially so, in some cases it is not always so by any means; especially when the home transmitting station, such as on ship-board, starts in operating. In this case, the steel hull of the boat is charged whenever the transmitting key is depressed.

The secret, if so we may call it, of the production of inflammatory sparks or discharges in metallic bodies such as here described, lies in the phenomena known as "resonance." This means that the nearer the metallic members come in tune with the radio waves, the more pronounced the induction effects produced in any instance. It is of course readily conceivable that a cargo of cotton bales presents many peculiar conditions of resonance, due to the varying capacities and inductances of the various loops. In fact, so obvious and possible is this condition, that a wooden vessel carrying bales of cotton or other material having wire or metal members to hold them, and providing she is fitted with a

MATHEMATICIANS

Engineers, Astronomers, Surveyors, Scientists—

The Mathematical Multiplex contains the characters and signs used for writing in higher and lower mathematics, and for engineering, mechanics, etc., as well as typo for all the ordinary work that can be done on any typewriter.

Write for special Folder showing scientific type-sets.

"Just Turn the Knob"

on the

Hammond MULTIPLEX

"Many Typewriters In One"

—and you have a

Different Style of Type



A few Samples of Multiplex Type:

Types for all purposes

and for all languages

Spacing to suit size of type

Perfect alignment

Automatic Type Impression

All on one MULTIPLEX

Over 365

Different Type-Sets

Including All Languages, to Select From

Any one of which may be substituted in a few seconds: "Just Turn the Knob"

The Multiplex does *all* that *any* other typewriter will do, and many other things that *no* other typewriter *can* do.

The six samples of the Multiplex type reproduced above, show how **you can make your writing TALK**—a revelation in typewriterdom!

This marvelous **INSTANTLY interchangeable-type feature** is only one of the many reasons why these, and thousands of other prominent men and women in all walks of life, and in all four corners of the globe, **prefer and personally use the Multiplex:**

President Wilson
Queen Alexandria of England
King and Crown Prince of Sweden
Caliph of Morocco
King and Queen of Norway
William Dean Howells Cardinal Merry del Val
Bertha M. Clay Sir James Matthew Barrie
John Kendrick Bangs Walt Mason, Poet
Leigh Mitchell Hodges Wallace Irwin
Prof. L. A. Loiseaux Etc., Etc

Mail the Coupon for FREE BOOKLET

It will show you how, with the Multiplex, you can put the **force of emphasis** into your typed matter—how you can **drive home** with strength of accent the fullness of **your argument**—how you can write with the same convincing force that you use in speaking—an **exclusive feature** of the Multiplex.

We will also send our pamphlet, **"The President and His Typewriter."**



Also—An Aluminum PORTABLE Model

For Traveling — for Home. Weighs only about 11 lbs. Full capacity. Ask for special folder.

Write your name, address and occupation in the margin below and mail the margin to—

Hammond Typewriter Co., 589 E. 69th St., New York City

www.americanradiohistory.com

YOUR OPPORTUNITY

Canceled Government Contracts

We have secured a large quantity of Small Motors, Generators and Charging Outfits. This material is new, still in original cases and carries the full factory guarantee.

This is Your Opportunity to buy new, guaranteed Electrical Apparatus of Standard Manufacture



Battery Charging Outfits

For use on 110 volt, A. C., 60 cycle, single phase current only.

60 watts, 8 volts, 10 amperes . $48.50
150 watts, 30 volts, 5 amperes . $68.50
150 watts, 15 volts, 10 amperes . $68.50
300 watts, 30 volts, 10 amperes . $94.50

All outfits complete with switchboard as cut shown.



1/2 H. P. INDUCTION MOTOR 110 or 220 volts, A. C. 60 cycle, single phase, 1750 R. P. M. **$32.50**

ALL MOTORS COMPLETE AS CUT

Mail $5.00 cash or Money Order. We will send C. O. D. subject to full examination.

MONEY BACK GUARANTEE



1/4 H. P. 110 volts A. C., 60 cycle, single phase 1750 R. P. M.

WASHING MACHINE MOTOR

Suitable for operating Small Compressors, Coffee Grinders, Bottle Washers, Lathes Drill Presses, etc. **$18.50**

WRITE FOR CATALOGUE. BARGAINS IN MOTORS AND GENERATORS. SPECIAL QUANTITY PRICES

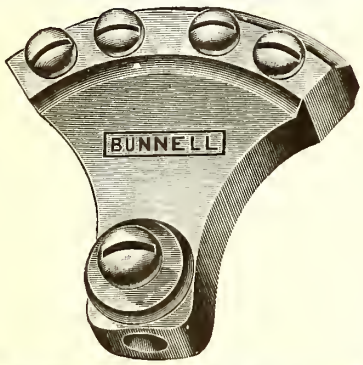
220 volts **POLYPHASE MOTORS** 1750 RPM. 60 cycle, 2 or 3 phase. Complete, pulley end base
1 H. P. $59.50 3 H. P. $ 84 50
2 H. P. $72.50 5 H. P. $102.50

NEW MOTORS

110-220 volts **REPULSION MOTORS** 1800 RPM. 60 cycle, single phase. Complete with pulley.
1/2 Hp. $44.50 1 Hp. $67.50

MANUFACTURERS' DISTRIBUTER

CHAS. H. JOHNSTON - West End - PITTSBURGH, PA.



Manufacturers and Distributors of
HIGH GRADE

Amateur Wireless Apparatus

Send Stamp for Catalog 40E

J. H. Bunnell & Company
32 Park Place
New York City, New York

TEL. BACK BAY 5964

EASTERN RADIO INSTITUTE

RADIO

899 Boylston St. Boston - Mass.

RADIO—Splendid opportunities now in the Merchant Marine for Wireless Operators. Big salaries! New Schedule: Junior operators, $100 per month; Chief operators, $125; food and quarters besides. Equivalent ashore from $40 to $50 a week. Graduates in all parts of the world as Inspectors, Instructors, Engineers, Operators, etc.

The oldest, largest and best equipped radio school in New England. Recommended by Marconi and Government officials. DAY AND EVENING CLASSES. START ANY MONDAY.

"The Eastern" is a Large Achromatic Telescope



MADE UPON NEW SCIENTIFIC PRINCIPLES.

Positively such a good Telescope was never sold for this price before. **Eastern Telescopes** are made by one of the largest manufacturers of telescopes in America; we control entire production; measure closed 9 inchss and open over 3 feet in 4 sections. They are nicely brass bound, with scientifically ground lenses. **Guaranteed by the maker.** Every sojourner in the country or at the seaside resorts should certainly secure one of these instruments, and no farmer should be without one. The scenery just now is beautiful, a Telescope will aid you in taking views. Objects are brought to view with astonishing clearness. Sent by mail or express, safely packed, prepaid, for only **99 cents.** Our new Catalogue of Watches, etc., sent with each order. This is a grand offer and you should not miss it. **We warrant** each telescope just as represented or money refunded. Send **99 cents** by Registered Letter, Post Office Money Order, Express Money Order, or Bank Draft payable to our order, or your newsdealer or store-keeper will order one for you. Whether consumer or dealer, send cash with order. **To dealers 6 for Four Dollars.**

EASTERN NOVELTY CO., 67, 177 E. 93d STREET, NEW YORK

SMOKE IT BEFORE YOU PAY FOR IT

Order on your Business Stationery



To introduce this new and better way to make a pipe we make this extraordinary offer, we will let you smoke this pipe before you pay for it. More than 10,000 BANKERS HAVE BOUGHT BY MAIL. Genuine French Briar, solid Vulcanite mouth piece. Its simple construction makes cleaning easy. Try it. If it is not satisfactory you may return it. Price $1.50. Straight or Bent Models. You breathe, not pull through this excellent pipe and we guarantee satisfaction.

THE CALUMET CO.
CINCINNATI, OHIO
(Mail Sales Division Dept. A)

wireless station of even a few kilowatts, that the Editors would prefer to stay on land than go to sea on such a ship.

One of the accompanying photographs shows how a great multitude of close oscillatory circuits are provided unwittingly in all-framed or rigid gas airships, and even in the non-rigid gas airships there is usually a sufficient amount of metal present in the gondola, wires and other fittings to form one or more resonant circuits, which may cause a spark at an imperfect joint or other gap. It should be remembered, as laboratory tests have demonstrated beyond cavil, that it is not necessary to have a metal wire coil *in spiral form* in order to have powerful currents induced of sufficient strength to cause a spark to jump from it; a straight metallic wire, bar or even tools, lying within a few yards of a small high frequency coil, will pick up sufficient energy to cause sparks to jump from them, and they will sometimes glow with a vivid brush discharge when viewed in a darkened room.

NATIONAL INSTITUTE OF INVENTORS.

The installation of the officers of the National Institute of Inventors, 118 Fulton Street, New York City, N. Y., was held at the Broadway Central Hotel recently, in the presence of 1,000 guests and members. After a very fine entertainment in which the well-known coloratura-soprano, Miss Edna Blanche Showalter, had rendered selections, and Miss Cecelia Bornstein executed in remarkable fashion her salome dance, the newly elected officers were installed.

Addresses were given by Prof. Chandler, a chemist of international reputation and patent expert; Joseph H. Choate, Jr., who spoke of the founding of the Chemical Foundation, Inc., to which foundation all the German chemical patents had been turned over by former Alien Custodian, Attorney-General Palmer, and an address was made by Thomas Howard, executive chairman of the institute, on the severance and dissociation of the patent office from the Department of the Interior, and the establishing of a Court of Appeals to pass upon patent litigation. He was presented with a medal for faithful services. Refreshments were served and the guests danced until the wee hours of the morning.

The newly elected officers, to serve until 1920, were L. J. Wing, President, pioneer inventor of exhaust fans; Carl Schonert, manufacturer of automobile accessories, of Newark, First Vice-President; Robert C. Lafferty, architect, New York City, Second Vice-President; George Julian Houtain, attorney at law, of 44 Court Street, Brooklyn, Third Vice-President; Milton F. Williams, manufacturer of pulverizers, St. Louis, Mo., Fifth Vice-President; W. H. Kennedy, Recording Secretary; Nathan Langer, Treasurer; Paul Revere Fay, one of the fighting Sixty-ninth, Executive Secretary, and R. Nerenstone, Assistant Executive Secretary.

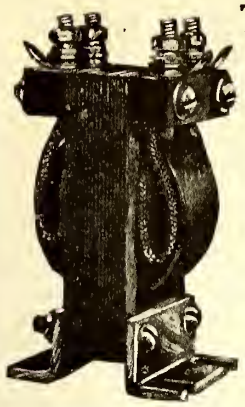
On the Board of Governors to serve for five years were elected: David Moss, New York City; L. Kenner, New Orleans; Julius Glantz, New York City; Michael Quinane, Paterson, N. J.; J. M. Harding, New York City.

AND WOMAN IS LUCKY TO MAKE ONE MATCH.

One of our newspaper friends—the Oklahoma City *Times*—quotes us as follows: "The ELECTRICAL EXPERIMENTER tells us that a man contains phosphorous enough to make 800,000 matches, and it might be added that a woman does well to make even one."—(Yes, very well, we'll say she does! With shoes at $25.00 a throw, dresses at $100.00 a piece, and food—Ach! Hoover—the needle!! The thought of H. C. L. to-day gives us a fever of 114° in the shade.—ED.)

www.americanradiohistory.com

Federal Audio Frequency Transformer



The only Transformer specially designed for Marconi and similar three-member internal Vacuum Tubes approved by leading experts.

No. 226-W
Type A
PRICE
$7.10 Each

Write for Bulletin No. 102-W.

Federal Telephone & Telegraph Co.
Buffalo, N. Y.
Distributors for Marconi Vacuum Tubes



Common Battery Wall Telephone

Complete wall telephone exactly like cut. Telephone companies all over the country use instruments of this type. Each phone contains a 1000 Ohm ringer, an induction coil, a switchhook, a receiver with hard rubber shell, latest type transmitter, and a condenser or resistance coil. Can be used as an extension in conjunction with your present telephone. We have a few which we are closing out at about one-third of regular price at .....$4.50 each with 1600 Ohm ringer same as above .....$4.75 each
Send 5c in stamps for our big illustrated catalogue showing scores of bargains in apparatus of interest to Electrical Experimenters.

ELECTRICAL SPECIALTY COMPANY
Dept. E, 128 So. Eleventh St., Philadelphia, Pa.
Dept. E, 48-50 So. Front Street, Columbus, Ohio

«CONSOLIDATED RADIO»

Consolidated Radio Call Book

The Telephone Directory of the Sea

No Radio Station Can properly operate without a Call Book. The Consolidated Radio Call Book is the only complete book of its kind on the market today. Price ONE DOLLAR postpaid.

Consolidated Radio Call Book Co., Inc.
Dept. "B". 41 Park Row. New York, N. Y.
Only 450 copies left so ACT NOW

AMERICAN ELECTRO TECHNICAL APPL. CO.
235 Fulton Street, N. Y. City Tel. Cort. 3153
BATTERIES—SPECIAL TYPE FOR AUDIONS



Detectors, Condensers, Variometers, Loose Couplers, Tuners, Bakelite, Brandes Head Sets, Army Head Bands, Binding Posts, Knobs, Levers, Sliders, Contact Points, Switch Knobs, etc. De Forest's High-Class Mfg. Radio Parts on hand.
Our Catalog ready Sept. 1st—send 10c for it.

RECO QUALITY

SUPERLATIVE RADIO EQUIPMENT
THE BEST KEY IN THE COUNTRY
10 Amp. $7.75—20 Amp. $8.25
A three cent stamp will bring bulletins of this and other higher grade apparatus.

The Radio Engineering Company
22 St. Paul St. BALTIMORE, MD.

Universal Radio System
Up to the minute radio apparatus for progressive users who can recognize quality.
Send stamp for catalogue.

Universal Radio Mfg. Corp.
Dept. W Elmira, N. Y.

Experimental Mechanics

By Samuel D. Cohen

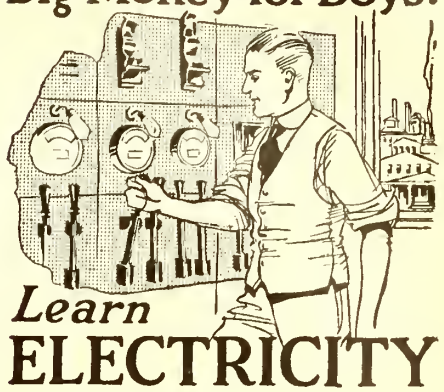
(*Continued from page 579*)

ing oil just above the work. A small brass pipe is soldered into the bottom of the can and leads down to a point just above the tap. By fitting a small valve or stopcock to the bottom of the brass pipe the amount of oil fed onto the tap may be regulated to any degree desired. In threading holes in this manner in the lathe, the tap is very easily backed out by reversing the shift lever on the lathe or counter-shaft, so as to reverse the direction of the chuck, when the threaded object will unwind itself from the tap. In performing this reverse operation to remove the tap, the tail-stock should of course be backed away from the tap so that no pressure whatever is on the tap or otherwise the thread may be ruined, due to the tap being jammed into the threads.

Holes often have to be tapt in very inaccessible locations and for such work a machinist usually provides himself with a long tap wrench. In fact a very good stunt for this work is to arrange a standard tap wrench, so as to fit several different lengths of threaded extension rods, and in this way such out-of-the-way holes can readily be threaded. (*To be continued.*)

Diam. Tap	Thds. per In.	Size of Drill	Diam. Tap	Thds. per In.	Size of Drill
3/32"	48	No. 50	19/32"	12	31/64"
3/32"	52	No. 50	19/32"	14	1/2"
3/32"	54	No. 49	5/8"	10	31/64"
3/32"	56	No. 49	5/8"	11	1/2"
3/32"	60	No. 48	5/8"	12	33/64"
7/64"	32	No. 50	21/32"	10	33/64"
7/64"	36	No. 49	21/32"	11	17/32"
7/64"	40	No. 47	21/32"	12	35/64"
7/64"	48	No. 44	11/16"	11	9/16"
7/64"	56	No. 43	11/16"	12	37/64"
1/8"	32	No. 44	23/32"	11	19/32"
1/8"	36	No. 43	23/32"	12	39/64"
1/8"	40	No. 42	3/4"	10	39/64"
1/8"	42	No. 41	3/4"	11	5/8"
1/8"	48	No. 39	3/4"	12	41/64"
9/64"	30	No. 41	25/32"	10	41/64"
9/64"	32	No. 40	25/32"	11	21/32"
9/64"	36	No. 37	25/32"	12	43/64"
9/64"	40	No. 34	13/16"	10	43/64"
5/32"	30	No. 33	27/32"	10	45/64"
5/32"	32	No. 32	7/8"	9	23/32"
5/32"	36	No. 31	7/8"	10	47/64"
5/32"	40	No. 30	29/32"	9	3/4"
11/64"	32	No. 30	15/16"	9	25/32"
11/64"	36	No. 29	31/32"	9	13/16"
11/64"	40	No. 28	1"	8	53/64"
3/16"	24	No. 29	1 1/32"	8	55/64"
3/16"	28	No. 28	1 1/16"	8	57/64"
3/16"	30	No. 27	1 3/32"	8	59/64"
3/16"	32	No. 26	1 1/8"	7	59/64"
3/16"	36	No. 24	1 1/8"	8	61/64"
13/64"	24	No. 26	1 5/32"	7	61/64"
13/64"	28	No. 22	1 5/32"	8	63/64"
13/64"	32	No. 20	1 3/16"	7	63/64"
13/64"	36	No. 18	1 3/16"	8	1 1/64"
7/32"	24	No. 20	1 7/32"	7	1 1/64"
7/32"	28	No. 17	1 7/32"	8	1 3/64"
7/32"	30	No. 16	1 1/4"	7	1 3/64"
7/32"	32	No. 15	1 9/32"	7	1 5/64"
15/64"	24	No. 16	1 5/16"	7	1 7/64"
15/64"	28	No. 12	1 11/32"	7	1 9/64"
15/64"	32	No. 10	1 3/8"	6	1 1/8"
1/4"	18	No. 17	1 13/32"	6	1 5/32"
1/4"	20	No. 14	1 7/16"	6	1 3/16"
1/4"	24	No. 9	1 15/32"	6	1 7/32"
9/32"	16	No. 10	1 1/2"	6	1 1 7/64"
9/32"	18	13/64"	1 17/32"	6	1 1 9/64"
9/32"	20	No. 3	1 9/16"	6	1 2 1/64"
5/16"	16	No. 1	1 19/32"	6	1 2 3/64"
5/16"	18	15/64"	1 5/8"	5	1 2 1/64"
11/32"	16	F	1 5/8"	5 1/2	1 2 3/64"
11/32"	18	17/64"	1 21/32"	5	1 2 3/64"
3/8"	14	J	1 21/32"	5 1/2	1 2 5/64"
3/8"	16	L	1 11/16"	5	1 2 5/64"
3/8"	18	19/64"	1 11/16"	5 1/2	1 2 7/64"
13/32"	14	N	1 23/32"	5	1 2 7/64"
13/32"	16	P	1 23/32"	5 1/2	1 2 9/64"
13/32"	18	21/64"	1 3/4"	5	1 2 9/64"
7/16"	14	R	1 25/32"	5	1 3 1/64"
7/16"	16	S	1 13/16"	5	1 3 3/64"
15/32"	14	3/8"	1 27/32"	5	1 3 5/64"
15/32"	16	W	1 7/8"	4 1/2	1 3 5/64"
1/2"	12	25/64"	1 7/8"	5	1 3 7/64"
1/2"	13	X	1 29/32"	4 1/2	1 3 7/64"
1/2"	14	13/32"	1 29/32"	5	1 3 9/64"
17/32"	12	27/64"	1 15/16"	4 1/2	1 3 9/64"
17/32"	13	27/64"	1 15/16"	5	1 4 1/64"
17/32"	14	7/16"	1 31/32"	4 1/2	1 4 1/64"
9/16"	12	29/64"	1 31/32"	5	1 4 3/64"
9/16"	14	15/32"	2"	4 1/2	1 4 3/64"

Big Money for Boys!



Learn ELECTRICITY

There is a wonderful opportunity right now for boys who like electricity. Boys who are ambitious and will train themselves in spare time can step into positions just as soon as they are ready. Good salaries are offered to start with splendid chances for rapid promotion.

For 28 years the International Correspondence Schools have been training boys for success in electricity and over 200 other subjects. They will help you prepare right at home for a position in the line of electrical work you like best—or in any other work that appeals to you. Thousands of boys, through I. C. S. training, have stepped into fine jobs, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least, and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6205, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

☐ ELECTRICAL ENGINEER
☐ Electrician
☐ Electric Wiring
☐ Electric Lighting
☐ Electric Car Running
☐ Heavy Electric Traction
☐ Electrical Draftsman
☐ Electric Machine Designer
☐ Telegraph Expert
☐ Practical Telephony
☐ MECHANICAL ENGINEER
☐ Mechanical Draftsman
☐ Ship Draftsman
☐ Machine Shop Practice
☐ Toolmaker
☐ Gas Engineer
☐ CIVIL ENGINEER
☐ Surveying and Mapping
☐ MINE FOREM'N OR ENG'R
☐ ARCHITECT
☐ Architectural Draftsman
☐ PLUMBING AND HEATING
☐ Sheet Metal Worker
☐ CHEMICAL ENGINEER
☐ SALESMANSHIP
☐ ADVERTISING MAN
☐ Window Trimmer
☐ Show Card Writer
☐ Outdoor Sign Painter
☐ RAILROADER
☐ ILLUSTRATOR
☐ DESIGNER
☐ BOOKKEEPER
☐ Stenographer and Typist
☐ Cert. Pub. Accountant
☐ Traffic Management
☐ Commercial Law
☐ GOOD ENGLISH
☐ STATIONARY ENGINEER
☐ CIVIL SERVICE
☐ Railway Mail Clerk
☐ Textile Overseer or Supt.
☐ AGRICULTURE
☐ Navigator
☐ Poultry Raising
☐ Automobiles
☐ Spanish
☐ French
☐ Italian

Name_____
Present Occupation_____
Street and No._____
City_____State_____

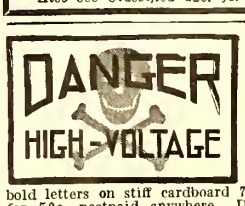
Look! Wireless Experimenters, Look!



22.5 Volts 15 Cells

We have received a shipment of 5,000 U. S. Army Standard Signal Corps B Batteries for Vacuum Tubes. Type BA-2, 22.5 Volts at 60c each. Shipping weight 1 lb. 45 Volt 30 Cell B. Batteries worth $6.00 at $3.50 postpaid. Also 1,000 Red Seal Batteries at 4 for $1.35. Shipping weight 8 lbs. **Aerial Wire** composed of copper and iron at 2 lbs. for 65c (200 ft. to 2 lbs.). Shipping weight 3 lbs. Mazda C 2 Blue Daylight Lamps, 150 Watts, Nitrogen, at $1.65 postpaid. Add enough for postage and 8c for insurance.

The H. S. Wireless Co. 164 Ross St., Brooklyn, N. Y.
Also see Classified ads. for other articles we sell



HOW

would you like to have this ghastly warning hanging in your room? It will make your station or den look big and command respect. It is the neatest sign made. Printed in bright red with big bold letters on stiff cardboard 7¾" x 11½". Price 20c, 3 for 50c, postpaid anywhere. Don't miss this opportunity.
LEONARD BECK, Dept. 10, 102 Meridith Avenue, Arverne, N. Y.

www.americanradiohistory.com

The greatest future for you lies in

CHIROPRACTIC

It is as a Doctor of Chiropractic that you have the greatest opportunity of rising to a pre-eminent position in the struggle for economic security. No other profession of the day offers such unlimited promise. And no other is as pregnant with possibilities for the suffering as well as for the practitioners. It is the nearest approach to exact science that the art of healing has made.

Become a Doctor of Chiropractic, and know what it is to be successful in alleviating human suffering, and in establishing yourself in a position of financial prosperity.

Class Forming This Month

Write for "Booklet X." Information gladly furnished regarding our co-educational day and evening courses.

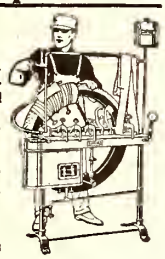
New York College of Chiropractic
1414-16 Broadway New York, N. Y.
Phone Bryant 6956-6957

AN EASY WAY TO MAKE MONEY

Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business. One man says "I made $60.00 the first day." Others average $200 to $500 a month. Very little capital needed. Jobs plentiful. Every motorist a possible customer. No experience needed. We teach you.

SHALER Tire Repair Outfit

Improved Wrapped Tread Method Used by Tire Manufacturers



Does as good work as the big high priced vulcanizing outfits. A boy can use it. It's the only vulcanizer that has Automatic Heat Control, and can't undercure or overcure a tire. Requires no watching or regulating.

FREE Book

"How to Open a Tire Repair Shop." It tells how to make big money. Don't delay. Write quick.

C. A. SHALER CO.
2239 Fourth St. Waupun, Wisconsin

Cheapest Way to Go is on a Bicycle



That is why in many European countries one in every six persons rides a bicycle. All armies use them by thousands. It is the **workman's street car**, with the cost of the rides saved. A complete **outdoor gymnasium** that keeps you fit in mind and muscle. The Mead Cycle Company special

Factory to Rider

Sales Plan saves you $10 to $25 on the **Ranger** model you select; your choice from 44 styles, colors and sizes. **30 Days Free Trial** and **Mead pays the Freight.**

TIRES Parts, Repairs, at half usual price. Don't buy until you get our **Free Catalog** describing all the wonderful new offers, liberal terms and low prices. Write a postal now to—

EASY PAYMENTS 9 months to pay if desired—at a small advance over our special cash prices.

MEAD CYCLE COMPANY
DEPT. H107 CHICAGO



takes marvelous photos, also other valuable presents, watches, air rifles, moving picture machines, talking machines, telescopes, typewriters, given absolutely free for selling our art and religious pictures at 10c. Send for 25, when sold send money and receive premium.

SPENCER PUB. CO., Dept. 301, Chicago

Learn Watchwork, Jewelrywork and Engraving A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL Department, Bradley Institute, Peoria, Ill., for our latest catalog.

To Europe in Three Hours

(*Continued from page* 575)

fair, not to be compared with our passenger carrying types of lighter-than-air aircraft, which incorporate the important factor of having a "dead load" (crew, engines, fuel, etc.); this takes a very large proportion of the total lifting effort exerted by the balloon envelope. In the testing balloon the ratio of "dead lift" to the weight of the balloon itself is very much less, and if some of the gas originally put into the bag has to be dissipated by an automatic valve, to keep the balloon from bursting, there will still be sufficient gas left in descending to lower levels to sustain the recording instruments carried, owing to two reasons, viz.: the greater free expansibility of the small, simple balloon of this type, whose diameter may have increased at the higher altitudes to four or five times its normal inflated diameter at sea level; and again due to the low ratio of the "dead weight" to the balloon weight proper.

High Altitude Airplanes

When it comes to operating airplanes at high altitudes several factors confront us. Some of these factors we have already mentioned in the foregoing text—such as increasing the wing-spread and the total exposed area of the wings; improving the thrust of the propellers by lengthening them and possibly increasing their specd; utilizing air-compressors for the pilot's cab and carburetor systems of the engines; using "vacuum bottle" cabs for the crew, etc. Variable pitch propellers are being strongly advocated by altitude fliers nowadays, including Major Schroeder. These would seem to improve the climbing and propelling efficiency.

As Mr. Harry E. Dey has pointed out, the reduction in the weight of the air falls off as we go up in the atmosphere; at say 3½ miles altitude the weight of the air is about one-half that at sea level, and the resistance has reduced to approximately one-half also. The airplane at this level should therefore, as Mr. Dey also believes and states, be accelerated to *double* its sea level velocity, which let us consider as having been 200 miles per hour. Here then the plane should travel at 400 miles an hour. Some one objects, however, that altho this may be quite true, the supporting power of the air has fallen to about one-half. True; it has decreased one-half for the *former* 200-mile-per-hour speed, but this loss has been neutralized by the *increased velocity*, 400 M.P.H., with the result that the net buoyancy is the same as formerly.

Reasoning on this basis of reduced weight and less air resistance at the higher altitudes, it becomes possible to attain some real hair-raising speeds in an airplane. For example, if we consider the weight of the air at eight miles altitude to be but (approximately, to simplify matters) one-fifth of that at sea level, then the speed which an airplane attaining 200 M.P.H. at sea level, would attain at this altitude (about 42,000 feet) figures to the astounding velocity of 1,000 *miles per hour*. According to this method of reasoning, as followed by Mr. Dey, Europe is only a stone's throw away from us, and we can call up Cousin John or Aunt Kate in London and tell them to hustle over for Sunday dinner. They'll be with you in your New York city apartment and raving over your wife's salad, *just three hours later!* 1,000 M.P.H. divided into 3,000 miles=3; simple, ain't it? Gad, tho, this is awful; our wife's folks will *all* be with us every week-end! Get that!!! You know there's such a thing as "too much speed." What?!

Q. S. T.

"All men having commercial licenses should report for jobs at once."

Big shortage of operators!

Every student completing the course has qualified himself to fill a position paying $85-$130 per month and keep.

Short, thoro course — excellent laboratory.

Dormitory — swimming pool.

Call or write for illustrated booklet.

Y. M. C. A.

RADIO SCHOOL

NEW YORK CITY

Manhattan Branch: 154 East 86th St. Tel. Lenox 6051
Brooklyn Branch: Marcy Ave. Near B'way Tel. W'msburg 3800



SLIGHTLY USED STANDARD MAKE TIRES

Size	New Tube	Price	Size	New Tube	Price
30x3	$1.85	$ 4.50	35x4½	$3.00	$10.25
30x3½	2.00	5.00	36x4½	3.50	10.50
31x3½		5.50	35x5	3.75	11.00
32x3½	2.25	6.00	36x5		11.50
31x4	2.75	6.50	37x5	4.00	12.00
32x4	2.40	7.50			
34x4	2.70	8.50	Special—Brand New		
34x4½	2.85	10.00	32x3½, Cord		$12.25

Order now. Shipment made the same day. $1 deposit required with each tire order, balance C. O. D., subject to your examination. Specify whether you desire to have clincher or straight side tire.

Special cash discount of 5 per cent if full amount accompanies order.

CENTRAL TIRE & VULCANIZING CO.,
2309 S. STATE ST., Dept. E. E. CHICAGO



½ Price $2.50

SEND NO MONEY

If You Can Tell it from a GENUINE DIAMOND Send it back

To prove that our blue-white MEXICAN DIAMOND closely resembles the finest gennine Sonth African Diamond (costing 50 times as much), with same DAZZLING RAINBOW-FIRE, (Guaranteed 20 yrs.) we will send this Ladies Solitaire Ring with one carat gem, (Catalogue price $4.98) for Half Price to introduce, $2.50, plus War Tax 13c. Same thing but Gents, Heavy Tooth Belcher Ring, (Catalogue price $6.26) for $3.10, plus War Tax 15c. Mountings are our finest 12 karat gold filled. Mexican Diamonds are GUARANTEED FOR 20 YEARS. **SEND NO MONEY.** Just mail postcard or this ad., state size and we will mail at once C. O. D. If not fully pleased, return in 2 days for MONEY BACK, less handling charges. Act quick; offer limited; only one to a customer. Write for FREE Catalog. AGENTS WANTED.

MEXICAN DIAMOND IMPORTING CO.
Dept. F-1 Las Cruces, N. Mex.
(Exclusive controllers Mexican Diamonds)

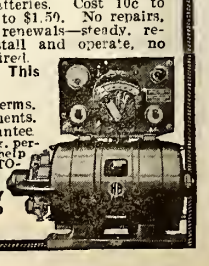
HB BATTERY CHARGING PAYS BIG PROFITS

Get Big Profits This Fall. $100 to $200 CLEAR Every Month.

Fall brings big demand for reliable HB Battery service. Get your HB 500 watt Charger NOW. Recharges 1 to 8 6-volt batteries. Cost 10c to 15c each, customer pays 75c to $1.50. No repairs, no burn outs or expensive renewals—steady, reliable service Easy to install and operate, no mechanical knowledge required.

Small Cash Payment Puts This Money-Maker in Your Shop.

Balance on easy monthly terms. Profits easily carry payments. Absolute Money-Back Guarantee Start NOW to build *your own*, big, permanent, profitable business. We help you. Tear out this ad and mail TODAY for information.



HOBART BROTHERS COMPANY
Box 101E Troy, Ohio
Successful Mfrs. Since 1893

www.americanradiohistory.com

And think of inviting your Aunt Kate or Cousin Myra, from London to make the aërial trip over the pond in three hours! Did you think of the catastrophe that might await you?! No? Well, listen Lester: your aunt, and the rest of the family tree hailing from "dear ol' Lunnun" would be eating your "dinner" at *their* "supper time," and the Sunday visitor from London! Can you imagine him arriving on the morning (at New York) aërial boat at 7 o'clock A. M. He left London at 9 o'clock, traveled over in three hours, which makes it 12 o'clock noon by his turnip; wherefore, and hence—Mr. England would have to sit down with you and eat his *breakfast* all over again, and at "dinner time," at that. It's not as bad as it sounds—the sea air would make it possible.

The Story of Rohlfs—New American "Altitude Flier."

Among other things, Roland Rohlfs, the new American altitude record holder, recently stated:

"I shall take every precaution on my next trial. In order to obviate the trouble I had in keeping my motor warm shutters will be provided, and the gasoline pump, which became airbound, making it necessary for me to pump by hand nearly two hours, has been adjusted. I shall also make more careful selection of the gasoline I use. In my last attempt I used a high test gas and I failed to get within 200 revolutions per minute what I got the first time.

"I shall also wear more clothing. My hands got very cold, in spite of the fact that I had on several pairs of gloves and mittens. I shall also try more oxygen, for on both my flights my supply has given out. I always try to be as sparing as possible, not using it until I reach approximately 23,000 feet.

"What is the purpose of altitude flights? I suppose most people think they are made merely to satisfy the vanity of the pilot or the airplane designer—something like the automobile speed race. Not at all. It has a distinct scientific value. It gives invaluable data to the meteorologist and will be of infinite value when the time comes for the establishment of air lanes of travel for airplanes.

"At the present time our knowledge of conditions is based largely on observations made from kites and from balloons, but these are stationary and, for the most part, the information gained is applicable only to localities in which the tests are made. With the airplane one can cruise about in the thin upper strata of the air and actually chart the conditions that can be expected to prevail there. It will enable us to make certain lanes of travel for airplanes of various types, say the upper levels for the speedier planes and the lower levels for the slower going machines.

"We also get valuable information concerning the kind of planes and motors that will have to be built for use at various air levels. It gives us data concerning the way motors act under certain conditions and at certain levels, how the machine maneuvers, what sort of wing construction is necessary.

"It also gives us valuable medical data concerning the effects of different altitudes on different people.

"It is almost impossible for us to conceive that six miles above one of our bathing beaches, six miles above cities where people are sweltering in the heat, the temperature is twenty-five degrees below zero and that a wind of from 100 to 200 miles an hour is blowing. That information in itself will be important when commercial aviation gets to be a regular thing. With all this information at hand, think how easy it will be for us to go up in a specially-

(*Continued on page* 599)



Let This Faculty of Specialized Experts Train You for Electrical Success

All are specialists in their professions—have had years of practical experience in addition to their scholastic attainments. Through the direct aid and personal attention of this well selected faculty you will forge rapidly ahead in the great electrical field.

All Branches of Electricity

are taught quickly, thoroughly, efficiently here. The maximum of education at the minimum of time and expense.

School of Practical Electricity—1 Year Course

Trains you to become a master electrician. Fully equipped laboratories, latest modern electrical installation. Fifteen years of continuous specialization in one branch—ELECTRICITY. This standard up to the minute course especially designed for us has proved its value through the trained men produced.

Institution of Electrotechnics—Junior and Senior Course

Trains young men of either eighth grade or part high school education for entering a brand new profession. A rapidly increasing demand for men to fill high salaried positions. Course also prepares for entering College of Electrical Engineering, Junior Division (1½ yrs.) open to 8th grade graduates. Senior division (1½ yrs.) for students with seven high school credits.

School of Mechanical & Electrical Drafting

One year course. No special educational requirements for entrance. Train to become an expert in a great and growing profession. "Earn While You Learn" if you like. Athletics. Glee Club. R. O. T. C. (optional). Students Fraternity House with board and room at cost.

SEND NOW!

For latest bulletins and booklet "Succeed Through Electricity."

SCHOOL OF ENGINEERING OF MILWAUKEE
121-373 Broadway Milwaukee, Wis.

Clip Here

School of Engineering of Milwaukee,
121-373 Broadway, Milwaukee, Wis.

Gentlemen:—Please send me, without obligation a "Photo-Story" and full information concerning the courses marked.

Electrical Engineering (B.S. Degree 3 Yrs.)
Electrotechnician Course 6-Month Trade Courses
1 Yr. Practical Electricity Home Study Courses
1 Yr. Electrical & Mechanical Drafting

Name.....
Address.....
City..... State.....
Education..... Age.....



4-cyl. Lycoming Motor—37 H. P.

For nearly five years the Bush Car has been doing heavy duty all over this country. It's sold by mail only—we do not have distributors. Our Proposition is liberal beyond your expectations. It contains a good selling profit for you. Get ALL the information quick. Write at once to J. H. Bush, Pres., Dept. M-15

BUSH MOTOR CO.
BUSH TEMPLE, CHICAGO

BUSH PASSENGER CARS

The Bush Car for 1919, in the Light Four is unequaled in value anywhere this year. Think of a car with all the modern refinements which includes in its equipment the Boyce Motor Meter, for instance, at prices modest in the extreme. The Bush method of marketing the Bush Motor Car not only gives the owner a better car than he usually gets, but the Bush method of sales gives the user the benefit of high quality at low price. We list below some of the big things—the high grade features—that go into the Bush Car for 1919.

Full Floating Rear Axle — **Willard Batteries**
Two Universal Joint Drive — **Timken Roller Bearings**
116-Inch Wheel Base — **Plate Glass Rear Windows in Top**
Copper Radiator — **Light Weight—2450 lbs.**
Electric Lighting and Starting (2 unit)

The best material obtainable—the very highest quality construction coupled with what every one knows to be good equipment, such as Willard Batteries and Timken Bearings, insures long life to the Bush Car even under unusually hard service. There is a Money-Back Guarantee Goes with Every Bush Automobile to show you we mean just what we say about the quality of this car and to prove to you that your confidence in us will not be abused. Our Guarantee is in writing.

What 15c Will Bring You from the Nation's Capital

Washington, the home of the Pathfinder, has become the World's Capital and reading the Pathfinder will be like sitting in the inner council with those who will mold the world's destiny for the next generation

The little matter of **15c** in stamps or coin will bring you the Pathfinder **13** weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth and only the truth; now in its **27th** year. This paper fills the bill without emptying the purse; it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you appreciate a paper which puts everything clearly, fairly, briefly—here it is. Send **15c** to show that you might like such a paper and we will send the Pathfinder **13** weeks. The 15c does not repay us; we are glad to invest in new friends. **Pathfinder, Box 76, Washington, D. C.**

www.americanradiohistory.com

Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

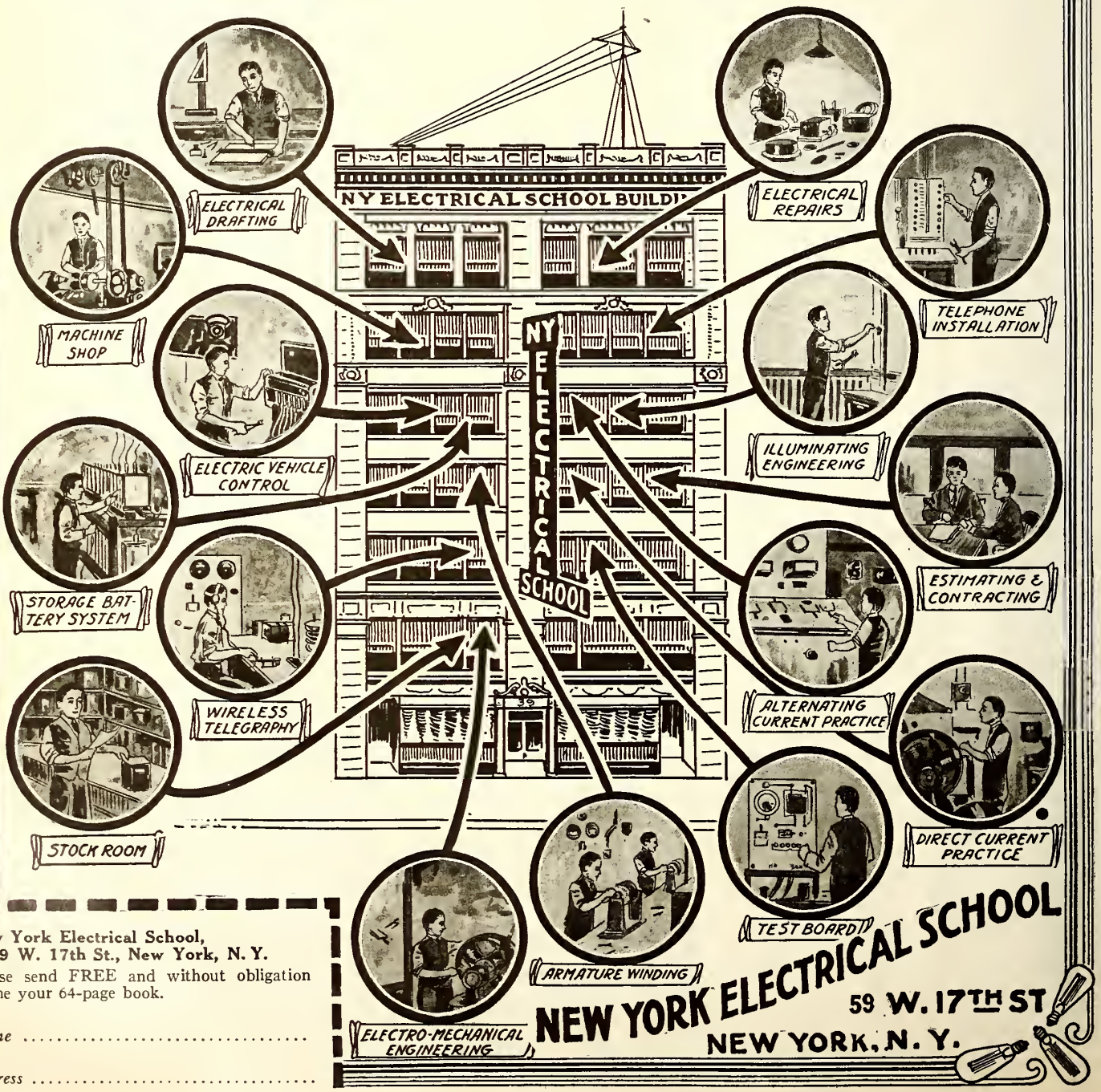
Over 5,500 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Special Automobile Ignition Course

We have just installed a special automobile ignition course for auto mechanics, garage men and owners. The course covers completely ignition, starting, lighting and other electrical equipment in connection with automobiles, motor boats, etc.

Let us explain our complete courses to you in person. If you can't call, send now for 64-page book—it's FREE to you.



New York Electrical School,
59 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

Name .....

Address .....

www.americanradiohistory.com

To Europe in Three Hours

(*Continued from page* 597)

constructed machine, the body built perhaps on the principle of the *vacuum-bottle,* take advantage of the 200-mile-an-hour wind which prevails from the east, *and land in Europe in half a day.* Because, with a wind of that velocity, you can conserve gasoline and simply let the wind blow you where you want to go. You can get the wind-direction at various levels by means of observation kites.

"Speeds greater than we have ever thought of will be attained and commercial aviation will take advantage of them sooner or later."

Rohlfs flew a Curtiss Wasp biplane equipt with a twelve-cylinder 400 horsepower Kirkham motor. The biplane weighed 1,900 pounds and had a wing span of 32 feet and half an inch and measured 23 feet over all in length. He tried out the climbing powers of the machine in an unofficial flight, in which he reported reaching a height of 31,000 feet. Numerous witnesses were called after his official altitude climb, to make the flight official, and the barograph was signed by Major J. T. Roessel, Major H. F. Miller, Lieut. Col. W. L. Moose, Jr., Captain A. F. Simonin, Colonel Archie Miller, Augustus Post, on behalf of the Aero Club of America; John T. Tarbox, Secretary of the Aero Club of America, and the pilot himself.

New Altitude Record with Passenger.

A new world's altitude record of 30,000 feet is said to have been establisht for an airplane with passenger by Lieutenant Weiss, the pilot, and Mechanician Begue, according to a message from Paris dated August 13. The flight, which took fifty-two minutes, was made at Villacoublay, near Paris. The aviators' instruments showed that they experienced a temperature of more than 25 degrees Fahrenheit below zero. The official figures on the ascent will be made public later.

ELECTRICITY STEERS BLIND MAN.

(*Continued from page* 530)

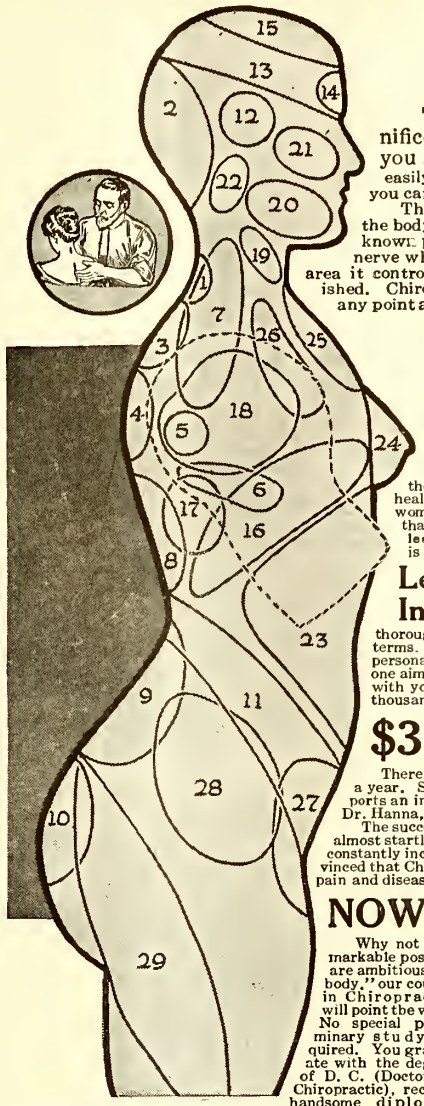
Not only is it possible to set the compass by touch or by sight so as to travel due north, south, east or west, by the four notches in the adjustable lid, but it is also possible to set the compass so as to maintain a course in any given direction. This is accomplisht by setting the compass so that the point on the compass which would point north with the needle when the instrument is in a natural position is pointed in the direction desired. The two contact pins are then dropt over the compass needle by means of the lid or cap.

It is difficult for men traveling in the woods or on the desert to maintain a set direction. But with the direction indicator attached to his belt, the wearer could set the compass before starting out—changing it when he desires—and it would warn him every time he deviated from the determined course.

The instrument can be used on boats to automatically maintain a desired course, and this development is being worked out by its inventor. It would also be practicable for aircraft. Instead of sounding an alarm, the device would result in throwing over a rudder, and the boat or aircraft would at once resume its predetermined direction. Especially valuable would the device be for torpedo or bombing craft that are automatically controlled, says its inventor.

Contributed by L. W. PADRONE.

Learn to Treat Disease This Way



This is a small reproduction of one of 22 magnificent charts **all of which** we want to send you **ABSOLUTELY FREE,** just to show you how easily you can master Chiropractic and how successfully you can treat disease by this modern drugless healing method. These charts show the different pain and nerve areas of the body. The science of Chiropractic is based upon the well known principle that when there is bone pressure on a trunk nerve where it leaves the spinal column there will be pain in the area it controls: and that by relieving the pressure the pain is banished. Chiropractic teaches you how to locate nerve pressure at any point along the spinal column and how to relieve it.

BE A DOCTOR OF CHIROPRACTIC

Advanced Science of Spinal Adjustment

The great profession that within the past few years has taken the longest forward strides ever known in the history of drugless healing. It has called to its ranks thousands of ambitious men and women from every walk of life. Today it is calling more insistently than ever because the **tide has turned strongly in favor of drugless healing. Right now** the demand for Doctors of Chiropractic is far greater than the supply.

Learn at Home In Spare Time

The American University method of teaching enables you to study by mail or in class and obtain a complete mastery of Chiropractic in the shortest time consistent with thoroughness, while you hold your position. You can pay on easy terms. From the day you enroll your instruction will be under the personal direction of a splendid faculty of Chiropractic experts. Our one aim will be to make you successful. We will work whole-heartedly with you to advance your interests so that in a short time you, like thousands of Chiropractors, can earn a good income.

$3000 to $5000 a Year

There are many instances of Chiropractors earning from $3000 to $5000 a year. Some upwards of $10,000. Dr. M. D. Moore, of Kentucky, reports an income of $9,000 a year. Dr. L. H. Roche, New Jersey, $5,000; Dr. Hanna, of Kentucky, over $5,000 yearly.

The success of Chiropractors in many cases has come so quickly as to be almost startling. And yet, it is not to be wondered at when you consider the constantly increasing number of intelligent, thinking people who are now convinced that Chiropractic is the common-sense and really scientific way to relieve pain and disease and who, therefore, **demand the services of Chiropractors.**

NOW—Your Great Opportunity

Why not qualify **now** for this splendid profession that offers such remarkable possibilities for making you prosperous and independent? If you are ambitious to make money, increase your social standing and be "somebody," our course in Chiropractic will point the way. No special preliminary study required. You graduate with the degree of D. C. (Doctor of Chiropractic), receive handsome diploma, **FREE,** and are ready at once to open your office.

Get Free Charts offer at once. Regular value of the 22 magnificent charts is $31.50. Many of these charts are handsomely lithographed in life-like colors. Mail coupon and get all the facts. We will send you our beautiful new illustrated book, full particulars regarding course, easy terms, together with free charts offer immediately. Don't put it off—mail coupon or send your name on a postal card—**today.**

AMERICAN UNIVERSITY
Manierre Bldg., Dept. 564 Chicago, Ill.

AMERICAN UNIVERSITY
Manierre Bldg., Dept. 564 Chicago, Ill.

Without cost or obligation send me by mail, your new illustrated, 72-page book and your Free Charts offer.

Name.....

Street No. or R.F.D..... .....

City..... .....State.....

10 LESSONS FREE

Learn Public Speaking

Write—quick—for particulars of this extraordinary offer; an opportunity you will never forget if you take advantage of it. Ten lessons in effective public speaking absolutely FREE to those who act promptly. This offer is made to introduce our course in localities where it is not already known.

NEW, EASY METHOD

We teach you by mail to talk before club, lodge, board meetings, respond to toasts, make political speeches, etc. Become a powerful and convincing speaker, overcome stage fright. New method, easy and simple. Do not let this chance escape you.

SEND THIS FREE COUPON

This special offer of Ten Lessons Free is made strictly for introductory purposes and for a limited time. Write now before it expires and receive full particulars by return mail. No obligation. Simply tear off and mail this free coupon. Dept. 7447
NORTH AMERICAN INSTITUTE, Manhattan Bldg., Chicago

FREE LESSON COUPON
NORTH AMERICAN INSTITUTE
7447 Manhattan Building Chicago, Ill.

I am interested in your course in Effective Public Speaking and your offer of ten lessons free. Please send full particulars. This request places me under no obligation of any kind.

Name.....

Address .....

Law Scholarships FREE

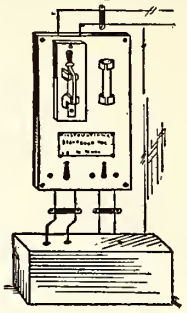
Write now—quick for particulars of this great publicity offer—a tremendous—positively tremendous opportunity for the ambitious man. Tuition absolutely free to those who act promptly, to introduce our new copyrighted easy method of instruction. Prepares for bar or business. Most practical and authoritative non-resident course. Endorsed by bench and bar. Scholarship students pay only nominal expense of text and postage. Write for particulars. No obligation. This is a once in a life-time proposition

AMERICAN CORRESPONDENCE SCHOOL OF LAW 7447 MANHATTAN BLDG. CHICAGO

www.americanradiohistory.com

$1.00 INEXPENSIVE ELECTRIC POWER $1.00

The wonder of the twentieth century inexpensive electric power, this is possible with our new electric power system, a new idea in electricity. With the aid of our instruction and chemicals you can make and install a power battery as shown in the illustration, absolutely safe and simple. **Stop wasting money** on buying batteries, install the new electric power battery. It is not an acid or dry battery, it is a new combination of wet and dry elements which produce electricity. These batteries are **powerful and cheap** to operate, they produce a direct current of more than 20 volts, cheaper than any other form of battery. They are wonderful for operating all kinds of experimental work, for lighting purposes and for many other uses where electric current is needed. Any user of batteries knows the value of an inexpensive high voltage electric current. These batteries should be in every home, office, shop and factory, no matter how small a current is needed; to reduce or raise the current of the battery, simply move the volt regulator on the switch board. The beauty of these power batteries is, that they do not evaporate or lose current when not in use, therefore, with every day use recharging the battery is necessary about every month or so, it can be recharged at home in a few minutes, **no electricity or machinery is required** for this operation, recharging material can usually be obtained around your home or can be bought for a few cents. These batteries when charged weigh about 84 pounds and if properly installed will last **for years.** Each battery making outfit consists of a completely wired switch board, battery connectors, wire, instructions and plan for making, installing and recharging the battery and complete chemicals. **Special introductory price, $1.00, prepaid.** Outside the U. S., $1.25.



NEW MODEL TELEPHONES $2.00



The most useful and inexpensive wall telephones yet developed. Good use can be found for a set of these telephones in many homes, and in office, store or shop, indoors and outdoors; they save many steps and much time. You can easily install these new model telephones and have your own private line with no operators to bother or listen to your conversation. They are thoroughly practical and serviceable all around telephones. Their construction is simple and neat, nothing to break or to get out of order, a child can operate them with ease, they will give satisfactory service at any distance up to 5 miles, and even at that distance the voice will be perfectly plain and understandable as with the **regular commercial telephone.** These new model telephones are electrically operated, two batteries will operate a set of phones for a long time, the cabinets are made of polished oak and finished with a durable varnish and fitted with excellent receivers and transmitters, fine workmanship and construction throughout, **guaranteed to operate** under all conditions. We are offering the New Model Telephones at an **exceptionally low price.** Each telephone set consists of two New Model Telephones, calling system, wire, instructions and diagram for installing. **Special price to introduce $2.00, prepaid.** Outside the U. S. $2.25. **FREE**—We want every reader to own a New Model Telephone set, so we are going to give away a 2-cell battery **FREE** to every purchaser of a New Model Telephone Set.



ELECTRIC LIGHT IN YOUR HOME $1.00

The latest electric light, no batteries to buy or electric bills to pay. Anyone can install and maintain this midget electric light. Safe, simple and inexpensive. No more smoke and smell, no wicks or oil, no chimneys to clean or break, just as safe in the barn, garage and clothes closet as in any open room, always ready for use, day or night. A touch on the switch and you instantly have a **bright electric light.** No matter where you live this light can be installed. It is not affected by heat or cold. Many homes have installed this electric light in their halls, closets, pantries, barns, sheds, cellars, garages, etc., with good results. It is an extremely useful light which no household should be without. The reason for this bright electric light is that the lighting bulb is fitted with a drawn Tungsten filament wire which is much more efficient and durable, besides giving a **300% increase in light** as compared with the ordinary carbon lamp. The power system furnished with this lighting outfit is somewhat similar to the electric power battery described above. Each electric light outfit includes the following: Complete directions and plans, copper wire, insulated wire holders, knife switch, drop light fixture with socket, friction tape, battery protector, maroon shade, national mazda globe. Our dry battery compound, which assists in renewing and supplying the current and our current renewing system with which you can **renew the current at home without expense.** With every day use one recharge usually lasts two to three weeks. This electric lighting outfit is undoubtedly the most practical and durable electric light of low cost and long service ever devised. **Special price to introduce these electric lighting outfits $1.00, prepaid.** Outside the U. S. $1.25.



Our Guarantee—It is our intention that every article described above will reach you exactly as described, that it will satisfy you perfectly, that it represents full value for the money you paid or we will refund your money.

Just to introduce our new line of goods we are offering them at these greatly reduced prices. We only have a limited number of the above described goods at these prices. **Order now,** direct from this ad. We guarantee safe delivery anywhere for additional 10 cents on each item.

A. B. C. PRODUCTS CO. 1 JOHNSON & 13th STS. CHICAGO

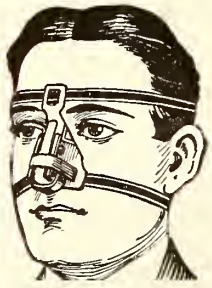
YOU HAVE A BEAUTIFUL FACE

BUT YOUR NOSE?









BEFORE **AFTER**

IN THIS DAY AND AGE attention to your appearance is an absolute necessity if you expect to make the most out of life. Not only should you wish to appear as attractive as possible, for your own self-satisfaction, which is alone well worth your efforts, but you will find the world in general judging you greatly, if not wholly, by your *"looks,"* therefore it pays to "look your best" at all times.

Permit no one to see you looking otherwise; it will injure your welfare! Upon the impression you constantly make rests the failure or success of your life. Which is to be your ultimate destiny? My new *Nose-Shaper,* "TRADOS" (Model 24) corrects now ill-shaped noses without operation, quickly, safely and permanently. Is pleasant and does not interfere with one's daily occupation, being worn at night.

Write today for free booklet, which tells you how to correct ill-shaped noses without cost if not satisfactory

M. TRILETY, Face Specialist **K-1283 Ackerman Bldg., Binghamton, N. Y.**

ALL THE PARTS AND PLANS



HERE BOYS

Model A, $1.00. Model B, $1.50. Completed Model, A, $1.50, B, $2.00. Made like a SKEETER, no other will fly. No other can BEAT her, all others so die; Made in a JIFFY, fly it in the Park, Maiden so NIFTY, fun as Noah's Ark!

Prepaid—Don't send stamps.

NIFTY NOVELTY & TOY CO. Newark, N. J.

LEARN WATCHMAKING

By our PROFIT SHARING plan watchmakers earn from $40 to $80 per week and the demand for competent men is greater than the supply. Write for free book.

CHICAGO SCHOOL OF WATCHMAKING
Dept. 30, 190 N. State Street, Chicago.

My Inventions

By Nikola Tesla

(*Continued from page* 556)

this is also true, and perhaps more so, of certain defects in the brain which deprive the automaton, more or less, of that vital quality and cause it to rush into destruction. A very sensitive and observant being, with his highly developed mechanism all intact, and acting with precision in obedience to the changing conditions of the environment, is endowed with a transcending mechanical sense, enabling him to evade perils too subtle to be directly perceived. When he comes in contact with others whose controlling organs are radically faulty, that sense asserts itself and he feels the "cosmic" pain. The truth of this has been borne out in hundreds of instances and I am inviting other students of nature to devote attention to this subject, believing that thru combined and systematic effort results of incalculable value to the world will be attained.

Dr. Tesla's First Automaton.

The idea of constructing an automaton, to bear out my theory, presented itself to me early but I did not begin active work until 1893, when I started my wireless investigations. During the succeeding two or three years a number of automatic mechanisms, to be actuated from a distance, were constructed by me and exhibited to visitors in my laboratory. In 1896, however, I designed a complete machine capable of a multitude of operations, but the consummation of my labors was delayed until late in 1897. This machine was illustrated and described in my article in the Century Magazine of June, 1900, and other periodicals of that time and, when first shown in the beginning of 1898, it created a sensation such as no other invention of mine has ever produced. In November, 1898, a basic patent on the novel art was granted to me, but only after the Examiner-in-Chief had come to New York and witnesst the performance, for what I claimed seemed unbelievable. I remember that when later I called on an official in Washington, with a view of offering the invention to the Government, he burst out in laughter upon my telling him what I had accomplished. Nobody thought then that there was the faintest prospect of perfecting such a device. It is unfortunate that in this patent, following the advice of my attorneys, I indicated the control as being effected thru the medium of a single circuit and a well-known form of detector, for the reason that I had not yet secured protection on my methods and apparatus for individualization. As a matter of fact, my boats were controlled thru the joint action of several circuits and interference of every kind was excluded. Most generally I employed receiving circuits in the form of loops, including condensers, because the discharges of my high-tension transmitter ionized the air in the hall so that even a very small aerial would draw electricity from the surrounding atmosphere for hours. Just to give an idea, I found, for instance, that a bulb 12" in diameter, highly exhausted, and with one single terminal to which a short wire was attached, would deliver well on to one thousand successive flashes before all charge of the air in the laboratory was neutralized. The loop form of receiver was not sensitive to such a disturbance and it is curious to note that it is becoming popular at this late date. In reality it collects much less energy than the aerials or a long grounded wire, but it so happens that it does away with a number of defects inherent to the present wireless devices. In demonstrating my invention before audiences, the visitors were requested to ask any questions, however involved, and the automaton

www.americanradiohistory.com

NEWS-WRITING PAYS

The WHITNEY COURSE IN JOURNALISM quickly and thoroughly develops your latent ability and prepares you for this fascinating work. Highly recommended by authorities. Cost moderate; terms easy.

Send for Prospectus giving full particulars and outlining every subject taught.

American Institute of Journalism
"A Newspaper School Run by Newspaper Men"
Dept. E, 22 Hawley St., Boston, Mass.

Become a
MOTION PICTURE OPERATOR
Prepare yourself for an all-year-round, steady, well-paying position; salary $30 weekly and upward; cost of instruction, $15; $5.00 will start you. Day and Evening Classes. No charge for positions secured.
Moving Picture Operators School
644 8th Ave., Near 42d St., New York

AVIATION Information FREE
Send us your name and address for full information regarding the Aviation and Airplane business. Find out about the many great opportunities now open and how we prepare you at home, during spare time, to qualify. Our new book "Opportunities in the Airplane Industry" also sent free if you answer at once.
AMERICAN SCHOOL OF AVIATION
Dept. 8037 431 S. Dearborn St. CHICAGO


Bewitching Pictures!
Exact reproductions from original Photographs, already for mounting and framing. If you are a lover of the beautiful in art, here is just what you have long wanted. For a short time we make a special introductory offer, as follows: Send 25c and we will send you eight selected beauties and our beautifully illustrated catalog. After seeing the samples you will want more.
PARIS NOVELTY COMPANY
Dept. P. 1, 26 E. Adams St. Chicago

How to Get Rid of Moles


A simple, safe home treatment—15 years' success in my practice. Moles (also BIG growths) Dry Up.
Ask for Free Booklet of Full Particulars
WM. DAVIS, M. D.
4140 State Street Perth Amboy, N.J.

BE HAPPY ! !
YOU NEED NOT
STAMMER
Many have been cured by my system. Complete cure in from four to five weeks' treatment. Terms according to arrangements.
Write or call for details and references.
CHARLES PFERDMENGES,
25 E. Washington St. Chicago
Tel. Rand. 3431


If you are earning less than **$50.00 PER WEEK** and like to draw—you should study
COMMERCIAL ART
Leading Art Managers—the men who know—recommend us and employ our students. We will guarantee to make you successful—Learn at home in your spare time—or in our resident school—Day or evening.
Write for FREE illustrated catalogue.
COMMERCIAL ART SCHOOL
703, 116 So. Michigan Ave., Chicago, Ill.

"Hang Your Own Lighting Fixtures"
One Light Bracket $1.05—4 Light Shower $6.15
Semi-Bowls $5.85—Plate & Ball 85c, complete with glassware, Wired, Fine finishes. Send for Photos complete line.
ERIE FIXTURE SUPPLY CO.
Sta. C., Erie, Pa.



LUMINOUS WATCH, tells time in dark, guaranteed 2 years, also other valuable presents, cameras, air rifles, talking machines, typewriters, telescopes, given absolutely free for selling our art and religious pictures at 10c. Send for 25, when sold, send money and receive premium.
SPENCER PUB. CO.
Dept. 303 Chicago

Be FREE From STAMMERING
Home Exercise Course. Results GUARANTEED or NO PAY. Write for full particulars.
Sutherland Course, Educational Bldg., 70-5th Ave., N. Y.

would answer them by signs. This was considered magic at that time but was extremely simple, for it was myself who gave the replies by means of the device.

At the same period another larger tetautomatic boat was constructed, a photograph of which is shown in this number of the ELECTRICAL EXPERIMENTER. It was controlled by loops, having several turns placed in the hull, which was made entirely water-tight and capable of submergence. The apparatus was similar to that used in the first with the exception of certain special features I introduced as, for example, incandescent lamps which afforded a visible evidence of the proper functioning of the machine.

Telautomatics of the Future.

These automata, controlled within the range of vision of the operator, were, however, the first and rather crude steps in the evolution of the Art of Telautomatics as I had conceived it. The next logical improvement was its application to automatic mechanisms beyond the limits of vision and at great distance from the center of control, and I have ever since advocated their employment as instruments of warfare in preference to guns. The importance of this now seems to be recognized, if I am to judge from casual announcements thru the press of achievements which are said to be extraordinary but contain no merit of novelty, whatever. In an imperfect manner it is practicable, with the existing wireless plants, to launch an aeroplane, have it follow a certain approximate course, and perform some operation at a distance of many hundreds of miles. A machine of this kind can also be mechanically controlled in several ways and I have no doubt that it may prove of some usefulness in war. But there are, to my best knowledge, no instrumentalities in existence today with which such an object could be accomplished in a precise manner. I have devoted years of study to this matter and have evolved means, making such and greater wonders easily realizable. As stated on a previous occasion, when I was a student at college I conceived a flying machine quite unlike the present ones. The underlying principle was sound but could not be carried into practice for want of a prime-mover of sufficiently great activity. In recent years I have successfully solved this problem and am now planning aerial machines devoid of sustaining planes, ailerons, propellers and other external attachments, which will be capable of immense speeds and are very likely to furnish powerful arguments for peace in the near future. Such a machine, sustained and propelled entirely by reaction, is shown on one of the pages and is supposed to be controlled either mechanically or by wireless energy. By installing proper plants it will be practicable to project a missile of this kind into the air and drop it almost on the very spot designated, which may be thousands of miles away. But we are not going to stop at this. Telautomata will be ultimately produced, capable of acting as if possessed of their own intelligence, and their advent will create a revolution. As early as 1898 I proposed to representatives of a large manufacturing concern the construction and public exhibition of an automobile carriage which, left to itself, would perform a great variety of operations involving something akin to judgment. But my proposal was deemed chimerical at that time and nothing came from it.

At present many of the ablest minds are trying to devise expedients for preventing a repetition of the awful conflict which is only theoretically ended and the duration and main issues of which I have correctly predicted in an article printed in the *Sun* of December 20, 1914. The proposed League is not a remedy but, on the con-

(*Continued on page* 603)


BOYS
Learn Drafting

Employers everywhere are looking for skilled draftsmen. They are offering good salaries to start with splendid chances for advancement.

Drafting offers exceptional opportunities to a young man because drafting itself not only commands good pay, but it is the first step toward success in Mechanical or Structural Engineering or Architecture. And drafting is just the kind of work a boy likes to do. There is an easy delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving boys just the training they need for success in Drafting and more than 200 other subjects. Thousands of boys have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon, then mark and mail it. This doesn't obligate you in the least and will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

TEAR OUT HERE
INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6204, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

☐ MECHANICAL DRAFTING	☐ SALESMANSHIP
☐ STRUCTURAL DRAFTING	☐ ADVERTISING
☐ SHIP DRAFTING	☐ Show Card Writer
☐ ELECTRICAL DRAFTING	☐ Sign Painter
☐ ARCHITECTURAL DRAFTING	☐ ILLUSTRATING
☐ SHEET METAL DRAFTING	☐ Cartooning
☐ BOILER MAKER DRAFTING	☐ BOOKKEEPER
☐ BRIDGE DRAFTING	☐ Stenographer and Typist
☐ MACHINE DESIGN	☐ Cert. Public Accountant
☐ ELECTRICAL ENGINEER	☐ TRAFFIC MANAGER
☐ Electric Lighting and Railways	☐ Railway Accountant
☐ Electric Wiring	☐ GOOD ENGLISH
☐ Telegraph Engineer	☐ Teacher
☐ Telephone Work	☐ Common School Subjects
☐ MECHANICAL ENGINEER	☐ Mathematics
☐ Machine Shop Practice	☐ CIVIL SERVICE
☐ Gas Engine Operating	☐ Railway Mail Clerk
☐ CIVIL ENGINEER	☐ AUTOMOBILE OPERAT'G
☐ Surveying and Mapping	☐ Auto Repairing
☐ STATIONARY ENGINEER	☐ PLUMBING AND HEATING
☐ Marine Engineer	☐ Textile Overseer or Supt.
☐ ARCHITECT	☐ CHEMIST
☐ Contractor and Builder	☐ Navigation ☐ Spanish
☐ Concrete Builder	☐ AGRICULTURE ☐ French
☐ Structural Engineer	☐ Poultry Raising ☐ Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____



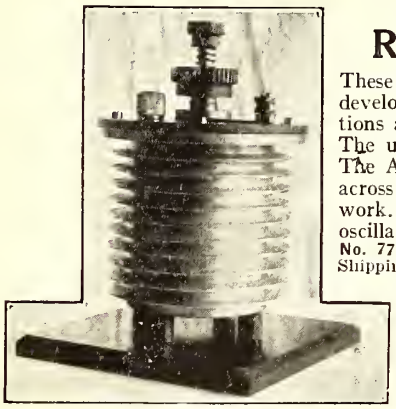
BUILD A $100 PHONOGRAPH
Assemble your own Phonograph
Do it yourself easily. Have the finest machine. Astounding saving. We give you the phonograph secrets. Complete instructions 10 cents.
ELECTRO MECHANICAL PARTS CO.
160 N. Wells St. CHICAGO

MATHEMATICS MADE EASY

The Arcascope—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 85 cents Postpaid. Order today before you forget.
Dept. J. L. J. LEISHMAN CO., Ogden, Utah

www.americanradiohistory.com

E. I. Co.'s High Grade Radio-Instruments
FOR SCHOOLS AND LABORATORIES AT REASONABLE PRICES



No. 7710

Arc for Generating Undamped Waves for Radio Telephonic & Telegraphic Transmission

These instruments are the acme of perfection in Radio Transmission. The latest and best developments in Radio during the *Great War* are embodied in this apparatus. Educational Institutions and Laboratories can now procure the most modern Radio equipment at a reasonable cost. The undamped *Wave Generator* illustrated is exceptionally well constructed of heavy aluminum. The Arc chamber is flanged in order to offer the greatest cooling surface. The Arc takes place across two solid special Tungsten electrodes which have been found particularly efficient for this work. The electrodes are fully adjustable, permitting very precise adjustment of the emitted oscillatory currents.

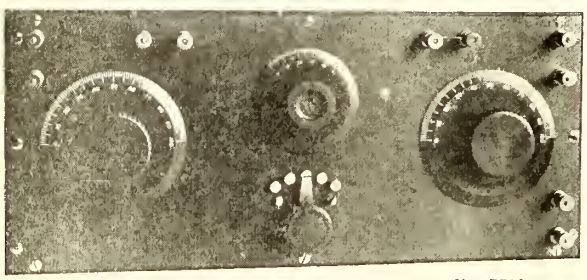
No. 7710—½ K.W. Sustained Wave Generator, as illustrated, operates on 110 V D.C. Size 6½ x 6½ x 8½. Shipping weight, 35 lbs.; price.....$50.00

This complete ***Radiophone Transmitter*** is unquestionably one of the finest pieces of Radio apparatus ever placed on the market. A Radiophone might have been sold heretofore; but it was felt that in justice to the purchaser, no instrument of this nature should be sold unless it were possible to obtain efficient results therefrom. This transmitter is the result of great effort expended in the design of a Radiophone set which should meet all requirements as to practicability and compactness combined with highest efficiency. It includes all apparatus necessary for transmission. The Arc is similar to the one illustrated elsewhere on this page.

No. 7711—Complete Sustained Wave Radiophone and Telegraph Transmitter, inclosed in a beautifully finished cabinet; size 14½ x 9 x 12½"; weight 50 pounds; as illustrated; price.....$150.00



No. 7711



No. 7712

The Short Wave Regenerative receiving cabinet shown is built in accordance with the most modern methods of reception. In work with oscillating audions it is necessary that all losses be diminuated as it was found that tuning should preferably be done with inductance alone, without using variable condensers.

This Receiving set will be found fully up to the mark in comparison with the highest priced set on the market to-day, yet its cost is well within the reach of all.

No. 7712—Regenerative Receiving Cabinet set, as illustrated; size 16¾ x 7⅝ x 8"; weight 25 pounds; price.....$50.00

The Vacuum Tube Socket illustrated was designed to be used by those who are desirous of assembling their own vacuum controls and who need a good socket to hold the bulbs. It is well designed, durable and reasonably priced.



No. 7715

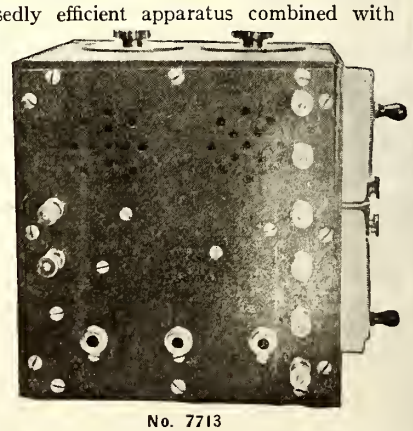
No. 7715—Vacuum Tube Socket; 2¼ x 2¼ x 1½"; weight 1 pound; price.....$1.50

This Tube socket is adaptable for both receiving and transmitting tubes.

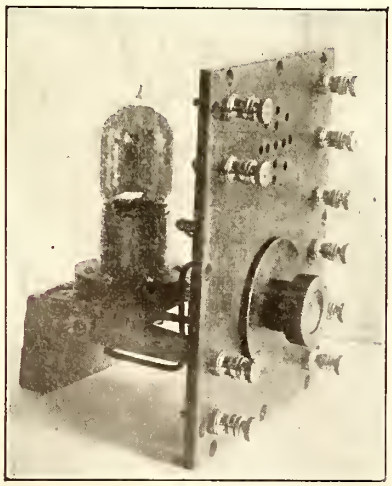
The Two Step Amplifier illustrated is undoubtedly one of the finest instruments offered to the experimenter. It is an example of unsurpassedly efficient apparatus combined with exceptional mechanical skill in its design and construction. Two Vacuum Tube sockets are mounted within the cabinet which also contains the two amplifying audio-frequency transformers which were especially designed for this instrument. It is of great consistance in amplifying live and radio telephone currents.

The telephones are plugged in any of three jacks mounted on the panel, permitting the use of either one or two steps of the amplifier or simply cutting the amplifier out entirely.

No. 7713—Two Step Amplifier, as illustrated; size 7⅝ x 7¼ x 8"; weight 7 pounds; price.....$55.00



No. 7713



No. 7714

The Vacuum Tube Control Cabinet is one of the essential instruments of the modern radio station. The Vacuum Tube holder, filament, rheostat, grid condenser and grid leak are mounted within the cabinet, the only part on the exterior being the rheostat control knob and dial. The construction throughout is on the same high level of excellence with the other instruments illustrated on this page.

No. 7714—Vacuum Tube Control Cabinet, as illustrated; size 6 x 7⅝ x 6¾; weight 5 pounds; price.....$25.00

P. S. No Tubes furnished by us with these instruments.

THE ELECTRO IMPORTING CO.

MANUFACTURERS

231 FULTON STREET, N. Y.

ALSO SEE OUR FULL PAGE "AD" ON PAGE 576

www.americanradiohistory.com



SAVE 25% to 60%
on slightly used
GRAFLEX-KODAKS
Cameras and Lenses of every description. Equal to new. Save money. Write now for **Free Bargain Book and Catalog** listing hundreds of money-saving bargains in slightly used and new cameras and supplies. **All goods sold on 10 days' Free Trial.** Money back if not satisfied. You take no chances dealing with us. We have been in the photographic business over 16 years. Write now.
CENTRAL CAMERA CO., Dept. 17 A 124 S. Wabash Ave., Chicago



GO INTO **MOVING PICTURE BUSINESS**
Small Capital Starts You
Our Catalog FREE. Show you how to earn $25.00 to $50.00 per day
on our easy payment plan. Begin now and get your share. We sell everything. Write today.
Atlas Moving Picture Co.
Dept. 50 538 S. Dearborn St., Chicago

Learn the Sign-Show Card Business

Big field—unlimited possibilities—increasing demand for men with creative ideas. Our course develops ability and originality. Work intensely interesting.
EARN $25 TO $75 WEEKLY
You can do it if ambitious. Successful graduates everywhere. Our course covers every phase of work completely and thoroughly. Our graduates command big salaries. Write for catalog, samples, guarantee and Free Outfit Offer.
DETROIT SCHOOL OF LETTERING, 490 D. S. L. Bldg. Detroit, Mich.

Fun, Magic and Mystery!
56 Feats in Magic, 250 New Jokes, 21 Puzzles, 1 Fortune Telling Tablet, 52 Money-Making Secrets, 15 Card Tricks, 71 Toasts, 58 Verses in Comic Poetry, 10 Funny Readings, 41 Epitaphs, and 11 Parlor Pastimes. You get all the above-mentioned and our big illustrated Catalog of 125 Magic Tricks for only 10 cents. Write today.
MYSTIC MFG. CO.,
909 Springwells Ave., Detroit, Mich.

SECURE A MOTOR-CYCLE AT LOW COST

by putting a RELIABLE STEFFEY MOTOR on your wheel. Easy to attach. Costs less to run than an expensive motorcycle. Write at once and secure low factory prices.
STEFFEY MFG. CO.
Dept. E, 5025 Brown St., Philadelphia, Pa

Learn Autos and Tractors

Wonderful opportunities constantly offered trained men; we train you thoroughly to start your own business or make good money as motor expert, driver, shop foreman, etc.
5000 Graduates making good. Catalog Free.
Cleveland Automobile School, 1807 E. 24th St., Cleveland, O.



$3 AND A MONTH **$4 WILL BUY**
A Beautifully Reconstructed
TYPEWRITER
With Every Modern Writing Convenience
WRITE TODAY FOR ILLUSTRATED CIRCULAR Explaining Try-Before-You-Buy Plan
HARRY A. SMITH, 738-218 North Wells St., Chicago, Ill.

WOULD YOU KNOW WHAT TO DO?
TO HAVE YOUR WISHES COME TRUE?
TO BE HAPPY AND SUCCESSFUL?
TO FEEL THE THRILL OF NEW POWERS?
TO HAVE A WINNING PERSONALITY?
Our system of Personal Development has shown thousands. It can show YOU. First lesson in SUCCESS, and your Personality Sketch for 10c and birthdate.
THOMSON-HEYWOOD CO.
Dept. 350, Chronicle Bldg., San Francisco, Cal.

You can be quickly cured, if you
STAMMER
Send 10 cents coin or stamps for 70-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering for 20 years.
Benjamin N. Bogue, 759 Bogue Building, Indianapolis

Dollars in Hares
We pay $7.00 to $9.50 a pair and express charges. **Big Profits.** We furnish guaranteed high grade stock and buy all you raise. Use back yard, barn, cellar, attic. Contract and Illustrated Catalog Free.
STANDARD FOOD & FUR ASS'N
303Z Broadway New York





GENUINE MOVING PICTURE MACHINE and film, also other valuable presents, watches, air rifles, cameras, talking machines, telescopes, typewriters, given absolutely free for selling our art and religious pictures at 10c. Send for 25, when sold send money and receive premium.
Spencer Pub. Co., Dept. 302, Chicago

My Inventions

By Nikola Tesla

(*Continued from page* 601)

trary, in the opinion of a number of competent men, may bring about results just the opposite. It is particularly regrettable that a punitive policy was adopted in framing the terms of peace, because a few years hence it will be possible for nations to fight without armies, ships or guns, by weapons far more terrible, to the destructive action and range of which there is virtually no limit. Any city, at a distance, whatsoever, from the enemy, can be destroyed by him and no power on earth can stop him from doing so. If we want to avert an impending calamity and a state of things which may transform this globe into an inferno, we should push the development of flying machines and wireless transmission of energy without an instant's delay and with all the power and resources of the nation.

What the X-Rays Show

(*Continued from page* 510)

hardly ever be suspected as being caused by the small and apparently infinitesimal "toothache." The modern dentist not only needs an X-ray, but he practically *must* have one of these scientific apparatus in order to be sure that every tooth is sound.

In figure 10 is shown one of the latest advances in X-rays—the "Movie X-ray." This branch of X-ray science has only been developed to a very slight extent, and gives promise of really wonderful possibilities in the near future. A year or so ago there was exhibited before a body of surgeons and physicians in New York City an *X-ray motion picture* in which the action of various organs, functioning in a live person, were shown, a bismuth meal having first been ingested; the intestines were shown functioning as well as the heart. It is not commonly known that with the modern X-ray, provided with an up-to-date tube of the Coolidge tube, and excited by a 5 to 10 kilowatt, 100,000-volt transformer, and the other necessary appurtenances, practically every part of the body and its organs may be seen on the fluoroscope, or otherwise on the photographic negative or skiagraph. This includes the heart, lungs, stomach, ulcers of the stomach, the intestines, the appendix, gall stones, the gall bladder, and many other ailments and organs within the body which sometimes have to be diagnosed and operated on in a very short length of time, or otherwise the death of the person would often result. *X-ray-therapy* is a new field being investigated today, and gives much promise in the treatment of cancer and various skin diseases.

X-raying tobacco in order to kill organisms, especially the *tobacco weevil,* has been carried on for several years in a number of large tobacco establishments. In this case, the tobacco in large bales is wheeled into an X-ray examination chamber on small trucks, see figure 12. In this manner the tobacco can be very rapidly X-rayed. The powerful rays from the bulb have the effect of killing the weevil even in its primary germinating state.

There are many other industrial uses of the X-ray which space does not allow us to mention here, but among which we may mention the X-raying of steel and copper ingots to analyze the structure and to detect flaws, such as cracks and air-pockets, and of coal for the purpose of extending our knowledge of geology.

Go to School at Home!


HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY HANDICAPPED if you lack High School training. You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE This Course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and *meets all requirements* of a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY
Most people *idle* away *fifty* hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within *two years*. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

TAKE 10 LESSONS FREE So that you may see for yourself how thorough and complete our training is. We invite you to take *ten lessons* in the High School Course—or any Course of specialized training in the Coupon below—before deciding whether you wish to continue. If you are not then satisfied you are not out one cent. *We absolutely guarantee satisfaction.* On that basis you owe it to yourself to make this test.
Check and mail the coupon NOW for full particulars and Free Bulletin.

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. H-267 Chicago, Illinois

TRAINING—THE KEY TO SUCCESS

Please explain how I can qualify for the position marked X

.....High School Graduate	.....Lawyer
.....Electrical Engineer	.....Business Manager
.....Elec. Light & Power Supt.	.....Certified Pub. Accountant
.....Hydroelectric Engineer	.....Accountant and Auditor
.....Telephone Engineer	.....Bookkeeper
.....Telegraph Engineer	.....Stenographer
.....Wireless Operator	.....Fire Insurance Expert
.....Architect	.....Sanitary Engineer
.....Building Contractor	.....Master Plumber
.....Civil Engineer	.....Heating and Vent. Engineer
.....Structural Engineer	.....Automobile Engineer
.....Mechanical Engineer	.....Automobile Repairman
.....Shop Superintendent	.....Airplane Mechanic
.....Steam Engineer	.....General Education Course
.....Draftsman and Designer	.....Common School Branches

Name.....
Address.....

www.americanradiohistory.com

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section seven cents a word for each insertion. No advertisement for less than 50c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency.

Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the November issue must reach us not later than September 22.

The Circulation of the Experimenter is over 115,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Automobile Accessories.

Tires—Direct to you prices. Exclusive representatives wanted each locality to use and sell Mellinger Extra Ply Tires. Guarantee Bond 8,000 Miles. Sample sections furnished. Mellinger Tire Company, 980 Oak, Kansas City, Mo.

Double Mileage Assured. Use self-cured blowout patches. They weld permanently to shoe, are extra strong, easily applied. The outcome of years' practice. Ben's Big Tire Shop, Dept. C, 378-382 Queen's Boulevard, Winfield, L. I.

Lock Your Car Against Theft. Price 25c. R. Wallner, Frontenac, Kan.

Equip Your Car with Air Brakes. Upon receipt of $2.00 I will send you blueprints and full description of my Patented Air Brake. R. E. Welch, 247 Auzerais Ave., San Jose, Calif.

Power Increased, Carbon Eliminated. Results guaranteed; write for booklet. No-Leak-O Piston Ring Co., Baltimore, Md.

Battery Charging Pays Big Profits. City current or gas engine operates. Easy terms. Hobart Brothers, Troy, Ohio.

Fords run 34 miles per gallon with our 1919 carburetors. Use cheapest gasoline or half kerosene. Start easy any weather. Increased power. Styles for all motors. Runs slow high gear. Attach yourself. Big profits for agents. Money back guarantee, 30 days' trial. Air-Friction Carburetor Co., 270 Madison St., Dayton, O.

Auto Motors and Supplies. Buick, Hupp, Franklin, Michigan, Everett, Hudson, Chalmers. Both water and air cooled motors, $40 each and up. Bosch Magnetos, $15 each and up. Presto Tanks, $5. Coils, Carburetors, Head Lamps, Horns, Air Compressors, Generators, Starters. Write for bargain bulletin second-hand auto accessories. Johnston, West End, Pittsburgh, Pa.

Agents Wanted.

Agents. Big returns, fast office sellers; particulars and samples free. One Dip Pen Co., 12 Daily Record Bldg., Baltimore, Md.

Wonderful Chance. Men's Shirts and Furnishings at wholesale rates or make $10 daily as agent starting real business. Goodell Co., 101 Duratex Bldg., New York.

$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Ave. D, Decatur, Ill.

Agents Wanted—To sell Tubes, Tires and other automobile accessories. DePalma & Main Co., 1105 Fourth St., Braddock, Pa.

Walk Agents—Men with spare time and specialty venders make $5 per day upward canvassing office buildings, banks and business offices selling the famous Calumet Piecepipe (three pieces), genuine French Briar. Put up in attractive individual package. Its sensible construction makes cleaning easy and appeals to everybody. Send for proposition. 10,000 Bankers Have Bought and Recommended It. The Calumet Co., Dept. Q, Mail Sales Division, Cincinnati, Ohio.

Agents—Here's the best line of food flavors, perfumes, soaps, toilet preparations, etc., ever offered. No capital needed. Complete outfits furnished free to workers. Write today for full particulars. American Products Co., 1499 American Bldg., Cincinnati, Ohio.

Insyde Tyres, inner armor for automobile tires, double mileage and prevent punctures and blowout. Quickly applied. Costs little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, O.

$100 Reward if you pick our Keyless Door Lock. New invention. Put on in ten seconds without nails or screws. A handsome brass lock guaranteed at low price of 15c each, coin. Agents wanted. Lock Company, 1551 West Washington, Springfield, Ohio.

Agents, Free Sample Outfit, Greatest Washing Tablet Proposition. Enormous profits, as much as 18c on 25c sale. B. Thayer, 2140 T Claybourn Ave., Chicago, Ill.

Agents Wanted.

Every Woman Wants Silvoplate—Magic Cleaner that never fails. Sure, easy sales plan; main or sideline; quick profits; prepaid deliveries. Sample 10c; dozen $1.60. L. B. Sutton, Manufacturer, D-5, New Canaan, Conn.

Make $30 Next Saturday. Agents, Salesmen, District Managers, brand new invention selling like wildfire. Sell Speederator for Fords. So good it's used by 17 officials of Ford Motor Co. Makes any Ford run like a Packard. Stops stalling and bucking. Put on quick—no special tools or holes to bore. Instant satisfaction. Listen, make money quick—sell ten to twelve a day easy. McAllister, Ill., sold four first afternoon; profit $12. Helton, Utah, makes over $300 every week. Dane, W. Va., $55 a week spare time only. Hurry, write quick for details and exclusive territory. Address Perrin Company, 1017 Hayward Bldg., Detroit, Mich.

Powerene is Equal to Gasoline at 5c a Gallon. Salesmen and agents wanted. Exclusive territory granted. Powerene is guaranteed to be harmless, to remove and prevent carbon, doubling life of all gasoline motors, saving repairs, adding snap, speed, power. An amount equal to 20 gallons of gasoline sent to any address in the United States, charges prepaid, for $1. W. Porter Barnes, Santa Rosa, Calif. Dept. B-18.

Beginners. Complete "Mail Order System." C, Box 1005, Atlantic City.

Agents—New Invention; wonderful chemical cloth; works like magic; one rub over rain or snow blurred windsbield, street car or locomotive window, presto! glass stays clear 24 hours; can't blur; world's fastest seller; 30,000 first month; exclusive territory free—worth fortune. Security Mfg. Co., Dept. 156, Toledo, Ohio.

Signs for Store and Office Windows. $50 week easily made. Chicago Sign System, G 326, River St., Chicago, Ill.

500 Agents Wanted at Once to take orders and sell Mitchell's Magic Marvel Washing Compound; 300% profit; enormous repeater. Own your own business. Astounds and delights every woman who uses it. Nothing like it on the market. Splendid proposition for general agents. We grant exclusive territory and absolutely protect our agents. No license required. Free samples furnished to boost sales. We positively guarantee the sale of every package. Our compound is nature's mightiest cleanser. Contains no lye, lime, acid or wax. Wonderful sales plan furnished free. You cannot fail to make big money. Hurry, hustle, grab this chance. Send for free sample and proof. Better still, send $1 for 10 full sized packages and samples sent by prepaid parcel post. You will make 100% profit on this small order. Territory going fast. Get busy at once. L. Mitchell & Co., Desk 318, 1312-1314 E. 61st, Chicago.

Motors, Engines and Dynamos.

Small Motors and Generators from bankruptcy and receivers' sales. Motors for all phases of current. Immediate delivery. Less than one-half regular prices. See display ad on page 594. Johnston, West End, Pittsburgh, Pa.

For Advertisers.

"Quick-Action Advertising—How it is Building Business for the Progressive Advertisers of America"; A little story of results told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 West 39th St., New York.

Money Makes Money. So does Good Advertising. Get wise. Jacobus Ads. Pull. Write Jacobus Advertising Service, Irvington, N. J.

Help Wanted.

Are You Satisfied with your position and prospects? If not, whatever your occupation, investigate your chance in Government Service. Just ask for Form RL 2081, free. Earl Hopkins, Washington, D. C.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 5665 St. Louis, Mo.

Wanted—Hundreds men—women—18 up. U. S. Government office and outside positions. $1,100 year. Write for list positions now open. Franklin Institute, Dept. K.26, Rochester, N. Y.

American Made Toys Wanted. An opportunity for homeworkers on small scale and manufacturers on large scale. Unlimited quantities needed of Toy Soldiers. Army, Navy, Marines, Cannons, Machine Guns, Warships and other Toys and Novelties. Greatest chance for industrious people for independent business. Enormous demand and future in American Made Toys, all over United States, Canada, Mexico and South America with over 50,000 10 cents stores and toy dealers. This new American industry stands out conspicuously. Factories are established, people trained, machineries made. Christmas Sets needed in millions this year. The great hit for 1919 without any competition. We are buyers of these goods all year, paying fixed prices. Attractive prices offered for painted goods. Experience or tools unnecessary. Hundred and more made complete per hour. Casting-form outfits from $3.00 up. If you mean business, send for booklet and information free. Toy Soldier Manufacturing Co., 32 Union Square, New York.

Government positions highly desirable; thousands appointed annually through frequent examinations everywhere; prepare immediately for Post Office Clerk, City or Rural Letter Carrier, Railway Mail Clerk, Washington Departmental Clerk, Stenographer-Typist; unexcelled correspondence instruction, $5. Request particulars concerning position desired. Federal Civil Service School, 602 Kellogg, Washington, D. C.

Artists in Great Demand. Big salaries paid for full or part time. Learn quickly at home in spare time. Commercial Art, Cartooning, Illustrating, Designing. Outfit free to new students. Send for handsome Free Book. Write Now. Washington School of Art., Inc., 1449 H St., N. W., Washington, D. C.

Learn Commercial Wireless by Mail in Ten Weeks. Thousands of positions now open for men and boys, ages 16 to 45, as Radio Operators, Electricians, Mechanics, Inspectors and Radio Draftsmen. Salaries for beginners now averaging $190 per month. Opportunity to travel and see the world or locate at one of many land radio offices. We train you by mail or at our local school to qualify for official license and help you secure position. No previous experience or wireless (radio) education necessary. Oldest and largest correspondence radio school in America. Established 1914. (Write for FREE Booklet.) Wireless outfit free to students for home practice. Write for Free Booklet. National Radio Institute, Dept. 137, 14th and U. T. St., Washington, D. C.

Become Auto experts. Hundreds needed. $35.00 week. Earn while learning. Franklin Institute, Dept. K 806, Rochester, N. Y.

Secret Service Operatives and Detectives are in demand. Earn Big money. Travel everywhere. Fascinating work. Learn this profession by home study. Particulars free. American School of Criminology, Dept. E., Detroit, Mich.

Salesmen Wanted.

Side-Line Salesmen—We have an attractive line of premium assortments for live salesmen. Commission from $5.00 to $20.00 per order. If you want an up-to-date line, write today. Canfield Mfg. Co., 4003 Broadway St., Chicago, Ill.

House-to-House Salesmen, why not the line that sells and repeats every 90 days? Our Sanitary brushes, mops and dusters pay big commissions, and we protect you in good territory. Only live ones wanted. Every promotion for producers. If you know and admit that you're good, write us. North Ridge Brush Co., 114 Clark Ave., Freeport, Ill.

www.americanradiohistory.com

Business Opportunities.

Detectives make big money. Travel, be your own boss. Either sex. We instruct; small cost. Write Johnson's Detective School, 232 Sheldon Ave., Grand Rapids, Mich., Dept. A.

Chiropractic—The New Profession. You can learn and earn your way. Practitioners earning $3,000 a year and upwards. Proficiency quickly acquired. Send card for information. Howard College, 515-25 S. Ashland Blvd., Chicago.

Breed Canaries. Profitable pastime. Particulars free. Bird Farm, Lynnhaven, Virginia.

Make Big Money Opening Safes and setting Combination. Wayne Strong, Box 1430, Los Angeles, Cal.

Money-Talks Magazine. Published for progressive men. Send for sample copy. 70-B Park Place, Newark, New Jersey.

$50 to $100 weekly writing moving picture plays in spare time. You can write them. We show you how. Experience unnecessary. Send for free book, valuable information and special prize offer. Photoplaywright College, Box 278, EE, Chicago.

Salesmen—New proposition that nets $100 to $200 weekly. Give moving picture shows at schools, colleges, universities, chuches, Y. M. C. A's, clubs, lodges, societies and homes. We furnish complete outfit. Write for particulars. W. H. Wade, Dept. 5, 14 N. Michigan Ave., Chicago.

Money-Making Farms. 19 States. $10 to $100 acre. Stock, tools, crops, often included to settle quickly. Write for big illustrated catalog. E. A. Strout Farm Agency, 150 E C Nassau St., New York.

Enter a New Business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks at small expense; no further capital required; no goods to buy; job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston, Mass.

$30 a Week. Evenings I made it with a small Mail Order Business; continued my regular job daytime. Free Booklet Tells How, 2c postage. Albert W. Scott, Cohocs, N. Y.

Substantial manufacturing corporation wants capable men to establish branch and manage salesmen; $300 to $1,500 necessary. You handle own money. Will allow expenses to Baltimore if you will qualify. For particulars address Secretary, 416 N. Howard St., Baltimore, Md.

Build Up an Income in Oil. Others are doing it—Why not you? Today is the opportunity. Join our easy monthly payment plan now—it may mean hundreds in profits. Write for information. National Oil Drilling Co., Dept. K, Houston, Texas.

Dollars Yearly in Your Back Yard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. Metz, 313 East 89, New York.

5 Big Money-making Schemes. $13.50 less than original price. Postpaid, 50c. Edgar James, 315 Douglass, Indianapolis, Ind.

Advertise. 24 words in 100 magazines, $1. Lists free. Stanford Company, Pittsburgh.

Just one Moment, please! Are you artistically inclined? Would you like to be one of the many well-paid Showcard Writers or Designers? Turn your idle moments into dollars. We will teach you THOROUGHLY, Showcard Writing, Lettering, and Designing by our special method of personal correspondence. Why not make $35 to $75 a week if you have talent? Write for FREE DETAILS NOW! Commercial School of Lettering, Wausau, Wisconsin.

Wanted—A man to organize branch office, engage salesmen, etc., for our indelible ink, which takes the place of check protector. This is a big money-making proposition to the right man. Must invest at least $100 for goods, etc. Attorney's Ink Co., 53 West 125th St., New York City.

Victory. Mechanical Toy Soldier window attraction. 30 inches high. Salutes, turns head, points with finger, etc., as set. Well made, nicely dressed officers, privates, Uncle Sam, etc. Electrically operated. Does some stunt every half minute or oftener as set and will salute soldier and pay no attention to other if desired. Representative wanted in each city and town. Write for prices. The John M. Biggs Co., Box 324, Chattanooga, Tenn.

"Quick-Action Advertising—How It Is Building Business for the Progressive Advertisers of America"; A little story of results told by the advertisers themselves—not the publishers. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates today. Douglas Wakefield Coutlee, 225 W. 39th St., New York.

Exchange Ads.

For Sale—$120.00 I. C. S. Electrical Engineering Course (Complete), $42.00. $60.00 I. C. S. Interior Wiring Course, $25.00. $120.00 I. C. S. Analytical Chemistry Course, $42.00. Many others. Send for list. Courses bought. W. J. Benson, 3722 "M" Str., Philadelphia, Pa.

For Sale cheap, anything electrical you want. Perry Leaphart, Jr., Pendleton St., Columbia, S. C.

For Sale—Three International Chicken Hovers. Used little. J. R. Simpson, Piermont, N. H.

For Sale—X-Ray tubes, high frequency and other apparatus. Write for list and description. Roy Black, Jefferson St., Madison, Ind.

For Sale—Camera and outfit, $15. Hawkins Guides (new), $7. Exide Battery, $10; Vesta Battery, $7. B Flat Cornet, $15. Weston Ammeter, $3. 250 W stepdown transformer, $10. C. W. 6V. 8A motor, $5. Write for description. Wm. Rudolphsen, 1807 S. Turner Ave., Chicago, Ill

Sell. 2½ Horse motor. Polished insulation marble, $.50 ft. Clarence Kositzky, 1602 Poplar, Lincoln, Nebraska.

For Sale—$25 Lionel Electric Train, $15; $3.00 steam engine, $1.50; New Murdock 43 plate variables, $4.00; Holtzer Cabot 3000 ohm lightweight receivers, while they last, $11.75. Big list free. King, Box 42, Mattoon, Ill.

1 Brand-new Lyon & Healy B flat, high pitch, Alto Saxophone, Silver plated sand blasted finish, gold plated bell, pearl buttons; beautifully engraved, leather carrying case with full outfit; cost $165.00; sells to first buyer for $120.00. 1 brand-new L. C. Smith visible typewriter, cost $115.00, sells $75.00. 1 set Eisner drafting and drawing instruments, 15 pieces with solid ivory handles, heavily nickel plated, in fine velvet case, never used; cost $34.00, sells for $15.00. Set new Ford coils, very good condition, $8.00. One Ford master vibrator, cost $12.00, sells $5.00. 1 U. S. Training Rifle, new, exact duplication of U. S. Army Springfield, $5.00. All these articles are wonderful bargains and will be shipped C. O. D. at price stated, with 20% down with order. H. O. Holm, Ryder, N. D.

For Sale—Mignon RW3, seal unbroken, $75. Mignon RJ1 Transmitting cabinet, new, $60. Electro Oscillation Transformer, $4. Duck Navy Type Receiving Transformer, $12.50. Burrows Rogers, Cainsville, Missouri.

For Sale—New Omnigraph and small Radio Receiving Outfit. Milton Jacobs, 428 Fourth Ave., City.

For Sale—Complete $150 ½ K.W. sending, 3,500 meter, bulb receiving set for $80. Write for separately listed prices. Stuart Nivling, 130 Aberdeen St., Rochester, N. Y.

For Sale—Set of Chemicals and Apparatus. Stamp brings particulars. Box 163, Beverly, N. J.

Bargain—Receiving set of phones, loose-coupler, detector, condenser, buzzer, $15. Set of Hawkins Electrical Guides, $7. Or will sell together for $20. M. W. Green, R No. 4 Dowagiac, Mich.

Sell—RLC5 Mignon Cabinet, $30. Audion, $10. Crystaloi Detector, $2.50. Brandes Superiors, new, $5.00. Audio Tron Bulb, $4.00. Money order acknowledged. E. Schuessler, 2209 Wheeler St., Cincinnati, O.

Sell—Large Supply electrical, wireless goods, cheap. Stamp for list. Walts, 2842 Market St., Louisville, Ky.

Swap! Buy! Sell! Free Advertising 3 months. Dime. Trade Topics, Detroit, Mich.

For Sale—Transmitting and receiving apparatus. Everything necessary to build a set. Includes brass, copper, fibre, screws, bolts, rods, binding posts, wire and complete apparatus. Very cheap. Write for list. Edw. C. Schureh, Deer Lodge, Mont.

For Sale—Wireless Mast—84 ft. sectional, built of northern fir, A-1 condition, with weather-proof guys, $30.00. F.O.B. Seneca Falls, N. Y., Loose Coupler, $8.00; New Audion Cabinet, Hard rubber front, New B bats less bulb, but including galena detector, $12.00. W. H. Stevens, The Edgeton, Philadelphia, Pa.

Sell—Cyclopedia Applied Electricity, $12.00; Steven's "Favorite" .22 rifle, $4.00 Electro Chemical Laboratory, $2.00. Schreyer, 72 Ridgewood Place, Staten Island.

Sell—Twin Motorcycle engine, $20; $65 aviation Course, $15. Wilson Ross, Laurelville, Ohio.

For Sale, less than half price, rebuilt chemical and electrical apparatus, also materials. Send 5 cents for list. A. L. Pouleur, Norton, Mass.

Gilbert Wireless. Skinderviken button. Bike-lamp. Telegraph. Printing press. Self-filler pen. Pool, Broadmoor, Colorado Springs.

Sale or Trade—Wireless outfit; Violin; Pyrometer; Foot Switch. Joe Richter, West Allis, Wisconsin.

For Sale. Blue prints for connecting A.C. motors. See ad under "Blueprints." Charles Chittenden.

Sell—Telescope. New. Cost $25. Highest offer takes. Huston Murdock, 734 Grant St., Johnstown, Pa.

Exchange Ads. (Cont'd.)

For Sale—Brand-new E. I. voltmeter, $2.00; jeweler's lathe, foot pedal wheel, $2.00. Geo. Koresh, 219 50th Ave., West Allis, Wisconsin.

Exchange, Buy, Sell. Wireless, electrical goods, etc. Large list 6c. State what you have and want. Zehrbach, Box 250, Hiram, O.

For Exchange—Want Smith motor wheel, good condition, for set of History of Civil War—beautiful books, splendid pictures, cost $30.00, or what have you—motors, etc. B. W. Earl, Edgewater Park, N. J.

For Sale—Complete set 160 ohm phones, $3.25. Shirley Hurlbut, Ilion, New York.

Exchange. Pair New telephones—cost $20.00. Want small gasoline motor. What have you? B. Earl, Edgewater Park, N. J.

For Sale or Exchange. Have fine little cycle car. Reversing gear and new body, 40 tread. Everything practically new. Am building larger car—want Smith motor wheels—Smith Flyer, or what have you? B. W. Earl, Edgewater Park, New Jersey, Burlington County.

Sell—Splendid Smith Premier typewriter, $25; Exchange—Good .22 Stevens rifle for 43 plate variable. Wilkes Dearing, Covington, Tenn, R. 2.

Must Sell. Send stamp for list of electrical goods. Earl Cook, Bernardston, Mass.

Exchange—3,000 meter wireless receiving outfit. Richard Christy, Ferris, Ill.

Aerial Wire—7 strands number 22, pure copper. Highest conductivity and strength. Supply limited at this price. 1c per foot—$0.00 per thousand. L. A. Bates, 8 Moen St., Worcester, Mass.

Exchange—Tesla Coil for Rotary Variable Condenser, or what have you, Wireless or Electrical? John Burke, Geldard St., Valley Falls, R. I.

Miscellaneous.

Wanted. Small gasoline and steam engines, small lathes, drill presses and other light machinery. Will pay high cash prices for good material. Johnston, West End, Pittsburgh, Pa.

Send Stamp for catalog. Chicago Aero Works, 328 River St.

Key Ring Tags, 20c; silver name plates for umbrellas, canes, etc., 20c; skeleton keys, 10c. Send coin. Albert Feth, Dayton, Ohio. (124 Lincoln St.)

"How to Read Thoughts"—Mind Reading at any distance, 20c; "How to Hypnotize"—Cure Diseases, Give Astounding Exhibitions, $1.00; "Silent Friend"—Key to Rapid and Honest Wealth, $1.00; "How to Win," 362 pages—success assured, $2.00; "Health Culture"—Insures Vital Strength, 25c; 5 dozen Money Makers, 30c. Catalogue gratis. Science Institute, E1336 Morse Ave., Chicago, Ill.

"Uncle Sam to the Front," brilliant March, Piano, 10c; "Town Talk," latest Rag Hit, Piano, 15c. Catalogue free. Quincke, Box 48, Station C, Los Angeles, Cal.

Shoes for All the Family, reasonable prices. Educational, business books, etc., Send for descriptive circulars. Retail only. Central Sales Co., 509 Ninth Ave., New York.

Song Poems.

Song-writers' Manual and Guide Sent Free! Contains valuable instructions and advice. Submit song-poems for examination. We will furnish music, copyright and facilitate publication or sale. Knickerbocker Studios, 319 Gaiety Bldg., New York.

Write the Words for a Song. We write music and guarantee publisher's acceptance. Submit poems on war, love or any subject. Chester Music Co., 920 So. Michigan Ave., Room 265, Chicago, Ill.

Write the Words for a Song. We revise poems, write music and guarantee to secure publication. Submit poems on any subject. Broadway Studios, 197C Fitzgerald Bldg., New York.

Song-writers. You can't afford to miss our proposition. Reference, any bank or first-class sheet music house. Warner C. Williams & Co., Dept. L, Indianapolis, Indiana.

Song-writers. Market your compositions. Our successful plan brings results. Work examined free and honest advice given. Morrison Music Shop, Dept. E, Indianapolis, Indiana.

Wanted to Buy.

Cash for Old False Teeth—We pay up to $35.00 per set (broken or not). Also buy discarded gold jewelry, gold crowns, bridges, platinum, diamonds, watches and silver. Send now. Cash by return mail. Package held 5 to 10 days for sender's approval of our offer. U. S. Smelting Works, Dept. 73, Chicago, Ill.

Continued on Page 606

www.americanradiohistory.com

Wireless.

Wireless Bargain Sale. Here is your opportunity to buy first-class Clapp-Eastham wireless apparatus at prices that you will never be able to buy again. These instruments were owned by a commercial company which is now out of business, after being in operation for only six months. Following articles are absolutely brand-new, never used: 3 K.W. Clapp-Eastham condenser in polished case, $40; cost $110. 2 K.W. Clapp-Eastham condenser in polished case, $25; cost $55. Two 3 K.W. Clapp-Eastham spark gaps in polished cases, $15 each; cost $60 each. 3 K.W. Clapp-Eastham "Boston" Key, $3.85; cost $9.00. Two hundred "Electrose" Ball insulators, 15c each; cost 30c each. One hundred "Electrose" ten-inch insulators, 30c each; cost 60c each. No order accepted for less than one dozen either size insulators. Six extra large "Electrose" ball insulators, 30c each. Clapp-Eastham glass plate condenser sections, each 85c; cost each, $3.50. No order accepted for less than three sections. Following articles slightly used, but are in just as good condition as the new instruments described above: 5 K.W. Clapp-Eastham oscillation transformer, edge-wise wound heavy copper strip on heavy rubber pillars, $10.00. 3 K.W. Clapp-Eastham oscillation transformer, wound with one inch wide copper ribbon, coils mounted on heavy rubber sheets, $4.00. 3 K.W. Clapp-Eastham Type "E" transformer in polished case with variation switch on end, $60.00; cost $150.00. 2 K.W. Clapp-Eastham condenser in polished case, $20.00; cost $55.00. Three early type Clapp-Eastham receiving sets in polished cabinets with loose coupler of variometer type; each set has two large variable condensers; set with genuine Periken detector, $20.00; set with Silicon detector, $15.00; set with part of mineral detector, $13.50. These sets cost more than $100.00 each when first placed on sale by Clapp-Eastham Co. 10 K.W. early type Clark wireless transformer sealed in oak case. Hardly used. A gigantic bargain at the very low price of $90.00. 30 ampere "Roller" hot wire meter, $6.00. 3 K.W. 1,800 RPM Eck Rotary Converter, 4-pole, takes 115 volts D C., gives 60 cycles, 75 volts, single phase, 40 amperes, A. C. Absolutely like new. With starting box, $75. Cost over $200. Brandes Navy Type 3,000 ohm receivers, $4.50. Brandes 2,800 ohm receivers, $3.50. Western Electric 2,000 ohm receivers, $2.75. All above F.O.B. San Antonio. No trades considered. Personal checks not accepted. Remit by money order. Considering the extraordinary cheap prices on this fine wireless apparatus, these great bargains will not last long, so send in your order today. Sydney Friedrich, 350 East Commerce Street, San Antonio, Texas.

Amateurs! Special seamless cardboard tubing 5" x 5¼" diameter, 25c per foot. One pound, postage extra. Send stamp for price list. Maier & Co., 335 East 93rd St., N. Y.

Panel Wireless Sets and Parts. Heavy rubber knobs 2¼", 26c; 1¼", 16c. Polished Formica Panels, ⅛ x 8 x 12", $1.10. Post extra. Klaus, Eureka, Ill.

Radio Apparatus of Quality manufactured to your own specifications. Radio Engineering Company, Baltimore, Md.

Transcontinental wireless receiving outfit, $20.00; 7x7x7 Wall Tent, $6.00, and No. 7 American Builder, $7.00. All three in excellent condition. Reason for selling is want of use. Adam S. Hahn, Jr., Hamburg, Pa.

Switch Points. Binding posts, switch levers, and small parts, send 2c. for catalogue describing these and other goods. A. W. Bowman & Co., 23 Church St. (Harvard Square), Cambridge, Mass.

Stamps & Coins.

California gold, quarter size, 27c. Half Dollar size, 53c. Columbian nickel and catalog, 10c. Norman Shültz, King City, Mo.

Free Set State Rev. Approvals, 50% discount. Browne, 111 Willow St., Wallaston, Mass.

Stamps—61 All Different Free. Postage, 3c. Mention paper. Quaker Stamp Co., Toledo, O.

61 different foreign stamps from Russia, Brazil, India, etc., free to applicants for our fine approvals. Send 2c postage. E. W. Spafford & Co., Martville, N. Y.

300 different stamps, 50c. Fred Onken, 630 79th St., Brooklyn, New York.

Free. 25 different stamps and lists, 2c postage. 100 different stamps, 10c. Nutley Stamp Ex., Nutley, N. J.

100 Different Stamps, 12c.; 200, 27c. Michaels, 5600 Prairie, Chicago.

South America. Buy direct. 1,000 fine assorted Paraguay, Uruguay, etc., for $2 bill. Exchange rare stamps with collectors and dealers. Lots or on sheets. C. P. Mego, Necochea 193, Lomas Dezamora, Argentine Republic.

Special Variety packets, 15c each; three for 40c. 50 Orientals, 40 Japanese, 30 South and Central American. Lionel Smith Stamp Co., Box 407 Hartford, Conn.

Best One Cent Approvals in America. F. P. Hand, 1117 So. 60th St., Philadelphia, Pa.

Stamps. Send 15c for 30 stamps, all different. Including war issues. W. Baumann, 1033 Levick St., Philadelphia, Pa.

Electrical Supplies & Appliances.

Boys—Here is the simplest and cheapest electric telegraph ever devised. With the "K" Applicator you need no batteries. Get electricity free, instantly, anywhere, at any time. Send 30c (postal money order) for full instructions how to make the "K" applicator and how to operate an electric telegraph without batteries. Is easier to make and requires less material than you would use in making a kite. Gives constant, smooth, even current day and night, never runs down, even upon closed circuit. Works on any metallic line, even barbed wire fence, as no insulators necessary. The "K" Applicator, Missouri Valley, Iowa.

Radio Paint Glows at night. Bottle, 20c. Box 3613 Kens. Station, Philadelphia.

Storage Batteries. Make the plates yourself, we will tell you how. Sample plate, 40c. Windsor Specialty Co. (not incorporated), 5419 Windsor Ave., Chicago, Ill.

Castings, Blueprints, Engines—Gas and Steam, ⅛ H.P. up. Gears, Pulleys, Pumps, Fittings, Small Boilers. Complete circulars for stamp. Latest models. Universal Gas Motor Co., 364 Monadnock Block, Chicago.

Magnets: Large Horseshoe Magnets. Will lift 12 lbs. Mail $1, stamps or Money Order. Parcel Post Prepaid to all parts of U. S. or Canada. West Side Novelty Co., Drawer No. 8 Wabash P. O., Pittsburgh, Pa.

Electrical Workers and all others who are interested in Electrical Work in the Reconstruction that is taking place. To send us their name and receive descriptive literature of our Modern Blue Print Chart Method of Electrical Wiring. Souvenir information card included. Electrical Wiring Diagram Co., Box C. 173, Altoona, Pa.

Lava Insulation is not molded but individually sawn, lathe turned, milled, drilled, threaded. No limitation on form, only on size. Kilned at two thousand degrees. Hard, strong, accurate, fire, acid proof. Ask for book. American Lava Insulator Company, Chattanooga, Tenn.

Battery Charging pays big profits with HB Equipment. Electric Light Generators and Motors can also be furnished on easy payments. Full information free. Hobart Brothers, Troy, Ohio.

Motor Winders. See ad under "Blueprints." Charles Chittenden.

Electric Lighting Outfit for Sale—35 H.P. two-cylinder Fairbanks heavy duty engine, direct connected to C. & C. 27 K.W. generator. Engine runs with either gasoline, artificial gas, or natural gas. Weight, complete, about 12,500 lbs. Run about six months. Like new. Has carried 3,200 ten-watt lamps. Price $2000.00. Maning Cleveland, Room 4 Cleveland Bldg., Academy St., Poughkeepsie, New York.

Blueprints

Blue Prints, 236 A.C. diagrams, contains 54 single phase, 42 two phase, 50 three phase Star, 40 Delta, 12 Star-Delta. Appendix 68 changes of voltage, phases, speed, cycles, etc. 10 samples 25c. Particulars free. Charles L. Chittenden, 811 West 18th Street, Kansas City, Missouri.

Printing.

1,000 Letterheads, Envelopes, Typewriter Letters, $2. Circulars, Labels, $1; samples. M. Lomond, 65 Broadway, Brooklyn, N. Y.

Printing? Good printing is the stepping stone to big business. We do it right. Send for quotations and samples. Parcel Post Printery, Dept. K, Kinmundy, Ill.

Your Stationery Printed. Good grade, $1.00. The Star Print Shop, Charlotte, Mich.

500 3x6 2-Color Circulars, neatly printed and sent prepaid for only $1.00. Robinson's Print Shop, Portland, Conn.

Personal.

Get Vital Strength. Retain youthful vigor. Wonderful results. Intensely interesting booklet free. Winslow H. Chase, Washington, D. C.

Get valuable interesting mail free. Cornish Co., Schenectady, N. Y.

The Salesman Win$. Thousands of positions open. We teach traveling salesmanship by mail and guarantee offer of position or refund tuition. For interesting particulars, address Kansas Vocational Bureau, Miltonvale, Kansas.

For Men.

Send us your dull razor blades. We re-edge them Good as New, any kind, 2½c each. Prompt service and satisfaction guaranteed. Dealers wanted. Keenedge Company, Inc., 184 Washington St., Chicago, Ill.

Dredge's Necktie Valet removes wrinkles (without ironing) from neckties. Sample 25c. Get one today, Dept. E, 190 Pilgrim, Highland Park, Mich.

Detectives Earn Big Money. Travel. Great demand. Experience unnecessary. We train you. Write for free particulars. American Detective System, 1968 Broadway, N. Y.

Books.

Dear Reader. If Occult, New-Thought and Scientific books appeal to you, send for my catalog, it's free. I have books on Personal Magnetism, Concentration, Spiritualism, Clairvoyance, Seership, Will, Mind, Hypnotism, Messmerism, Character Reading, Healing, Mysticism Success, Salesmanship, Mechanics, Entertainment, etc. A. W. Martens, J-49, Burlington, Iowa.

Books for Men—Also "classy" pictures. Catalog free. United Sales Co., Springfield, Ill.

Why "Flunk" in Latin, students? "Caesar"—First Eight Books—"Cicero," or "Virgil" and others translated, word for word, into English. Complete, clothbound $1.25 each, postpaid. Monongahela Novelty Co., Box 565, Monongahela, Pa.

World-Romic System. Masterkey to all languages. Six textbooks, $1.44; French chart, 37c.; Spanish, 37c.; aviation dictionary, $1.50; French-English aviation dictionary, 61c. Languages, 143 W. 47th St., New York.

20c Year "Popular Boy Magazine." 62 West First Ave., Columbus, Ohio. Display advertisements $1 per inch.

Books on Sex—For men and women. Catalog free. United Sales Co., Springfield, Ill.

Books. Practical Mechanical, Auto, Aviation, Home Study Books. Easy payments. Send dime "tonight" for catalogs. Amsco, Dept. EI, Aurora, Ill.

Laws of Nature every married and engaged person should know. 50c (no stamps). Central Co., 599 Ninth Ave., New York.

Concordia contains essays, formulas, plans. Year's subscription 50c., trial 20c. Concordia Magazine, 9 Water, York, Pa.

Will Pay 40c for a good copy November, 1918, Electrical Experimenter. Address Burnie Lazette, 49 Kentucky Ave., Monroe, Mich.

To Get Better Pictures. Read the amateur photographers' weekly; illustrated; weekly prize competitions; print criticisms; many unique features; $1.50 per year; three months' trial subscription 25c. Abel Publishing Company, 401 Caxton Bldg., Cleveland, O.

Telegraphy.

Telegraphy (both Morse and wireless) and Railway Accounting taught thoroughly and quickly. Big salaries now paid. Great opportunities. Oldest and Largest School—est. 45 years. Catalog free. Dodges Institute, 7th St., Valparaiso, Ind.

Sparking Metal.

Your Opportunity? Hundreds of unfound uses for Sparkmetal. Friction gives light. Smallest piece gives 2,000. Six pieces, dime. Colonial, Woodhaven, N. Y.

Formulas.

500 Formulas, including Resilvering Mirrors—Renewing Dry Batteries—Mechanics Soap—Luminous Paint, 25c. Ideal Book Shop, 5501-EE North Robey, Chicago.

1,000,000 Formulas, Processes, Trade Secrets, for every business; 1,016 pages, $2.00. Ideal Book Shop, 5501-EE North Robey, Chicago.

Send for free catalogue "Golden Opportunities," Typewritten tested Formulas, Chemical Analyses, Trade Secrets in every line. No printed trash. Satisfaction guaranteed; 23 years' manufacturing experience. Industrial Sales Service, 73 Washington, Memphis, Tenn.

500 Reliable Formulas, 20c. Egg Substitute, Orangeade Powder, Mechanics Soap, 10c. Norman Ovri, Dept. 3, Hemet, Calif.

500 Successful money-making formulas and trade secrets. Postpaid 25c. Charles Dynes, Winchester, Ind.

News Correspondents.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Tricks, Puzzles and Games.

Magic. Entertain at home. Tricks, puzzles, novelties. Big Catalogue A, 25c. Martinka & Co., Inc., Harry Houdini, President, 493 Sixth Avenue, New York City.

Black Art Hindoo experiments. 1919 edition, 25c. Invisible ink. Free trick. Catalogue each order. Lindhorst Magic X Shop, St. Louis.

Illusions—Stage Tricks with 500 Illustrations. Catalog 15c. Small catalog free. Hornmann Magic Company, 304 West 34th St., New York.

Magic—Card Tricks. Sensational escapes, jokes, novelties. Everything in the amusement line. Large illustrated catalogue of a thousand tricks free. Write today. Largest amusement goods manufacturers in the world. Heaney Magic Co., Desk 206, Berlin, Wis.

Scenery for Hire.

Collapsible Scenery for all plays. Decorations. Amelia Grain, Philadelphia.

www.americanradiohistory.com

Patent Attorneys.

M. H. Loughridge, Patent Attorney, Consulting Engineer. The high-class service of the large manufacturer at modest cost. Designs and manufacturing specifications prepared. Room 903, 1457 Broadway, New York.

Patents Procured—Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C., or 2278-T Woolworth Bldg., New York.

M. F. Miller, Ouray Building, Washington, D. C., Patent Attorney, Mechanical and Electrical Expert. Best quality of work and results. Moderate charges. Advice free.

Millions Spent Annually for Ideas! Hundreds now wanted! Patent yours and profit. Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. 212 Patent Dept., American Industries, Inc., Washington, D. C.

Patents. Prompt, personal, efficient service by an attorney-at-law, skilled in all branches of Patent practice. Over 12 years' actual experience. Full information upon request. B. P. Fishburne, 324 McGill Bldg., Washington, D. C.

Inventors—Send sketch of your invention for advice regarding patent protection. Twenty years' experience. Hand-book on Patents sent free. Talbert & Talbert, Patent Lawyers, 4822 Talbert Bldg., Washington, D. C.

John M. McLachlen, Atty.-at-Law. Patents, Trade Marks, Copyrights. 410 McLachlen Bldg., Washington, D. C.

"Investors' Adviser" sent free on request. William C. Linton, 918 F St., N. W., Washington, D. C., 363 University Street, Montreal, Canada.

Inventions Patented; Trade Marks Registered; Labels, Prints, Publications copyrighted; prompt service; reasonable fees; plain advice; request detailed information before placing your business. Jaynes & Jaynes, 802 Kellogg, Washington, D. C.

Patent Your Own Inventions. Save attorney's fees; we prepare applications; furnish full instructions and give satisfaction. Free information. Carl Larsen Co., Park Row Bldg., New York City.

Patents promptly procured by personal expert service. Information on request. James D. Lyles, Washington, D. C.

"How to Establish Your Rights" to patent protection is a bulletin every inventor should read before disclosing his idea to others. This bulletin form "Evidence of Conception" and other interesting and valuable patent information free. Lancaster & Allwine, 242 Ouray Bldg., Washington, D. C., originators of the form, "Evidence of Conception."

Patents—My fee payable in monthly installments. Send sketch for advice. Booklet free. Frank Fuller, Washington, D. C.

For Inventors.

Inventions Wanted. Cash or royalty for ideas. Adam Fisher Mfg. Co., 205 St. Louis, Mo.

Inventors, send sketch of model of your invention for opinion concerning patentable nature, and exact cost of applying for patent. Book, "How to Obtain a Patent," sent free. Gives information on patent procedure and tells what every inventor should know. Established twenty-five years. Chandlee & Chandlee, 408 Seventh St., N. W., Washington, D. C.

900 Mechanical Movements, also illustrations explaining 50 Perpetual Motions. My book, "Inventor's Universal Educator," Fifth Edition, tells how to procure and sell patents. Government and other costs. Covers the matter from A to Z. 160 pages, elegantly bound. Contains noted decisions of U. S. Supreme and State Courts on patent cases. Mechanical Movements greatly assist inventors—suggest new ideas that may prove of great aid in perfecting inventions. Tells how to select an attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers. Price, $2. Postage free everywhere. Fred G. Dietrich, 603 Ouray Bldg., Washington, D. C.

Inventors write me about patents. My fees payable monthly. Booklet free. Frank Fuller, Washington, D. C.

Inventors Protect yourselves. Record idea before exposing to anyone, including attorneys. Paul E. Klein, Cons. Eng., Reg. Pat. Att'y., 21 Park Row, New York.

"Inventor's Guide" Free on request; gives valuable advice and information for all inventors. Write. Frank Lederman, Registered Patent Attorney, 17 Park Row, New York.

Inventors join National Institute of Inventors, 118 Fulton St., New York City; membership society 1,900 strong; will help protect, develop, finance and market your invention. Absolutely no charge. Write for booklet.

"Sell or Finance Inventions." Read Money Talks Magazine. Send for free sample copy. 70-B Park Place, Newark, New Jersey.

Patents for Sale.

For Sale—Outright or Royalty, Patent No. 1,301,741 on Improved Automobile Signal. Send for particulars, enclosing 10c postage for Drawings and Specifications. A. Raul, 3534 N. Claremont Ave., Chicago.

Patent for sale covering simplified rotary spark gap machine. Extra high merit. Information, pictures. Address: Mr. Teele, 139 Genesee St., Buffalo, N. Y.

Chemicals.

Radium Radium! Advanced experimenters may at last obtain a variety of Rare and Radioactive metal salts at a reasonable cost. Order our Radium Rare Metal Collection immediately!! It contains over three grams each of Radium ore, Beryllium Nitrate, Zirconium Chloride, Thorium Nitrate, Selenium, Uranium Nitrate, Tungstic Acid, Titanium Oxalate, Lithium Chloride, and Cerium Nitrate. Can you beat this for only $1.75? One-half ounce each of above, $5.00. Radio Chemical Supply Co., 915 Westcott St., Syracuse, N. Y.

Two step! "Multi-Audi-Fone," $45. Chemicals, $20. Write! Sherman Whiting, 2010 Park Ave., Bridgeport, Conn.

Thousands pure Chemicals. Dime packages. Gleasman, Morris St., Utica, N. Y.

Amateurs and Experimenters—We can supply you with any chemicals and apparatus at the lowest prices. Write for our price list. Jos. Simpson, 3880 Windsor Pl., St. Louis, Mo.

One Hundred Chemical Experiments printed in book form, 25c. Oliver R. Stalter, Oshawa, Ontario, Canada.

Experimenters "Chemset" No. 2 Startling Chemical Outfit, containing Chemicals and direction booklet, 20c. No. 1 "Chemset," 15c. Both, 30c. Cactus plant 8c, X-ray Novelty 8c, Magic Trick 5c. All three, 15c. Mystic Shop, 714 Vinton, Waterloo, Iowa.

Cameras, Supplies—Photo Developing.

For 15c we will develop and furnish prints from one, six or eight exposure film or enlargement 8x10, your favorite negative, 20c to show quality and service. Associated Photo Company, Sta. A 12, Cincinnati, Ohio.

Clean, Neat, Perfect Kodak Finishing at the lowest prices. Work returned the same day received. Send film for sample print and copy of catalogue on developing, printing, enlarging and hand coloring, also copy of Photo Craft Magazine, which will help you make better pictures. Photo Craft Co., Box 69, Ann Arbor, Mich

Special Offer—Your next Kodak Film Developed, 10c, and prints 2c each. Best workmanship. Enlargements a specialty; 24 hours' service. Enclose money with order. Write for price list "6" and sample print. Johnston & Tunick, 53 Nassau St., New York.

Mail us 15c with any size film for development and six velvet prints. Or send six negatives any size and 15c for six prints. Or send 35c for one 8 x 10 mounted enlargement. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke, Va.

For the Photographer.

Do you take pictures? Write for free sample of our big magazine showing how to make better pictures and earn money. American Photography, 465 Pope Building, Boston, Mass.

Correct Distance at a glance. MacMillan's Distograph, when adjusted for user's height, will accurately measure the distance at a glance. Sharp picture assured. A war-time invention. Fits in vest pocket. Nickel silver with etched scales. At your dealer's or postpaid, $1.25. A. W. MacMillan, Ellis Ave. and 43rd St., Chicago, Ill.

Postcards.

Rare Real Photos: Bathing beauties, models, the kind you want. Sample, dime. Write. Artiste, Auburn, Ind.

Join a post card club! Have friends everywhere. Membership, 10c. John Miller, 1430 H Street, Sacramento, California.

Five Prettiest Women Cards, hand colored, 25c. Chas. Durso, Dept. 41, 25 Mulberry St., New York City.

Pictures.

French Art Models, Bathing girls. Real Photos. Generous samples and list for dime. E. Davis, Box 71, West Somerville, Mass.

Novelties.

Here, Boys Make a toy aeroplane; see our Nifty ad., page 600.

Stammering.

St-Stu-t-t-tering and Stammering cured at home. Instructive booklet free. Walter McDonnell, 105 Potomac Bank Bldg., Washington, D. C.

Health.

Tobacco or Snuff Habit Cured or no pay; $1 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

Cigarette, pipe or chewing habit conquered. Nature's method. Guaranteed. Write for free brochure. Edw. J. Woods, TA-300, Station F, New York.

Goiter. Rid yourself of this Terrible Disease at home. Cure Guaranteed or money refunded. Formula and full directions for using this wonderful New Discovery sent to all those afflicted. Price $2.00. P. O. or Ex. Money Order. Address: Wellington Laboratories, No. 40 15th Street, Detroit, Michigan.

Pyorrhea (Rigg's Disease—Bleeding or Swollen Gums). H. E. Kelty, D.D.S., M.D., pyorrhea specialist for 15 years, has developed a successful home treatment for pyorrhea Purifying, healing, preventative. Full month's treatment $1, postpaid. Or, write for free booklet. Pyorem Mfg. Co., 430 Seventh Street, Brooklyn, N. Y.

Instruction.

Stuck? What is it? A question, problem or experiment in physics, chemistry, biology, electricity, mathematics, radio, X-Ray, etc. Prompt and accurate information furnished by us. Enclose 25c to cover expenses. Address: Association Amateur Scientists, Bureau of Technical Information, 225 Lynch St., Brooklyn, N. Y.

Questions answered. All subjects. Answerall Information Bureau, 51 Cliff St., N. Y.

Cartooning Comics and Lettering in 14 easy lessons. Only $3, postpaid. Over 300 illustrations. Sample Lesson 25c. Ernie's School, Elyria, Ohio.

Play Piano in thirty minutes with this new vamping card. Placed behind keys. Colored chart, 20 cents, postpaid. C. Maxwell, Box 903, Portland, Maine.

Cornetists—Trombonists. Send for "Free Pointers" Weak Lips—High Tones. Virtuoso Cornet School. Buffalo, New York.

Progressive Shorthand—home study course complete in five lessons for $5. System based on longhand; easy to learn, easy to read—simple yet perfectly adapted to English or any Latin language. Progressive Shorthand School (E), 1010 East Fir, Seattle, Wash.

For the Hair.

I Was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have good hair-growing results. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E. 32nd St., BA-300, New York.

Portable Garages.

Portable Garages, wood or steel, reasonable prices. Write Bona Fide Building Mfrs., 24 Borden Ave., Long Island City.

Phonographs and Supplies.

Build Your Own Phonograph and manufacture them for profit. Drawing instructions, parts, price list, blueprints, etc., complete, sent free upon request. Write today. Associated Phonograph Co., Dept. E-1, Cincinnati, Ohio.

Make Your Own Phonograph. Particulars free. DeSelO-PhonE, P. O. Box 720, Attica, Indiana.

Build Your Phonograph. "Perfection" high-quality spring and electric motors, tone arms, reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Ind.

Old Money Wanted.

We Buy and Sell Old Coins. $2 to $500 each paid. Keep All Old Money; you may have valuable coins. Send 10c. for New Illustrated Coin Value Book, 4 x 6. Guaranteed prices. Get posted. Clarke Coin Co., Box 110, Le Roy, N. Y.

Never Sell Old Coins until you see our copyrighted 6 x 9 Illustrated Coin Value Book (New Edition)—showing high prices we pay. $100 paid for 1894 dime, S Mint. $5.00 for 1856 Eagle Cent. Send 10c for your copy today. Hundreds of old coins wanted. International Coin Co., Box 151-P, Philadelphia, Pa.

Motion Picture Plays.

Earn $1,200 a Year in Spare Time writing photoplays. Experience unnecessary. Send for free book valuable information, special prize offer. Photo Playwright College, Box 278 E-6, Chicago.

Photoplays Wanted. Big prices paid. You can write them. We show you how. Free particulars. Rex Publishers, Box 175, E.-6, Chicago.

Musical Instruments.

Violins. Deep, Mellow, Soulful—on credit. Easy terms for wonderful instrument. Get details today. Gustav Henning, 231 11th St., Miami, Florida.

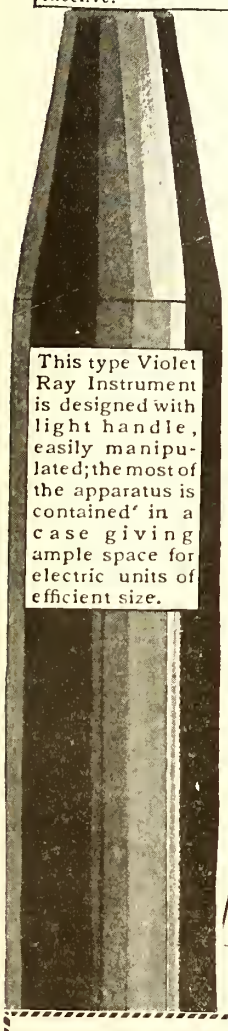
www.americanradiohistory.com

Regain Your Health Thru Renulife VIOLET RAY Treatments at Home



Unequaled for neuritis and rheumatism

More Than 25,000 Volts
No pain, shock or muscular contraction. Entirely harmless — powerfully effective.



This type Violet Ray Instrument is designed with light handle, easily manipulated; the most of the apparatus is contained in a case giving ample space for electric units of efficient size.

There is no "quackery" or uncertainty about *Renulife Violet Ray.* It is not claimed to be a "Cure All," but it has proved in thousands of cases a practical health-producing, revitalizing agent—powerful in restoring normal physical conditions—yet gentle, soothing and perfectly safe. *You* can treat yourself. Get full information regarding uses shown on coupon below.

Users Get Wonderful Results

(Voluntary Testimonials)

"The Renulife Violet Ray High Frequency Generator is superior in efficiency because of its perfect character and control of current, compactness and perfect insulation. The smallness and lightness of Electrode holder is also a great advantage." "The doctor told me that the trouble was hardening of the arteries. I wish I had got it a year ago. I would not be without it for all the money in the world." "I cannot recommend it too highly." "I have been using mine now for a week for Sciatica and I am highly pleased with results." "I think it is one of the best little machines that was ever invented." "I have used it with excellent results for the restoration of hair and stiff and sore rheumatic finger joints." "Am well pleased with the Generator, and the kind treatment received from your Company." "My Generator has stopped my neuritis." "Every house should have a Renulife Violet Ray High Frequency Generator, for the treatment of Neuralgia, Neuritis, Sore Throat, Kernels in Neck, Cramps, Headache, Stiff Neck, Muscular Soreness, Rheumatism, Paralysis—in short, pains of all kinds."—M. D. "I have been much relieved by the use of your Violet Ray Generator." "It is fine for Insomnia." "I find it such a help in nervousness." "I would not part with it for five times the price. It is sure a little wonder." "I am more than pleased with the Generator; the whole family are using it." "A neighbor lady was suffering from lumbago and could not move, and my wife brought over the Generator and in less than ten minutes the lady was greatly relieved." "Your Generator is just the thing for me. That tired feeling has left me, and I feel like myself again." "It has relieved me of the nervousness and also it has helped me a great deal in using it for the treatment of rheumatism."

How Renulife Benefits

Science has demonstrated a strange relation between electricity and life cells. This instrument harnesses a tremendous current of electricity and applies in the form of Violet Rays so that the body welcomes and responds to it in a marvelous manner—no pain—shock or the slightest harmful effects. A few seconds of Renulife Violet Ray gives more benefit than hours of the old time battery methods—because a thousand times as much voltage is made use of.

The irresistible, revitalizing powers of *Renulife Violet Ray* reach every nerve cell, fibre and part of body. Blood is enriched and purified by a flood of oxygen, giving added vitality and strength. Assimilation and digestion improved—functions retored to normal—extra supply of fresh blood quickly brought to area treated, removing congestion and supplying nourishment. While relieving pains and aches, the manifest results of disorders, it removes the deep seated cause, combines the benefits of electricity, vibration, exercise, stimulation and oxidation.

Get Book "Health via Violet Ray"

Learn the whole marvelous story of the Violet Ray—this method that works with nature to restore and build up. Learn how you, at home, can now use these great curative forces of Violet Ray—heretofore only available at big expense from physicians or beauty doctors. Send coupon or postal card now and receive free book describing uses, quoting low prices (within the reach of all) and explaining liberal *Trial Plan.*

Renulife Electric Co., Inc.
1210 Marquette Bldg., Detroit, Mich.
CANADIAN RENULIFE ELECTRIC CO., Ltd.,
1210 Netting Bldg., Windsor, Ont.
Toronto Office: 612 C. P. R. Building.

{Live Sales Representatives write for proposition



Increases energy and vitality



Treatment for nervousness and general debility



Ozone most beneficial for catarrh, throat and lungs. Also anemia



Stops falling hair — promotes hair growth. Wonderful beauty aid

Chicago Office
Room 410
123 West Madison

BOOK **FREE**



COUPON FOR BOOK and Special Information

RENULIFE ELECTRIC CO.,
1210 Marquette Bldg., Detroit, Mich.

Please send without obligation, your book "Health," explaining Violet Ray treatments with Renulife Generators; also give full particulars as to its application for ailments checked below.

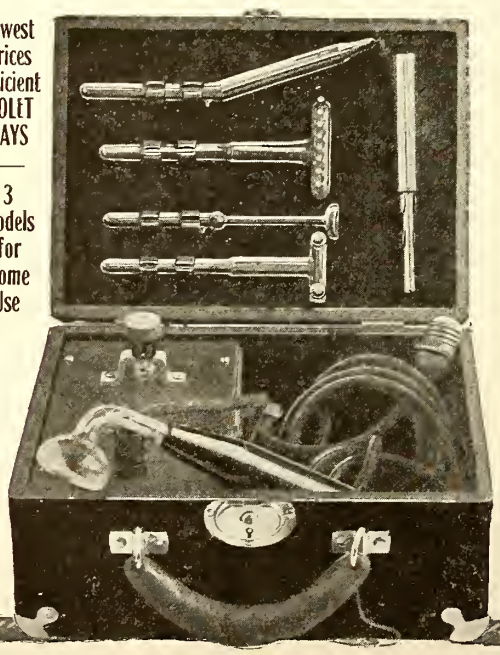
TREATS SUCCESSFULLY

..Abscesses	..Facial Neuralgia	..Piles
..Anemia	..Failing Hair	..Pimples
..Asthma	..Goitre	..Pyorrhea
..Arteriosclerosis	..Gout	..Rheumatism
..Baldness	..Hay Fever	..Scars
..Blackheads	..Infantile Paralysis	..Sciatica
..Brain Fag	..Insomnia	..Skin Diseases
..Catarrh	..Lameness	..Throat Diseases
..Colds	..Locomotor Ataxia	..Sprains
..Chilblains	..Lumbago	..Toothache
..Dandruff	..Nervous Affections	..Weak Eyes
..Deafness	..Neuralgia	..Wrinkles
..Eczema	..Neuritis	..Warts and Moles
..Enlarged Prostate	..Paralysis	

Write your name and address in margin below and cut cut with coupon

Lowest Prices Efficient VIOLET RAYS

3 Models for Home Use



Copyright, 1919, R. E. Co.

www.americanradiohistory.com

ELECTRICITY

AS EXPERTS KNOW IT

Learn electricity as you would in actual PRACTICE—in accordance with the methods employed by the highest paid electrical experts in America. The New McGraw-Hill Library of Practical Electricity contains the actual working facts which you need in order to succeed in the electrical field. Terrell Croft, formerly with the Westinghouse Company, makes the conquest easy for you.

A New Standard in Electrical Literature

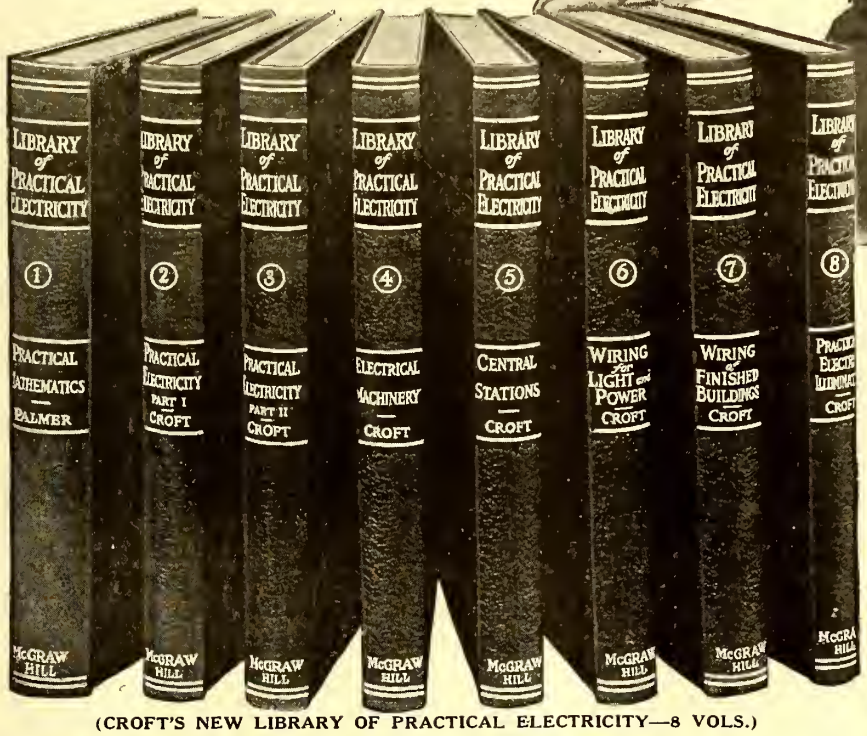
The New Library of Practical Electricity by Terrel Croft marks a new era in electrical literature.

The great field of electrical engineering, with its limitless possibilities of earning power, is brought to you in a form that makes success easy. The Library is a creation—an achievement that is without parallel in technical literature, because it sticks to actual practice throughout its 3000 pages.

"See them First—Pay afterwards"



$3 per month starts you to bigger pay



(CROFT'S NEW LIBRARY OF PRACTICAL ELECTRICITY—8 VOLS.)

A letter that means something to YOU—

McGraw-Hill Book Company, Inc.,
239 West 39th Street,
New York, N. Y.

Gentlemen: In an attempt to express myself about CROFT'S NEW LIBRARY OF PRACTICAL ELECTRICITY, I have never seen, and do not believe there was ever printed in the English language, a more comprehensive set of books. It is a library that is just as valuable to the novice as to the expert, because it is all practice.

Respectfully,

GUY H. PEIFER,
Chief, Doplan Silk Corporation,
Hazeltown, Pa.

NOW is the time to Master Electricity---NOW is the time to prepare for a High Salary---

Old books won't do. Amateurish books won't do. Books compiled by "desk authors" or men with no practical experience will not serve your purpose.

Practical books are easiest mastered. Practical books, written by practical men, teach you accurately and rapidly. There is nothing in the Croft Library which you can not understand. Terrell Croft tells you the secrets of success in electricity in plain words, figures and illustrations. Nothing is left to the imagination. There is no guesswork. There is no theory or higher mathematics.

Send now for these eight volumes. No matter how many books on electricity you possess, you are unfair to yourself unless you take advantage of this free examination privilege. No matter whether you are beginner or expert, these books will show you the clear road to success. Inspection will prove this.

Not one cent in advance—Just the coupon

Examine this new Library for ten full days without expense. Find out for yourself why it is now taking the lead in electrical book sales in America. Use the books as you see fit for ten days. Look at the hundreds of illustrations that clear up all the mysteries in electrical practice. Stick a couple of the volumes in your pockets, and refer to them during the day. Figure out in an instant the problems that have heretofore taken hours.

Then send us $2 in ten days and $3 per month for six months, or return the set entirely at our expense. You risk nothing by returning the attached coupon.

McGraw-Hill Book Company, Inc.
239 West 39th Street, New York, N. Y.

ACT NOW FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc.
239 W. 39th St.
NEW YORK

Gentlemen:
Please send me the Library of Practical Electricity (shipping charges prepaid) for 10 days' free examination. If satisfactory, I will send $2 in ten days and $3 per month until $20 has been paid. If not wanted, I will write you for return shipping instructions.

Name .....
Home Address .....
City and State .....
Name of Employer .....
His Address .....
Your Position ..... Ex. Nov. '19

www.americanradiohistory.com

TO OUR READERS: Due to the printers' strike in New York, which has paralyzed the entire printing trade with the exception of newspapers, no magazines have been issued from New York during the past eight weeks. Accordingly, this issue is printed out of town, 750 miles from New York. Subsequent issues may be delayed as well until we are caught up with our schedule again. We sincerely trust our readers will understand our difficulties and be patient until conditions become normal.

THE PUBLISHERS.

Electrical Experimenter

233 FULTON STREET, NEW YORK

Publisht by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer: R. W. DeMott, Sec'y:) 233 Fulton Street, New York.

Vol. VII. Whole No. 79. **Contents for NOVEMBER, 1919** **No. 7**

COLD "FIRE".....Front Cover
From a painting by Harold Brown
NEW ARC SUNLIGHT..... 627
SUN SIGNAL FOR FIGHTING FOREST FIRES..... 628
By Frank C. Perkins
MARRIED BY RADIOPHONE WHILE FLYING..... 629
ELECTRIC DRIVE ON U. S. S. NEW MEXICO..... 630
COLD "FIRE," By H. Gernsback..... 632
ODD PHOTO CONTEST..... 634
CHURCH SERMON HEARD FOR ONE-HALF MILE..... 636
LIGHT HOUSES—HOW THEY SIGNAL..... 637
By A. H. Whedon, Radio Electrician, U. S. Navy
MOUNT WILSON 100 FOOT TELESCOPE..... 638
By Isabel M. Lewis, U. S. Naval Observatory
NEW ELECTRIC GYRO COMPASS..... 639
SIR CHARLES PARSONS ON WAR INVENTIONS..... 640
INTERPLANETARY COMMUNICATION..... 641
By Dr. C. S. Brainin, Ph. D., Dept. of Astronomy, Columbia University
A COMBINED BLIMP AND AIRPLANE..... 642
SURFPLANING IN MID AIR..... 644
OLD "PHONOGRAPH RECORD" CONTEST..... 646
PLAN "T," A TWENTIETH CENTURY WIRELESS STORY..... 648
By John White
PERPETUAL MOTION CONTEST..... 649
POPULAR ASTRONOMY, THE EARTH'S ATMOSPHERE..... 650
By Isabel M. Lewis, U. S. Naval Observatory
AUTOMOBILE PAGE..... 652
EXPERIMENTS IN PHYSICS, WATER JETS AND AIR JETS.. 653
By John J. Furia, A. M.
A MODEL ELECTRIC THEATRE..... 654
THE ELECTRICAL MACHINIST..... 658
By H. Winfield Secor

EDITORIAL

Gravitation and Light

AT the joint meeting of the Royal Society and the Royal Astronomical Society of London, Sir Joseph Thomson recently announced the correctness of the famous Einstein theory. Photographic plates made by British astronomers in northern Brazil on May 29th of this year, at the occasion of the total solar eclipse, showed that the light of the stars passing close by the sun *had been deflected considerably*. In other words the photographs of the stars near the sun revealed the fact that they were not in their accustomed stations, but at a considerable distance away.

If Einstein's theory is correct, it will be seen at once that for one thing our astronomical atlases must be revised and corrected to a certain degree. Every star, as is well known is a huge sun. This means that stars closely together—or rather if they are in a line as viewed from earth—may not be where we think they are. They would be further apart in certain cases.

Many new puzzles will have to be worked out by astronomers. For instance our present figures as to the distance of stars are all wrong if Einstein's theory holds. All our former calculations are based upon the assumption that a ray of light is a mathematically straight line. If it is not, how are we now to determinate the parallax of a certain star? If gravitation affects light, the same as wind affects a long jet of water, how can we possibly know what we are doing? Suppose we wish to determine the distance of a star. That star is billions upon billions of miles distant, and if its light rays pass near one or more dead (dark) suns, *which consequently cannot be seen* by us, how then will we calculate our distance? For the dark stars will deflect the light rays several times *unbeknown to us!* The case thus seems hopeless.

While Einstein's theory is sound, real proofs are still wanting despite what the photographic plate shows. To elucidate: When a light ray passes from one medium to another, it is refracted or bent in its course. Thus, it is well known that due to the earth's atmosphere, we never *actually* see the sun either rise or set. Now the sun too has a gaseous envelope just like the earth, only much more so. In fact, it has several: the corona, the chromosphere and the photosphere. The corona reaches several million miles away from the sun's surface. Any light ray passing thru these intensely heated gases must be bent considerably. Hot gases refract light rays more than cold ones, as anyone knows who has looked over a hot stove plate or thru a bonfire. It is reasoned therefore that the photographic proof is really no proof at all, as the bending of the distant star's light might be caused by the sun's chromosphere.

This immediately brings many questions to mind. If Einstein's theory is correct, and if light rays are affected by gravitation, why then for instance could we not measure the deflection, of a light ray coming from one of Jupiter's moons as it shoots past the huge mother planet?

It should be—theoretically—far easier to prove Einstein's theory within the realms of our planetary system. Here we know the distances accurately because we know the exact orbital time periods down to the smallest fraction of a second, of all planets and their sattelites.

If the objection is made that the case of Jupiter cited above might prove fallacious due to the fact that this planet has a gaseous envelope, or an atmosphere, which would refract and bend the light rays, we still have the reverse case of a light ray coming from a planet as it passes one of its moons, which we know possesses no atmosphere. However, due to the small gravitational influence of such a moon, we would require very sensitive measuring instruments to detect the exceedingly small deflection of the light rays.

Another thought: Faraday over 100 years ago deflected a light ray by means of a small magnet. Gravitation—which has been proved to be of an electrical nature, should not act differently.

H. GERNSBACK.

The ELECTRICAL EXPERIMENTER is publisht on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions. Canada and foreign countries, $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 20 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. **A green wrapper indicates expiration. No copies sent after expiration.**

All communications and contributions to this journal should be address to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

ELECTRICAL EXPERIMENTER. Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered U. S. Patent Office.

Copyright, 1919, by E. P. Co., Inc., New York. **The Contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.**

ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and [illegible] Brentano's, 37 Avenue de l'Opera, Paris. Sole British agents—Geoffrey [illegible] 62 and 64 The Strd., Ealing, London.

[illegible] of the Audit Bureau of Circulations.

www.americanradiohistory.com



"The Master Key is too modest a title for such a stupendous revelation"

SOME men seem to attract success, power, wealth, health and attainment with very little conscious effort, others conquer with great difficulty, still others fail altogether to realize their ambitions, desires and ideals. Why is this so?

The Master Key will tell you why! It will tell you that these things are controlled by Natural Laws, precisely the same as the falling of an apple.

The Master Key is a key with which many are converting loss into gain, fear into courage, despair into joy, hope into fruition. No one will emerge from its magic pages but with a firmer grasp of the future, a surer understanding of what he can do.

This may seem to be too good to be true, but remember that within a few years, by the touch of a button or the turn of a lever, science has placed almost infinite resources at the disposal of man, is it not possible that there are other laws containing still greater possibilities.

An understanding of this law will enable you to control every other power which exists. It is without doubt the greatest discovery of the Twentieth Century. In it may be found the remedy for every ill, the solution to every difficulty, the gratification for every desire; in fact, it would appear to be the Creator's magnificent provision for human emancipation.

A copy of this magnificent, richly bound hundred-page book will be sent to any address, without cost or obligation of any kind.

Charles F. Haanel, 203 Howard Bldg., St. Louis, Mo.

You should send for a Master Key!

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com



Learn Wireless By Mail—In Ten Weeks

Calls Coming in Steadily, for National Radio Institute Graduates, from all Parts of the Country. Two Concerns Will Take All Operators We Can Furnish.

Commercial Radio has arrived and many attractive positions are now open in the Merchant Marine, Commercial Land Radio Service, Railroads, Radio Supply Factories, Lake and Ocean Steamship Lines, Telegraph Companies and Aerial Mail Service. We are now receiving requests for more National Radio Institute Graduates than we can furnish.

Salaries Up to $250 a Month

With exceptional opportunity for promotion to Radio Mechanic, Electrician, or Engineer. No previous experience or training is necessary. You can Learn Wireless the National Radio Institute way, in Ten Weeks, by mail, right in your own home. With our help you can quickly qualify for a good position at big pay. Many of our students secure positions before completing the course, because it is based on actual practice and teaches what is needed to make a big success of Wireless work.

Get Your Instructions from the Nation's Capital

(Our Course is Endorsed by the U. S. Government Officials)

The National Radio Institute, headed by authorities who have been closely allied with government training of students, was established in 1914 and is the first school in America to successfully teach Wireless by Mail. The work is under the direction of J. E. Smith, E.E., director of the Radio Department, Howard University, and E. R. Haas, formerly of the Radio Division of Yale University.

We now have students throughout the world. Our location in the Nation's Capital, together with the standing of our officers and their wide acquaintance among government officials connected with Wireless activities, places us in position to give our students the best instructions obtainable and to be of the utmost help in assisting them to secure good paying positions.

Travel If You Want To

If you want to travel and see the world, go to foreign countries and increase your knowledge of world affairs, Wireless offers you the chance of a lifetime. However, you are not obliged to travel, but may secure a permanent position at one of the big Land Stations, Railroad, Telegraph or Steamship Companies if preferred.

Pay as You Learn

Our plans of payment bring a wireless education within the reach of anyone who desires to learn. A small payment down on our convenient payment plan, and small following payments, enables you to earn the cost of your tuition while actually learning to be a wireless operator.

Free Instruments to Every Student

In addition to five text books—35 special Lessons and 18 Personal Examinations—we send you, while taking our course, a Standard Automatic Wireless Transmitting and Receiving Set for sending and receiving messages. These fine instruments are Free only to National Radio Institute Students.

Oldest Correspondence Wireless School in America

In addition to being the oldest and largest Wireless School in America, our location in the Nation's Capital enables our Students' Employment Department to keep in close touch with the best openings for our graduates. A Post Graduate Course is Given Free to every graduate.

FREE

Our booklet, "Wireless the Opportunity of Today," gives you complete information in regard to our course, the quick and easy methods by which you can master wireless, and other important facts you should know. It is free. Just mail the coupon. No obligation whatever on your part.

Mail This Coupon Today

National Radio Institute,
Dept. 140, 14th & U Sts., N. W.
Washington, D. C.

Send me, free of charge, your booklet "Wireless The Opportunity of Today", with full particulars regarding your famous 10 weeks' Home Study Course and your Special FREE INSTRUMENT OFFER.

Name .....

Address .....

City ..... State .....

www.americanradiohistory.com

FREE TRIAL
No Money Down

10c a day soon buys an Oliver Typewriter—latest model

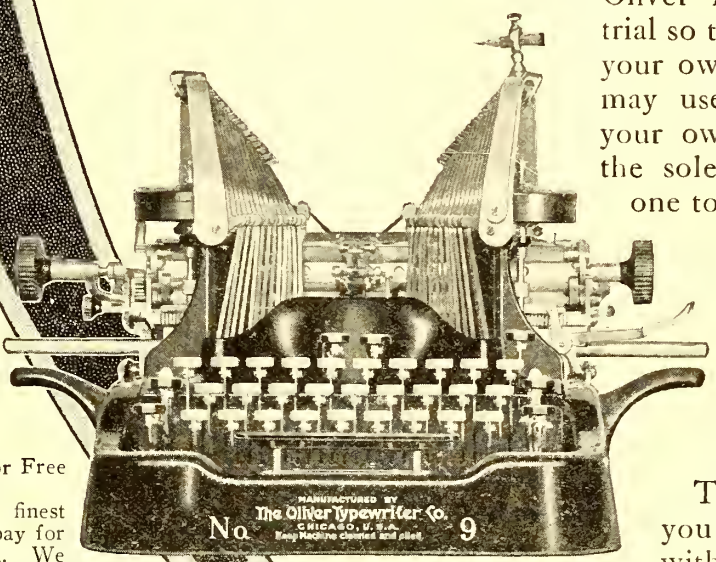
Before you realize it you have this splendid Oliver paid for. And you get to use it right away—while you pay.

To begin with, you save $43 on the price, for we now sell the $100 Oliver for $57. It is our latest and best model, the No. 9. The finest product of our factories.

We are able to make this great saving for you through the economies we learned during the war. We found that it was unnecessary to have great numbers of traveling salesmen and numerous expensive branch houses through the country. We were also able to discontinue many other superfluous sales methods

You may buy direct from us via coupon. We even send the Oliver for five days' free trial so that you may act as your own salesman. You may use it as if it were your own. You can be the sole judge, with no one to influence you.

Used by U. S. Steel Corporation, Pennsylvania R. R., National City Bank of New York, Encyclopedia Britannica, New York Edison Co., Otis Elevator Co., Boston Elevated Railways, and other big concerns.



Was $100

Now $57

Let us send you the Oliver for Free Trial. The coupon brings it.

If you agree that it is the finest typewriter, regardless of price, pay for it at the rate of $3 per month. We ask no partial payment in advance. You have over a year to pay. And you'll have the Oliver all that time. There is no need to wait until you have the full amount.

If, after trying it, you wish to return it, we even refund the outgoing transportation charges. So the trial does not cost you a cent. Nor does it place you under obligations to buy.

Our new plan has been a tremendous success. We are selling more Olivers this way that ever before. Over 700,000 Olivers have been sold! Oliver popularity is increasing daily.

This, the Oliver 9, has all the latest improvements. It is noted for its sturdiness, speed and fine workmanship. It is handsomely finished in olive enamel and polished nickel. If any typewriter is worth $100, it is this Oliver, for which we now ask only $57, after its being priced for years at $100.

Mail the coupon for EITHER a free trial Oliver or further information. Be your own salesman and save $43. This is your great opportunity.

Canadian Price $72

THE OLIVER TYPEWRITER COMPANY
678 Oliver Typewriter Building, Chicago, Ill. (29.02)

This coupon brings you a Free Trial Oliver without your paying in advance. Decide yourself. Save $43.

Or this coupon brings further information. Check which you wish.

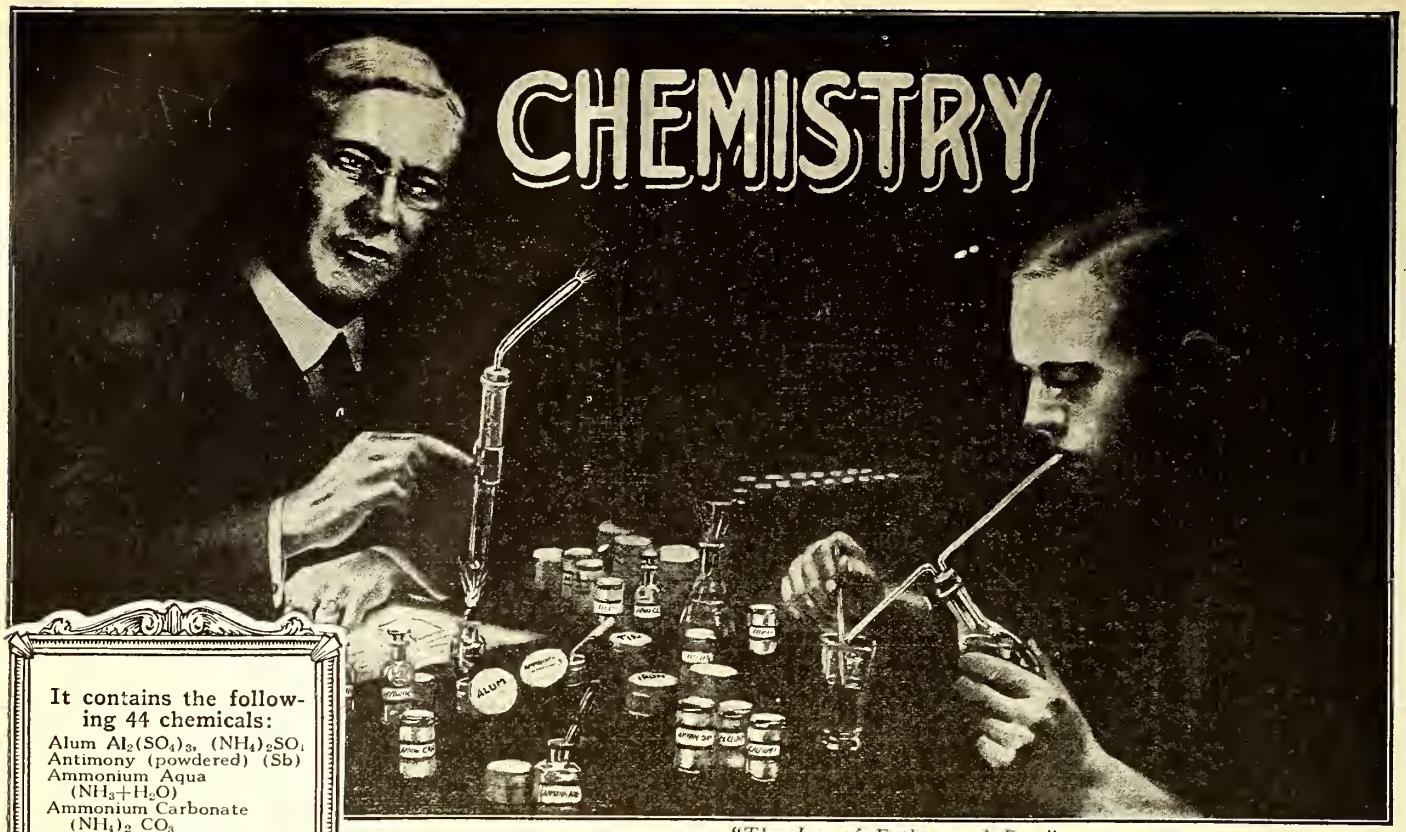
THE OLIVER TYPEWRITER COMPANY,
678 Oliver Typewriter Bldg., Chicago, Ill.

☐ Ship me a new Oliver Nine for five days free inspection. If I keep it, I will pay $57 at the rate of $3 per month. The title to remain in you until fully paid for.
My shipping point is.....
This does not place me under any obligation to buy. If I choose to return the Oliver, I will ship it back at your expense at the end of five days.

☐ Do not send a machine until I order it. Mail me your book—"The High Cost of Typewriters—The Reason and the Remedy," your de luxe catalog and further information.

Name .....
Street Address .....
City..... State.....
Occupation or Business.....

www.americanradiohistory.com



"The Joy of Father and Boy."

Chemical Laboratory

We present herewith to our friends our new **E. I. Co. Chemical Laboratory** which contains real chemicals and apparata to perform real chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a **Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.**

It contains the following 44 chemicals:

Alum $Al_2(SO_4)_3$, $(NH_4)_2SO_4$
Antimony (powdered) (Sb)
Ammonium Aqua (NH_3+H_2O)
Ammonium Carbonate $(NH_4)_2\ CO_3$
Ammonium Chloride (NH_4Cl)
Ammonium Sulphate $(NH_4)_2\ SO_4$
Barium Chloride $(BaCl_2)$
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride $(CaCl_2)$
Calcium Oxide (CaO)
Calcium Sulphate $(CaSO_4 2H_2O)$
Charcoal (Carbon) (C)
Chloride of Zinc $(ZnCl_2)$
Copper Sulphate $(CuSO_4)$
Ferrous Sulphate $(FeSO_4)$
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5(OH)_3$
Hydrochloric Acid (HCl)
Iodine (I)
Iron Chloride $(FeCl_2)$
Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
Magnesium Carbonate $(MgCO_3)$
Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
Nickel Chloride $(NiCl_2)$
Oxalic Acid $(H_2C_2O_4)$
Sodium Bicarbonate $(NaHCO_3)$
Sodium Borate $(NaBO_2)$
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate $(NaNO_3)$
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride $(SnCl_2)$
Sulphate of Nickel $(NiSO_4)$
Sulphate of Zinc $(ZnSO_4)$
Sulphuric Acid (H_2SO_4)
Tin (Granulated) (Sn)
Zinc (Metal) (Zn)
Zinc Carbonate $(ZnCO_3)$

The following apparata are furnished:

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube
Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure
Glass Tubing
One book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

DESCRIPTION OF THE OUTFIT:

The outfit consists of forty-four (44) Chemicals all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) enough to make dozens of experiments with each. See list of Chemicals herewith.

The apparata furnished are all of the best obtainable make and of standard laboratory size and shape. A list of the 17 pieces of apparata furnished with this outfit is printed also herewith.

The Instruction book is a real **Chemistry Course for the Beginner.** Some of the Contents are: **Division of Matter:** This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. **Chemical Nomenclature:** This explains in simple language the derivation of the chemical names of the Elements and their compounds. There is a chapter on **Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms,** etc.

A good part of the book is devoted to Weights and Measures. The Metric System, the English system and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights, Volume, Capacity and Length; Per Cent solutions; Conversion of Measure expressed in parts; Poisons and their antidotes; Technical and common name of chemical substances; Formulas for Cleaning various substances, etc., etc.

Among the **100 Experiments** are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to Make Chlorine Gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

The price is still $5.00. Shipping Weight 10 lbs. (Can be shipped by Express only.)

TRADE MARK **THE ELECTRO IMPORTING CO., Mfrs.** TRADE MARK
231 FULTON STREET NEW YORK CITY

"THE LIVIEST CATALOG IN AMERICA"

Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 176 Big Pages, 400 illustrations. 300 instruments and apparatus, etc. Big **"Treatise on Wireless Telegraphy."** 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 20 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

I enclose herewith 6 cents in stamps or coin, to cover postage, for which please send me your latest Cyclopedia Catalog No. 20 as described.

NAME .....
ADDRESS .....
STATE.....E. E. 11-19

www.americanradiohistory.com

How I Improved My Memory In One Evening

The Amazing Experience of Victor Jones

"Of *course* I place you! Mr. Addison Sims of Seattle.

"If I remember correctly—and I *do* remember correctly—Mr. Burroughs, the lumberman, introduced me to you at the luncheon of the Seattle Rotary Club three years ago in May. This is a pleasure indeed! I haven't laid eyes on you since that day. How is the grain business? And how did that amalgamation work out?"

The assurance of this speaker—in the crowded corridor of the Hotel McAlpin—compelled me to turn and look at him, though I must say it is not my usual habit to "listen in" even in a hotel lobby.

"He is David M. Roth, the most famous memory expert in the United States," said my friend Kennedy, answering my question before I could get it out. "He will show you a lot more wonderful things than that, before the evening is over."

And he did.

As we went into the banquet room the toastmaster was introducing a long line of the guests to Mr. Roth. I got in line and when it came my turn, Mr. Roth asked, "What are your initials, Mr. Jones, and your business connection and telephone number?" Why he asked this, I learned later, when he picked out from the crowd the 60 men he had met two hours before and called each by name without a mistake. What is more, he named each man's business and telephone number, for good measure.

I wont tell you all the other amazing things this man did except to tell how he called back, without a minute's hesitation, long lists of numbers, bank clearings, prices, lot numbers, parcel post rates and anything else the guests gave him in rapid order.

* * * *

When I met Mr. Roth—which you may be sure I did the first chance I got—he rather bowled me over by saying in his quiet, modest way:

"There is nothing miraculous about my remembering anything I want to remember, whether it be names, faces, figures, facts or something I have read in a magazine.

"You can do this just as easily as I do. Anyone with an average mind can learn quickly to do exactly the same things which seem so miraculous when I do them.

"My own memory," continued Mr. Roth, "was originally very faulty. Yes it was—a really *poor* memory. On meeting a man I would lose his name in thirty seconds, while now there are probably 10,000 men and women in the United States, many of whom I have met but once, whose names I can call instantly on meeting them."

"That is all right for you, Mr. Roth," I interrupted, "you have given years to it. But how about me?"

"Mr. Jones," he replied, "I can teach you the secret of a good memory in one evening. This is not a guess, because I have done it with thousands of pupils. In the first of seven simple lessons which I have prepared for home study, I show you the basic principle of my whole system and you will find it—not hard work as you might fear—but just like playing a fascinating game. I will prove it to you."

He didn't have to prove it. His Course did; I got it the very next day from his publishers, the Independent Corporation.

When I tackled the first lesson, I suppose I was the most surprised man in forty-eight states to find that I had learned in about one hour—how to remember a list of one hundred words so that I could call them off forward and back without a single mistake.

That first lesson *stuck*. And so did the other six.

Read this letter from Terence J. McManus, of the firm of Olcott, Bonynge, McManus & Ernst, Attorneys and Counsellors at Law, 170 Broadway, and one of the most famous trial lawyers in New York:

> "May I take occasion to state that I regard your service in giving this system to the world as a public benefaction. The wonderful simplicity of the method, and the ease with which its principles may be acquired, especially appeal to me. I may add that I already had occasion to test the effectiveness of the first two lessons in the preparation for trial of an important action in which I am about to engage."

Mr. McManus didn't put it a bit too strong.

The Roth Course is priceless! I can absolutely *count* on my memory now. I can call the name of most any man I have met before—and I am getting better all the time. I can remember any figures I wish to remember. Telephone numbers come to mind instantly, once I have filed them by Mr. Roth's easy method. Street addresses are just as easy.

The old fear of forgetting (you know what that is) has vanished. I used to be "scared stiff" on my feet—because I wasn't *sure*. I couldn't remember what I wanted to say.

Now I am sure of myself, and confident, and "easy as an old shoe" when I get on my feet at the club, or at a banquet, or in a business meeting, or in any social gathering.

Perhaps the most enjoyable part of it all is that I have become a good conversationalist—and I used to be as silent as a sphinx when I got into a crowd of people who knew things.

Now I can call up like a flash of lightning most any fact I want right at the instant I need it most. I used to think a "hair trigger" memory belonged only to the prodigy and genius. Now I see that every man of us has that kind of a memory if he only knows how to make it work right.

I tell you it is a wonderful thing, after groping around in the dark for so many years to be able to switch the big searchlight on your mind and see instantly everything you want to remember.

This Roth Course will do wonders in your office.

Since we took it up you never hear anyone in *our* office say "I guess" or "I think it was about so much" or "I forget that right now" or "I can't remember" or "I must look up his name." Now they are right there with the answer—like a shot.

Have you ever heard of "Multigraph Smith?" Real name H. Q. Smith, Division Manager of the Multigraph Sales Company, Ltd., in Montreal. Here is just a bit from a letter of his that I saw last week:

> "Here is the whole thing in a nutshell: Mr. Roth has a most remarkable Memory Course. It is simple, and easy as falling off a log. Yet with one hour a day of practice anyone—I don't care who he is—can improve his Memory 100% in a week and 1,000% in six months."

My advice to you is don't wait another minute. Send to Independent Corporation for Mr. Roth's amazing course and see what a wonderful memory you have got. Your dividends in *increased power* will be enormous.

VICTOR JONES.

While Mr. Jones has chosen the story form for this account of his experience and that of others with the Roth Memory Course, he has used only facts that are known personally to the President of the Independent Corporation, who hereby verifies the accurrary of Mr. Jones' story in all its particulars.

Send No Money

So confident is the Independent Corporation, the publishers of the Roth Memory Course, that once you have an opportunity to see in your own home how easy it is to double, yes, triple your memory power in a few short hours, that they are willing to send the course on free examination.

Don't send any money. Merely mail the coupon or write a letter and the complete course will be sent, all charges prepaid, at once. If you are not entirely satisfied send it back any time within five days after you receive it and you will owe nothing.

On the other hand, if you are as pleased as are the thousands of other men and women who have used the course, send only $5 in full payment. You take no risk and you have everything to gain, so mail the coupon now before this remarkable offer is withdrawn.

FREE EXAMINATION COUPON

Independent Corporation

Publishers of The Independent Weekly

Dept. R-11011 119 W. 40th Street, New York

Please send me the Roth Memory Course of seven lessons. I will either mail the course to you within five days after its receipt or send you $5, in full payment of course.

Name.....

Address.....

.....

.....Elec. Exper-11-19

www.americanradiohistory.com

MAGAZINE Prices Slashed



Millions of magazine subscriptions expire this month! With the tremendous advance of paper prices and labor it is certain that nearly all magazines will advance their subscription prices at least from 25% to 50%.

BY ORDERING NOW YOU WILL SAVE BIG MONEY.

In announcing these wonderful prices it is with the absolute knowledge that our readers are offered the lowest prices for standard Magazines that it is possible to obtain anywhere. Only by special arrangement with the publishers are these prices possible, but to take advantage of them, you must act quickly. **Don't delay, do it now.** This offer is so good that of necessity it must be limited in time. Just think of buying standard Magazines at reduced prices in time for Xmas Presents, and they certainly make ideal gifts being a constant reminder for a whole year of a considerate friend. Just glance over our wonderful prices, and see how we enable one dollar to bring you two dollars' worth, and then make up your list. When sending your order, don't forget to state where magazines are to be sent. But be sure you do it now. To-morrow means you may forget and lose this wonderful opportunity. All prices quoted are for subscribers in U S. A. only, Canadian and Foreign subscriptions require additional postage.

The Publishers Will Mail the Magazine Direct From Their Own Office to You.

Electrical Experimenter $2.00 Popular Science ..... 2.00 Regular Price..... $4.00	Our Price	$3.50
Electrical Experimenter $2.00 Scientific American ..... 5.00 Illustrated World ..... 2.00 Regular Price..... $9.00	Our Price	$8.25
Electrical Experimenter $2.00 American Magazine..... 2.00 Woman's Home Companion..... 2.00 Regular Price..... $6.00	Our Price	$4.75
Electrical Experimenter $2.00 Etude (for Music Lovers) 2.00 Regular Price..... $4.00	Our Price	$3.35
Electrical Experimenter $2.00 Boy's Magazine..... 1.50 Regular Price..... $3.50	Our Price	$3.00
Electrical Experimenter $2.00 World's Work ..... 4.00 Regular Price..... $6.00	Our Price	$4.75
Electrical Experimenter $2.00 Everybody's Magazine..... 2.00 Delineator ..... 2.00 Regular Price..... $6.00	Our Price	$4.75
Electrical Experimenter $2.00 Designer ..... 1.50 Woman's Magazine..... 1.50 Regular Price..... $5.00	Our Price	$4.00
Electrical Experimenter $2.00 McCall's Magazine..... 1.00 Regular Price..... $3.00	Our Price	$2.50
Electrical Experimenter $2.00 Today's Housewife ..... 1.00 Regular Price..... $3.00	Our Price	$2.50
Electrical Experimenter $2.00 McCall's Magazine..... 1.00 Review of Reviews..... 3.00 Regular Price..... $6.00	Our Price	$5.25
Electrical Experimenter $2.00 St. Nicholas..... 3.00 Boy's Magazine..... 1.50 Regular Price..... $6.50	Our Price	$5.50
Electrical Experimenter $2.00 Century..... 4.00 Scribner's..... 4.00 Regular Price $10.00	Our Price	$8.75
Electrical Experimenter $2.00 Wireless Age..... 2.00 Radio Amateur News..... 1.50 Regular Price..... $5.50	Our Price	$4.75
Electrical Experimenter $2.00 Boy's Life..... 2.00 Regular Price..... $4.00	Our Price	$3.50
Electrical Experimenter $2.00 Illustrated World ..... 2.00 Radio Amateur News..... 1.50 Regular Price..... $5.50	Our Price	$4.50
Electrical Experimenter $2.00 Field and Stream..... 2.00 Regular Price..... $4.00	Our Price	$3.50



Special Clubbing Prices of Electrical Experimenter WITH:

Club No.	Magazine	Regular Price	Our Price
60	Adventure	$3.00	$4.75
40	American	2.00	3.75
35	Boy's Life	2.00	3.75
25	Boy's Magazine	1.50	3.00
70	Century	4.00	5.25
40	Christian Herald	2.25	4.00
40	Cosmopolitan	2.00	3.75
20	Country Gentleman	1.00	2.75
100	Country Life	5.00	6.75
60	Current History	3.00	4.75
60	Current Opinion		
35	Delineator	2.00	3.50
28	Designer	1.50	3.15
35	Everybody's	2.00	3.50
35	Etude (For Music Lover's)	2.00	3.25
60	Factory	3.00	4.75
35	Field & Stream	2.00	3.50
35	Garden Magazine		
40	Good Housekeeping	2.00	3.75
80	Harper's Bazar	4.00	5.75
40	Hearst's Magazine	2.00	3.75
35	Illustrated World	2.00	3.50
35	Ladies Home Journal	1.75	3.50
80	Literary Digest	4.00	5.75
60	Metropolitan	3.00	4.75
100	Mid-Week Pictorial	5.00	6.75
27	Modern Priscilla	1.50	3.15
60	Motor	3.00	4.75
40	Motor Boating	2.00	3.75
40	Munsey's Magazine	2.00	3.75
20	McCall's Magazine	1.00	2.75
35	McClure's Magazine	2.00	3.50
70	Outing	4.00	5.25
40	Pictorial Review	2.00	3.75
40	Popular Science	2.00	3.50
25	Radio Amateur News	1.50	3.00
50	St. Nicholas	3.00	4.25
40	Saturday Evening Post	2.00	3.75
95	Scientific American	5.00	6.50
70	Scribner's	4.00	5.25
70	Smart Set	4.00	5.25
60	System	3.00	4.75
15	Today's Housewife	1.00	2.50
35	Wireless Age	2.00	3.50
40	Woman's Home Companion	2.00	3.75
17	Woman's Magazine	1.00	2.65
60	World's Work	4.00	4.75
50	Youth's Companion	2.50	4.25

For computing together Magazines listed separately, add Class Numbers before title and multiply by 5, giving our price to you in dollars and cents.

Write for Special Prices on ANY Publication not listed here

We will save you money

SEND ALL ORDERS TO "CIRCULATION DEPARTMENT"

EXPERIMENTER PUBLISHING CO., Inc.

233 Fulton Street, New York City, N. Y.

www.americanradiohistory.com

Are You a Blond?

The Secret of Making People Like You



Gloria Swanson
In "Male and Female"
Paramount-Artcraft Picture

THE greatest asset any man can possibly have is the faculty for making people like him. It is even more important than ability.

The secret of making people like you lies in your ability to understand the emotional and mental characteristics of the people you meet.

Did you know that a blond has an entirely different temperament than a brunet?—that to get along with a blond type you must act entirely different than you would to get along with a brunet?

When you really know the difference between blonds and brunets, the difference in their characters, temperaments, abilities and peculiar traits you will save yourself many a mistake—and you will incidentally learn much you never knew before about yourself.

* * * * * * * * *

PAUL GRAHAM was a blond, and not until he learned that there was all the difference in the world between the characteristics of a blond and those of a brunet did he discover the secret of making people like him.

Paul had been keeping books for years for a large corporation which had branches all over the country. It was generally thought by his associates that he would never rise above that job. He had a tremendous ability with figures—could wind them around his little finger—but he did *not* have the ability to mix with big men; he did *not* know how to make people like him.

Then one day the impossible happened. Paul Graham became popular.

Business men of importance who had formerly given him only a passing nod of acquaintance suddenly showed a desire for his friendship. People—even strangers—actually went out of their way to do things for him. Even *he* was astounded at his new power over men and women. Not only could he get them to do what he wanted them to do, but they actually anticipated his wishes and seemed eager to please him.

From the day the change took place he began to go up in business. Now he is the Head Auditor for his corporation at an immense increase in salary. And all this came to him simply because he learned the secret of making people like him.

You, too, can have the power of making people like you. For by the same method used by Paul Graham, you can, at a glance tell the characteristics of any man, woman or child—tell instantly their likes and dislikes, and YOU CAN MAKE PEOPLE LIKE YOU! Here is how it is done:

Everyone you know can be placed in one of two general types—blond or brunet. There is as big a difference between the mental and emotional characteristics of a blond and those of a brunet as there is between night and day. You persuade a blond in one way—a brunet in another. Blonds enjoy one phase of life—brunets another. Blonds make good in one kind of a job—brunets in one entirely different.

To know these differences scientifically is the first step in judging men and women, in getting on well with them; in mastering their minds; in making them like you; in winning their respect, admiration, love and friendship.

And when you have learned these differences—when you can tell at a glance just what to do and say to make any man or woman like you, your success in life is assured.

For example, there's the case of a large manufacturing concern. Trouble sprang up at one of the factories. The men talked strike. Things looked ugly. Harry Winslow was sent to straighten it out. On the eve of a general walkout he pacified the men and headed off the strike. And not only this, but ever since then, that factory has led all the others for production. He was able to do this, because he knew how to make these men like him and do what he wanted them to do.

Another case, entirely different, is that of Henry Peters. Because of his ability to make people like him—his faculty for "getting under the skin" and making people think his way, he was given the position of Assistant to the President of a large firm. Two other men, both well-liked by their fellow employees, had each expected to get the job. So when the outside man, Peters, came in, he was looked upon by everyone as an interloper and was openly disliked by every other person in the office.

Peters was handicapped in every way. But in spite of that, in three weeks he had made fast friends of everyone in the house and had even won over the two men who had been most bitter against him. The whole secret is that he could tell in an instant how to appeal to any man and make him well-liked.

A certain woman who had this ability moved with her family to another town. As is often the case, it is a very difficult thing for any woman to break into the chill circle of society in this town, if she was not known. But her ability to make people like her soon won for her the close friendship of many of the "best families" in the town. Some people wonder how she did it. It was simply the secret at work—the secret of judging people's character and making them like you.

* * * * * * * * *

YOU realize, of course, that just knowing the difference between a blond and a brunet could not accomplish all these wonderful things. There are other things to be taken into account. But here is the whole secret.

You know that every one does not think alike. What one likes another dislikes. What pleases one offends another. And what offends one pleases another. Well, there is your cue. You can make an instant "hit" with anyone if you say the things they want you to say, and act the way they want you to act. Do this and they will surely like you and believe in you and will go miles out of their way to PLEASE YOU.



Wallace Reid
Star in "The Valley of the Giants"
A Paramount-Artcraft Picture

You can do this easily by knowing certain simple signs. In addition to the difference in complexion, every man, woman and child has written on them signs as distinct as though they were in letters a foot high, which show you from one quick glance exactly what to say and to do to please them—to get them to believe what you want them to believe—to think as you think—to do exactly what you want them to do.

Knowing these simple signs is the whole secret of getting what you want out of life—of making friends, of business and social advantage. Every great leader uses this method. That is why he IS a leader. Use it yourself and you will quickly become a leader—nothing can stop you.

You have heard of Dr. Blackford, the Master Character Analyst. Many concerns will not employ a man without first getting Dr. Blackford to pass on him. Concerns such as Westinghouse Electric and Manufacturing Company, Baker, Vawter Company, Scott Paper Company and many others pay Dr. Blackford large annual fees for advice on dealing with human nature.

So great was the demand for these services that Dr. Blackford could not even begin to fill all the engagements. So Dr. Blackford has explained the method in a simple, seven-lesson course, entitled, "Reading Character at Sight." Even a half hour's reading of this wonderful course will give you an insight into human nature and a power over people which will surprise you.

Such confidence have the publishers in Dr. Blackford's course, "Reading Character at Sight," that they will gladly send it to you on approval, all charges prepaid. Look it over thoroughly. See if it lives up to all the claims made for it. If you do not want to keep it, then return it and the transaction is closed. And if you decide to keep it—as you surely will—then merely remit five dollars in full payment.

Remember, you take no risk, you assume no obligation. The entire course goes to you on approval. You have everything to gain—nothing to lose. So mail the coupon NOW and learn how to make people like you, while this remarkable offer is still open.

FREE EXAMINATION COUPON

Independent Corporation
Publishers of The Independent Weekly

Dept. B-11011, 119 West 40th Street, New York

You may send me Dr. Blackford's Course of seven lessons entitled "Reading Character at Sight." I will either remail the course to you within five days after its receipt, or send you $5 in full payment of the course.

Name .....

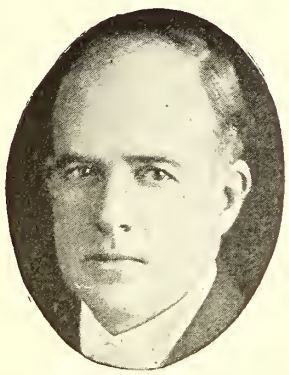
Address .....

..... Elect. Exper.-11-19

www.americanradiohistory.com

Electricity
taught by a practical man!

Home Study Courses of Definite Value
For Experienced Men and Beginners



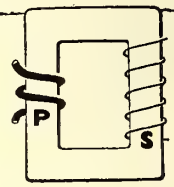
PERSONALLY CONDUCTED

by a man who has long experience as a consulting engineer and who has developed the ability to impart his knowledge to others.

RIGHT in your own home, if you are ambitious, you can fit yourself for an electrical position and graduate forever from the ranks of those who are held back because of lack of technical knowledge. I don't make any false statements about the wonderful salaries you will command. But I do promise, if you are in earnest, to give you unusually valuable service that has enabled many others to increase their earnings greatly.

Each Lesson Meant for You

My method is different from others. It is based upon my years of practical experience. It leads the student quickly over fundamentals right up to practical information, such as is experienced in everyday work. You get my personal attention. It's really a class where you who want to learn and I who know the angles of the electrical industry from experience, get together. This method has been so successful that my students are sending others to me and a number of concerns require their employees to take my course.



Advancement

is made possible to any ambitious man—whether a beginner or experienced in electrical work—who will conscientiously devote his spare time to my course of study.

Tough Problems Made Simple

There isn't a problem that can't be solved if you have the proper foundation of knowledge. There is no limit to what you can achieve with the aid of the practical electrical information supplied in my course. It's up to you. I can't tell you much in this little space. Let me send you my catalog.

What Our Students Think of Our Course

"It has been several years since I graduated and since that time I have been connected with The General Electric Company, The Westinghouse Electric Company, and several other electrical manufacturing concerns.

During this time it has been impossible for me to keep in close touch with you to whom I owe, to a large extent, the measure of success I have had in the electrical field.

I wish to take this opportunity to thank you for the instruction given me, and to say that I believe you have exceptional ability along educational lines. Yours, very truly,

E. DICKEY, *Asst. Chief Engineer,*
The Domestic Engineering Company.
Dayton, Ohio.

"I took some of my lessons down to the plant and studied them. The Superintendent saw them and asked me what they were so I told him. The next day he informed me that I would draw $150.00 instead of $110.00. This came in very handy for me of course. Hoping to hear from my exams real soon, I remain,"

Your pupil,
G. D. WATERS, Fairview, W. Va.

RESULTS OF MY SERVICE

Practical Electricians Recommend My Course to Others.
My Students Are Invariably Promoted and Get Better Salaries.
Over 65 Per Cent. of My Students Are Engaged in the Electrical Business.
Over 11 Per Cent. of My Present Enrollment Came Through Satisfied Students.
Beginners Get Employment in Electrical Work After Taking My Course a Short While.

The Right Way to Pay

You pay me a small amount each month. You may stop any time and your payments will then stop. I don't want your money if I'm not teaching you satisfactorily.

Apparatus Supplied

Electrical materials, charts, electrical apparatus, drafting material, etc., are furnished with the course without charge. Write me frankly about yourself—what you are doing now and what you hope to do. Let's get together on your problems.

SEND FOR MY BOOK which clearly tells you how the work is handled, what I have done for others and the benefit you can expect to receive.

YORKE BURGESS, Superintendent

BURGESS ELECTRICAL SCHOOL, 745 E. 42nd Street, Chicago, Illinois

The Opinions of Men Who Have Bought the Blue Book

"I am sure it will solve many problems that may arise in my line of work. I have showed this book to some of my fellow workers and they think it really is a wonderful book and they told me to get copies for them."

JOHN H. GOTCHEL,
Santa Barbara, Cal.

"It is surprising how much information, drawings, etc., can be concentrated into such a small pocket size book."

JOSEPH C. HANHAUSER,
Philadelphia, Pa.

"It is such a good publication that you will find enolosed my check for 12 copies for just a few friends I happened to see last night."

E. T. BROWN,
New Orleans, La.

"Your Burgess Blue Book which I have received recently, has caused quite a stir among my fellow electricians for many of them asked me to get one for them as soon as they read mine. They think it is a great help to them in their work."

FRANK STALZER,
Toledo, Ohio.

BURGESS BLUE BOOK
ELECTRICAL MEN AND STUDENTS



A pocket hand-book for ELECTRICAL MEN and STUDENTS. Contains over 200 CALCULATION FORMULAS and worked-out problems showing their use. Also DRAWINGS of ELECTRICAL APPARATUS and DEVICES of which the *inside connections* are clearly shown. ALTERNATING CURRENT CALCULATIONS and dozens of everyday problems are covered. Recommended by electrical men all over the country. Used in technical schools. Purchased by electrical concerns for employees and customers. There is no other book like it.

A $1.00 bill brings the book. We refund your money if you are not fully satisfied.

PRICE $1.00

BURGESS ENGINEERING CO.

Yorke Burgess, President
Consulting Electrical Engineering
750 East Forty-Second Street, Chicago, Illinois.

We give information on electrical subjects, design and perfect electrical devices and apparatus. Power plants, electric railway and operation and railway signals a specialty. Write us your needs and let us furnish data and advise you. Our service is prompt, reliable and satisfactory.

www.americanradiohistory.com

How "Silent Simms" Became a Master of Speech

BY MARTIN M. BYRON

"YOU are exasperating beyond words," shot out Mr. Worden. "Why didn't you keep Mr. Truesdale here? You knew I would be back in ten minutes."

Harry Simms gulped hard, and replied weakly, "I did try to keep him here, Mr. Worden, but he wouldn't stay."

"What? Wouldn't stay even ten minutes? Why you could have kept him that long without his realizing it. Why didn't you *talk* to him about the weather, about peace, about the price of potatoes, about *anything?*"

This wasn't the first calling down I had heard Simms get. He had been with the firm for eight years and had reached the point where he was as much a fixture around the office as the desk or the chairs. He was a slow-going, steady plugger, earning $40 a week. He managed to keep busy in the Sales Department, keeping records of salesmen's reports. No one around the office seemed to notice him. He was so quiet that the only things that would start him talking were such momentous events as the beginning of the war or the end of the war. Even when his baby was born, Harry said only three words—"It's a boy."

It wasn't long before we nicknamed him "Silent Simms."

Yet the "Silent Simms" of two years ago is now our Sales Manager, regarded as one of the most brilliant men in our organization, getting an annual salary that runs close to five figures, and is slated for the vice-presidency!

How all this happened in so short a time makes one of the most remarkable stories of success I have ever heard. But let Harry tell the story as he told it to me when I asked him point-blank what sort of magic he used in transforming himself.

"Well," said Harry, "you remember when Mr. Truesdale came in that day and I could not hold him for ten minutes until the Chief got back? And when the Chief came back and found Truesdale gone, how he bawled me out? *That incident marked the turning point of my life.* I made up my mind that I was going to live down the nickname of 'Silent Simms,' that had fastened itself upon me to a point where I hardly spoke to my wife. I was just afraid. I had almost forgotten how to use my tongue. Perhaps I got that way because every time I opened my mouth I 'put my foot in it.' I was always getting in wrong. I would give instructions and then have to spend twenty minutes trying to explain them. I would dictate a letter and then have to write five more to explain the first one. I would try to explain an idea to the Chief and would get so flustered that I couldn't make myself understood at all. In my social life I became almost a hermit. We never went out because I was like a sphinx among people. I was the best listener you ever saw and the *worst talker.*

"Well, when the Chief called me down that day it was the 'straw that broke the camel's back.' It was the most humiliating experience I ever went through. I had been with the firm 8 years—was getting $40 a week—and was the office 'football.' I went home that night determined to learn how to talk convincingly, interestingly, and forcibly, so that I could hold people spellbound, not only for ten minutes, but by the hour. No more of the silent stuff for me. I had no more idea of how to do it than I have of how to jump across the ocean, but I knew that I wanted to do it, and I knew that I would never get anywhere until I did do it. It took a shock to make me realize what it was that was holding me down to the grind of detail work, but when I finally realized why I was called 'Silent Simms' I began to investigate all that had been written on the subject of talking. I did not want to become a public speaker—what I wanted was the ability to talk as a business asset. I bought numberless books on public speaking, but they all taught oratory, and were so complicated that I gave up almost in discouragement. I continued my search, however, and was rewarded a few weeks later by hearing about the work of Dr. Frederick Houk Law, who was conducting a course in business talking and public speaking.

"You may be sure that I lost no time in attending the lectures. I went after them as eagerly as a hungry wolf goes after food. To my great surprise and pleasure I grasped the secret of being a convincing talker—the secret I had needed all my life—almost in the first lesson.



—the chief wired me to come back and gave me Morgan's job as the sales manager.

"Almost at once I learned why I was afraid to stand up and talk to others. I learned how to talk to a number of people at the same time. I learned how to make people listen to every word I said. I learned how to say things interestingly, forcibly and convincingly. I learned how to listen while others talked. I learned how to say exactly what I meant. I learned when to be humorous with telling effect, and how to avoid being humorous at the wrong time.

"More important than these vital fundamentals were the actual examples of what things to say and when to say them to meet every condition. I found that there was a knack in making reports to my superiors. I found that there was a right and wrong way to make complaints, to answer complaints, to give estimates, to issue orders, to give opinions, to bring people around to my way of thinking without antagonizing them, and about how to ask banks for a loan. Then, of course, there were also lessons on speaking before large audiences, advice on how to find material for talking and speaking, actual rules on how to talk to friends, to servants, and even to children.

"And the whole thing was so simple that in a single evening I learned the secrets that turned me into a very dynamo of ambition. I knew that I had at last found the road to Mastery of Speech. I began to apply the principles at once, and found that my words were electrifying people. I began to get things done. I began to put a new kind of ginger into my letters, into my memoranda, into my talks with customers, and with people in the office. In a little three minute talk with the Chief I nearly floored him with some ideas that had been in my mind for years, but which I had always been afraid to mention. It wasn't long before I was taken off my old desk and put at the city salesman's desk. You know how I made good. Seems almost like a dream now. Then, a short time later, I was given Roger's job on the road, in the hardest territory we have. And when I began to break records there the Chief wired me to come back and gave me Morgan's job as the sales manager when Morgan was put in charge of the Seattle office.

"This great change came over me simply as a result of my having learned how to talk. I imagine there are thousands of others who are in the same boat in which I found myself and who could become big money-makers if they only learned the secret of being a convincing talker."

When Harry Simms finished, I asked him if I could not have the benefit of Dr. Law's Course and he told me that only recently Dr. Law had prepared a complete course in printed form which contained exactly the same instructions as he had given in his lectures. I sent for it and found it to be exactly as he stated. After studying the eight simple lessons I began to realize that Simm's success was the natural outcome of real ability to talk. For my own success with the Course has been as great as his. I can never thank Simms enough for telling me about Dr. Law's Course in Business Talking and Public Speaking.

SEND NO MONEY

So confident is The Independent Corporation, publishers of "Mastery of Speech," Dr. Law's Course in Business Talking and Public Speaking, that once you have an opportunity to see in your own home how you can, in one hour, learn the secret of speaking and how you can apply the principles of effective speech under all conditions, that they are willing to send you the Course on free examination.

Don't send any money. Merely mail the coupon or write a letter and the complete course will be sent, all charges prepaid, at once. If you are not entirely satisfied, send it back any time within five days after you receive it and you will owe nothing.

On the other hand if you are as pleased as are the thousands of other men and women who have used the Course, send only $5 in full payment. You take no risk and you have everything to gain, so mail the coupon now before this remarkable offer is withdrawn.

FREE EXAMINATION COUPON

Independent Corporation

Publishers of The Independent Weekly

Dept. L 11011, 119 W. 40th St., New York

Please send me Dr. Frederick Houk Law's "Mastery of Speech," a Course in Business Talking and Public Speaking in eight lessons. I will either remail the Course to you within five days after its receipt, or send you $5 in full payment of the Course.

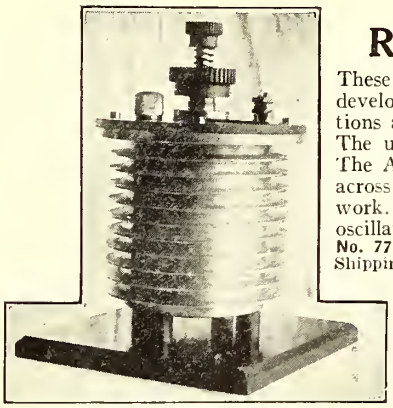
Name .....

Address .....

.....

www.americanradiohistory.com

E. I. Co.'s High Grade Radio-Instruments
FOR SCHOOLS AND LABORATORIES AT REASONABLE PRICES



No. 7710

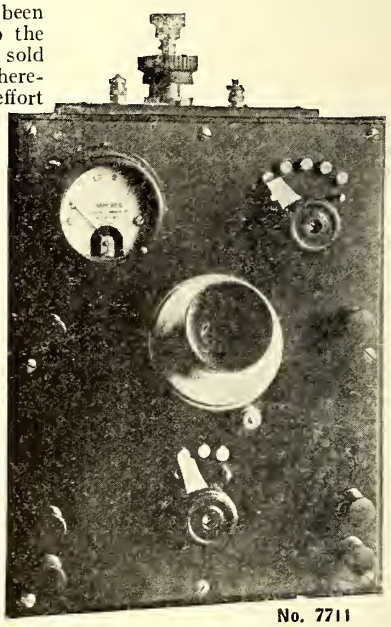
Arc for Generating Undamped Waves for Radio Telephonic & Telegraphic Transmission

These instruments are the acme of perfection in Radio Transmission. The latest and best developments in Radio during the *Great War* are embodied in this apparatus. Educational Institutions and Laboratories can now procure the most modern Radio equipment at a reasonable cost. The undamped *Wave Generator* illustrated is exceptionally well constructed of heavy aluminum. The Arc chamber is flanged in order to offer the greatest cooling surface. The Arc takes place across two solid special Tungsten electrodes which have been found particularly efficient for this work. The electrodes are fully adjustable, permitting very precise adjustment of the emitted oscillatory currents.

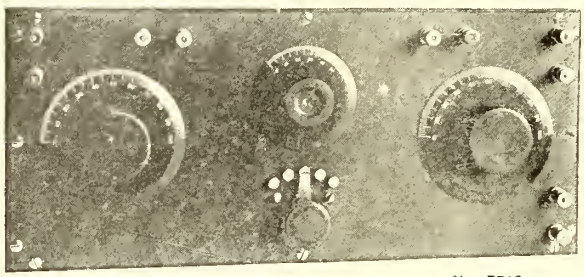
No. 7710—½ K.W. Sustained Wave Generator, as illustrated, operates on 110 V D.C. Size 6½ x 6½ x 8½. Shipping weight, 35 lbs.; price.....**$50.00**

This complete ***Radiophone Transmitter*** is unquestionably one of the finest pieces of Radio apparatus ever placed on the market. A Radiophone might have been sold heretofore; but it was felt that in justice to the purchaser, no instrument of this nature should be sold unless it were possible to obtain efficient results therefrom. This transmitter is the result of great effort expended in the design of a Radiophone set which should meet all requirements as to practicability and compactness combined with highest efficiency. It includes all apparatus necessary for transmission. The Arc is similar to the one illustrated elsewhere on this page.

No. 7711—Complete Sustained Wave Radiophone and Telegraph Transmitter, inclosed in a beautifully finished cabinet; size 14½ x 9 x 12½"; weight 50 pounds; as illustrated; price.....**$150.00**



No. 7711



No. 7712

The Short Wave Regenerative receiving cabinet shown is built in accordance with the most modern methods of reception. In work with oscillating audions it is necessary that all losses be diminuated as it was found that tuning should preferably be done with inductance alone, without using variable condensers.

This Receiving set will be found fully up to the mark in comparison with the highest priced set on the market to-day, yet its cost is well within the reach of all.

No. 7712—Regenerative Receiving Cabinet set, as illustrated; size 16¾ x 7⅝ x 8"; weight 25 pounds; price.....**$50.00**

The Vacuum Tube Socket illustrated was designed to be used by those who are desirous of assembling their own vacuum controls and who need a good socket to hold the bulbs. It is well designed, durable and reasonably priced.



No. 7715

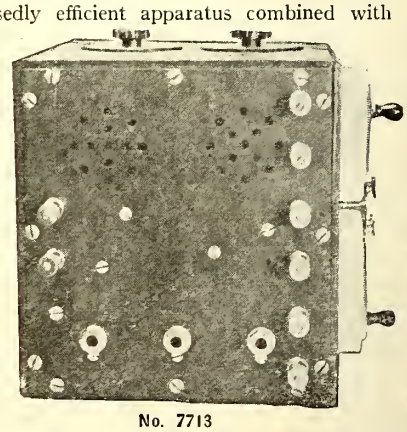
No. 7715—Vacuum Tube Socket; 2¼ x 2¼ x 1½"; weight 1 pound; price.....**$1.50**

This Tube socket is adaptable for both receiving and transmitting tubes.

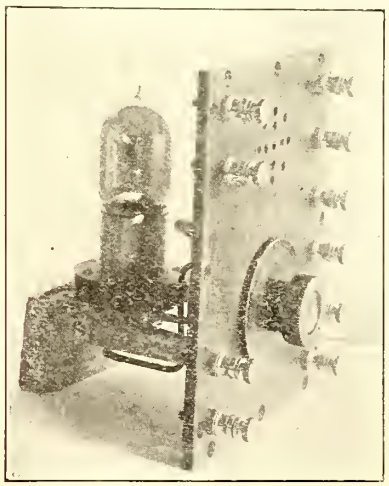
The Two Step Amplifier illustrated is undoubtedly one of the finest instruments offered to the experimenter. It is an example of unsurpassedly efficient apparatus combined with exceptional mechanical skill in its design and construction. Two Vacuum Tube sockets are mounted within the cabinet which also contains the two amplifying audio-frequency transformers which were especially designed for this instrument. It is of great consistance in amplifying live and radio telephone currents.

The telephones are plugged in any of three jacks mounted on the panel, permitting the use of either one or two steps of the amplifier or simply cutting the amplifier out entirely.

No. 7713—Two Step Amplifier, as illustrated; size 7⅝ x 7¼ x 8"; weight 7 pounds; price.....**$55.00**



No. 7713



No. 7714

The Vacuum Tube Control Cabinet is one of the essential instruments of the modern radio station. The Vacuum Tube holder, filament, rheostat, grid condenser and grid leak are mounted within the cabinet, the only part on the exterior being the rheostat control knob and dial. The construction throughout is on the same high level of excellence with the other instruments illustrated on this page.

No. 7714—Vacuum Tube Control Cabinet, as illustrated; size 6 x 7⅝ x 6¾; weight 5 pounds; price.....**$25.00**

P. S. No Tubes furnished by us with these instruments.

THE ELECTRO IMPORTING CO.

MANUFACTURERS

231 FULTON STREET, N. Y.

ALSO SEE OUR FULL PAGE "AD" ON PAGE 614

www.americanradiohistory.com

How We Stopped the Leaks That Kept Us Poor



How Howard Lindsay and His Wife Discovered an Easy Way to Save One-Third of Their Income. A Secret That Applies to Any Income

By HARRISON OTIS

WHO should walk into the room but Howard Lindsay! Of all men perhaps he was the last I had expected to find as the president of this great new company. They had told me that Mr. Lindsay, of the Consolidated, was looking for a fine country home and was interested in buying the Dollard Place in Englewood; so as executor of the Dollard estate I had come to discuss the terms with him.

But Lindsay! Surely some miracle had happened. For it was the very man who had come to me "dead broke" about four years back and had asked me to help him get a new job.

"You are surprised, Mr. Otis, I can see that without your telling me. Let that real estate matter rest for a moment while I tell you how the change happened. It won't take five minutes. It all seems simple as A B C, as I look back on it now.

How It All Began

"Our new life began when we discovered *how to save money.* That happened soon after I started in the new job you helped me secure. And it all came about right in my own home. Our sole source of supply was my salary of $3,000. That first year we didn't save one cent. Besides that, we woke up on New Year's day to find a big hunch of unpaid bills to be taken care of somehow or other out of future salary checks.

"When I asked myself the reason for all this I found that I did not *know* the reason, and no more did my wife, because we hadn't the faintest idea what our money had been spent for.

"Then we looked around among our friends and learned a great lesson.

"The Weeds, I knew, were getting more than $5,000 a year. They lived in a modest apartment, did not wear fine clothes, seldom went to the theatre, did little entertaining, yet we knew they barely had enough money to pay current bills.

"In the case of the Wells, I found a very different story and one that set me thinking hard. Their income was $2,000 a year, yet, to my amazement, they confided to us that they had saved $600 a year ever since they were married. They didn't have any grand opera in their program—except on their little Victrola—but they did go to the theatre regularly, they wore good clothes, entertained their friends at their home and were about the happiest and most contented couple of all our married friends.

"The difference between these two families was that in one case the expenditures were made without any plan—while in the other the income was regulated on a weekly budget system.

"We sat down that evening and made up a budget of *all* our expenses for the next fifty-two weeks. We discovered leaks galore. We found a hundred ways where little amounts could be saved.

"In one short month we had a 'strangle hold' on our expenses and knew just where we were going. In one year my wife proudly produced a bank book showing a tidy savings account of $800.

My New Grip on Business

"In the meantime an extraordinary change had come over me in business.

"I didn't fully realize this until the president called me in one day and said, 'Lindsay, you have been doing exceptionally well. I have been studying your work for the last year and you have saved the company a lot of money. We have decided to give you an interest in the business.'

"So there you are. It is wonderful, isn't it? I often wish I might tell my story to the thousands of young married couples who are having the hardest time of their lives just when they ought to be having the best time."

So now I have the opportunity and you are lucky, if only you will act on the wonderful message this story contains. HARRISON OTIS.

The Magic Budget Plan

The Ferrin Money Making Account System is built on the experience of Howard Lindsay. This system, which is simplicity itself, comprises:

The Ferrin Money Making Account Book.

The Ferrin Kitchen Calendar (for the household).

The Ferrin Pocket Account Book.

The Ferrin Investment and Insurance Register.

The Ferrin Household Inventory and Fire Insurance Record.

Compact information is given on Making a Budget, Keeping Expense Accounts, Making Safe Investments, Making an Inventory of Household Goods.

There is no red tape or complicated bookkeeping in this system—it is so simple that anyone can keep it—so convenient that you will not notice the few moments of your time required to make entries. The Pocket Account Book (price when sold separately 50 cents) contains *printed* slips so that you have only to jot down the amounts of your daily expenditures. The Kitchen Calendar (price 50 cents) keeps track of household expenses. At the end of each week or month these amounts are transferred to the Money Making Account Book, which contains 112 pages, size 8¼x10¾ inches, and is bound in half blue Silk Cloth Back—Cadet Blue Cover, Paper Sides—Turned Edges, semi-flexible, stamped in gold on Front Cover. This book has been prepared by an expert to fit any salary from the smallest to the largest. Incorporated in it is a recapitulation for every month of the year, which shows at a glance the Budget and the amounts paid out during the month for the various classified items of expense. It is the only book to our knowledge which has a Budget column for every month. Special columns are provided for items on which an income tax does not have to be paid, so that these amounts may be deducted at the end of the year.

One Money Saving Feature

A war tax is now levied on almost every kind of article you buy. Few people know that the amounts so paid on daily purchases may properly be deducted from their income tax report. By keeping track of these war taxes on the pages for daily expenditures, and transferring the weekly or monthly totals to the Money Making Account Book, you will effect a saving on your income tax that will surprise you and that will pay the small price of the System many times over.

The Ferrin Investment Insurance Register is designed to keep an accurate record of your investments, insurance policies, etc. Contains 32 pages, size 5x8 inches, price separately, 50c. The Ferrin Inventory and Fire Insurance Record will enable you to make and keep a complete inventory of every room in the house; also provides for record of your fire insurance policy. It is an absolute necessity in case of a fire. It may save you many thousand times the cost, which is 50c when sold separately.

Two Minutes a Day

The Ferrin Money Making Account System takes only two minutes a day. Any bright grammar school boy or girl can keep the accounts. This method is not a hard task.

Now you need not worry about the money you spend for clothes, food, rent or the theatre. You will spend it freely because you will know how much you can afford to spend.

The Ferrin Money Making System is a most practical gift to any newly married couple. Many people use them for Christmas gifts.

Send No Money

See how magically the Ferrin Money Making Account System works, no matter how much or how little your income. We know what you will think of it when you see it. So we are willing to send you the complete system without your sending us any money in advance. Just mail the coupon, and back will come the system by return mail. If you feel that you can afford *not* to have it, simply send it back and you will owe nothing.

But when you have seen what big returns the Ferrin System will pay you, you will surely want to keep this wonderful aid to money-making, especially as we are now making a special, short-time offer of only $3 for the complete system.

You will appreciate what a remarkable offer this is when you consider that other expense account hooks are sold for $3 and cover a period of only two years. The Ferrin Money Making Account Book covers four years, and therefore has twice the value, $6. And in addition you get the Ferrin Kitchen Calendar, the Ferrin Pocket Account Book, the Ferrin Investment and Insurance Register, the Ferrin Household Inventory and Fire Insurance Record, each worth 50c, or $2.00. You have the opportunity, therefore, of securing $8 value for only $3.

But we can make this special combination offer only for a limited time. We expect to place this System in one hundred thousand homes this year. We want your home to be one of them. You are therefore urged to mail the coupon now—to do so costs nothing and does not obligate you in any way, and it may be a revelation to you of how much more you can get out of your income.

READ!

Letter from Head of Financial Department of Largest Corporation of Its Kind in the United States.

Independent Corporation

Gentlemen:

I consider your account book a remarkable contribution to the people of this country at this time.

In our company we have 5000 employes and it was a revelation to me in giving them advice in regard to the making out of their income tax returns to find how few had any intelligent idea of their income and their living expenses.

The simplicity of your plan which by comparison with previous methods of account keeping would seem to be well-nigh automatic appeals to me strongly.

They say you can't teach an old dog new tricks, but I will say to you that I am going to use the Ferrin Book for my own family expenses, and consider it will make money for me right from the start.

(Signed) D. S. BURTON

FREE EXAMINATION COUPON

INDEPENDENT CORPORATION

Publishers of The Independent Weekly

Dept. F-11011 119 W. 40th St., N. Y.

Please send me the Ferrin Money Making Account System (the entire five books) for Free Examination. I will send you $3 in full payment within 5 days after receipt, or return the books.

Name .....

Address .....

..... El. Exp. 11-19

www.americanradiohistory.com



"THE 100% WIRELESS MAGAZINE"

Partial CONTENTS OF NOVEMBER ISSUE:

"Why I Am Opposed to Government Radio Control."
By Dr. Lee de Forest and G. W. Pickard

"Developing an Audion for the Amateur."
By E. T. Jones

"A 170-25000 Meter Receptor."
By Francis R. Pray

"Second Prize Award—Radio Contest."
"Junior Radio Course."
By W. A. Heppner, Associate Editor

"Audio Frequency Wireless Telephone."
By E. T. Jones

"Local Forecast—Stormy."
By Dorothy Kantro

"The Third Pill."
By J. K. Henney

"How Manufacturers Work 'Formica' and 'Bakelite.'"
By J. Stanley Brown

"Ideas—2nd Spasm."
By Thos. W. Benson

"Notes on Crystal Detectors."
By C. H. Byron

"Your 'Fist.'"
By C. H. Pfeiffer

"Destruction of the Brussels Station in 1914."
By Henry M. de Gallaix

What "Radio Amateur News" Is:

With its fifth issue RADIO AMATEUR NEWS holds the field undisputedly as the greatest radio magazine in print today. In point of circulation, number of articles, illustrations, RADIO AMATEUR NEWS now leads all other wireless magazines. Take for instance the November issue with its fifty-six pages; there were fifty-one separate purely radio articles and 112 illustrations. *Over twenty-seven thousand copies were printed and circulated.*

Each issue of the RADIO AMATEUR NEWS now contains 56 pages (or more) and an artistic cover in two colors. The illustrations average 125 every month and there are from 40 to 50 up-to-date articles, some by our biggest radio scientists, in every issue.

RADIO AMATEUR NEWS is the greatest and biggest radio magazine in print today.

RADIO AMATEUR NEWS is the only INDEPENDENT monthly wireless magazine in existence. It caters to no commercial interests—it has no boss save its readers. It is "different"—it has the latest radio news. It is a scientific magazine but it caters largely to the RADIO AMATEUR—it is by and for the Amateur. It is published by the publishers of the ELECTRICAL EXPERIMENTER, but there will be no duplication of articles in the two magazines. Both are entirely different—but both together will give you ALL the radio news of all the world. Whether you are a professor or an Amateur, get a sample copy or order it from your Newsdealer today.

Junior Radio Course

A distinctly new feature began with the September issue in our new **Junior Radio Course.** In the November issue Lesson No. 3 appears complete. This course is intended for the beginner and everything presented will be in plain English—even the merest tyro in radio will find no trouble in understanding and assimilating the knowledge. The series is a very important one and nothing like it has ever appeared in print before. Everyone owes it to himself in this new age to know something about wireless and this course will enlighten all laymen. Profusely illustrated with pictures that anyone can understand.

15c
The Copy
$1.50
A Year
Canada and Foreign
$2.00 A Year

SEND 15c FOR SAMPLE COPY TODAY

56 PAGES
125 ILLUSTRATIONS

SPECIAL OFFER

Gentlemen:

Please enter my subscription for RADIO AMATEUR NEWS for the term of one year for which I enclose herewith $1.50. For this you will send to me immediately your great Wireless Course, containing 160 pages. 350 illustrations, size 6¾ x 10" with fine flexible cloth cover. I have added 5c extra for postage. (I have written my name and address in margin below.)

EXPERIMENTER PUB. CO., 231 Fulton St., New York City

www.americanradiohistory.com



Learn Electricity —the New Way

IT'S no longer necessary to go to school or serve an apprenticeship to learn electricity. With this new library of APPLIED PRACTICAL ELECTRICITY you learn right at home—in your spare time without interfering with your present work.

Any big job that you want in the electrical field is yours if you will train yourself to fill it. It only takes an hour or two a day with these books.

This is the 1920 edition—new from cover to cover—chuck full of the latest methods and most recent discoveries in this fascinating field. Everything is written in plain, good old U. S. language by 27 of the greatest experts in the business. The eight volumes with 3800 pages make up a complete course in electrical engineering. It's a home study course for the beginner and a handy reference guide for the expert combined.

Big Pay for Trained Men Jobs paying $1500.00 to $5000.00 a year are waiting for men who can qualify as Electrical Engineers—Substation Operators—Troublemen—Switchboard Operators—Dynamo Tenders—Electricians. Electricity is the greatest force in the world and it is growing bigger and bigger every day. More and more men are needed all the time. Why don't you get into this big paying field now?

Good Jobs Are Waiting If you are trained in some branch of electricity you will never have to look for a job. The job and the big pay will be looking for you. You can't dodge a good job if you have the "know how" under your hat. Let these 27 great engineers help you to the best kind of job with their books.

Send the coupon below and get them for FREE examination. See our free offer below.

What the Books Teach Elements of Electricity—Electrical Measurements—Electric Wiring—Underwriter's Electrical Requirements—Theory, Calculation, Design and Construction of Direct Current Generators and Motors—Types of Generators and Motors—Management of Electrical Machinery—Electric Lighting—Alternating Current Machinery—Power Transmission—Electric Railways—Self-Propelled Railway Cars—Trackless Trolley—Power Stations—Switchboards and Switching—Storage Batteries—Applied Electro-chemistry—Electric Elevators—Electric Welding and Heating—Wireless Telegraphy and Telephony—Land and Submarine Telegraphy.

The World's Greatest Electrical Books LOANED to You FREE

We will lend you this wonderful library to use in your own home or shop a whole week FREE. It won't cost you one cent. DON'T SEND ANY MONEY. Just fill out and mail the coupon today and the set of eight volumes will come to you by express collect. You be the judge and find out for yourself what the books will do for you. Use them as you please. Show them to your friends and get their opinion. Then if you have any doubt as to their value send them back at our expense and you won't owe us anything.

Free Service With every set of these great electrical books we give a one year membership in this society. This entitles you to consult our engineers and experts on any electrical problem. Write as often as you like. Ask as many question as you like for one year.

Only 7 Cents a Day

If you like the books after a week's examination you pay us only $2.00 and the same amount each month until $24.80 is paid. This is only 50 cents a week—7 cents a day. You can't afford to pass up a better job on these easy terms. MAIL THE COUPON NOW.

American Technical Society
Dept. E 258, CHICAGO

Coupon is All You Need— Send it Now

American Technical Society
Dept. E 258
Chicago, U. S. A.

Please send me the 8-volume set of Electrical Engineering for 7 days' examination, shipping charges collect. If I decide to buy I will send $2.00 within 7 days and balance at the rate of $2.00 a month until $24.80 has been paid. Then you will send me a receipt showing that the set of books and the Consulting Membership are mine and fully paid for. If I want to get along without the books, I will return them, after 7 days, at your expense.

Name.....

Address.....

Reference.....

www.americanradiohistory.com

PRINCE ALBERT

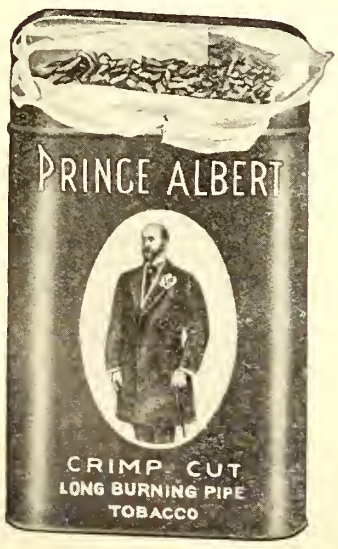
the national joy smoke



Copyright 1919 by
R. J. Reynolds Tobacco Co.

Awaiting your say-so, you'll find toppy red bags, tidy red tins, handsome pound and half-pound tin humidors — and — that classy, practical pound crystal glass humidor with sponge moistener top that keeps Prince Albert in such perfect condition!

R. J. Reynolds Tobacco Company
Winston-Salem, N. C.



P. A. has such a joy'us way of making men glad about jimmy pipes!

To shoot it quick:—Prince Albert turns over a new leaf in your smoke-career! Shovels smokesorrows right out the attic airshaft and throws wide open the smoke-section-shutters! Talk about letting in a flood of smoke-sunshine! Bet your pet luckystone that the best you ever heard tell about can't hold a candle *with what Prince Albert will hand you* seven days out of every week! And, then, some-on-the-side!

Smoking Prince Albert is just about twins with having the top time of your life on each fire-up! *It gives you a brand new idea of how delightful a pipe smoke really can be!* Such flavor and fragrance and coolness; such freedom from bite and parch! Prove personally that Prince Albert's exclusive patented process *really does cut out bite and parch!*

Talk about ringing the bell every time you take *just one more little smoke!* You'll agree with your old fellow citizen, General Approval, that Prince Albert puts a man on the firing line with a jimmy pipe, *and keeps him there;* that it sends all previous smoke setto records to the rear-ranks; that it just slams in one good time on top of another so fast, so happy-like, you realize that heretofore you've been hunting regular-man-sport with the wrong ammunition!

www.americanradiohistory.com
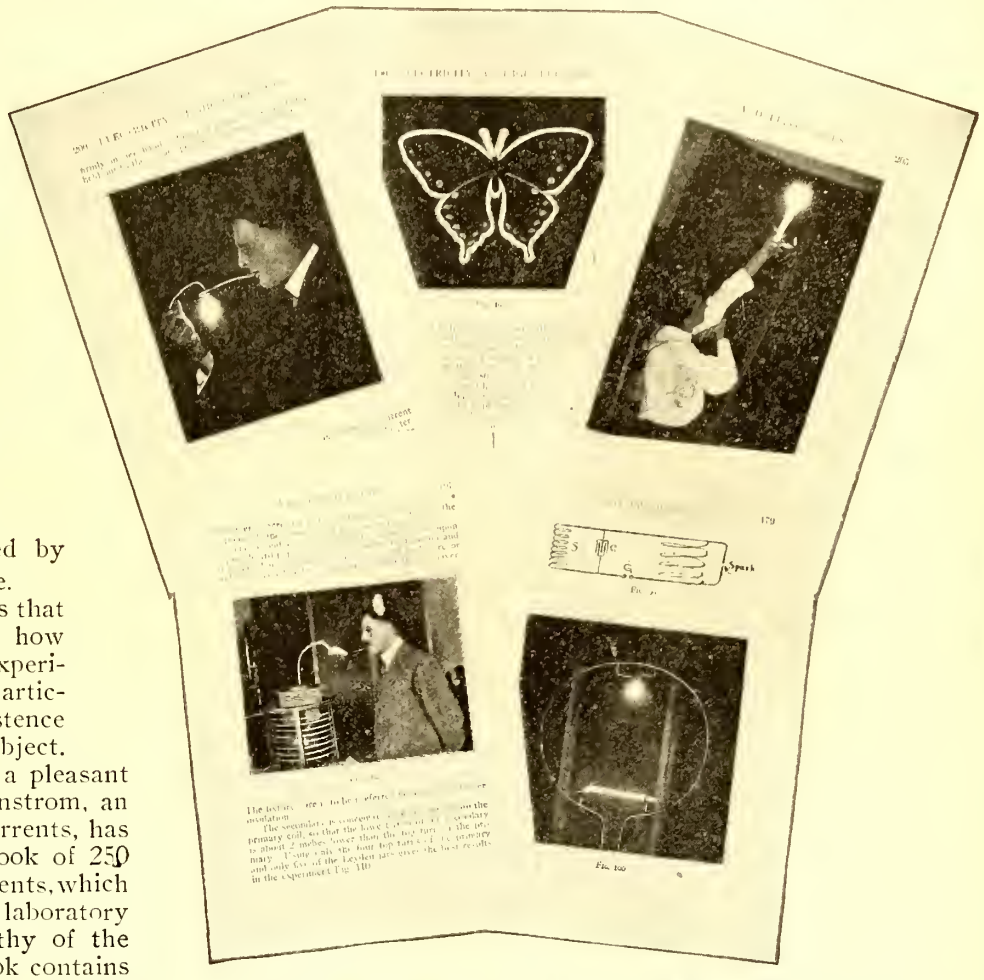
Spectacular Tesla Experiments

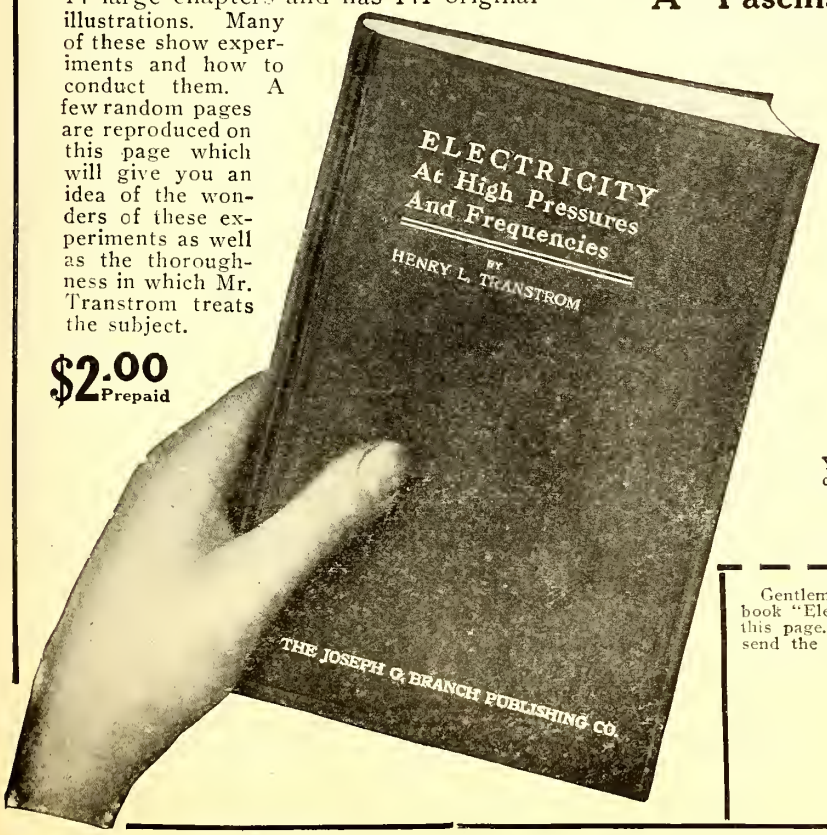
High Frequency Currents

There is possibly no more fascinating branch of the electrical art than the high frequency currents or electricity at high pressures and frequencies. The subject is one that fascinates every student of electricity. Moreover these most wonderful experiments can be performed by anyone at but small expense.

The trouble in the past was that very little has been printed how to actually conduct these experiments outside of magazine articles. Few books are in existence today that treat on the subject.

It will therefore come as a pleasant surprise that Henry L. Transtrom, an expert on high frequency currents, has written a comprehensible book of 250 pages on high frequency currents, which we know will be in every laboratory of every experimenter worthy of the name. Mr. Transtrom's book contains 14 large chapters and has 141 original illustrations. Many of these show experiments and how to conduct them. A few random pages are reproduced on this page which will give you an idea of the wonders of these experiments as well as the thoroughness in which Mr. Transtrom treats the subject.





$2.00 Prepaid

A Fascinating Book that EVERY Experimenter Needs

The book itself is very cleverly written, explaining all the fundamentals of high frequency currents, devoid of any obtruse mathematics and technicalities, which would only hamper the average student

The fundamentals of high frequency currents are carefully explained, so that the student will have a good insight into this fascinating art.

The book itself is bound in blue linen and measures 7½ x 5½ inches.

Order Your Copy To-day

You can not afford to be without this book. Fill in the coupon today and the book will be sent to you prepaid at once

The Jos. G. Branch Publishing Co.,
Dept. EE, 542 S. Dearborn St., Chicago, Ill.

Gentlemen:—Please send me at once your Mr. Henry L. Transtrom's book "Electricity at High Pressures and Frequencies" as described on this page. I enclose herewith value of $2.00, for which you are to send the book prepaid at once.

Name.....

Address.....

City.....

State.....

www.americanradiohistory.com



Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 5,500 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Special Automobile Ignition Course

We have just installed a special automobile ignition course for auto mechanics, garage men and owners. The course covers completely ignition, starting, lighting and other electrical equipment in connection with automobiles, motor boats, etc.

Let us explain our complete courses to you in person. If you can't call, send now for 64-page book—it's FREE to you.

New York Electrical School
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

.....(NAME)

.....(ADDRESS)

New York Electrical School

29 West 17th Street, New York

www.americanradiohistory.com

ELECTRICAL EXPERIMENTER

H. GERNSBACK – EDITOR
H. W. SECOR – ASSOCIATE EDITOR

Vol. VII. Whole No. 79 NOVEMBER, 1919 No. 7

DEC 18 1919

NEW ARC RIVALS SUNLIGHT

Moving Picture Photography Obtains Remarkable Results Thru the Use of 100,000 Candle-Power Arc

UTILIZING arcs for the taking of motion pictures and for general illumination in theaters has long been possible. However, the old style arcs consumed too much current, and did not meet the demands of the photoplay producers. This new "sunlight arc," however, is superior to anything yet produced along the line of illumination, inasmuch as one single unit will give the same amount and better illumination than the sixteen units which are now used in producing a photoplay. By its use photographs may be taken by day or night, and the same effect obtained as if the sun were shining brightly. In proof of this, one of the accompanying photographs is of Marguerite Clark, the famous moving picture actress, enjoying the beautiful "sunlight," thanks to the Sunlight Arc which made this possible.

The Sunlight Arc is a mechanism arranged in such a manner that an operator can handle several arcs at the same time, unless it is necessary to shift them constantly. The arc itself consists of a positive carbon of special composition, which is rotated by a motor, and a negative carbon, which is likewise of special composition. When a 24-inch parabolic mirror is used in order to throw a *spot-light*, the extent of the beam spread may be adjusted to wide limits; in other words, the beam can be made to cover a distance of 130 degrees, and by moving the lamp arcs, in respect to the reflector, this tremendously strong flood-light, which can be used for interiors of ball-rooms and the larger stage sets, can be narrowed down to three degrees. The maximum candle-power of each beam is 120,000,000. This beam has been photographed while passing thru the air, and has been used to wonderful advantage in producing fog, moon and sunbeam effects. Motion pictures have been taken with this lamp, *one-fourth mile away*, shining upon the scene of action. If the ground glass and iris diafram are used, and the diafram is stopt way down and then gradually opened so as to form one of those fade-in pictures in which the head of the person is first seen, the picture then gradually developing itself, the illumination from the smallest opening to the largest is absolutely equivalent; in other words, there is no change whatever in the intensity of illumination as the stop is opened. One very re

(Continued on page 696)

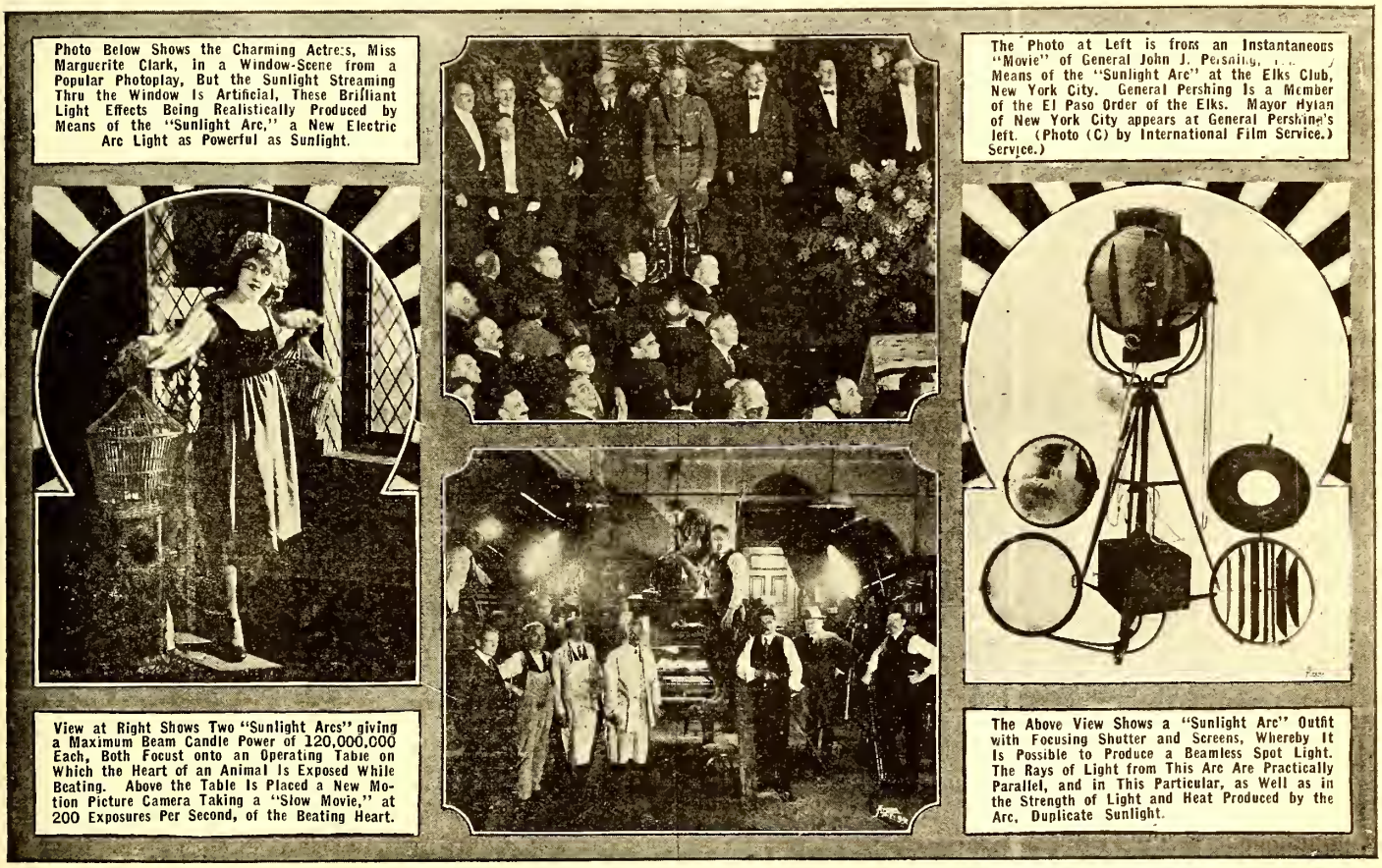


Photo Below Shows the Charming Actress, Miss Marguerite Clark, in a Window-Scene from a Popular Photoplay, But the Sunlight Streaming Thru the Window Is Artificial, These Brilliant Light Effects Being Realistically Produced by Means of the "Sunlight Arc," a New Electric Arc Light as Powerful as Sunlight.

The Photo at Left is from an Instantaneous "Movie" of General John J. Pershing, ... Means of the "Sunlight Arc" at the Elks Club, New York City. General Pershing Is a Member of the El Paso Order of the Elks. Mayor Hylan of New York City appears at General Pershing's left. (Photo (C) by International Film Service.)

View at Right Shows Two "Sunlight Arcs" giving a Maximum Beam Candle Power of 120,000,000 Each, Both Focust onto an Operating Table on Which the Heart of an Animal Is Exposed While Beating. Above the Table Is Placed a New Motion Picture Camera Taking a "Slow Movie," at 200 Exposures Per Second, of the Beating Heart.

The Above View Shows a "Sunlight Arc" Outfit with Focusing Shutter and Screens, Whereby It Is Possible to Produce a Beamless Spot Light. The Rays of Light from This Arc Are Practically Parallel, and in This Particular, as Well as in the Strength of Light and Heat Produced by the Arc, Duplicate Sunlight.

www.americanradiohistory.com

The Eiffel Tower Illuminated



Photo—France-America Corporation

The Famous "Eiffel Tower" in Paris, France, Illuminated on the Night of the Bastile Parade, and Forming a Veritable Blazing Torch of Liberty and Victory, 1,000 Feet in Height.

The accompanying photo shows something of interest to all Americans, especially at this time when the bonds of friendship and patriotism between the two great republics—La République Française and the United States of America—is many times stronger than it ever was previously. This photograph shows the sky-piercing *Eiffel Tower*, one of the greatest engineering masterpieces in all Europe, illuminated at night and forming veritably a blazing torch of liberty and victory, nearly 1,000 feet in height. The illumination here shown occurred on the night of the Bastile parade in Paris. The gigantic steel structure of the Eiffel Tower was illuminated by thousands of lamps, both of the incandescent and arc type, and due to the rays of light shining thru the steel work, a very beautiful and inspiring sight was the result. It represents, when illuminated, undoubtedly one of the finest examples of modern engineering in Europe, even in the world.

How would you have liked to have been in Paris the night peace was signed, the day—*le jour de la victoire?* You can bet your last dollar you would, for nobody can beat the French when it comes to entertaining and enjoying themselves. Take it from an ex-marine, who told the writer a short time ago that he never saw anything like it in his career. The American, French, Belgian, Italian and British soldiers hauled the great camouflaged German field guns down the boulevards while the French mademoiselles mounted the gun barrels. Searchlights flashed across the sky until it was as bright as day. The restaurants and cafés were illuminated as never before, and believe the story, friends, of one of your own all-American "devildogs"—the French cognac ran up hill and down again. They say liquids never run up hill, but this was a night of exceptions.

Contributed by LUTHER YOUNG.

Sun Signals for Fighting Forest Fires

By Frank C. Perkins

THE accompanying illustration shows the heliograph used by the Forest Service lookouts for sending sunlight signals in fighting forest fires.

Herbert A. Smith, Editor of the *Forester* of the U. S. Department of Agriculture, states that the heliograph is ordinarily used only at stations where telephone communication is impracticable and that its great value consists in establishing a system of communication with isolated forest fire "lookouts" on the tops of high mountains where the expense of building telephone lines would be prohibitory.

These lookout stations are used by the Forest Service to detect forest fires. They are placed on the tops of the highest peaks and during the fire season are occupied constantly by trained observers. Each "lookout man" has before him the best obtainable map of the surrounding country, on which the exact location of his station is shown. Around the point representing the station there is a circle graduated in 360 degrees. When a smoke is seen the lookout man ascertains its exact bearing upon his station and at once gets into communication with headquarters. Every effort is made to have at least two lookout points overlook the same section of country, and consequently it is usually possible to ascertain almost the exact location of a fire by the intersection of angles.

It is, of course, highly important that the lookout points be kept in close touch with headquarters, since success in fire-fighting depends largely on getting at the fire while it is small. For this reason the heliograph is not altogether satisfactory, because it can be used only on sunny days, and is of no use during cloudy weather or at night.

Attention is called to the fact that the heliograph instrument as a means of communication has been used for a great many years, but its use has been almost entirely restricted to the Army. Interesting and successful experiments, however, were recently conducted by the United States For-

(Continued on page 703)



Science on the Mountain Tops—The Telephone and Heliograph or "Sun Mirror," Used in Signaling the News of Forest Fires in Our Great Timber Sections of the West and Northwest.

www.americanradiohistory.com

Married by Radiophone While Flying

"I DO"—answered the blushing bride, by wireless telephone, as she flew thru the air, piloted by her newly acquired husband.

Fifteen hundred feet above Sheepshead Bay Speedway Park, the two airplanes circled together slowly, like bird mates. On the ground below 200,000 people watched them and listened to the droning of large megaphones attached to the ground station of a wireless telephone. At 5:40 o'clock a woman's voice was transmitted to them and her words were, "I do." The first aerial wedding ceremony had been performed.

Miss Emily Schaeffer of Sea Gate, L. I., and Lt. George Burgess of Brooklyn, N. Y., were the principals in the ceremony that featured the second of the two Police Field Days recently held at Sheepshead Bay, near New York City. They flew in a plane piloted by the groom, who is an aviator attached to the Mineola forces. In the second plane the Rev. Alexander Wouters of the Edgewood Dutch Reformed Church, the first real "sky pilot," flew, with Lt. Eugene Barksdale, the best man, as pilot. A long streamer of bunting indicated the bride's plane.

The two planes rose from the inclosure of the speedway at 5:10 o'clock, each being supplied with a wireless telephone transmitting and receiving outfit. In front of the grandstand was a third station, at which Miss Doris K. Schob, the bridesmaid, sat. Extensions carried receivers to other members of the bridal party, Mrs. Katherine Schaeffer, mother of the bride; Mr. and Mrs. Andrew Mills, Sgt. William B. Stewart, U. S. M. C., and others. A fourth station connected with amplifying 'phones distributed among the boxes.

At 5:25 o'clock the 'planes had reached 1,500 feet altitude, and began to circle above the field. The wireless telephone began to talk.

"Station 3, can you hear me?" asked the groom of the minister's machine.

"Station 1 is O. K.," responded Lt. Barksdale, speaking for Dr. Wouters.

"Hello, Dr. Wouters," spoke the groom, "we are now ready."

"Hello, George," came again from the best man. Speak to Dr. Wouters."

"Dr. Wouters, we are ready for the ceremony," replied Lt. Burgess.

Without further conversation, Dr. Wouters began to read the ceremony from the Common Prayer. The voices came distinctly to the telephone listeners on the ground, and every response from the couple was carried clearly to the section of the boxes immediately adjacent to Gov. Smith's box.

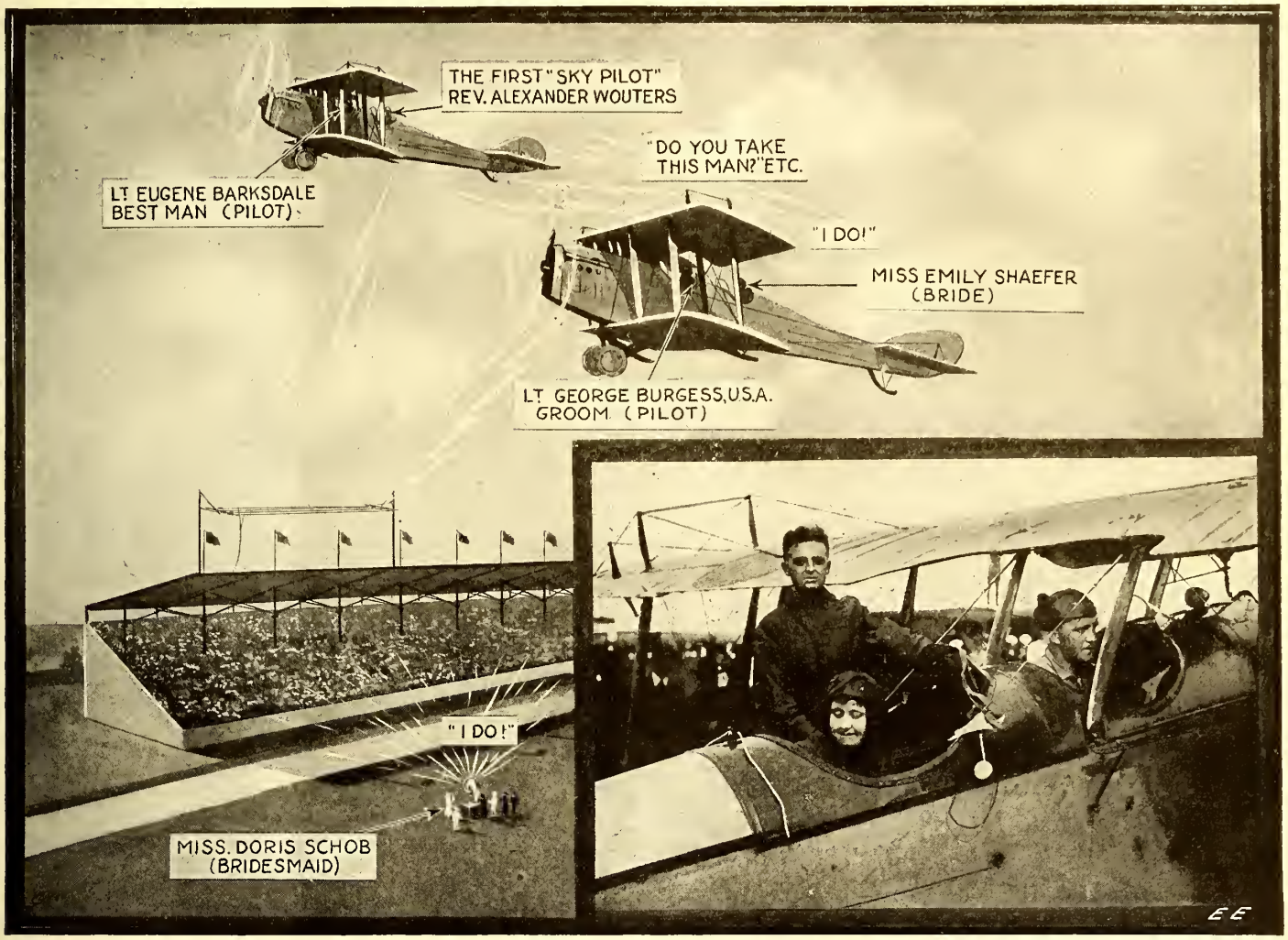
At 5:40 o'clock Dr. Wouters' voice came: "Do you take George Burgess to be your lawful wedded husband?"

The bride responded: "I do," and a cheer arose from the enormous throng that must have reached the two planes. "I pronounce you to be man and wife," said Dr. Wouters. Then followed a prayer and finally—"Amen." Then congratulations and responses between the two planes were passed, mostly unintelligible to the listening congregation. Then silence.

"We are coming down," called the 'planes to the ground station.

Circling slowly, lower and lower, the two planes, now escorted by two more, past over the grandstand twice and each time they were greeted with applause and a sea of waving hats and hands. From the 'plane with the streamers, a white-gloved hand waved its greeting to the ground. Then the 'planes glided to the field, and Lt. and Mrs. George Burgess stept out and awaited the congratulations of Dr. Wouters and Lt. Barksdale.

Then, for the third time, the bridal party, now riding in automobiles, past the stands while the Police Band played the wedding march.



Copyright, 1919, by E. P. Co. Photo (C) by Underwood & Underwood

Lt. George Burgess and Miss Emily K. Schaefer, the First Couple to Be Married in Air. The Ceremony Was Performed by Chaplain Alexander Wouters Who Was Flying in Another Plane. The Ceremony Was Conducted by Wireless Telephone. The Wedding Was the Feature of the Police Field Day Meet at Sheepshead Bay Speedway, near New York City.

www.americanradiohistory.com

The Electrically Driven U. S. S. New Mexico

By Brewster S. Beach

I RECENTLY paid a visit to the battleship *New Mexico,* which is one of the latest dreadnoughts to join the fleet and the first and only one of any nation to have *electrically operated* propelling machinery" said Josephus Daniels, Secretary of the Navy, in recent testimony before a congressional committee. "On this account she has been an object of surpassing interest to the officers of our own navy and to those of foreign navies as well, and to electrical engineers in general.

"The result was satisfactory from every point of view and confirmed the judgment of all who were in any way concerned in its design and adoption. There was not the slightest mishap with any part of it, everything worked to perfection, and the crew was as enthusiastic over the performance of the machinery as is the department proud in the possession of such an efficient dreadnought.

"When we entered into contract for the machinery of the *New Mexico,* we stipulated that, in addition to being capable of developing the maximum power, she should also give an economy at cruising speed very much superior to that obtainable with the turbine installations that we had previously used, and I am happy to say that this stringent requirement was also met. As a matter of fact, the *New Mexico* will steam at 10 knots on less fuel than the best turbine-driven ship that preceded her.

"On the whole, I think the country has cause to be proud of this achievement in engineering not alone because of the pronounced success in this particular instance, but because of the assurance it gives us of the superiority of our capital ships to those of foreign nations."

Secretary Daniels' expressions noted above, have served to create of late considerable interest in the electrical propulsion of ships. Altho the subject has been discussed widely in the technical press for several years, no popular explanation of this invention has appeared.

One of the oldest practical examples of the electrically propelled vessel in this country is to be found in the fire boats of the city of Chicago, Ill., where the first boat was equipt in 1908. Chicago was the first municipality to accept the theory of electric drive for boats of this class.

Now the popular mind, no doubt, conceives an electric ship as like an electric automobile or truck—something that stores the energy necessary to its operation, carries it along and draws upon it as occasion may demand.

But this is not so. It may, therefore, be of interest to explain briefly what an electric ship really is.

WHAT Secretary of the Navy Josephus Daniels Thinks of the Electrically Driven U. S. S. "New Mexico"

WHAT AN ELECTRICAL SHIP IS.

In the first place, electric current must be generated within the ship in order that this energy may be put to its proper use in propelling the vessel.

The current is usually produced by a steam turbine which turns a generator. The apparatus is called a *turbo-generator* and this unit together with the usual engine room auxiliaries constitutes the power plant. The electric current thus generated is led thru copper cables and suitable control apparatus to electric motors and it is these motors which actually drive the propellers of the ship. Thus electricity acts as a connecting link between the steam or other motive force and the propellers. The internal combustion engine, which is somewhat similar to ordinary gasoline engine, is also coming into prominence as a power for the generation of electricity. This apparatus, whether it be a steam turbine or an oil engine, is called the *prime mover.*

The question, "What is a steam turbine?" may well be asked at this point. Conceive an enclosed water-wheel with steam playing against the paddles instead of water and you have a simple elementary idea of what a turbine is and how it operates.

NO MECHANICAL GEARS.

Next, there need be no gears in the electrically driven ship. The function usually performed by gears (that is, to make a connection between the turbine, which to be efficient must revolve at a relatively high speed, and the propeller, which to be also efficient must rotate relatively slowly) is accomplished electrically, thus permitting both turbine and propeller to operate at high efficiency.

Just as in the automobile it is desirable to "shift gears," it is also desirable at times to accomplish the same result on board ship, though not necessarily for the same reason.

Electricity lends itself admirably to effecting these changes, whereas no practical means has yet been found to accomplish this mechanically in large ships.

In addition to this factor, electric drive has appealed especially to naval men from a military point of view.

NAVAL ADVANTAGES OF ELECTRIC DRIVE.

The primary naval advantage of the electric ship, as recently pointed out by Commander S. M. Robinson, U. S. N., rests on the ability to arrange the propelling machinery in a number of separate watertight compartments thruout the ship placed near the center so that they may be protected from damage due to torpedo attack, shell fire, grounding, collision, etc.

The U. S. S. battleship *New Mexico* weighs 32,000 tons and requires 28,000 H. P. —nearly one H. P. for every ton of weight.

She is of the oil burning type with a total oil capacity of 3,400 tons, or 6,800,000 pounds, or about one million gallons.

The oil burners heat nine steam boilers, each of which can deliver 4,000 H. P. at a pressure of 250 lbs. to the square inch. The steam from these boilers operates two turbo-generators which constitute the power plant, each capable of producing 14,000 H. P. The current generated from the turbines operates 4 motors—one for each propeller. The motors are twelve feet in diameter. They are operated from a central switchboard or control station, where the engineers, on receipt of instructions from the ship's bridge, can start the ship forward, or backward, run the propellers at different speeds in either direction. They can run all four motors from one turbo-generator or they can run the two port motors from one generator and the two starboard motors from the other generator.

If one of the propellers breaks down, by simply disconnecting the motor circuit, the power of the two power plants can be used to operate the remaining three propellers. There are only a few of the various combinations of control and operation which form one of the main features of the electric ship.

Among other battleships being equipt with electric drive are the *California, Tennessee, Maryland, West Virginia, Colorado* and *Washington.*

The large calibre guns of the *New Mexico* are fired by electricity; ammunition is hoisted from the magazines by electric motors and some of the guns are loaded by electricity.

The ponderous rudder is moved into any desirel position by the simple turn of a controller on the navigating bridge, which sets in motion machinery in the hold of the vessel for this purpose. There are several steering stations located in various parts of the ship where this operation may be performed in case one station should be disabled. In all, there are five different ways of steering the *New Mexico,* one of which is the hand method, *which requires the exertions of six men.* Think of it!

The ventilation and heating of the ship is by air—cold air forced into the vessel in warm weather and hot air during the winter months. The air is forced thru pipes by blowers operated by electric motors.

There is a completely equipt electric carpenter shop, machine shop, foundry, laundry, hospital operating room, and bakery where bread is baked in electrically heated ovens, while the galley or kitchen is steam operated, the ranges burn oil instead of coal, and there are big steam pots for heating.—*Photos courtesy of General Electric Company.*

For "December"

"Flash and Sound Ranging with the A. E. F." Special feature article written by army officer in charge of this work. By Col. Augustus Trowbridge, Professor of Physics, Princeton University.

"The Helicopter or Vertically Rising Airplane." It stays stationary in the air. Special article by the inventor of a successful helicopter—W. J. Beach.

"The Human Aerial Rocket." A sky rocket that carries passengers.

"Magnetic Storms." Did you know that wind, sunset, et cetera, affect the magnetic compass? Interestingly told by Prof. Lindley M. Pyle, of Washington University.

What Atomic Forces Could Do. The inconceivable power locked up in the atom. Illustrated by diagram and picture.

Is There a Sub-Electron? By Rogers D. Rusk, M. A. A scientific conjecture of timely interest.

Rochelle Salt Crystals Talk. Special article by the scientist that accomplished the trick.

Submarines Raise Sunken Ships. By George Wall. An original and novel scheme for salvaging the hundreds of vessels sunk by the piratical U-boats.

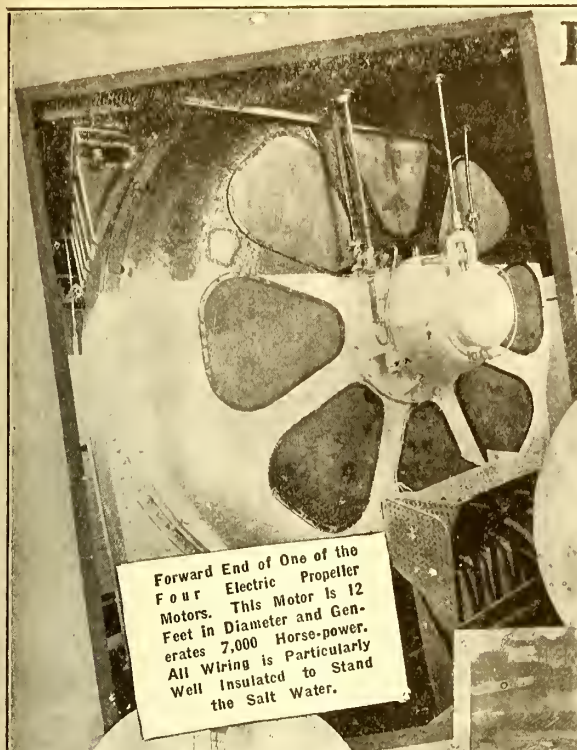
Guiding Vessels Thru Fog and Darkness by Electrified Cable. The remarkable invention of a California genius—Earl S. Hanson.

Electrical Tricks of Stage-Craft. By H. Winfield Secor. A score of stage secrets which you have pondered over are here illustrated and described.

The Moss Airplane Supercharger. It gives the engine the same power at 35,000 feet as at sea level. By Charles M. Ripley.

www.americanradiohistory.com

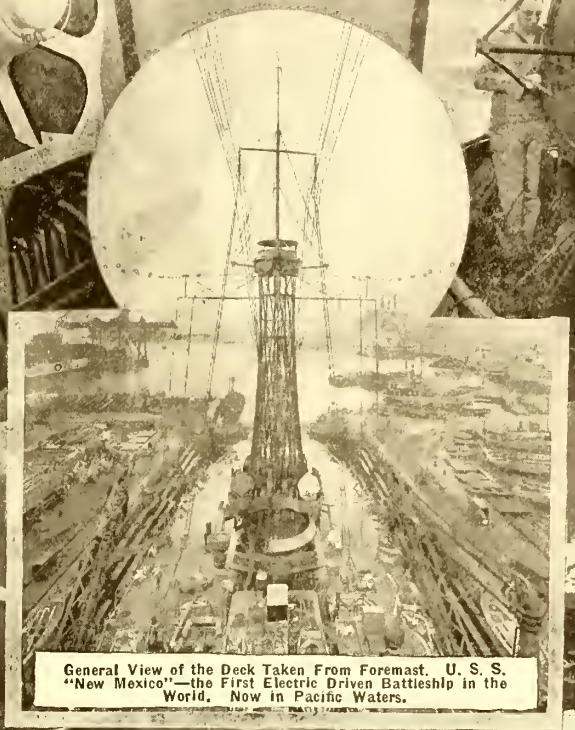
ELECTRIC DRIVE on U.S.S. NEW MEXICO



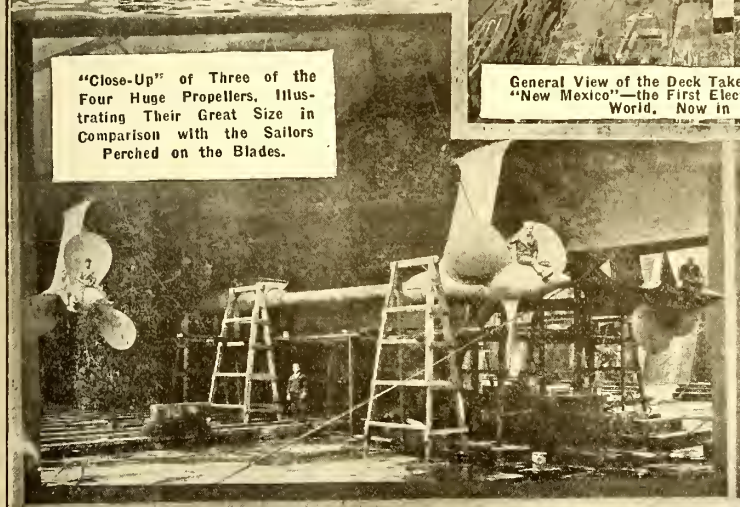
Forward End of One of the Four Electric Propeller Motors. This Motor Is 12 Feet in Diameter and Generates 7,000 Horse-power. All Wiring is Particularly Well Insulated to Stand the Salt Water.



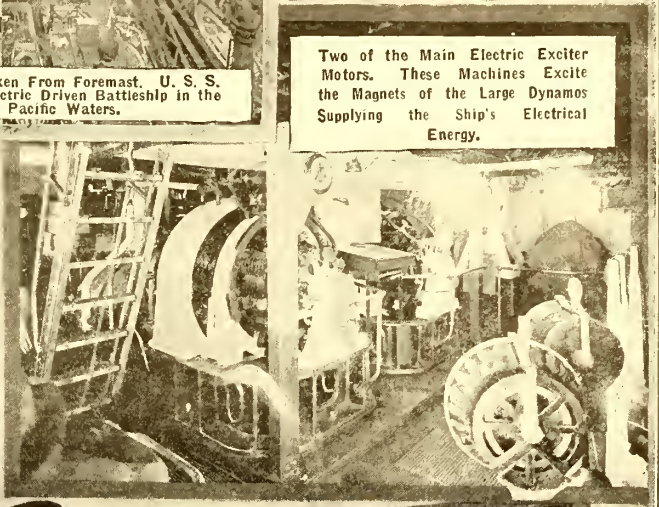
View of One of the Powerful Searchlights of the Ship—the Two Eyes of the Vessel Which Can See for Miles in Inky Darkness. This is One of Eight Similar Lights.



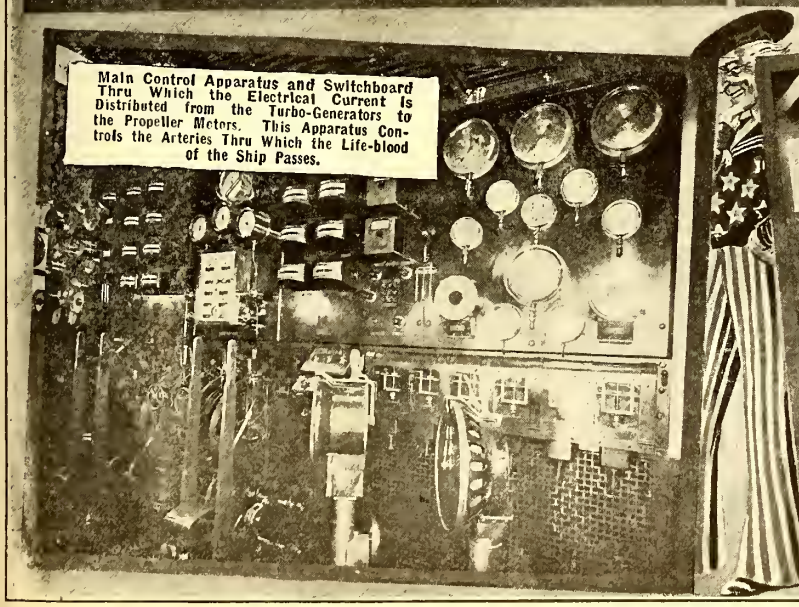
General View of the Deck Taken From Foremast. U. S. S. "New Mexico"—the First Electric Driven Battleship in the World. Now in Pacific Waters.



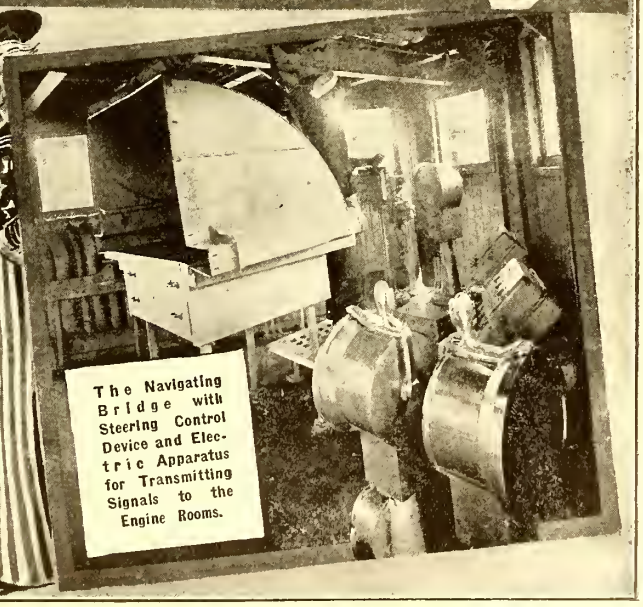
"Close-Up" of Three of the Four Huge Propellers, Illustrating Their Great Size in Comparison with the Sailors Perched on the Blades.



Two of the Main Electric Exciter Motors. These Machines Excite the Magnets of the Large Dynamos Supplying the Ship's Electrical Energy.



Main Control Apparatus and Switchboard Thru Which the Electrical Current Is Distributed from the Turbo-Generators to the Propeller Motors. This Apparatus Controls the Arteries Thru Which the Life-blood of the Ship Passes.



The Navigating Bridge with Steering Control Device and Electric Apparatus for Transmitting Signals to the Engine Rooms.

www.americanradiohistory.com

"Cold Fire"

By H. Gernsback

Charging the Body with High Frequency Currents.

EVER since Nikola Tesla began experimenting with the high frequency currents which bear his illustrious name, the world has stood aghast at the many and wonderful effects made possible only by his discoveries.

Most of our readers are no doubt familiar with nearly all high frequency "stunts," emanating either from the stage or from the laboratory, and not much that is new can be written upon the subject.

But not so long ago the writer, while waiting for an electric train out on Long Island, amusedly watched two boys who took turns in jumping upon a live third rail, carrying 500 volts. They would jump upon the rail with both feet at once, and then balanced themselves upon the rail. There is, of course, no danger to this as long as *both* feet are on the rail. One foot on the rail with the other foot on the ground means certain death. The explanation, as most of our readers know, is that when you stand on the rail with both feet, there is *no return circuit*. The body in this case takes on a charge of 500 volts, which, however, is not felt at all by the experimenter, the same as you are not conscious that over 14 pounds of weight are pressing down upon your body on every square inch of you at all times, due to atmospheric pressure.

This made the writer wonder what would happen if you stood on one pole of a very powerful Tesla coil. In a recent conversation with Dr. Nikola Tesla, the inventor pointed out that he had indeed performed many such experiments in his Colorado laboratory many years ago. The currents which he then used were far greater and higher than those produced anywhere now. Thousands of horsepower were used by him at that time. Dr. Tesla explained that he frequently stood upon one pole of his mastodonic coils while the full current was on. Of course, he had to stand upon a metallic plate, but he had to be careful so that no sparks jumped from his body to other objects or to the ceiling. This would have meant instant electrocution. Dr. Tesla pointed out that as the human body has a certain capacity, it radiated a good deal of energy into the surrounding air. Due to the tremendous current the sensation was anything but comfortable. The current heating the blood vessels raised the bodily temperature, and the experiment for this reason alone could not be extended for any great length of time. Dr. Tesla explained that during the experiment sparks and long spark-streams would envelop his entire body. At the extremities, elbows, knees, hip bones, nose, ears, etc., the spark display was most pronounced. Streams five to ten feet long would shoot out from the extremities with a crackling noise. Due to the exceedingly high frequencies used, however, the sparks did neither sting nor burn the flesh. Mr. Nikola Tesla's own words, his body, indeed, was enveloped in "cold fire." Dr. Tesla also explained that during the experiments his hair would rise on end, producing the same effect as if a large static machine had been used, with the well-known result, on the hair.

The other day we endeavored to repeat Dr. Tesla's experiments, and the illustrations shown here are the result. We called upon the Electrical Testing Laboratories of New York, who have one of the most powerful high frequency machines in the country. Altho but a pigmy alongside of Dr. Tesla's Colorado thunderers, the machine gives 500,000 volts and uses 20 kilowatts. The transformer is sunk into oil, and when the full load is on throws streams six to seven feet long. The noise of the tremendous sparks can be heard for blocks.



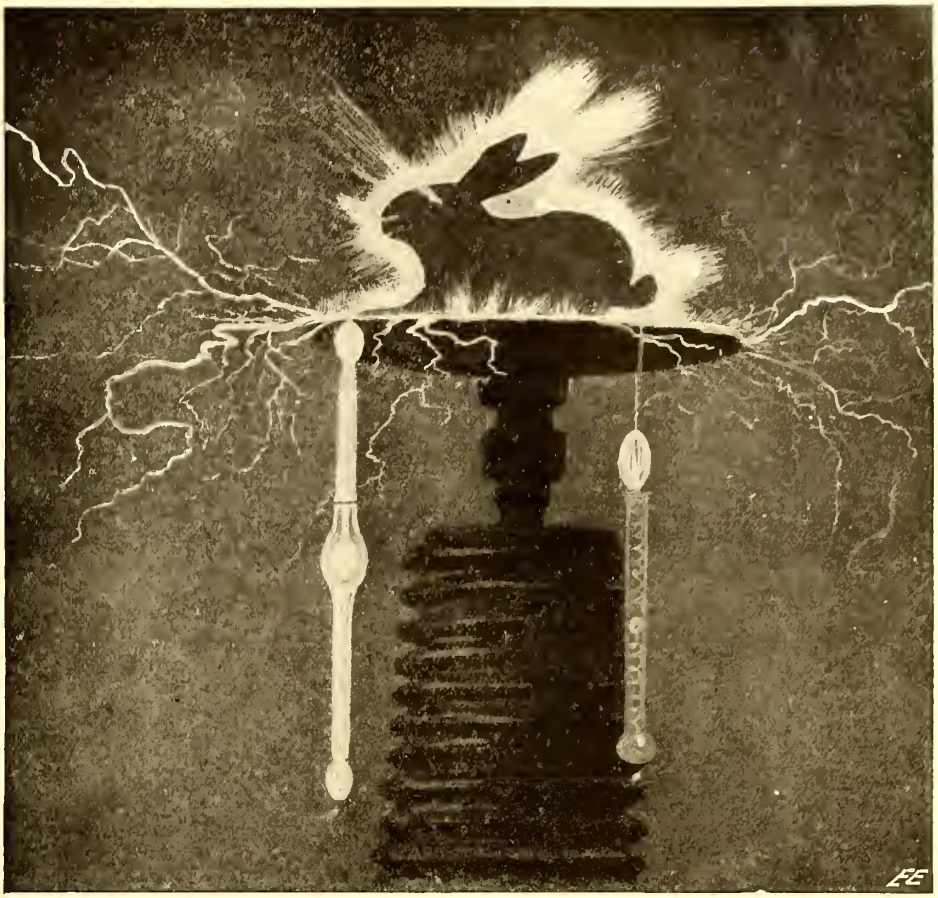
Fig. 1. A dry bath with "cold fire." Altho millions of volts are used in the process, this form of bath is quite pleasant. The currents throw off all dead skin, scale and dirt clinging to the skin. Besides the treatment is distinctly invigorating, leaving the skin rosy and all a-tingling. Every home will soon be equipt with a huge Tesla coil.

We first took a rabbit and placed him upon the metal plate of the "high" terminal of the transformer. At first he was much frightened and jumped off the plate at about 5 kilowatts. Long sparks had shot out from his nose and above his eyes and at the end of the ears. So the writer wetted the platform with water, because he thought that sparks might be jumping into the rabbit's belly and legs which insulated the fur part of his body, giving rise to stinging sparks. An improvement was seen immediately. The rabbit now held perfectly still for about 20 seconds, taking the full charge of 20 kilowatts at 500,000 volts. Long spark streamers, four or five feet long, shot from brer' rabbit's nose, ears and back, and, curious to note, immediately above the eyes. Here the sparks were so hot that they singed the hair. So the writer wetted the spots above the eyes, and after that the rabbit took the full charge, never moving once for twenty seconds at a time. See Fig. 2. Altho long streamers came principally from the nose, the photograph does not show it. After awhile the rabbit seemed to enjoy the performance, and right after his séance

www.americanradiohistory.com

he was as lively as ever, eating a big carrot at once. He is still well and about now.

We next wished to try a human being instead of the rabbit, but the management of the laboratory, due to possible danger, would not grant permission. It was explained that the frequency of the big machine was too low for the experiment, which had never been tried before on a human being, so we desisted. The photograph shown in Fig. 1 was made with a regulation Tesla coil of a very high frequency, but of comparatively low power. Only 1 K.W. was used. The subject, Mr. Joseph Kraus, field editor of this publication, experienced hardly any sensation worth mentioning. Only at the extremities, such as the ears and the nose, a slight prickling sensation, not at all uncomfortable, was felt. The feet were wetted with salt water to insure perfect contact.



Bre'r Rabbit taking a trifling 500,000 volts at 20 kilowatts, and liking it well, thank you! He held still for 20 seconds, only blinking once in awhile. He was not chained nor held down otherwise. "Movie" operators were at hand and filmed him, too. He is still alive, so Sis needn't worry that we killed him. Fig. 2.

And the value of these experiments? As Dr. Tesla points out, if these machines come into daily use, and duly invade our homes, it will be possible for us to have a dry bath, more sanitary and infinitely better than our present water baths. If the current conditions are right, the body will throw off scale, dead skin, dust and dirt particles, hurling them far from the body. For it should not be forgotten that Tesla currents travel mostly over the skin, ridding it of all impurities. But that is not all. The unquestioned therapeutical effects to the human body are of great value, not only to the muscles but to the entire nervous system. Tesla currents, by softening the arteries, make the old feel younger, and the young, younger and more aggressive. Women, particularly, should derive great benefits from their future high frequency dry baths.

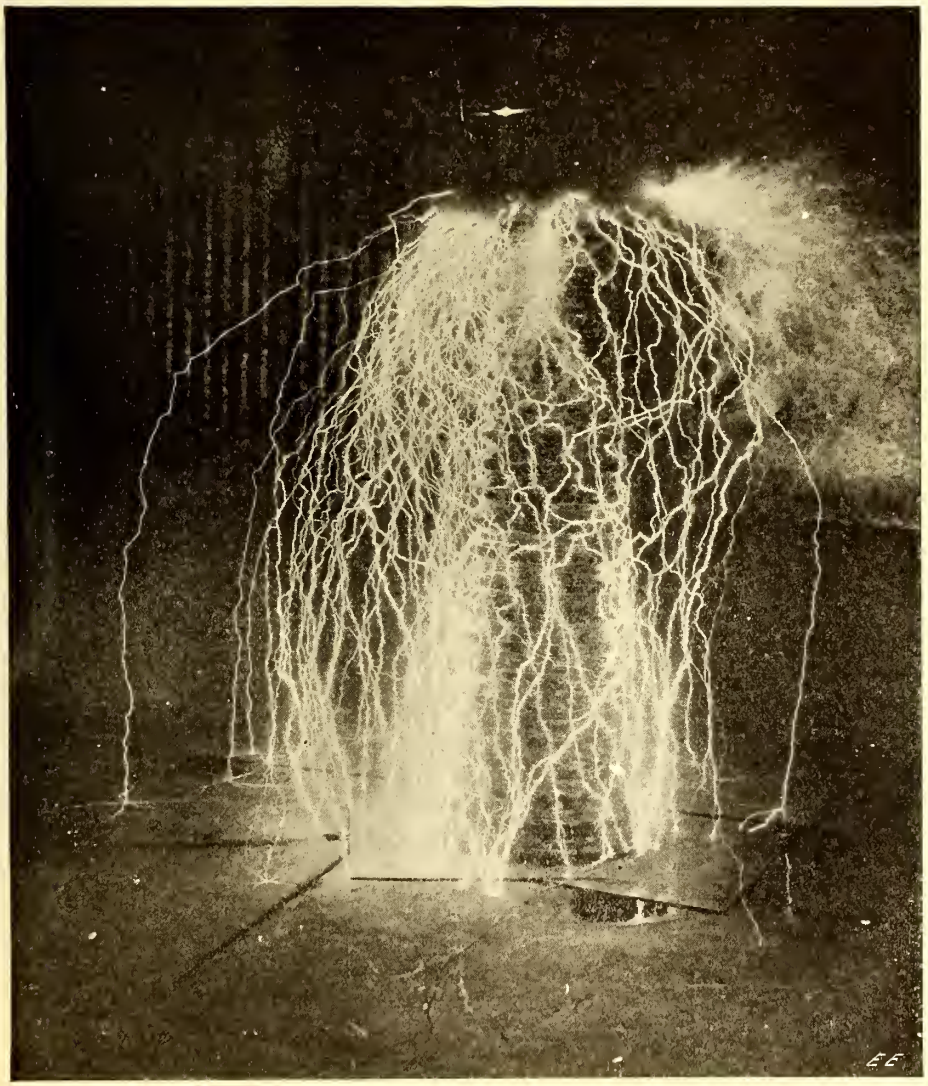


Fig. 3. This shows a wonderful corona and flash-over on a 37-inch porcelain pedestal insulator. This corona is occurring at a potential of 234,000 volts and 51,000 cycles per second.

Largest High Frequency Laboratory of the World.

The insulating of apparatus for voltages of from 100,000 to 150,000 at sustained frequencies varying from 15,000 to 500,000 cycles per second, such as used in radio telegraphy, is a far more difficult problem than that of insulating for the same voltages at "commercial" frequencies, such as 60 cycles per second.

To study this problem, the Federal Telegraph Company built at its plant at Palo Alto, California, a high voltage laboratory, in which it is possible to duplicate the high voltage and high frequency phenomena which have to be met with in operating a high power radio station.

The laboratory is unique in that it is capable of generating a potential *to earth* of a half a million volts, which is about as high as is obtainable in any of the 60-cycle high voltage laboratories of the country, and at the same time this voltage is generated at a sustained frequency of 50,000 to 100,000 cycles per second. Thus, this laboratory is the largest of its kind in the United States, and, as far as is known, the largest in the world.

Photograph No. 3 shows a corona and flash-over on a 37" porcelain pedestal

(Continued on page 709)

www.americanradiohistory.com

"ODD PHOTOS"

A MOVIE PHOTO THAT "RAN."

We have often heard of the "run" of motion pictures, but the brilliant phantasy gracing the top center of this group of "Odd Photos" is a motion photo that "ran" on one hot summer day in the Pathé film studios. It originally represented a scene from the "Isle of Jewels," a photo play of note, but this plate of a "still" view was overcome with the heat and so distorted the faces and forms of Stuart Holmes and Frances Mann that they now look most grotesque. The effect was produced by accident, of course, the emulsion on the plate having become distorted, due to trying to force rapid drying by artificial heat, before the photographer caught it, "freezing" the graceful forms of the actors in the poses here portrayed.

This is liable to happen to those who indulge in an overdose of 2.75 Bock. This is what the editors would call an "Ideal" type of "Odd Photo." So all those interested in our "Odd Photo" contest take notice, that what we desire is novelty, snap and something different!

IS SHE TRIPLETS?

Triplets? No! Just one girl having her picture taken three times on the same plate. The black background turns the trick.

Contributed by A. J. VIKEN.

A REAL GHOST PHOTO?

The accompanying *ghost plate* was produced to convince a steadfast believer in spiritualism that photos of ghosts were not genuine, but only fakes, easily produced by making double exposure using a black background.

The lady in the picture by posing as both ghost and a living person in the same photo succeeded in convincing a lady friend that photos of ghosts are not always what they seem!

Contributed by A. J. VIKEN

TORPEDO TUBE IN FRONT OF MUSEUM.

This clever superimposed or double exposure photo shows two of Uncle Sam's blue-jackets mounting a full-size, honest-to-goodness torpedo tube, and right in front of the New York Museum of Art—the naughty boys. Old "Pop Knickerbocker" sure will be sore when he finds it out.

Contributed by F. E. ZIESSE.

PAUL BRAS IS "2" ELECTRICIANS, ALREADY YET.

Herewith is a photo for your "Odd Photo" contest. Although it has nothing to do directly with electricity, it is odd. This is a photo of an electrician, or rather two of him, in front of a switchboard. It is a double exposure, of course.

Contributed by PAUL BRAS.

A NOVEL "LIGHTNING" PHOTO.

I am sending you herewith a photo for your "Odd Photo" contest. It shows a great forked "ribbon" lightning discharge which was a very pretty sight. It seemed to start in the lower right-hand corner of the picture and streamed upward, splitting into three very brilliant and several less brilliant "ribbons."

Contributed by A. J. VIKEN.

STANDING ON THE "3RD RAIL."

The picture, as you will see, shows two boys standing on a "live" third rail, which proves that as long as a person stands on the rail with both feet at the *same* time they cannot be harmed unless they place one foot on the ground and the other on the rail, which causes a circuit, thus killing or severely shocking the person.

Contributed by EDWARD HINES.

THE "ELECTRIC TOP" AT NIGHT.

I herewith submit an "Odd Photo." I took this photo while out at Riverview in Chicago. It is a picture of "The Top" at night. It was a time exposure. It is the same "Top" that you described in one of your back numbers of the ELECTRICAL EXPERIMENTER.

Contributed by ROBT. H. FREEMAN.

Cheesit! Willie! The Electric Spanker

It's kind of rough on Willie to tip off his dad this way, but news is news and it's got to be printed.

Next time Willie smashes the neighbor's kid on the nose, or sticks a surreptitious finger in father's wallet, or chucks the cat in sister's bath, he's in for it. He can't go out and brag to the gang.

"Shucks," says Willie, "I don't care. The old man will take me to the woodshed and massage me with his palm, and then he'll get tired and let me go."

The "old man" will give Willie the walloping of his young life, but he won't have a streak of red on an overexerted palm when the woodshed dialogue is done. For dad will merely thumb a button on the wall, tie Willie in a chair or on the table, apply this new "Electric Spanker," and sit by smoking a pipe or playing solitaire while Willie's heels kick in the air and Willies vocal cords contract and expand.

There was exhibited at the New York Electrical Show a mechanism that Willie will vote nefarious and his dad will proclaim a blessing. It is the Electrical Spanker!

A small motor, which retrieves with passionate vigor what it lacks in size, is the substitute for irate dads biceps. It is connected by a four-inch rod to a broad applicator that performs the painful function of liason between spanker and spankee. It is about the breadth and length of the parental palm, but packs a more violent wallop.

It has the advantage or disadvantage, according to the point of view, of deadly accuracy. Dad's palm, when fatigued, sometimes misses a few spanks. The applicator lands "smack!" every jolt. It is to be considered, too, that whereas at about the twenty-second onslaught fathers hand becomes weary, the electrical device can continue delivering a regular, rhythmic and impressive chastisement so long as the "juice" holds out.

Indeed, by tying Willie to the chair or table, father can go out for a beer, or go to the office and saunter home, to find the applicator still applicating.

Now, father's adamant determination to wallop Willie may undergo an emotional softening and regret, stimulated by Willie's tears and wails, and may cause him to quit spanking Willie with his palm. The machine, on the other hand, is relentless. Willie can howl until the moon melts and the device will keep on earning its keep until father shuts off the current or mother sneaks into the woodshed to help sonny out of his predicament.

There is only one advantage accruing to Willie. He can say with truth hereafter, "That's a lot of bunk," when dad pulls the old bromide that "this hurts me worse," and so forth.



Photo Copyrighted by Underwood & Underwood.

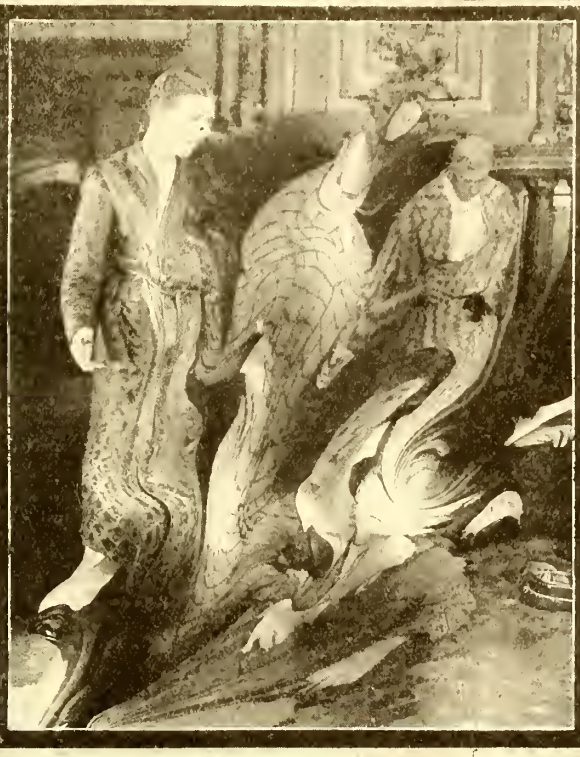
An Electric Spanker, the Latest Contribution to Science. Yes, But Never Before Has a Scientific Development Met with as Much Disapproval Among the Younger Set. And Why Not? Jimmie's and Johnny's Naughtiness Will Now Be Answered by a Nice and Shiny Electric Spanker Replacing the Cat-o'-Nine-Tail. So Far the Only Danger in the Use of the Spanker Is That the Spankee Will Be Tickled to Death by It.

www.americanradiohistory.com

ODD PHOTOS



These Three Triplets—Excuse Us Please, They Are All the Same Girl. Fine Sample of Triple Exposure.

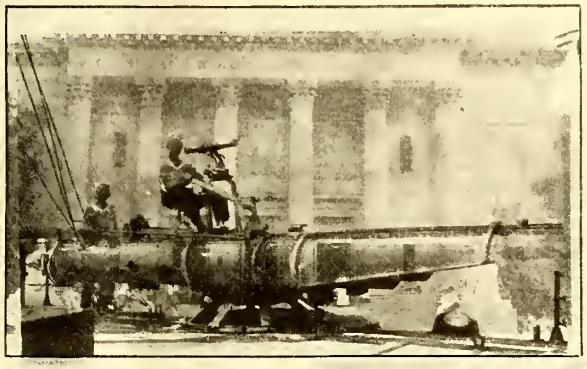


A "Real" Odd Photo—A Pathe Photo of a Photoplay Still, Which, Due to the Unexpected Creeping of the Emulsion



Looks Like a Sure-Enough Ghost—But Its Not. Just an Example of Double Exposure on the Same Negative.

Caused by the Forced Drying of the Negative by Heat. Resulted in the Grotesque Effect Here Portrayed.



Ever See This Torpedo Tube in Front of the New York Museum of Art? Neither Did We. Two Exposures on the Same Plate Explains It.



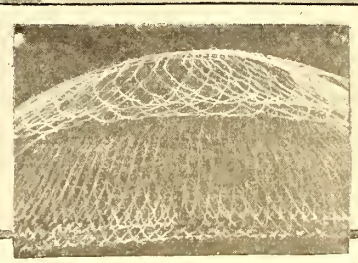
This Electrician was able to Project His Inner Self to a Distance of Several Feet. So a Psychical Expert Told Us. Only We Know That a "Duplicator" or Double Exposure Cap is Responsible for This.



An Extra Fine Photo of Ribbon Lightning. It Takes Patience to Obtain a Picture of the Bolts of Thor as Good as This One.

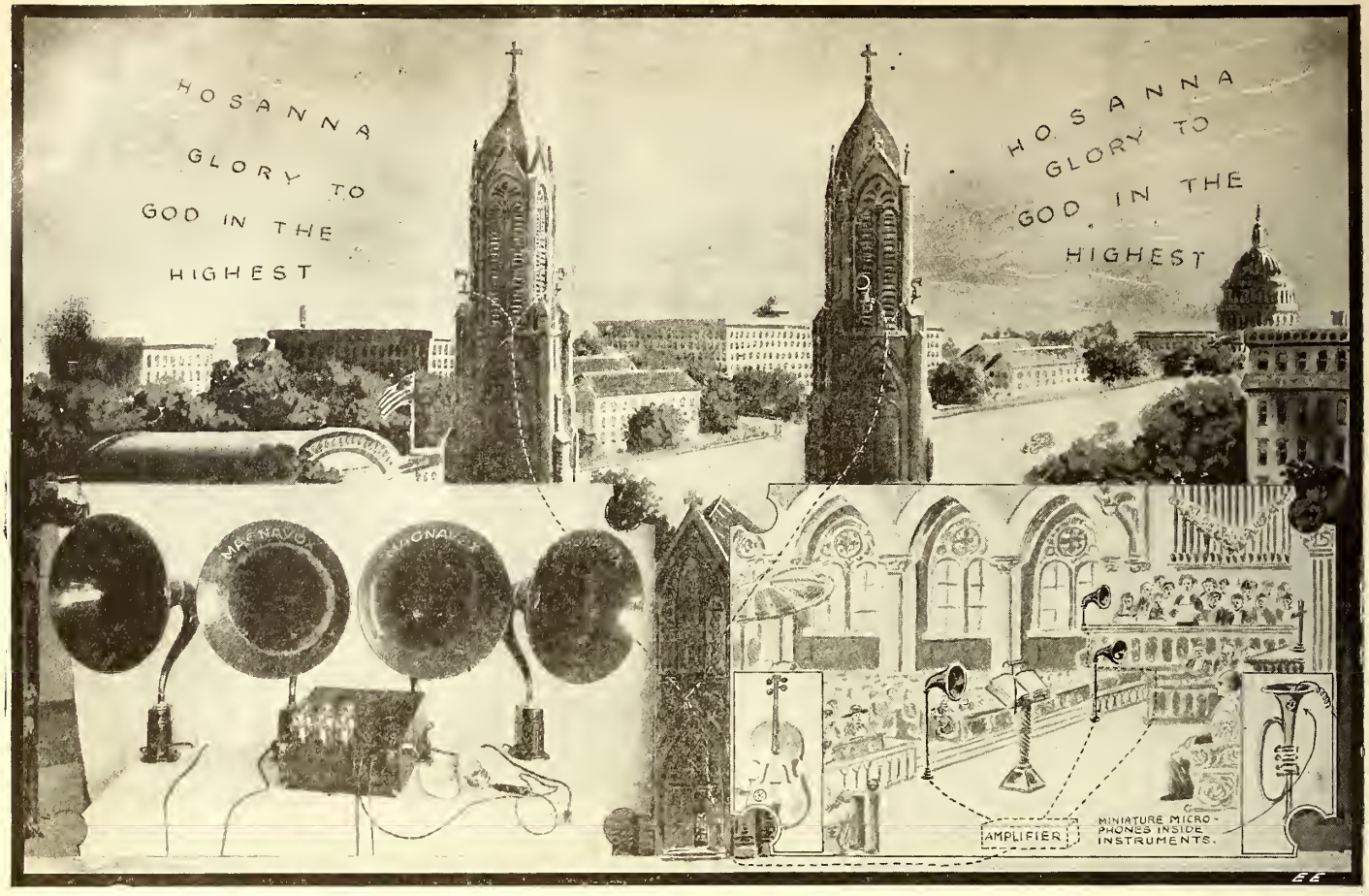


Is the "Third Rail" Dangerous?!! Not if You Jump on It With Both Feet Simultaneously Like These Boys.



A Night Photo of—Guess? Yes, Its "The Top," Snapt While Spinning, at Chicago.

www.americanradiohistory.com



Recently, in the City of Washington, D. C., a Minister Had the Satisfaction of Broadcasting His Voice Over an Area One Mile in Diameter. His Sermon, Also the Choir and Organ Music, was Thus Heard One-half Mile Away from the Church, Thanks to the Magnavox, the Wonderful Sound Amplifier. People Eight Miles Away Heard the Voice, and it Wafted One and One-half Miles Heavenward to an Airplane Flying Overhead.

Church Sermon Heard Over One-Half Mile

HAVE you ever been in the country on a quiet Sabbath morning and endeavored to note how far away from a church you could hear the minister's voice,—or for that matter, the choir singing, or the organ? Not very far you will say, if you have ever tried it. But in Washington, D. C., recently, a minister had the satisfaction of speaking to more people than any other minister, possibly, in church history. His voice, as well as the singing of the choir and the organ music, were amplified to such a tremendous volume, thanks to the newest electro-mechanical amplifier, known as the Magnavox—that the sermon was clearly audible over a circle whose diameter measured one mile, or over an area having a radius of about one-half mile. The Magnavox amplifier, which has been described several times in recent numbers of this journal in connection with public speaking events, was used on the present occasion in connection with a vacuum tube or audion amplifier, which is connected to the microphones and horns; these gathered the sounds of the minister's voice and the choir singing, in the manner here illustrated. The microphones, or sound detectors with the horns, were mounted as inconspicuously as possible about the pulpit and choral gallery, and concealed wires led to the large vacuum tube amplifier, shown in the accompanying illustration at the left. This was in turn connected up with wires and a suitable source of current, which led up to the belfries atop the two church spires, where there were placed on the outside of each belfry two of the Magnavox special amplifiers, fitted with large horns of the type shown at the left of the photograph just mentioned,

The minister spoke in an ordinary tone of voice, and in fact it was somewhat uncanny to be walking down a shady Washington street, when suddenly out of the very air above you, there came the command—"Thou shalt not steal!" in stentorian tones. Verily it sounded as if the prophets had come down to earth, and that the Day of Judgment had surely arrived. While it perhaps, would not prove beneficial in a strictly ecclesiastical or religious sense to think of conducting our church services in such a broadcast manner as this, it would not seem a bad idea if in forthcoming years, our churches looked carefully into such matters, and considered the practice of broadcasting their pastors' sermons, organ and choral music by means of telephonic amplifiers, which it would seem, would surely have a beneficial effect and would do no harm, that is certain. Talking on the lighter side, there will probably be but one regret, and that will be on the part of the board of trustees of the church, which let us say has installed at some expense one of these amplifying outfits. Mr. Stay-at-Home who is enjoying the sermon may make his remittance to the collection basket when His Reverence pronounces the all important words—"The usual Sunday offering will now be received," by contributing a weekly or annual amount for maintaining the equipment and its operating expense! If he *heard* the sermon.

General Layout of Amplifiers.

Two Magnavox loud-speakers are installed on the belfry of each tower of Trinity Church, corner "D" and Third Streets, Washington, D. C. A special three-step amplifier using a special combined audio and radio frequency circuit, is employed, so arranged that the output is 250 watts of voice modulated current. The input current can be any ordinary telephone current, radio, or the voice, spoken into special transmitters which are attached to the instrument.

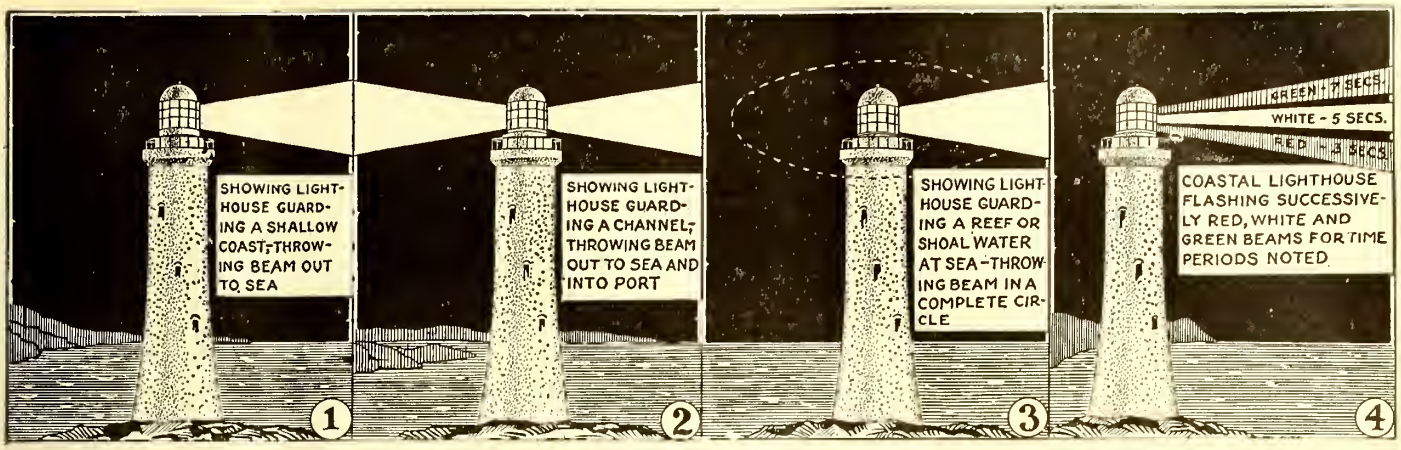
Six volts are used on the filaments, and 300 to 600 volts are used on the plate circuits, depending on the volume of sound required. A special set of attachments are furnished, such as a minute transmitter utilizing a silk cord, which can be placed inside of a violin, cello, banjo, or other string musical instrument; also a small transmitter button can be attached to horned or other instruments. Any of these attachments *will magnify the original instrument one hundred times' by actual measurement.*

In the church are installed special transmitters, one along each side of the pulpit, also one for each section of the pipe organ. These transmitters are equipt with papier-maché horns, 18 inches long and 14 inches at the opening of the bell. They will pick up a speaker's voice three to four feet away from the horn and reproduce it faithfully.

Preliminary tests were made with an Ingersoll watch touching one of the transmitters, and with the three-step amplifier, the *ticking of this watch was heard two blocks away* thru normal street traffic. Pipe organ music, choir singing and special solo pieces

(Continued on page 684)

www.americanradiohistory.com



Lighthouses--How They Signal

By A. H. Whedon
Ex-Radio Electrician, U. S. Navy

EVERYBODY knows what a lighthouse is, and what its duties are supposed to be. But how many know how they work?

To begin with, lighthouses are not always on the coast, many times they are a number of miles at sea and entirely out of sight of land. And the keeper is very rarely an old retired sea captain with a beautiful daughter. More often he is an energetic young man who is not afraid of good, hard work, or the possibility of it, and in many cases also, facing the probability of being left alone for three or four months at a time.

A lighthouse on the coast line is usually in a wild and lonely spot that nobody ever comes near without a very good reason. The keeper's supplies are brought to him by land or by boat whichever is most convenient for the authorities, and are brought when it is most convenient for them.

It is of course, imperative that the keeper know all about gasoline engines and electricity. For the motor whereby the light is rotated is usually run by a gasoline engine supplemented by hand gear in case the engine breaks down. In some houses the light is an electric one, instead of gas.

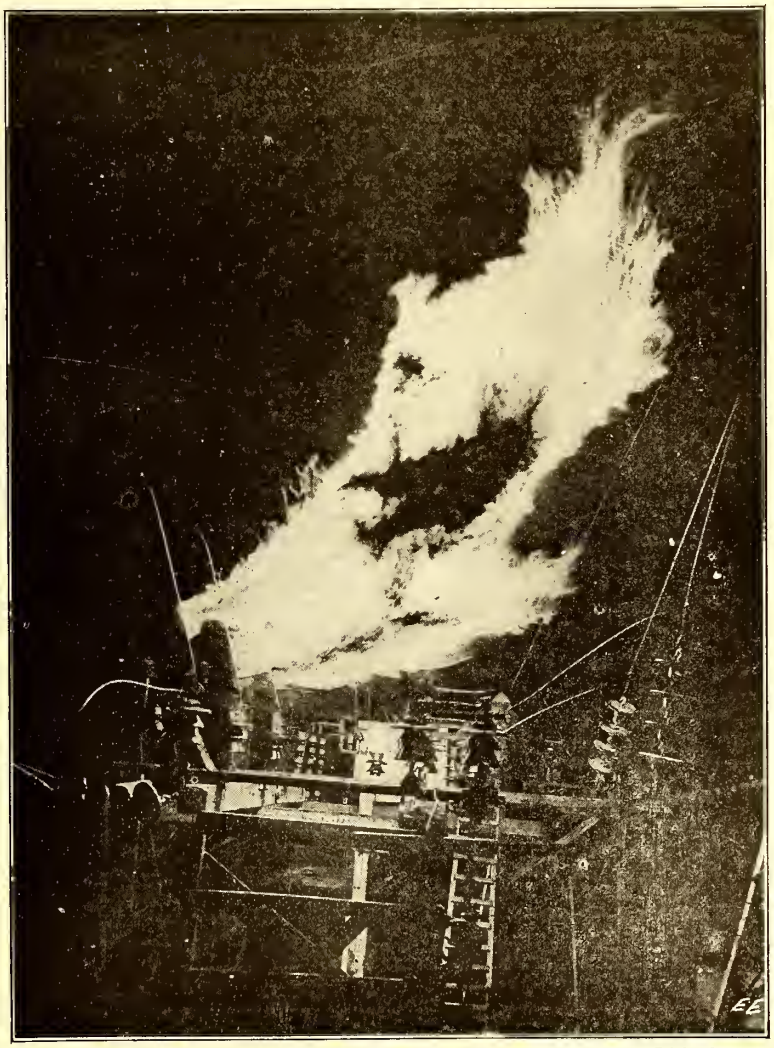
There are in general three types of lights—*steady, flashing and occulting.* The "steady" light is easy enough to understand. The lighthouse simply burns a steady red, white or green light, according to how it is marked on the navigator's chart.

The *steady light* may be fixt so that its light may be seen from all points of the compass, or its beam may be trained to any point or to several different points, if desirable. For instance, a lighthouse guarding a reef at sea would throw her beam to all points, so as to warn ships to keep off. But a lighthouse guarding a sandy beach would only throw her beam seaward, for there would be no advantage in throwing it on land.

The *flashing light* requires a little more care, for the light is mounted on a platform and rotated slowly, so that a ship at sea would see a flash every few seconds, depending upon the length of time it took for the light to make one complete revolution. This light also may be flashed in white, red and green, using a combination of two colors, or perhaps just one. For instance, it may be flashed as follows: "red, red, green," "red, white, green, white, red," —and so on. By varying these combinations and by varying the time of flash, it may be seen that endless combinations may be obtained. Thus it is made possible for each lighthouse to have its own particular flash and code designation, so as to be instantly recognized by the skipper.

Now we come to the last of the three general classes—the *occulting light.* Instead of rotating and having its beam sweep the whole horizon, it is simply lit for a few seconds and then extinguished for a time. It is seen only from certain angles, according to the position of the dangerous object it is guarding. If the object lies in a channel running North and South, then the beam will show only North and South.

And here, as before, the light may flash "red, green, red, green," or any other of a thousand possible combinations. Each combination together with the length of time of the flashes, is placed on the navigator's chart, and is also listed in all nautical tables, so that the navigator can, by timing the flashes and observing the color, look it up and at once obtain his exact position.



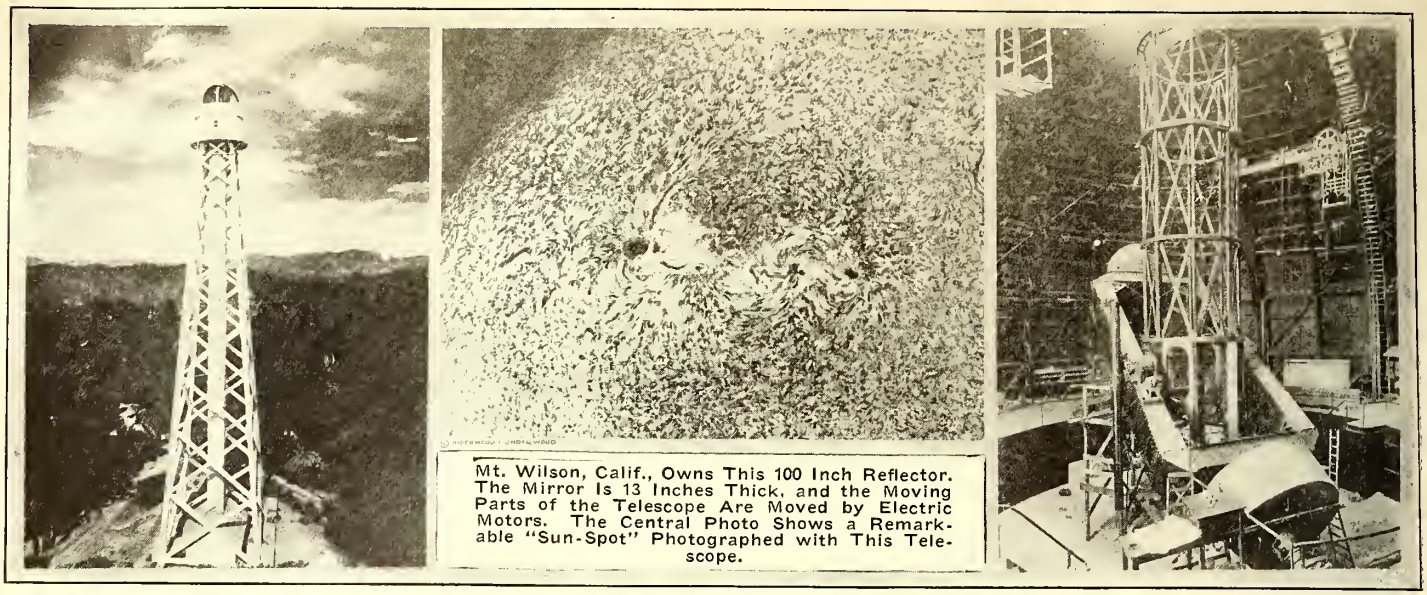
Looks Like Lightning, Doesn't It? It Is—Man-Made Lightning. This Gigantic Sheet of Flame Occurred When a High Tension Feed Wire Switch Was Suddenly Opened. It Lasted But a Few Seconds.

18-FOOT ELECTRIC ARC

The size and power of an electric arc was recently shown in an unusual photograph taken by the Superintendent of a power-house at Tallulah, Georgia, at night, when the switches were opened on a 110,000 volt transmission line that carried no load at the time. The arc, as shown in the accompanying picture, jumped 18 feet and appeared as a huge flame. It disappeared almost instantly and caused no damage. Contrary to expectation, however, these flaming arcs are very dangerous as they evolve considerable heat and will burn any person or combustible material in their path. These giant switches are controlled from the ground or other position by long handled levers, as the operator could not of course stand anywhere near it when opening a circuit carrying a hundred thousand volts or so—veritable man-made lightning.

Contributed by
STANLEY W. TODD.

www.americanradiohistory.com



Mt. Wilson, Calif., Owns This 100 Inch Reflector. The Mirror Is 13 Inches Thick, and the Moving Parts of the Telescope Are Moved by Electric Motors. The Central Photo Shows a Remarkable "Sun-Spot" Photographed with This Telescope.

Mt. Wilson 100 inch Telescope

By ISABEL M. LEWIS

OF THE U. S. NAVAL OBSERVATORY

World's Largest Telescope

THE one-hundred-inch reflector of the Mt. Wilson Observatory on Mt. Wilson, Cal., is the largest telescope in the world. The mirror, which is one hundred inches in diameter and thirteen inches in thickness, weighs four and one-half tons, and the moving parts of the telescope, which are electrically controlled, about one hundred tons.

The glass for the mirror was manufactured at the St. Gobain glass works in France after many attempts covering an interval of three years, as it was difficult to find a piece of glass large enough and sufficiently free from imperfections for the purpose. It was then shipped to the optical shops of the observatory in Pasadena, Cal., where it underwent a long grinding and polishing process for seven years. All of this work was done by Prof. George Ritchey, a member of the staff of the observatory. As the work progressed the mirror was subjected to frequent and rigorous test, and finally, on July 1, 1917, the completed mirror, which had been pronounced practically perfect in form, was packed in an octagonal-shaped box lined with paraffin, placed on an automobile truck geared to a maximum speed of two miles an hour and taken up the steep and winding mountain road to the summit of Mt. Wilson at an elevation of nearly 6,000 feet.

The huge sections of the iron castings for the telescope were made at the Fore River Shipyard at Quincy, Mass., and shipped around Cape Horn, as they were refused shipment by the railroads on account of their great size.

All smaller parts of the great telescope and those that required special care were designed and constructed in the instrument shops of the Mt. Wilson Observatory in Pasadena.

The huge reflector is now housed in a steel building designed for that purpose with a 100-foot dome that weighs five hundred tons and is quickly and easily moved by electricity.

The 100-inch mirror lies at the base of the telescope tube and simply acts as a support for the silver coating that is placed on its upper concaved surface. The rays of light from the stars do not enter the mirror, and therefore it was not necessary that the glass be entirely free from imperfections. It is the form of the upper surface of the mirror that is of chief importance, and this must be practically perfect.

Reflector Resilvered Every Six Months.

Every six months it becomes necessary to resilver the mirror. This is done very quickly and easily by means of an electric elevator which lowers the great mirror from its position at the base of the telescope to the resilvering room below and returns it after the process is completed.

The parallel rays of light from the stars pass down the telescope tube and fall upon the silvered surface of the great mirror and are reflected back in the direction of the upper end of the tube, coming to a focus on a secondary mirror near the top of the tube, which reflects them to the photographic plate or observer stationed at one side of the tube.

Preliminary tests of the instrument in the fall of 1917 revealed a slight flare of the star image, due partly to temperature effects and partly to lack of rigidity in the support of one of the secondary mirrors. The latter difficulty was overcome by adding a compression ring to the tube carrying this mirror, and the temperature effect was also looked into and overcome.

Shows Extraordinary Details of Moon's Surface.

These necessary changes were greatly delayed by the fact that the staff of the observatory was largely occupied with war work of an urgent nature and the instrument shops were needed for the same purpose.

The great instrument is now fully prepared to enter upon its observing career, however. Test observations of the moon, Saturn and other celestial objects have shown the wonderful light-gathering power of the huge reflector and revealed an extraordinary amount of detail on the moon.

Its work will be largely photographic and spectroscopic and comparatively few direct visual observations will be made. It is expected that it will soon be storing away on photographic plates light from stars and nebulae that lie far beyond the reach of all other telecopes in existence and that as a result of these observations our knowledge of the form and extent and nature of the universe will be materially increased.

QUESTIONS AND ANSWERS.

Q. 1. Will you explain what astronomers mean by "the cepheids"?

A. 1. From the context of your letter I should judge that you refer to the cepheid variables, tho the cepheids is also an expression for a swarm of meteors whose radiant point lies in the constellation Cepheus.

The cepheid variables constitute a very important class of variable stars. They receive their name from Delta Sephei, a well-known star of this class.

The light of a cepheid variable fluctuates periodically in a most peculiar manner. There is a sudden rise to maximum brightness that occupies about one-third of the entire period, followed by a much slower decline of brightness which usually has a more or less pronounced pause. These light changes are performed with the greatest regularity and have been likened in effect to a revolving light in a lighthouse in which there is the same sudden increase to maximum brightness, followed by a slow and gradual decline repeated over and over with absolute regularity.

The periods of light changes of the cepheids range from less than a day to forty-five days and there is a close connection existing between the *period* of the *light variation* and the *actual size or luminosity* of the star.

The discovery of this fact has led to some very far-reaching results and made this class of stars of the highest importance in determining the distance of the globular star clusters.

Dr. Shapley's revolutionizing discoveries concerning the distances of these objects are founded upon the simple relationship found existing between the periods and luminosities of the variable stars in these clusters, which are simply short period cepheid variables.

It has been found that cepheids whose periods are less than a day are giant stars whose absolute magnitude is constant at one hundred times the light-giving power

(*Continued on page 721.*)

www.americanradiohistory.com

New Electrical Gyro Compass

UNTIL recently the *magnetic compass* has been relied upon as a means of indicating direction to mariners at sea. In doing so it utilizes the directive forces of the earth's magnetic North Pole. In indicating direction the magnetic compass is subject to a great number of errors and influences which make its indications unreliable. When used on board a ship, especially a steel ship, many devices and precautions must be taken to obtain a compass indication which is anywhere near accurate.

It is well known that the direction of magnetic fields upon which the compass relies vary in different localities of the earth. Magnetic mountains will distract the needle—magnetic and electric storms also influence it.

INACCURACIES OF THE "MAGNETIC COMPASS."

On board a steel ship the change in character or displacement of a cargo seriously influences the magnetic compass. Even a slight change in wind will cause the smokestack to change its magnetic characteristics by changing its temperature. The magnetic compass will show deflection—it is caused when the ship rolls. The compass needle is caused to oscillate as the mass of the ship is displaced to either side of the compass needle.

An altogether different force is now used to indicate direction. This force is as old as the earth itself—the earth's rotation. The earth's rotation is made to indicate direction by utilizing the new Sperry gyroscopic compass. The Gyro Compass is nothing more than a small electrically driven wheel rotating at a high speed.

Scientists have discovered that any small wheel rotating about its own axis and freely suspended to move in any plane when placed upon a larger wheel, will place its axis in the same direction as the axis of the larger wheel. This principle has been demonstrated, proven, and in practical use for years. The Gyro Compass forms the smaller wheel referred to, while the earth forms the larger wheel. As the earth rotates it combines forces with the small rotating gyro wheel and causes the axis of the compass to point *true north*.

The captain or navigator of a ship in using the Gyro Compass does not have to take into consideration any variation or deviation. He does not have to compensate his compass. He does not have to check the compensation of his compass.

Instead of encountering the disadvantages outlined, he is free to steer a true course and to keep his ship on the straight line course.

Perhaps the greatest feature of the use of the Gyro Compass is the safety factor. Many ships have been wrecked due to inaccuracies of navigation resulting from the use of the magnetic compass. The Gyro Compass insures against such contingencies, thereby insuring the ship, passengers, crew and cargo.

HOW THE GYRO COMPASS WORKS.

When used on land one wheel, or element, is sufficient to show the *true North* Pole. When used on board ship, however, the roll, pitch and yaw of the ship introduces forces which would tend to throw the wheel from off its indication. In the

(Continued on page 700)

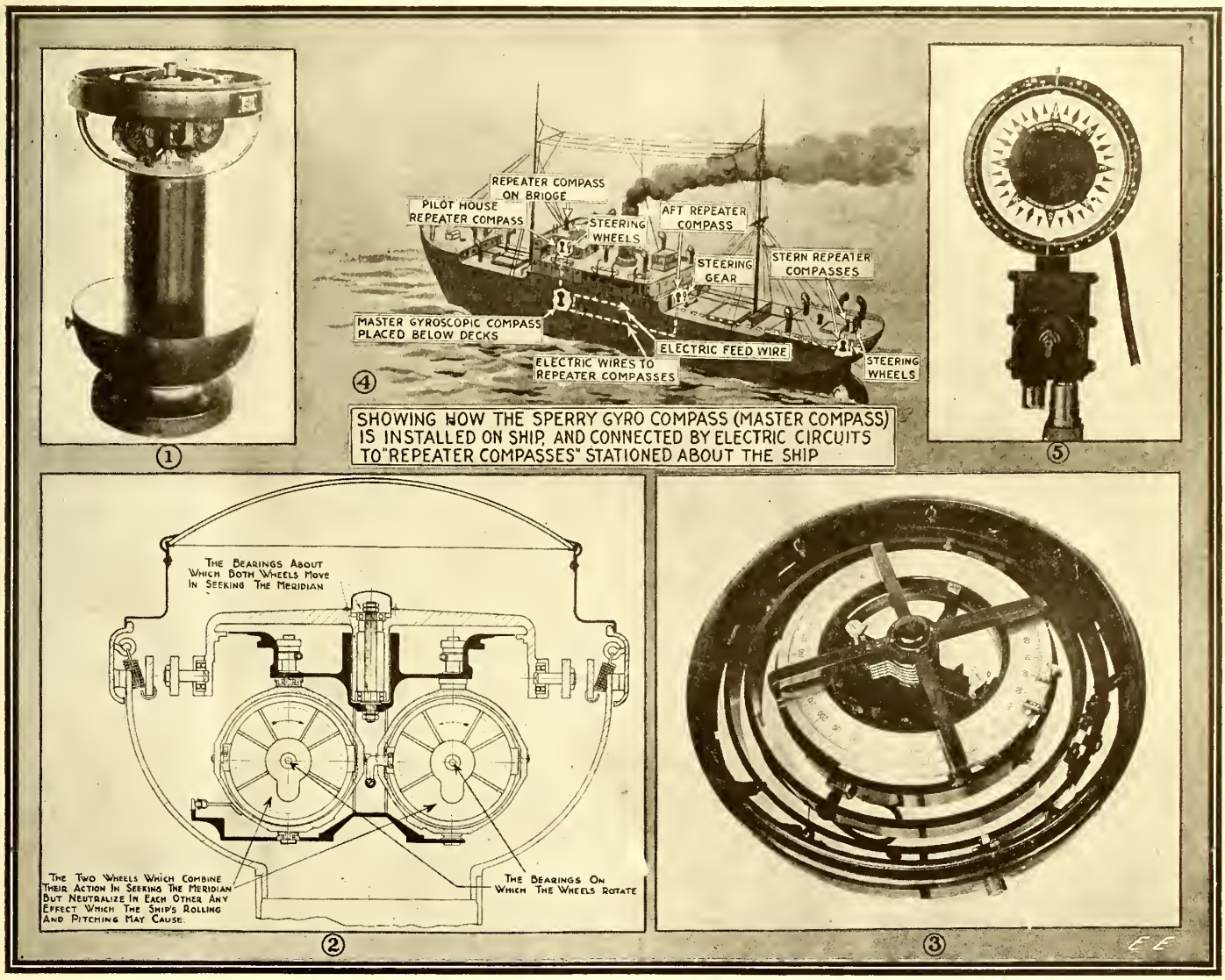
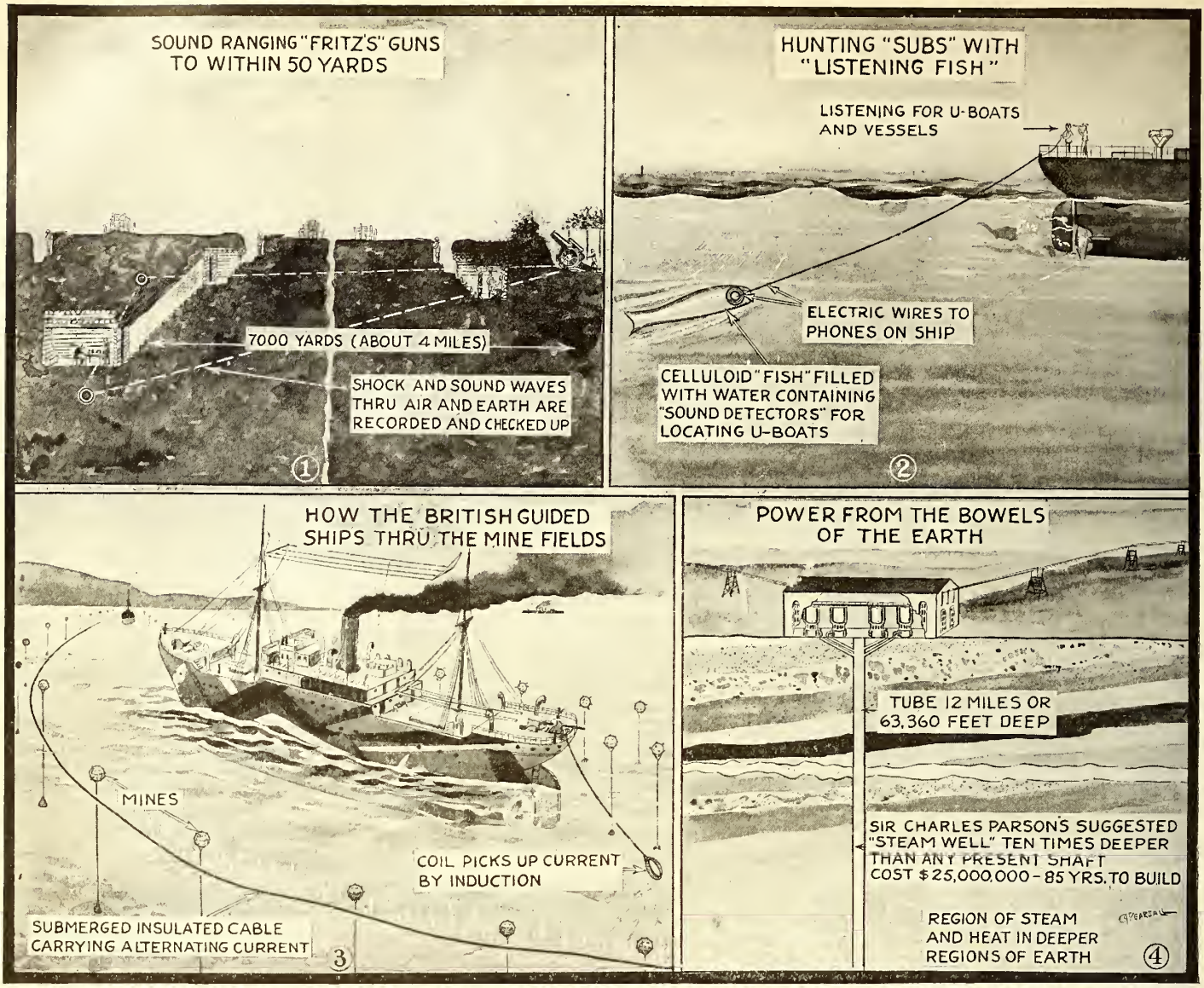


Fig. 1. The "Master" Gyroscopic Compass, Which Does Not Depend Upon Magnets for Its Operation, and Which Is Placed Below Decks on the Ship as Shown in Fig. 4, While "Repeater" Compasses Are Stationed at Various Points About the Ship, Such as Steering Wheels, Etc. Fig. 2 Is a Sectional View Thru the Gyro Compass, Showing the Revolving Wheels. Fig. 3, Top View of Master Compass, Showing New Navy Type of Dial, Graduated in Degrees, Instead of Points of the Compass. Fig. 4. This View Shows the Location of the "Repeater" Compasses About the Vessel. Fig. 5. The "Repeater" Compass, Operated by Electric Currents Transmitted from the Master Compass.

www.americanradiohistory.com



Four Important Wartime Developments Described by the Eminent Scientist and Inventor of the Parsons Steam Turbine—Sir Charles Parsons—before the "British Association for the Advancement of Science."

Sir Charles Parsons on War Inventions

THE work of scientists in the war occupied the greater part of the Presidential address delivered before the *British Association for the Advancement of Science* at its meeting at Bournemouth by Sir Charles A. Parsons, inventor of the marine turbine engine.

British scientists, he said, "worked in close collaboratiou with the men of science of the allied nations and eventually produced better war material, chemicals and apparatus of all kinds for vanquishing the enemy and the saving of our men than had been devised by the enemy during many years of preparation, planned on a basis of total discregard of treaties and the conventions of war.

As illustrating the immense difference between the recent and all preceding wars, Sir Charles gave some interesting figures. At Waterloo 9,044 artillery rounds, with a weight of 37.3 tons, were fired, whereas in the last offensive in France on the British front alone 943,837 artillery rounds, weighing 18,080 tons, were fired. Again, in the entire South African war 273,000 artillery rounds, weighing 2,800 tons, were fired, while on the British front in France during the entire war over 17,000,000 rounds were fired!

SOUND RANGING AND LISTENING DEVICES.

Many of the new war devices Sir Charles left to be discus' in the meetings of the sections, but he dwelt on *sound-ranging* and *telephonie listening* methods. By the end of 1916, he said, the whole front in France was covered by devices which enabled the British to locate the position of the enemy's batteries merely by sound. In 1918 more batteries were thus detected than by any other means, and a single good set of observations could give the position of an enemy gun at 7,000 yards range to within about fifty yards. Listening devices were also largely used at sea, but it was found that the motion of the vessel carrying them when the sea was rough, and also the noises caused by dragging the devices themselves thru the water made them useless.

HOW THE WHALE HELPED PERFECT SUBMARINE DETECTORS.

"So," Sir Charles went on, "the assistance of eminent biologists was of invaluable help at this juncture. Experiments were made with sea lions by Sir Richard Paget, who found that they have directional hearing under water up to speeds of six knots. Also Professor Keith explained the construction of the hearing organs of the whale, the ear proper being a capillary tube too small to be capable of performing any useful function in transmitting sound to the relatively large aural organs, which are deep-seated in the head. The whale, therefore, hears by means of sound waves transmitted thru the substance of the head. It was further seen that the organs of hearing of the whale, to some extent, resembled a hydrophone.

"The course now became clear. Hollow towing bodies in the form of a fish or porpoise were made of celluloid, varnished canvas, or very thin metal, and a hydrophone suitably fixt in the centre of the head. The body is filled with water, and the cable towing the 'fish' contains insulated leads to an observer aboard the vessel. When towed at some distance behind the chasing ship the disturbing noises are small, and enemy noises can be heard up to speeds of 14 knots and at considerable distances."

Other listening devices made use of the echo, and were developed until they could pick up a submarine a mile away. Sound-ranging stations were established ashore, and from them ships steaming in a fog were informed of their positions accurately for ranges up to 50 miles.

SHIPS PILOTED THRU MINES BY CHARGED CABLES.

Another device, used first by the Ger-

(Continued on page 720)

www.americanradiohistory.com

Interplanetary Communication

By Dr. C. S. BRAININ, Ph.D.
Of the Columbia University Observatory

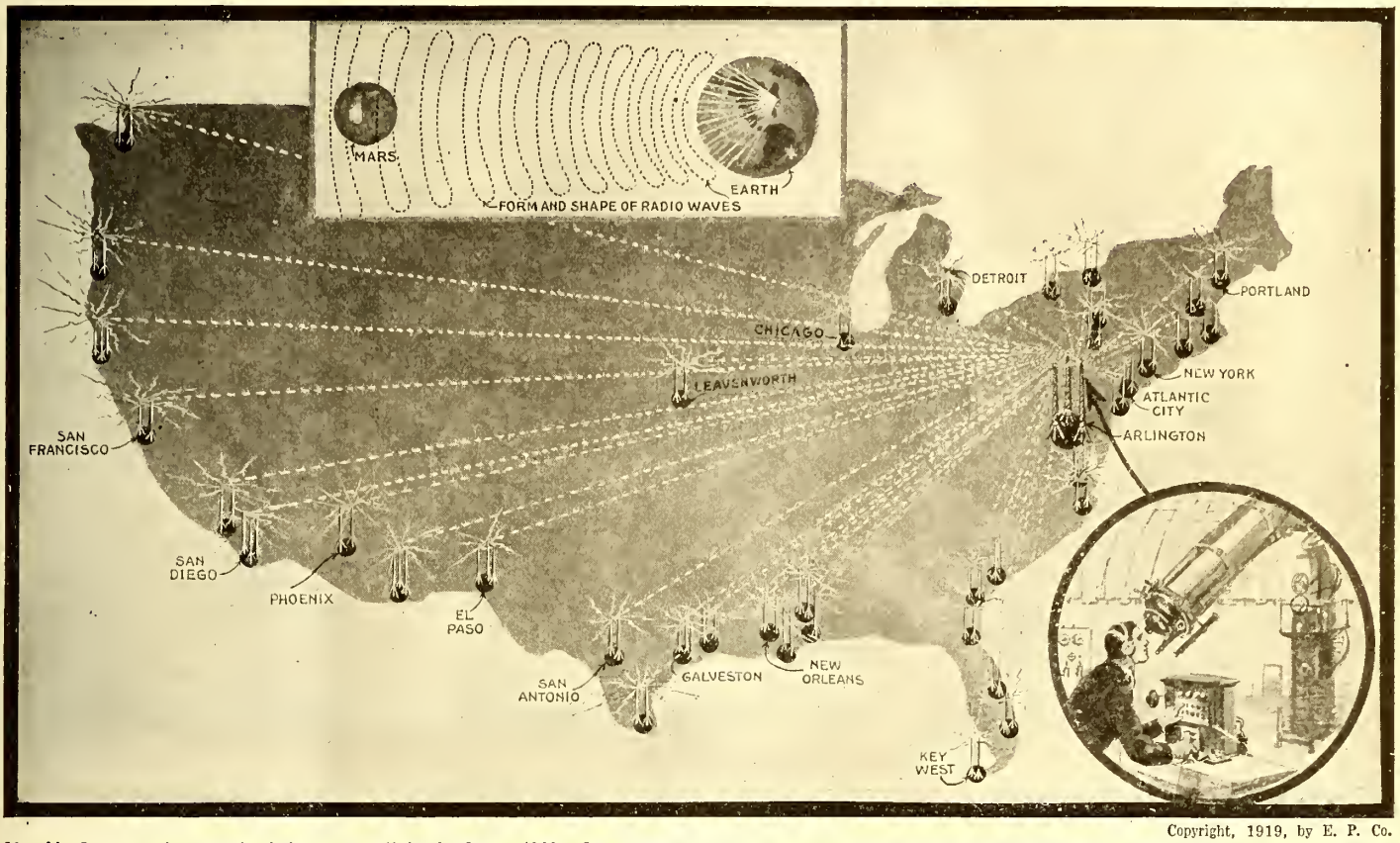
THE tremendous advances made by wireless telegraphy and telephony during the last decade and particularly in connection with the activities of the great war have given renewed impetus to the already considerable speculation as to the possibilities of pushing this method of communication beyond the limits of man's earth and using it for the purpose of "speaking" with other inhabitants of the universe with which the popular imagination has peopled cosmic bodies. The subject falls naturally into two divisions: Are there in space or within the confines of the solar system other inhabited spheres, and secondly, is radio a suitable means for interplanetary communication? And in the discussion we must distinguish clearly between that which is science—knowledge—and that which is merely speculation based upon science.

The first division of our subject presents the bigger IF. Astronomy is not as yet so far advanced as to be able to speak with finality. Much has been learned about the physical and surface conditions of the earth's fellow members in the solar system, but not enough to decide the question. Should we wish to extend our field to outside space, instead of limiting ourselves to the planets of our own system, we may speculate with safety. Every star in the heavens is a sun, more or less like our own sun, and multitudes of them must possess planetary systems. No doubt upon many of these planets conditions have been such as to be favorable for the development of some kind of life. But the question of life in other systems can be left here; it need hardly be considered further in connection with the problem of communication for the distances are too great. In the first place, too much of the original energy of the emitted signal would be squandered unless it were possible to make the transmission truly undirectional, and secondly, the time between the emission and the receipt of the signal at the other end would be too long. Even the *nearest* star is so far away that it would take the electric waves about *four and a third years* to reach it: and only a very small number of stars are within even a hundred years by wireless from us.

There has, of course, not as yet been found any direct, unimpeachable evidence of the existence of inhabitants upon the other planets, and we are limited, therefore, to a consideration of the planets' physical conditions and to a discussion as to whether these are favorable for the development and maintenance of life. We ourselves are the products of the terrestrial conditions of temperature, atmosphere, humidity, etc.; a different combination of these factors would no doubt have produced an entirely different form of life. We cannot, however, discard a planet as uninhabitable because its condition differs somewhat from the earth's, but we are safe in discarding the major planets, Jupiter, Saturn, Uranus and Neptune. It is certain that conditions upon these are unfavorable. The temperature seems to be far too high and the surfaces of these planets have not yet reached the state of solidity attained by the surfaces of Mars and earth. Undoubtedly, the temperature is far too high, also, for the existence of the very complicated organic chemical compounds necessary for any imaginable form of life, different tho it be from ours. Of Mercury we know very little, indeed; it is so close to the sun that observation is extremely difficult and unsatisfactory. Venus and Mars remain.

Mars has been the favorite playground. Since the first announcement of the "canali" by Schiaparelli and the subsequent observations and speculations of W. H. Pickering and Percival Lowell, much has been written and said on both sides of the question. We may briefly sum up the affirmative: The surface of Mars is declared to be crost by a network of straight lines, some of them double; the poles of the planet show at their respective winters, broad sheets of white, very like the terrestrial ice-caps, which decrease rapidly in area with the coming of the summer, and at the same time the "canals" broaden, "germinate," as they say. Evidently, then, Mars is an arid planet with very little water and these "canals" have been constructed by the Martian engineers to carry the water from the melting polar caps to different parts of the Martian surface. Therefore, Mars is inhabited, and by advanced beings, too, for their engineering feats are of the greatest difficulty. But the observations upon which all this rests are not accepted by the astronomic world at large. The great majority of observers, among whom are the most skilled and experienced in the whole world, have declared themselves entirely unable to see this complicated network of straight lines. Streaks and patches are seen by all but nothing like Lowell's maps; nor do published photographs reveal them, and we are reluctantly forced to decide in the negative. There is

(Continued on page 692)



Copyright, 1919, by E. P. Co.

Mr. H. Gernsback's Radio Scheme Publisht in May, 1909. The Underlying Idea Is to Operate All the Powerful Radio Stations in the United States and Canada Simultaneously by Means of Long Distance Radio Control. A Radio Operator Seated at Arlington (Washington) by Pressing His Key Would Operate All the Radio Stations Over the United States as if All These Stations Were But One Huge Powerful Station. Theoretically, This Would Give Us Enough Energy to Bridge the 35 Million Miles Separating Us from Mars. The Insert Shows How the Radio Waves Are Propagated. It Is Understood, However, That the Waves Go in All Directions, Not Only Towards Mars. Thus if Venus Were to the Right, She Also Would Receive the Messages.

MR. TESLA'S ARTICLE

announced in our October issue was unavoidably delayed due to important research work of the great inventor. We hope to present it in an early issue.

—Editor.

www.americanradiohistory.com

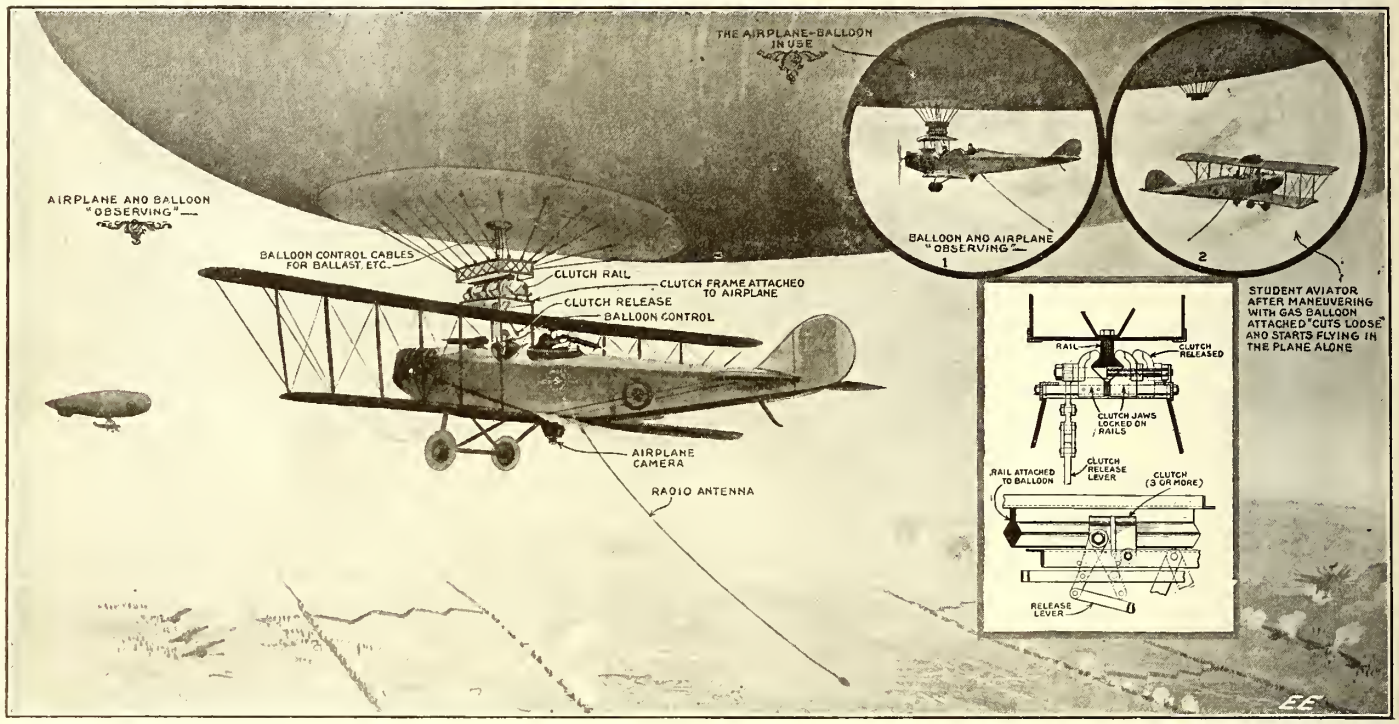
Combination Airplane and Blimp

THIS clever invention, combining some of the characteristics and qualities of the airplane with the blimp or gas-filled balloon, is due to Mr. James N. Lewis, of Detroit, who has recently taken out a patent on it. There are many military as well as other features, which seem to give great promise in this combination of the lighter-than-air flying machine or balloon, with the heavier-than-air craft or airplane.

For one thing, the airplane is attached to the blimp or gas-filled balloon by means of a special and powerful design of quick-acting clutch; by simply throwing a lever attached to this clutch, the aviator, seated in the airplane, may at any time release the clutch and sail off, having, of course, started his engine going before doing so, altho he can in emergency and if necessary, cut loose from the balloon and volplane to earth without the engine running. This would seem to be one of the principal features of Mr. Lewis' invention, particularly where aircraft are used for artillery observation, etc., over the battlefields, where balloons were frequently set afire by incendiary shells or balloons, or else attacked by enemy aircraft. Under such a condition, the observer, if he were seated in an airplane carried by the balloon could cut the plane loose and descend to earth safely, much more safely, we believe, than is the case where the observer has to depend upon a parachute, for in some cases the parachute fails to open and the observer is killed.

Another purpose of the invention, as pointed out by Mr. Lewis, is the feasibility of using the airplane with the attached gas-bag to provide auxiliary buoyancy, the airplane being operated or propelled in the regular manner by its usual engine and propeller. Naturally, of course, the speed of the airplane in this case would not be as great as if it were flying without the attached balloon, owing to the great bulk of the gas-bag, which would have to be propelled thru the air. At this juncture we perceive another very fine point of interchangeability and adaptability, which would seem very useful and commendable for war-time requirements, and which is here made evident in our estimation, for it would not be necessary to build expensively equipt blimps or balloons of the dirigible type if this idea be put in practice. For example, by providing these special clutches on simple forms of balloons with no gondola gear, or other attachments, then by simply attaching the balloon onto the airplane we would have a dirigible which could be driven at 30 to 40 miles an hour and maneuvered in all the regular ways in which dirigibles are steered. Suitable control ropes or cables may lead down so as to be readily accessible to the airplane pilot, so that so long as he is flying attached to the blimp, he may have control of the relief valves for the gas compartments, air valves, et cetera.

Another very important feature of this invention lies in the fact that it should prove one of the greatest advances yet brought out in safely training aviation pilots for the army and navy service. As is well known, it is very risky to send aloft a young pilot or aviation student who is not very familiar with the idiosyncrasies of the machine he is trying to fly, and this was very forcibly brought out at the army training fields during the war. The seaplane pilot has much more chance to save himself in such an emergency than the land plane pilot or student, for with the seaplane he can always land on the water, and, with the present design of this aircraft, the machine will safely volplane down from any height with the engine dead. Landplanes may also volplane down in most cases, even if the engine should go dead. But with the seaplane the landing area is not restricted as long as it is over water. With the land plane, the angle at which the volplane occurs is dependent upon the height at which the plane starts, and, before he knows it, the student may find himself headed directly for a group of trees or several high, piercing church spires with a few dozen brick chimneys and iron fences thrown in for good measure. All of what we have just said is intended in its application to the embryo aviator, while he is learning the graces of ordinary or trick flying. Ever imagine what a difference there is when his buoyancy is not dependent upon the exact movement of his hands and feet, when a slight misjudgment may spell death to him. Now, with this invention he simply throws on the clutch, so as to secure the plane to the gas-bag, and at the command, "Let go!" he is hauled skyward by the buoyancy of the balloon.



Copyright, 1919, by E. P. Co.

No Need to Fall Any More While Learning to Fly an Airplane, if You Are Equipt with This New Balloon Release Clutch. You Can Enjoy the Safety Afforded by the Superior Buoyancy of the Gas-Filled Balloon. When Sufficient Skill Has Been Attained by the Student Aviator, He Can Cut Loose from the Balloon and Fly in the Plane Alone. The Combination Forms an Ideal Observation Unit for Military Work, In That the Balloon Is Under Control of the Pilot. In Case of Attack the Observer Can Also Cut Loose and Descend Safely to Earth in the Airplane, Which for This Work Need Not Have a Very Powerful Engine.

THOMAS A. EDISON

will talk to you in our December issue. This important as well as unusual feature should not be mist by any reader of the Electrical Experimenter. Mr. H. Gernsback, who interviewed the famous inventor, asked Mr. Edison a multitude of important and timely questions, which, with the inventor's answers, will be presented to the world for the first time next month.

We have also secured many new and unique photographs about Mr. Edison and his work, all of which will be publisht for the first time in our December issue.

There being no oil-painting in existence of Mr. Edison—altho several attempts were made by great painters, but their paintings having been rejected and destroyed by the great inventor—a well-known artist was selected by us to execute Mr. Edison's portrait. Upon completion of the work, Mr. Edison was highly elated over the painting and exprest himself as well pleased with the excellent likeness.

The cover of our December issue is an artistic reproduction of this historic painting and should not be mist by any reader.

The next issue being heavily advertised thruout the country, regular newsstand readers should order at once from their newsdealer to be sure of their copy.

—THE PUBLISHERS.

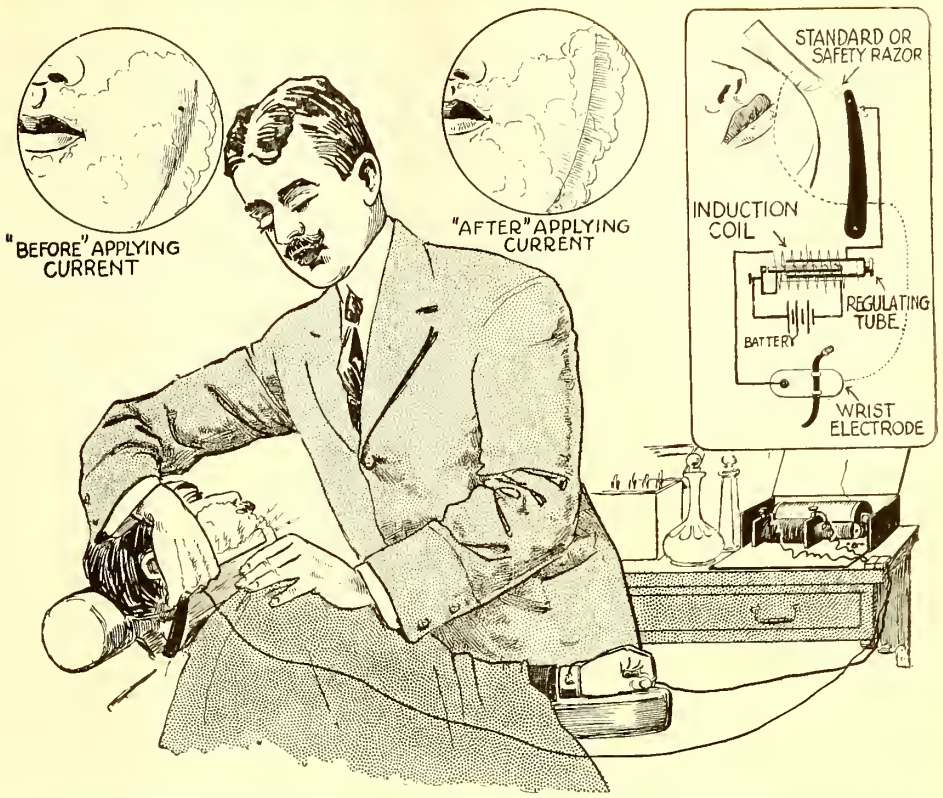
www.americanradiohistory.com

A Hair-Raising Razor

Users of faradic electric coils, such as used for medicinal purposes and shocks, may have thought that the day of the faradic coil had about reached its zenith. But such is not the case, for behold in the present illustration we have the very latest in tonsorial arts and sciences—the *faradic electric razor,* invented by Frank White of St. Louis, Mo., which not only shocks the little hairs into a vertical position so that they can be cut off painlessly, but also the application of the mild electric current to the patient's physiognomy produces the effect of an excellent massage, and not only do these two wonderful phenomena take place, but thirdly, the inventor makes another strong claim in his recent patented invention on the faradic razor—wherein he states that the current flowing from the razor to the face has the effect of aligning the metal fibers on the keen edge; in other words, the faradic current flowing thru the razor acts on the steel fibers, particularly at the edge, with the same effect as when the razor is stropt.

The apparatus required with the faradic razor outfit here shown, is quite simple and comprises a dry battery or other source of electric current, and an induction coil provided with primary and secondary windings. One terminal from the secondary or faradic current circuit is connected to a metal part of the razor, which may be a safety razor; while the second terminal from the faradic coil leads to a suitable electrode or contact plate, strapt to the wrist of the shaver. Sweet dreams of Ossining's electric chair!

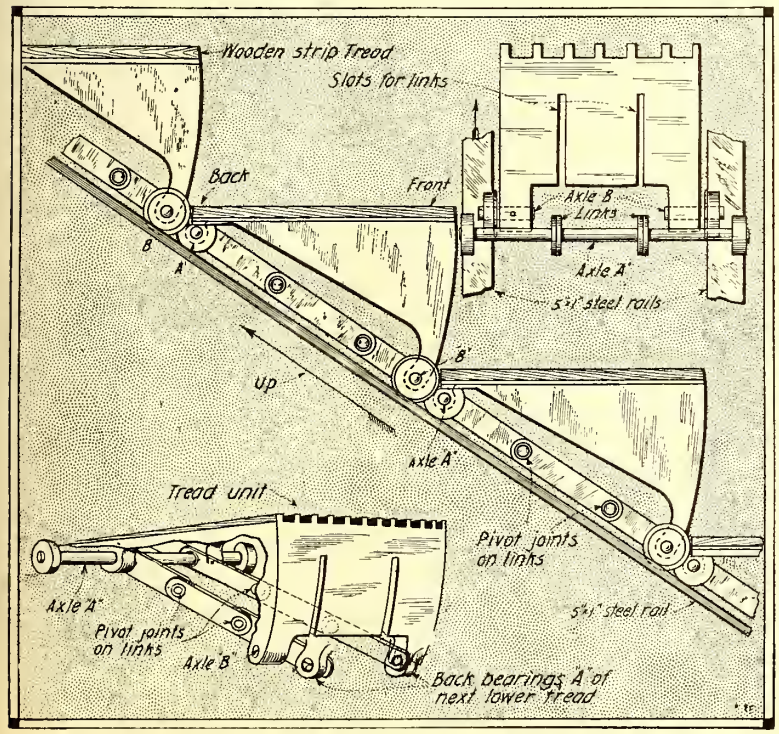
The accompanying illustrations show precisely the effect "before and after" the application of the faradic current to the lathered skin—before a current is applied, the hairs lie down—Fido-like—and a little while after the current is turned on and the razor applied, the hairs stand in line just like a platoon of soldiers, so that when the razor blade waltzes along over the skin the hairs are *guillotined* at the roots, not lynched, as with the present-day un-faradized—or should we say un-paradized—razor! Watson—the needle!!



Eureka! We Have Found It!! After a Long Many Years of Searching Thru Patent Gazettes from All Over the World, We Had to Dust Off Our Glasses Carefully to Make Certain That We Had Not Been Foozled: For What Did Our Eyes Behold!!! Sure Enough, the Electro-Faradic Razor That Makes Papa's Little Whiskers Stand up on End as Here Shown, so That the Keen Edge of the Razor Can Zip Them off without Mangling Them, Heretofore Causing Papa to Ejaculate Profanely.

More About New York's Subway Escalator

In the May issue of the ELECTRICAL EXPERIMENTER there appeared a feature article with special illustrations on page 20, showing the four motor-driven escalators being installed at the Park Place station of the New York subway system, which is one of the most elaborate and highest lift escalators anywhere in the world.



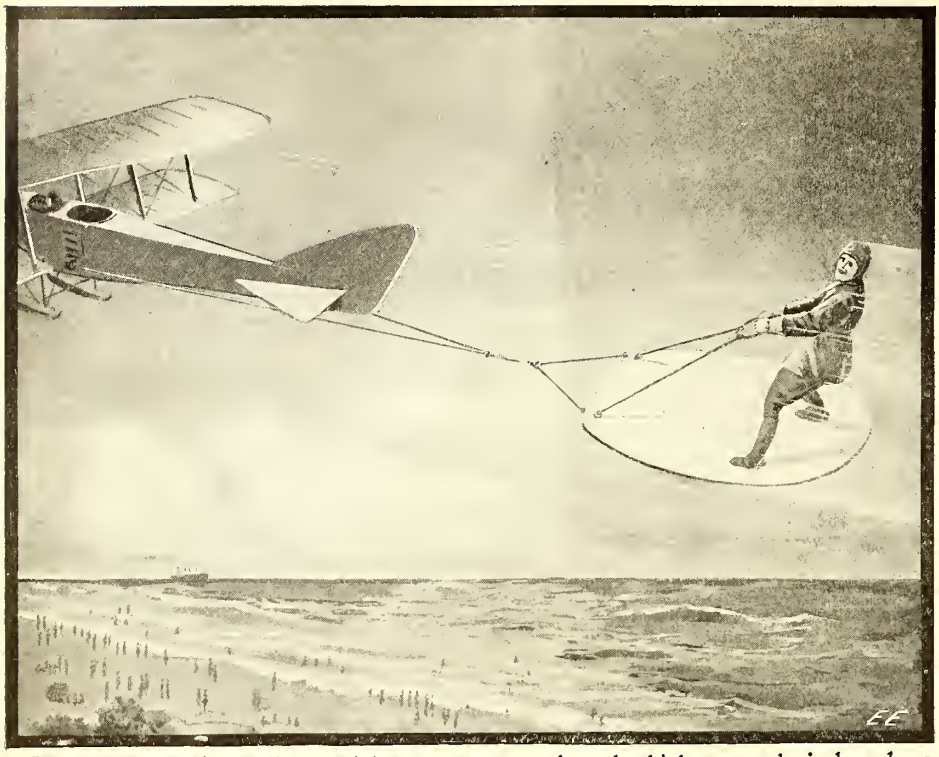
In the May issue of this Magazine there was publisht a sectional illustration and description of the new duplex escalators, installed at the Park Place subway station in New York City. This new escalator presents several novel features, and the accompanying detail illustration shows the ingenious design of the treads or steps. Each step is made in the form of a casting, and it travels up the inclined rails on four wheels. The steps are linked together by a series of link belts, which give sufficient flexibility for the series of steps to round the curved return-bends of the escalator at top and bottom, in order that the returning steps may follow in their reversed position on the underside of the escalator. These escalators are electrically operated, and mark the very latest advance in the design of moving stairways.

The details of the steps used on these escalators, which are four in number, are very interesting, and the accompanying illustration shows how the steel plate steps, which are fitted with wooden tread strips, are linked together by an endless chain, so as to be carried by the escalator upward and over the toothed-end drums in the usual manner.

The steps are independent units. This is due to the novel arrangement of the small iron wheels on which they they are carried up the escalator tracks. These tracks are flat steel members measuring about 5 inches by 1 inch. The rear wheels are flanged and travel on the inner edges of the tracks, while the front wheels of each step unit are plain flat wheels without flanges. The step units are held rigidly in line owing to the link belt or chain construction followed in connecting up one step with another, as the illustration shows clearly. The links are made of light steel about 3 inches by ½ inch in section, which gives great solidity and ruggedness to the construction, while at the same time preserving the necessary degree of flexibility, so that the step units will properly intermesh in passing over the cogged drums at the top and bottom of the escalator. Each of the four escalators is driven by means of a powerful electric motor mounted at the top of the structure and properly geared to the cogged drum at the top, over which the moving stairway belt passes. The steps return to the base of the structure under the rising treads, within the enclosed stairway provided for it as shown in the illustration in the May issue.

www.americanradiohistory.com

Surfplaning in Mid-air



Sensations! That's What We All Crave These Days. And Here's One That Will Make You Stare for Some Time. Surfplaning in Mid-air, from the Tail of an Airplane. As the Magician Said—"It's a Good Trick If I Do It—and it's a Good Trick If I Don't Do It." We'll Say So.

Imagine yourself standing upright on a piece of plank in mid-air, and skimming thru space at a speed of 100 miles an hour, while the green fields, rivers and houses flit along beneath you with dizzying speed. "How did I get out there?" you will say, "on that skimming board in mid-air? I have seen the natives at Wakakee beach ride the surf boards—'Surfplaning' they call it in that part of the world—but this stunt has sure got me." Well, it all happened this way. The planing board was secured to the high-powered airplane by a small, strong wire cable secured to a quick-acting reel. This board was held close up under the fuselage or body, with release clips, so that when the pilot pushed a button, the board swung loose, and you proceeded to scramble on it and hold fast for dear life. The next minute the pilot unlocked the cable reel, and before you got your second breath, you found yourself standing up vertically in mid-air on the planing board and being hurtled thru space at a terrifying velocity, with the wind whipping by you with an exhilarating, yet awe-inspiring velocity.

Planing thru the sky in this fashion promises to become one of our newest hair-raising "air circus" stunts. The inventor, Frank H. Ellison, of New York City, guarantees to bring out all the people in any town or city, including his own home town, wherever this death defying air trick is performed. We said it!!—*"Wherever" it is performed,* with the accent on the whole four words.

In describing his invention, Mr. Ellison, goes on to say: "A skilful rider can manipulate a planing board in the air as many ways and even more than on the surface of the water, balancing himself with his feet placed in the toe-clips on the top of the board, and using the ropes and ring as a rein. In carrying out this astounding feat, the observer releases the board from the side of the airship, holding it edgewise to the wind as he climbs on board, holding on to it with one end and grasping the hand support on the fuselage of the airplane with the other. The pilot lowers the prospective steeple-jack of the air by means of an automatic reel, a sufficient distance to clear the ship. By this time the wind has caught the board, turning it flat in the air, after which time the airplane pilot opens up his engine and proceeds to drive his machine at such a speed as to hold the rider in a vertical position on the planing board. Yes, boys, its some sport,—take it from us land lubbers.

Catching Worms by Electricity

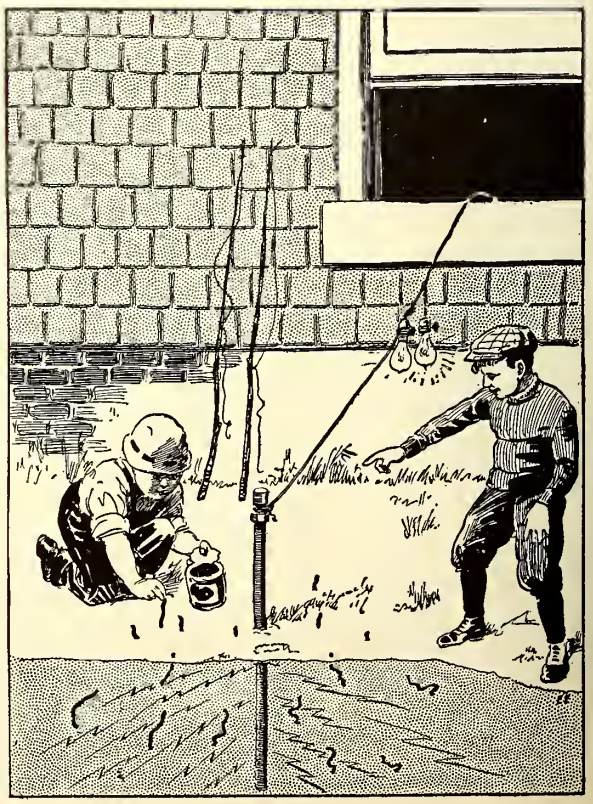
Ever want to go fishing and couldn't catch enough worms? "Many's the time," says you. Well, right here we have something new and original in fish worm enticers. I have recently found that by driving a piece of iron pipe down in the ground a few feet (and, by the way, it should be good, damp ground), and then connecting a wire to the house electric light circuit (with a 110 volt lamp or two in series), the current passing over this wire to the earth and spreading thru the soil about the pipe, will tickle Mr. Worm and his fellow reptiles so that they will come out of the ground helter skelter and post haste,—not by ones and twos, but by the dozens!

The worms are so glad to get out of the ground, that they fairly jump out of their holes into your hand. Don't believe me, I suppose, but go ahead and try it. But before you start, be sure and get a sufficient number of large 40 quart milk cans, in which to put the worms. With this remarkable electric worm catcher, you can safely invite the whole neighborhood to go fishing, for there will be plenty of worms to go around. There is only one bad thing about it, and that is when the office boy finds out how beautiful it works, he will be out fishing five days a week, and will be in on Saturday to spend those immortal three hours between nine and twelve o'clock with us.

One more word of caution before you try out this stunt. You may find that in order to have a current pass thru the lamps and down thru the pipe to earth, that you will have to reverse the wire where you connect it, owing to the arrangement of the electric light circuit, one side of which only is *grounded,* while the other is not. It is to the *ungrounded* side that you will have to connect the wire, and you can immediately tell when you have the right side of the circuit hooked up, as the lamp or lamps will immediately light up as soon as the connection is made.

Contributed by
TOWNSEND BROWN.

Do You Have Trouble In Catching Fish Worms? Of Course, You Do. Well, Here's a Trick Taught the Editors Recently by a Youthful Electrical Experimenter. Quoth He—Ever Try Sticking a Charged Electric Light Wire In the Wet Earth, and See the Worms Come Wiggling Out; Oodles of them? No, Said We. Well Try It. And We Hereby Confer on the Esteemed Inventor, the Croix de Angleworm, Pour la Merit.

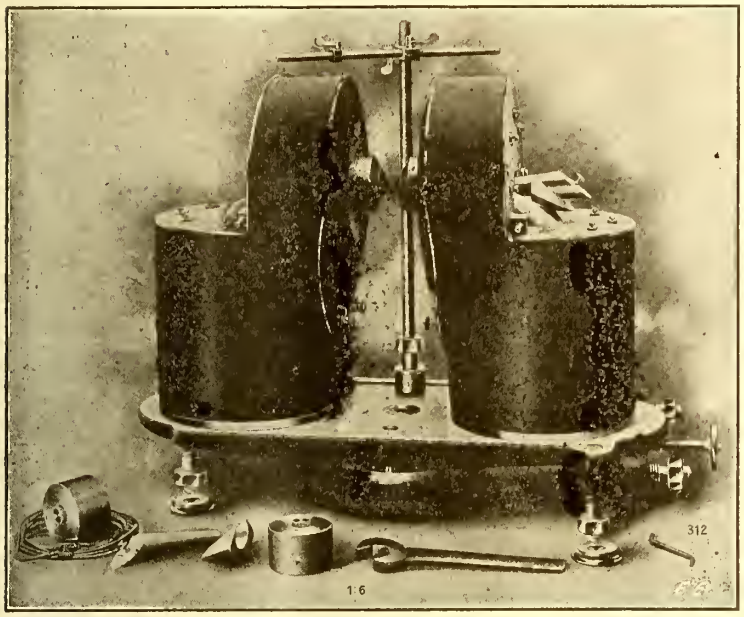


www.americanradiohistory.com

New Laboratory Electro Magnet

Frank C. Perkins

The accompanying illustration and drawing show a new laboratory electro-magnet designed by Dr. Du Bois for making various physical tests. With these coils a half ring core is provided besides various shapes of pole-pieces. It is possible to produce an extremely powerful magnetic effect and one of the strongest fields ever obtained. Provision is made for a very narrow air gap when desired and swivel poles in cylindrical sockets may be used so as to turn about at any angle. This magnet may thus be utilized to great advantage for effects of light beam and magneto-optical investigations upon different substances put in the air gap.



For Laboratory Researches an Electro-magnet Must Possess Many Unusual Features. The One Here Shown, Designed by Du Bois, Permits Experiments in Magneto-optics as Well as Those at Very High and Very Cold Temperatures.

It is possible to send the light thru the poles by means of axial holes or crosswise in the air gap. Interesting experiments can be made at different temperatures and provision is made for using liquid air contained in leather bellows mounted on the magnet or by surrounding the poles by a porcelain heating vessel.

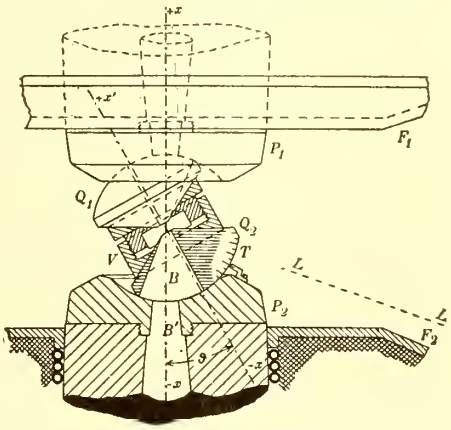
It is possible to work between temperatures of 200 degrees Centigrade and 1300 degrees in a very strong magnetic field. This powerful magnet allows of observations of all kinds of effects in a very strong magnetic field and a widely different degree of heat, and microscopic apparatus may be utilized to great advantage with the attachments provided.

NEW RADIATOR TYPE, SELF-COOLED X-RAY TUBE.

A new self-cooled, radiator type X-ray tube is described by Dr. W. D. Coolidge, in the *General Electric Review*: The type of tube described in this article was developed specifically for military use in the portable Roentgen-ray outfits at the Front. Its characteristics are such, however, that it seems ultimately destined to supplant the earlier type of hot-cathode tube for all diagnostic work.

The earlier form of hot-cathode tube having a solid tungsten target is capable of rectifying its own current; but only for such amounts of energy as do not heat the focal spot to a temperature approximating that of the cathode spiral. As soon, however, as any part of the focal spot is heated to a sufficiently high temperature, it emits electrons copiously, and, therefore, when supplied from a source of alternating potential, it permits so-called "inverse" current to pass. The "inverse" cathode-ray stream comes out from the focal spot in a direction perpendicular to the face of the target and proceeds, in the form of a narrow pencil, straight to the glass wall of the bulb close to and slightly behind the cathode. The glass at this spot fluoresces vigorously, becomes locally heated, and usually cracks. As air enters the bulb, a spark discharge passes thru the opening and it is then easy, for one who has not studied the phenomenon, to conclude that the tube failed by *puncturing* under electrostatic strain.

The essential condition to be fulfilled was that heat should be more rapidly withdrawn from the focal spot. This could have been accomplished by water-cooling, but this method clearly involved undesirable complications for portable work. Experiment showed that the most effective simple method consisted in providing a target having a large heat capacity and high heat conductivity, and then in arranging to effectively cool this mass of metal during the interval between radiographic exposures. The importance of having the target cold at the start is shown by the following experience with a tube having a 3.2 mm. focal spot and a solid tungsten target: With the maximum allowable energy input, it was possible when beginning with the target at room temperature to run four times as long before "inverse" current appeared as when the experiment was started with the target at dull red heat.



Detail of Swiveling Pole-pieces on New Laboratory Magnet Shown Above. They Are Calibrated and Can Be Swung to Any Angle Desired—a Very Important Feature.

The considerations which are described finally led to the *anode* design shown. The anode stem consists of a solid bar of copper 5/8 inch in diameter which is brought out thru the glass of the anode arm to a multiple wing *copper radiator*. The head of the anode consists of a mass of specially purified copper which is first cast in vacuum onto a tungsten button and is then electrically welded to the stem. The tungsten button, which is destined to receive the cathode ray bombardment is 2.5 mm. (0.1 in.) thick and 9.5 mm. (3/8 in.) in diameter.

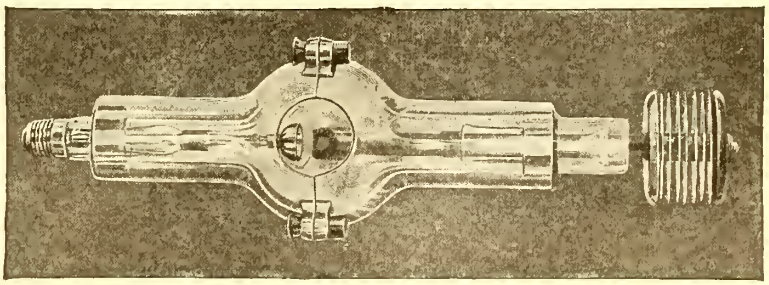
The complete target, with radiator, weighs 860 gm. and has a heat capacity of 81 calories per degree Centigrade; while the present standard solid tungsten target, complete with molybdenum stem and iron supporting tube, has a heat capacity of less than 10 calories. Because of its greater heat capacity, it takes much longer to heat the radiator type of target to a given temperature than it does the solid tungsten target. What is much more important, however, is the fact that between radiographic exposures the target in the new tube cools comparatively rapidly owing to the large copper stem and the radiator.

In the standard hot-cathode tube with the solid tungsten target, the target gets very hot and radiates thru the glass walls of the tube the greater part of the energy it receives. As a result, the glass becomes strongly heated. In the new *radiator type* of tube, by far the greatest part of the energy imparted to the target is conducted to the radiator. It, therefore, becomes possible to make the glass bulb *very small*. For portable work, a diameter of 9.5 cm. (3¾ in.) has been standardized.

For some applications it has been found best to enclose the X-ray tube in a lead glass shield. Glass of good quality and containing sufficient lead is satisfactory material from which to make such a shield. The ordinary X-ray protective glass with which the author is familiar does not have as high a lead content as seems desirable. However, the author was finally able to obtain glass containing enough lead that, for the same protective effect, the glass layer has to be but four times as thick as sheet lead.

As seen from the photograph, the lead glass shield has a round opening thru which the Roentgen-rays can pass. The two halves of the shield are bolted together.

Two portable Roentgen-ray generating units have already been built around the first model of this tube. These are the "U. S. Army Portable Unit" and the "U. S Army Bedside Unit."



Interesting Form of Improved X-ray Tube Fitted with Radiator Flanges so as to Be Self-cooling. It is Encased in a Lead-glass Shield, the Desired Rays Issuing Thru a Circular Opening at the Center.

www.americanradiohistory.com

"Old Phonograph Record" Contest

OUR old phonograph record contest as announced in our *August* issue proved to be one of the most popular contests that we have ever held. Hundreds and thousands of letters were received and many clever as well as ingenious and practical suggestions poured in upon the editors. It was no easy task for the judges to pick out the winners, and in making the first prize award the following was taken into consideration by them.

While perhaps many of the other suggestions were more ingenious, it struck the judges that a new idea tending to improve our health should receive first consideration, and this is why the first prize was awarded to Mr. F. R. Spindler. Not only were the judges prompted to award the prize on account of this feature, but also because the suggestion is not only new, but is eminently practical.

Furthermore, the bar bell as well as the dumb bells *can be made adjustable* by adding only two records at a time. Thus, as the user becomes accustomed to it, he can add more and more weight as he sees fit. This is an important consideration, as at the present time there are no bar bells or dumb bells on the market that are adjustable to such a fine degree.

On the opposite page we have endeavored to illustrate a few of the good ideas; there were of course thousands of others, but most of them were either duplications of similar ones publisht herewith, or were not very practical to the minds of the judges.

Many contributors suggested the use of phonograph records as fan blades by heating the record in hot water and then shaping the blades. This was not a bad idea. However, the danger of the blades breaking is very great and while flying thru the air might seriously injure people.

Our wireless enthusiasts, to be sure, came in with a rush and had many good ideas. There were loading coils, switch-board panels, oscillation transformers, adjustable transmitting condensers, tuning coils, bases, condensers, fixt, variable and otherwise, lead-ins, washers, scales for rotary condensers, loose coupler ends, etc.

Then we had knife sharpeners, a great number of Tesla water turbines, many formulae how to melt the records and make various compounds from them, switches, panels for wireless instruments, covers for all sorts of chemical bottles and otherwise, rheostat bases and even clock dials. One ingenious contributor even showed us how to make a mantle clock casing made entirely of phonograph records, bent and worked into shape.

One contributor from the middle west sent in an elaborate design for a colored disc apparatus to show the changing colors of rotating discs. There were of course a number of so-called omnigraphs, using the record to make the dots and dashes by cutting notches around the rim for the dots and dashes. There were a great number of electrical switches as well.

Some of the wireless ideas and several others were so good that we will run them in our other departments shortly. Particular mention should go to Victor H. Tegge, of Haddonfield, N. J., who succeeded in making a synchronous telegraph which he calls a codeless telegraph. A very good idea, which will be publisht later.

Mr. W. L. Lyndon, of Lyndon P. O., Alta., Can., showed us how to make a large switchboard panel in four layers by shellacking together a great number of records.

Frank J. Pastern, of Chicago, takes the cake by submitting an idea how to bend a record in the form of a horn so it can be used as a bicycle or automobile horn, using a buzzer in the back to make the noise.

FIRST PRIZE.

ADJUSTABLE BAR BELL AND DUMB BELLS.

By F. R. SPINDLER,
83 Saranac Street, Rochester, N. Y.

Every Experimenter needs physical as well as mechanical or electrical training, therefore he can make a real muscle builder from cast-off or worn-out phonograph records.

A steel bar about ¾" diameter and approximately 4 ft. long, threaded 12" from each end, will serve as the support for the records.

Variable diameter records are used to give it a fairly spherical appearance. The amount can be varied to suit the user. Steel washers are placed on each side of the series of records, which are held in place by the hexagon nuts. The weight can be made adjustable by simply increasing or decreasing the number of records. A bar bell too heavy is not practical as it tires the user. About 50 lbs. is a good maximum weight for the average athlete.

The second illustration shows how dumb bells are made by using a short steel bar, threaded at ends, and a number of 10c or else 7" records.

Prize Winners

First Prize—$25.00. F. R. Spindler, 83 Saranac St., Rochester, N. Y.

Second Prize—$15.00. Jackson H. Sterrett, 1001 Walnut St., Erie, Pa.

Third Prize—$10.00. E. M. Williams, 301 Main St., Salisbury, Md.

SECOND PRIZE.

CHEMIST'S TEST TUBE RACK.

Herein is shown a revolving test tube rack which the writer has constructed and considers a very practical and useful application for phonograph records which have outworn their welcome.

Several points about its practicability are:

1. It is very easy to construct.

2. It will hold a great number of tubes, especially if large discs are used.

3. Being made of the phonograph discs, it is quite impervious to most chemicals.

No dimensions are given, as the individual will invariably desire to construct it according to his own requirements. Single face records with the blank faces up, will look best; otherwise the name plates may be enameled black.

All small holes were drilled with a twist-drill, and those in the lower disc were reamed out to accommodate the bottoms of the tubes nicely. Having no twist-drill large enough for the holes in the upper disc, a hole just large enough to pass the threaded part of a bit was first drilled with a twist-drill; then the bit was carefully applied from both sides, until the piece could be pushed out.

The Experimenter who possesses a lathe can make many improvements over the very simple construction here suggested.

Contributed by Jackson H. Sterrett, 1001 Walnut Street, Erie, Pa.

THIRD PRIZE.

RADIO SET MOUNTED ON RECORD.

The accompanying photograph shows my idea of one use old phonograph records can be put to. This is in the form of a combination Radio Receiving and Practice Set, fastened on an old phonograph record with a tuning coil on the back. Very accurate tuning can be accomplished by moving knobs up or down which extend out at each side. Arms which contain knobs extend to the center of record on back, and by means of a flexible wire are connected to each slider, so that the set can be tuned to any desired pitch.

Contributed by E. M. Williams, 301 Main Street, Salisbury, Md.

FIRST HONORABLE MENTION.

Novel Lamp Shade.

I submit herewith a description for using old phonograph records in constructing a beautiful electric lamp shade. The bracket supports were made out of ⅛" galvanized iron wire in the following manner:

First measure the radius of a record to be used, double this length, then find the distance wanted between opposite records at the top. Add these dimensions together and add 1" for making loops at ends of wire.

Now cut two wires, each being the total length just measured, and bend as shown in diagram. When this is completed they are then placed to cross each other at centers and fastened with thin wire so as always to remain at right angles to each other. Now obtain four small store bolts about ⅛" x ½" and bolt on phonograph records, one to each of the four loops on the wire supports. Then get a shade support which can be placed over the electric bulb, fasten it centrally on the bracket and the shade is completed.

Contributed by Jacob Keener, 3145 West 54th Street, Chicago, Ill.

SECOND HONORABLE MENTION.

Tool or Bricabrac Stand.

The photo herewith shows how to build a useful tool or bric-a-brac stand, of service in every shop or parlor, respectively.

To make this stand you should collect (it sounds much better than swipe) a number of records, seven spools 3" long, one spool 1½" long, two pieces of wood 10½ x 1¼" x ½", and one long rod that is to pass thru the holes in the spools and records with a nut on top to tighten them. Then take the two pieces of wood and cut out a piece ½" from the side and about 1" from the ends. In the center of one of these pieces cut a piece ⅜" deep. Cut out a piece ⅜" deep from the bottom in the other piece. Then put these pieces together. Drill a hole ¼" in diameter thru these pieces so the rod can pass thru. The next thing to do is to take the rod, pass it thru the base, put on the small spool, then a record, then a spool, etc., until they have reached the top of the rod. Put the nut on and tighten it. Many variations of this design will suggest themselves. The stand may, for instance, be composed of gradually decreasing sizes of records. Then again, it is well to drill holes in the records to fit some of the tools, especially those that tend to roll off easily. This makes a nice stand for small articles.

Contributed by George Kostka, 2347 S. Ridgeway Avenue, Chicago, Ill.

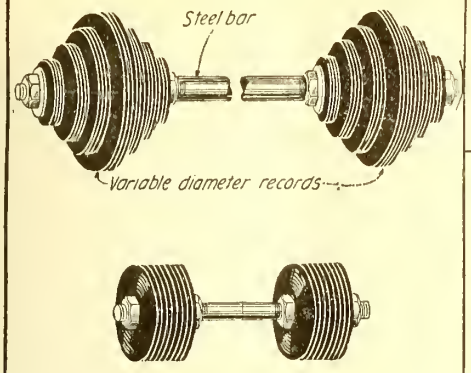
THIRD HONORABLE MENTION.

Tesla Turbine.

Below is my idea for the "Old Phonograph Record" Competition. This Tesla

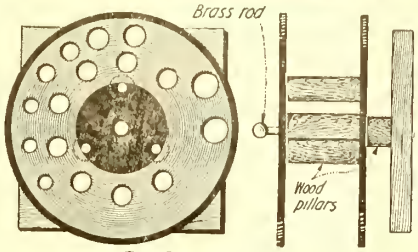
(Continued on page 697)

www.americanradiohistory.com



1ST PRIZE



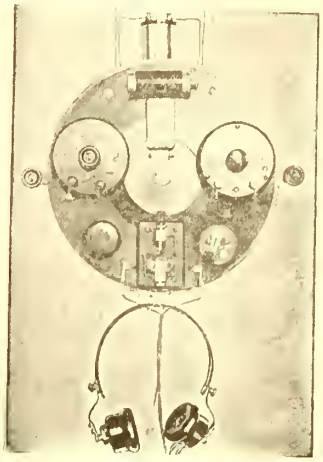


2D PRIZE



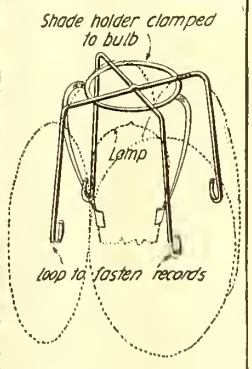
3rd Prize



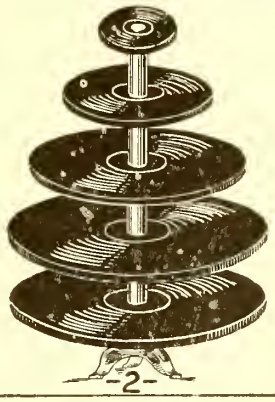


HONORABLE MENTION

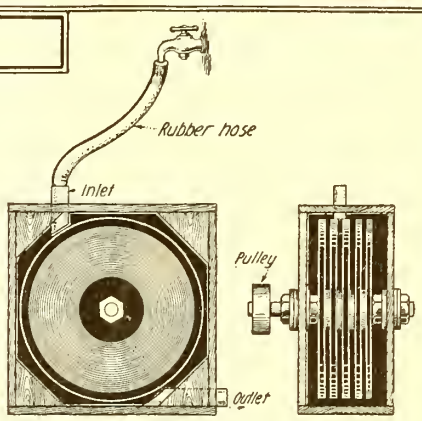




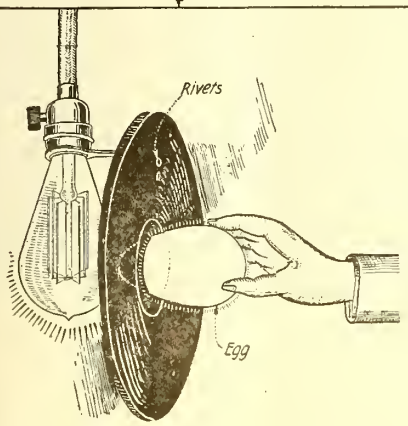
-1-



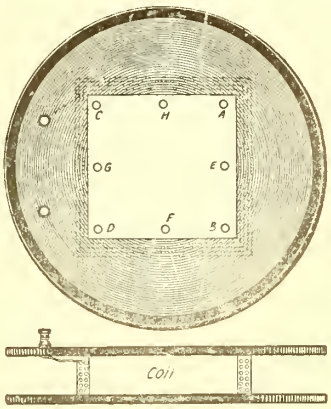
-2-



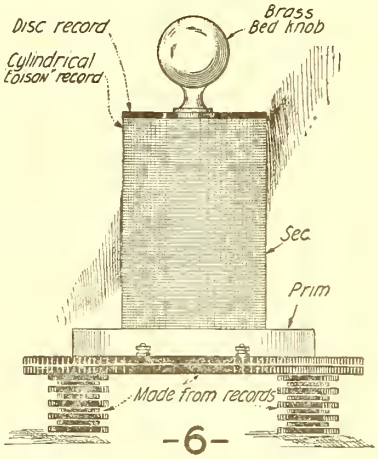
-3-



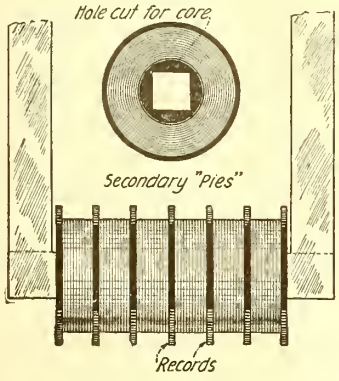
-4-



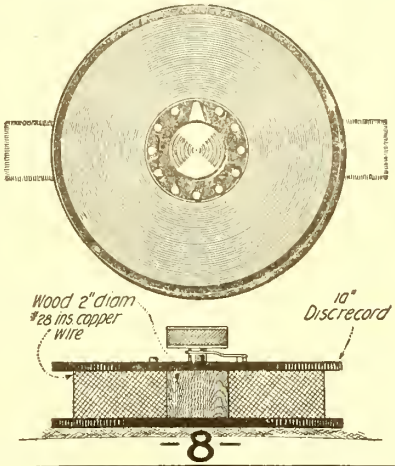
-5-



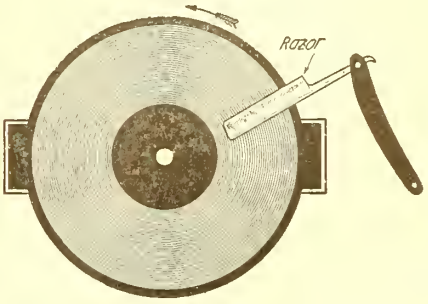
-6-



-7-



-8-



-9-

DRAWN BY M.P.

www.americanradiohistory.com

"PLAN-T"

By JOHN WHITE

"LARNELLE! and have all on fifth and taken here s. Bordinage."

The clipping scissors ran swiftly up the margin of the daily newspaper and neatly cut the foregoing from its personal column. With a little murmur of satisfaction, such as a naturalist might give upon the capture of a new and interesting specimen, Paul Stevenson viewed the latest addition to his collection. Paul Stevenson was a hobbyist. Owing to former experience in the U. S. Secret Service, he was more or less adept in the solution of codes, and gathered material for this pastime from the personal advertisements in newspapers. These deciphered excerpts formed a collection of human and unique interest. His other hobby, possibly more practical, was that of Radio telegraphy, and his he had profitably turned to the benefit of the government when his fine six-foot physique gained him easy admittance to the navy as a Radio-man. During the war he had been injured in U-boat patrol, and, tho not slightly, he had been forced to abandon his work with the navy. Upon complete recuperation he hoped to continue in his former capacity as detective for the nation.

As he fingered the "personal" it appeared to offer no formidable obstacle to decodation. Opening an album, which he had removed from the polished oak shelf over his desk, he disclosed any number of personals ranged alphabetically, in regard to the recipient, while on the opposite page under corresponding names were their deciphering.

Stevenson's careful perusal assured him that he was the possessor of no other advertisement directed to a "Larnelle" by which to be guided in his solution of the present excerpt.

Replacing the volume he applied various methods to the solving of the cipher. He attempted the solution by the assumption that each word was an individual letter, then rearranging the order of the words and the letters themselves. As a last resort he applied the dictionary, hoping to discern its actual meaning by a definite number of words above or below those of the code, or in possible alternation. Having vainly endeavored to do this with several universal editions of dictionaries, he finally considered the possibility of the message—for such he assumed it to be—being void of code and understandable only to one cognizant of its reference. However, he decided that its very lack of unity and coherence proclaimed that this was not the case, and that the message was really conveyed in a very subtle code at present impervious to his attempts to decipher.

That evening, after another futile endeavor at solution, he diverted to his other hobby in despair. At one extremity of his study his instruments were arranged in panel formation, the majority of them hidden within a highly veneered oak cabinet. On a desk, adjoining the instrument table, reposed magazines relating to radio work, many containing articles f his own, dealing comprehensibly with the subject.

The night was damp and the ether seething with the invisible pulsations. Orders and conversation raced back and forth between the battleships in the lower Hudson. One of the men-o'-war was experimenting with wireless telephony and the *Marseillaise* chimed with bell-like clearness in his telephone headset. The Brooklyn Navy Yard roared in with a running jargon, and Stevenson, in attempting to copy it, realized that it was code. Disgusted with code, he tuned them out instantly.

He noted the time—nine-forty-five—and threw on more meterage with the intention of receiving the *time signals* within the next quarter hour.

Suddenly the clear, quenched note of a high-powered station other than Arlington reached his ear. Stevenson's face depicted his astonishment as the air screeched out the uncommon name of "Larnelle." He quickly and with increasing surprise, penciled down the remainder of the message:

"……and have all on fifth and taken here s. Bordinage."

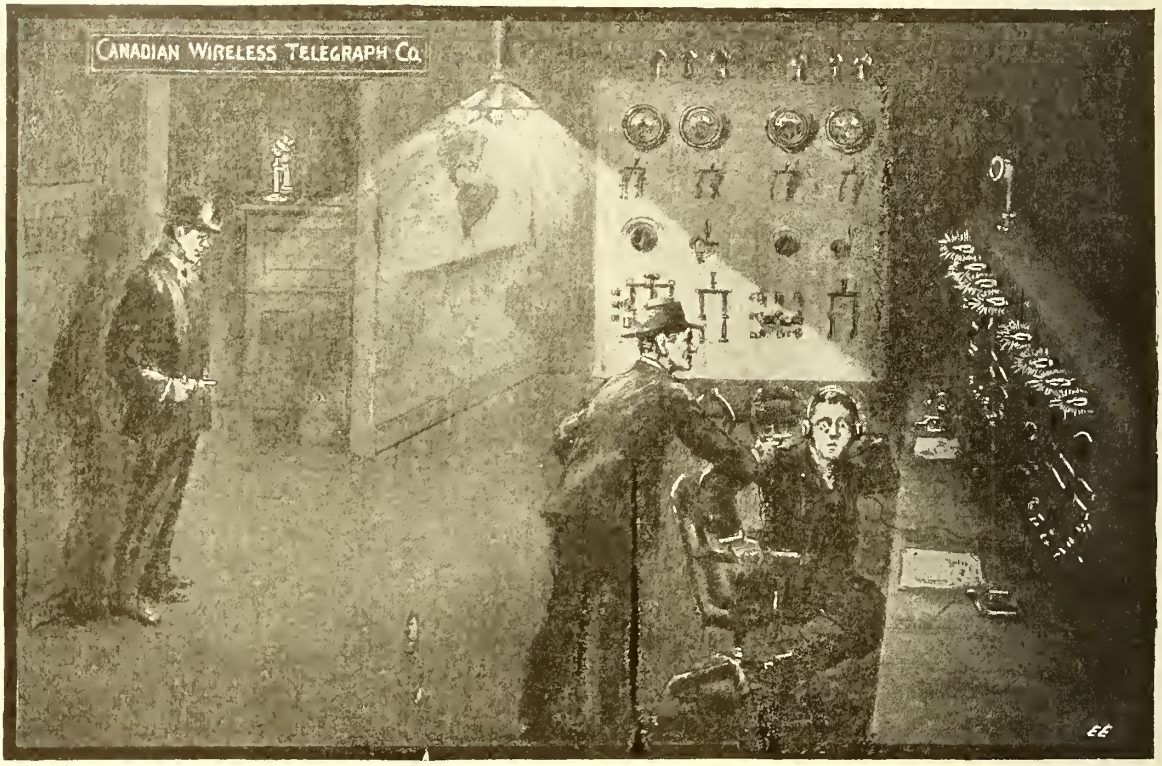
It was identical with that of the "personal."

As he was puzzling over this startling coincidence, the possible answer, calling "Bordinage" broke in upon him.

"Damn fool," it read, "that's the same thing. Wait now."

There was silence, then Arlington dashed out the time and Stevenson threw down his headset in the midst of the weather report.

The first was the sending of an expert, and from the sound he judged it to be that of a professional station, while the reply was more slow and amateurish and possest the coarseness of other than a quenched gap



"Then Back Crashed the 'O. K.' in the High-Pitched Tone of the Q— Station. The Operator at Q— and Bordinage Were the Same! The Light from the Powerful Nitrogen Bulbs Flooded the Transatlantic Radio Station at Q—. One of the Secret Service Men in the Outer Office Replaced the Long Distance 'Phone. The Radio Operator Moved Nervously, as for the Fifth Time He Had Tried to Call the Unresponsive 'Larnelle.' Feeling a Hand on His Shoulder, He Whirled About, and Faced — a Representative of the Canadian Secret Service."

Replacing the receivers he listened on the same wave length for a possible solution to the enigma. However, the ether was still as the grave in regard to the call of "Larnelle" or "Bordinage." Again scanning the response, it dawned on him that the wrong communication had apparently been transmitted, and that the first operator was to wait, probably until the morrow, before rectifying his mistake and sending, as Stevenson thought, the correct key to the cipher.

The next evening with little excitement the ex-secret service man adjusted his instruments to two-thousand, five-hundred meters, the Arlington wave length. It was not until the evening was well over and the hour was close at hand for the *time signals*, that his vigilance was rewarded. The high-powered station screeched in his ears:

"-.-- .- .-. -. . .-.. .-.. . . Larnelle Larnelle, Bordinage."

Stevenson listened with unnecessary tenseness for the signals rushed in with the tone and loudness which marks only the professional of great range:

"...watkins short delivery send four the danger directions up s."

(Continued on page 712)

www.americanradiohistory.com

Will These Perpetual Motion Schemes Work?

By JOHN D. ADAMS

IT usually requires but the most elementary knowledge of physics to detect the fatally weak point in most "perpetual motion" devices. In the three schemes illustrated in the accompanying illustrations, however, the inherent defects are rather hidden, and the writer has known not a few practical mechanics and electricians who have been led astray by them. As the youthful and enthusiastic inventor will find it instructive to uncover the underlying errors, we will not expose them here, but will confine our remarks to a brief description and incidentally point out why they "ought" to operate.

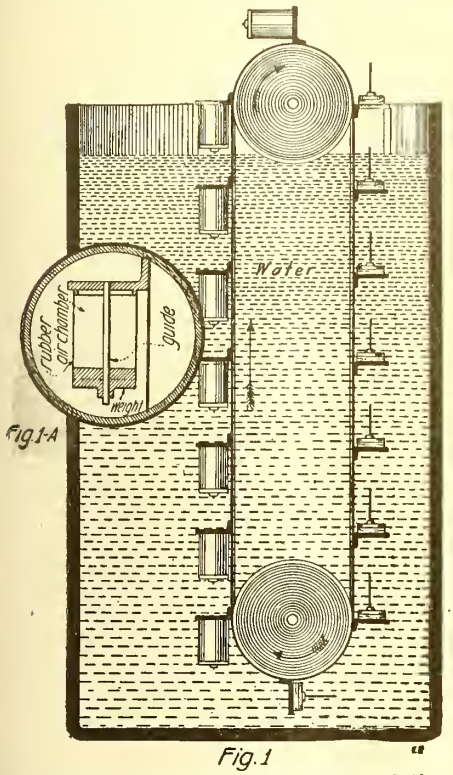


Fig. 1

A Proposed Hydrostatic Perpetual Motion Machine Which Would Appear to Offer Several Advantages Over Simpler Types. The Expansive Rubber Chambers Have Weights Fitted to Them, Which Weights Cause These Chambers to Collapse as They Descend Down Through the Water on One Side of the Belt; While as They Start to Ascend on the up Side of the Belt, the Chambers Open up and Present a Considerable Amount of Buoyancy. Imagine What a Tremendous Amount of Buoyancy a Series of These Air Chambers Will Give! It Looks Like Free Power, Sure Enough!!—But Will It Work? Think It Over!

SCHEME I.

In the first one, Fig. 1, a large pulley is placed at the top and another at the bottom of a deep vertical tank of water. On these pullies a belt is placed, and at regular intervals along this belt brackets are attached. To each bracket a guide rod is secured, and along this rod a heavy circular weight is arranged to slide. The weight and the bracket are connected by a suitable length of soft rubb r tube of large diameter. The bracket, weight and tube, when all assembled constitute an airtight pocket or cylinder, as illustrated in the detail sketch, Fig. 1-A.

It will now be evident that the weight will tend to distend the pockets on the left-hand half of the belt and to compress them on the right-hand half, as the weights in the latter position are on top. Imagine, then, the enormous buoyant effect of all the submerged air pockets on the left side, and it will readily be seen that this side of the belt will have a very strong upward pull. As each pocket comes up out of the water and starts to descend on the right side, it will collapse, and the whole series of collapsed pockets on that side will present just so much dead weight, which will accordingly add to the turning effect on the pullies. Most perpetual motion machines depend on one force being stronger than another, but the fundamental principle here employed has the distinct advantage of having all the forces involved act in the same direction.

SCHEME II.

In scheme number 2, Fig. 2, the water is contained in a vertical stand-pipe, and, by providing one several hundred feet high and attaching it to the back of a skyscraper, it will be apparent that enormous power may be generated as long as the force of gravity remains on the job.

$10.00 CASH PRIZE FOR THE BEST ANSWER.

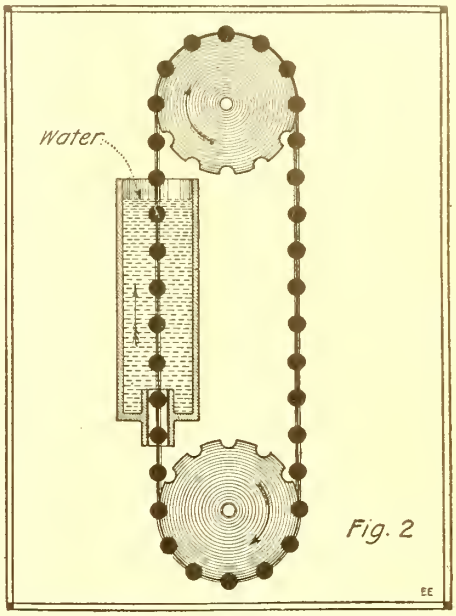
What is your opinion as to why the three proposed "perpetual motion" machine schemes here described and illustrated will not work? Here are the rules by which to write your answer to this problem:

Typewritten replies preferred, or else hand-written letters in ink, but not in pencil. Try to make your reply as short as possible—about 150 to 200 words should cover it easily. As thousands of replies will be received, this will greatly expedite the work of examining all the answers which come to hand. No mathematics are required or desired in explaining the fallacy of the machines here illustrated. The answers received will be past upon by a board of experts, including the following:

Mr. John J. Furia, A.B., M.A.; Mr. H. Gernsback, editor, and Mr. H. W. Secor, associate editor. This contest will close January 15.

Address all letters to "Perpetual Motion Contest."

At the top and bottom of the stand-pipe are two large sprocket wheels, and around these is operated a continuous belt composed of light, hollow copper balls connected with suitable links. These balls enter the stand-pipe thru a tube placed in the bottom, the accuracy of fitting being such that no appreciable leakage will occur If the reader will now suppose our illustration extended in a vertical direction several feet, and will form a mental picture of the string of several hundred submerged air pockets, the tremendous upward pull will be appreciated. For every ball that passes out of the water at the top, another will take its place at the bottom, so that the motion will necessarily go on perpetually. If one should feel alarmed lest the motion become *too rapid and violent* at light load, there would be no objection to providing a *governor!*



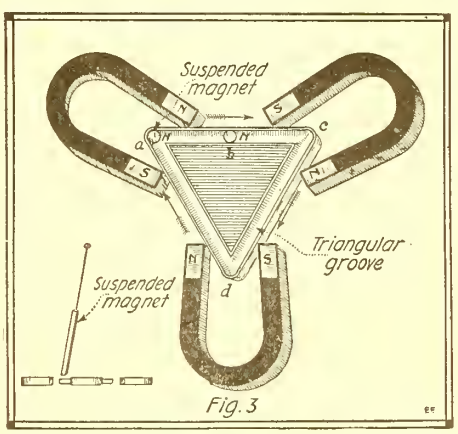
Another Water Power Perpetual Motion Idea Which Is Out of the Ordinary Class. This Promising Design of "Everlasting Motion" Machine Utilizes a Series of Hollow Balls Mounted on a Continuous Belt. Gravity Helps the Downward Motion of the Balls on the Right Side, While as Soon as They Enter the Water Chamber at the Left, There Is Realized a Considerable Amount of Buoyancy Created by the Long Series of Hollow Balls Which Are Pushed Upward by the Water. Again We Say, "Think It Over." You May Win a TEN DOLLAR Prize!

SCHEME III.

In scheme number three, shown at Fig. 3, permanent magnets are employed in a horizontal position in the manner illustrated. A long slender bar magnet is suspended from above on a swivel in such a way that the lower end—the North pole—can move freely about in the same plane as the three horseshoe magnets. A triangular groove is provided so that the free North pole can only move along its three sides.

First, consider only the upper left-hand of the three magnets, and start with the free North pole at the point "a." It will be evident now that the North pole will tend to move in the direction indicated by the arrow, because there is no point along that side of the triangle which is not nearer to the North pole of the horseshoe magnet than to its South pole, in consequence of which repulsion will prevail over attraction. When the point "c" is reached (still forgetting the two other magnets) the motion will tend to continue in the direction of the arrow because motion in that direction tends to move the free North pole further from the North pole of the horseshoe magnet and slightly nearer to its South pole. True enough, there will not

(Continued on page 712)



A Magnetic Pendulum Arranged in the Manner Shown, so That a Suspended Magnet Reacts in a Field Created by Three Horseshoe Magnets. The Lower End of the Suspended Magnet Runs in a Triangular Groove, as Shown. Apparently, the Pendulum Magnet Should Keep on Rotating Around the Groove, and In the Direction of the Arrows Perpetually! Is It So?

www.americanradiohistory.com

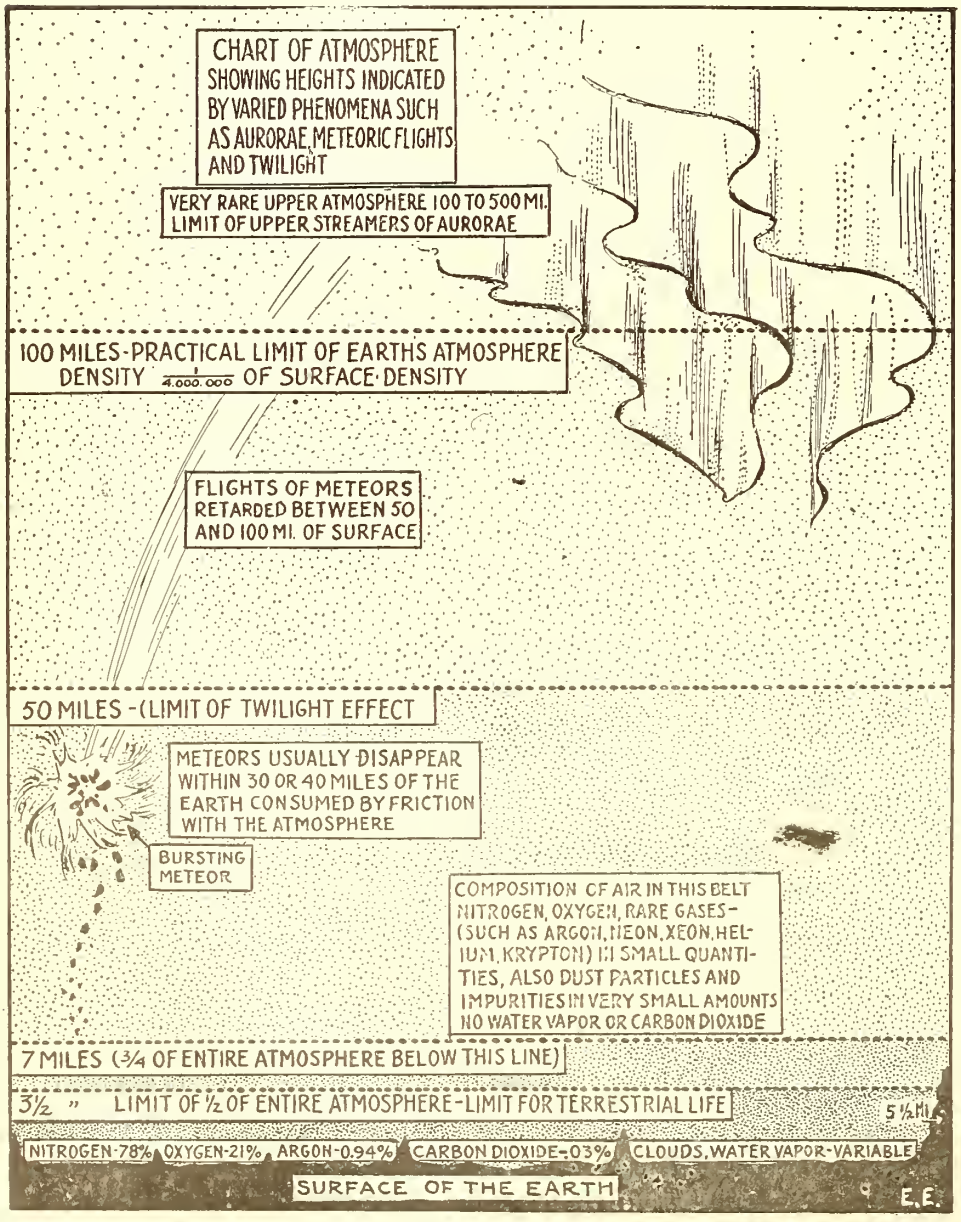
Popular Astronomy

By ISABEL M. LEWIS
Of the U. S. Naval Observatory

The Earth's Atmosphere

IT is a fact, well known to all of us, that no form of life could exist upon our planet earth for the briefest interval of time if the light and heat-giving rays of the sun were suddenly withdrawn.

Yet an equally vital factor in the maintenance of terrestrial life is the earth's atmosphere. Were the thin veil of gases that envelopes our planet to drift away into interplanetary space, all life upon earth would cease as suddenly and as effectively as if the rays of the sun were to fail us.



This Illustration Vividly Depicts How Thin Our Earth's Atmosphere Really Is. Note That Three-Quarters of the Entire Atmosphere Is Only 7 Miles Above the Earth. Even at This Moderate Height It Is Impossible for Man to Live, Unless He Brings His Own Air with Him.

If we should take for a model of the earth a ball, two feet in diameter, the highest mountain on the earth (Mt. Everest, 5½ miles high) would be no more than a grain of sand on its surface, since on this scale one-fiftieth of an inch represents six and two-thirds miles.

The extent of the earth's atmosphere on the same scale would be represented by an outer shell about one-third of an inch wide, assuming that the limits of the atmosphere are practically reached at one hundred miles above sea level.

As we rise above the surface of the earth, the density and pressure of the atmosphere decrease with great rapidity. At sea level, the pressure of the earth's atmosphere is about fifteen pounds upon every square inch of the surface. At an elevation of only three miles it has decreased to such an extent that the average human being would find it impossible to live and breathe at this heighth for any length of time, soon becoming violently ill from "mountain sickness" as a result of the reduced pressure to which the human system cannot suddenly adapt itself.

Aviators who fly high above the surface of the earth are also apt to be overcome by the effects of this reduced atmospheric pressure. So earth-bound is man even in his aerial flights that very moderate atmospheric heights are as inaccessible to him as the moon and the summit of Mt Everest, represented by a grain of sand on our two-foot model of the earth, lies beyond the reach of man and could not be capped by him in his flights thru the air

It can be shown, in accord with the law that governs the decrease in density of the air with altitude, that *one-half of the earth' atmosphere lies within three and one-half miles of the surface,* one-half of the remaining atmosphere within the next three and one-half miles, and so on until the atmosphere becomes so rare that this law no longer applies.

Three-fourths of all the earth's atmosphere, therefore, lies within seven miles of its surface.

It is an interesting result of this rapidly decreasing density that celestial objects shine most brightly when they are overhead for their rays then strike the earth's surface more vertically, and, therefore, have a much shorter path to travel thru the lower densest layers of the atmosphere than when the object lies close to the horizon. (See Fig. 1.) We are all aware of the fact that there are always more stars visible overhead than at low altitudes, the light of the fainter stars being blotted out by the densest lower strata lying close to the horizon.

No reliable observations of the heavenly bodies are ever made within ten or fifteen degrees of the horizon, and whenever star positions of great accuracy are desired the object is observed at the highest altitude possible. This is owing to the fact that the path of a ray of light is changed by refraction as soon as it enters the atmosphere and bent more and more toward the vertical as it penetrates the denser layers. Rays from objects directly overhead or in the zenith suffer no refraction, for they strike the earth vertically, but the nearer the object lies to the horizon the more are its rays refracted by the atmosphere and the more is it thrown out of its true position. (See Fig. 1.)

Refraction at the horizon amounts to more than one-half a degree, varying with the changing temperature and density of the air, and decreasing very rapidly with altitude above the horizon.

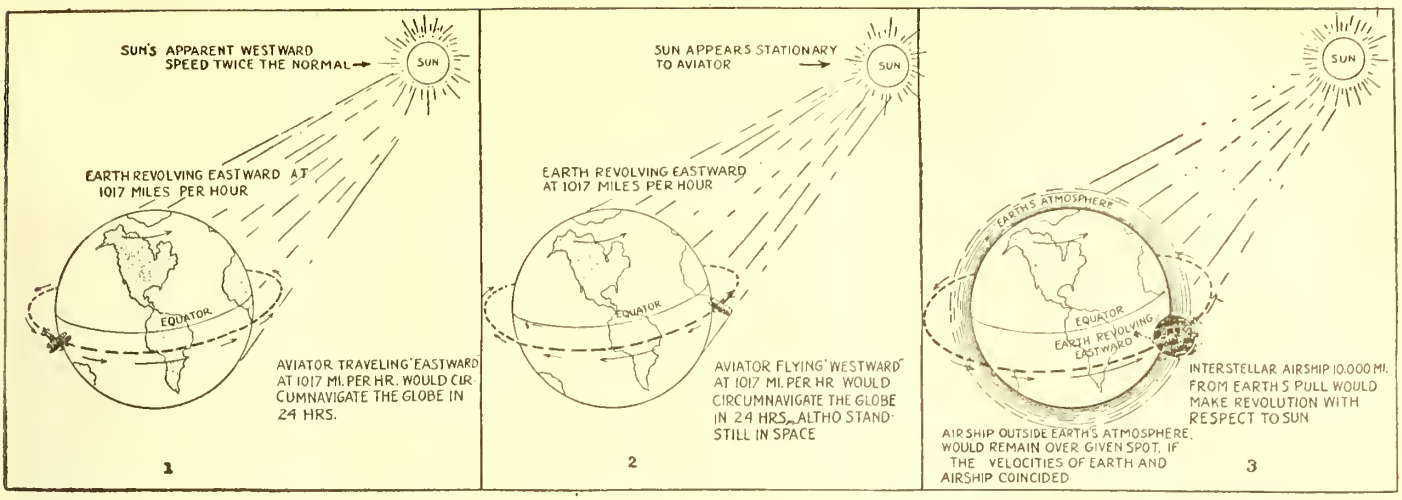
Since the diameter of both sun and moon about equals the amount of refraction at the horizon, it follows that these bodies appear to be just *above* the horizon when in reality they are just *below*.

The oval shape of the sun or moon so noticeable at the time of rising or setting is an atmospheric effect that is due entirely to the fact that the amount of refraction increases so rapidly in the immediate vicinity of the horizon. As a result the lower limb of the sun or moon is raised more than the upper limb and the vertical diameter is shortened while the horizontal diameter is unaffected and the disk, therefore, appears oval.

The apparently greatly increased size of the sun or moon at rising or setting is not generally considered an atmospheric effect, but due to the fact that we then unconsciously compare them with nearby terrestrial objects, such as houses and trees; but this explanation seems hardly satisfactory.

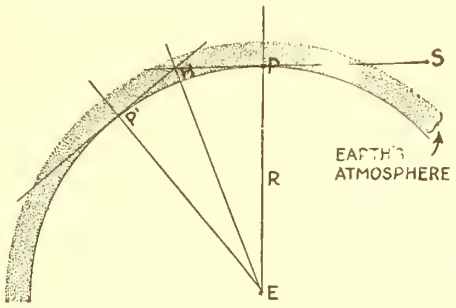
At the earth's surface the atmosphere, measured by volume, contains 78 per cent

www.americanradiohistory.com



nitrogen and 21 per cent oxygen, with less than 1 per cent argon and minute quantities of helium, krypton, xeon, neon and other rare gases, as well as such impurities as soot, ammonia, etc. It contains, in addition, water vapor and carbon dioxide. These two constituents of the atmosphere represent scarcely 3 per cent of its weight, but they are absolutely essential to all living organisms upon our planet.

Fig. 2. To Show How the Height of the Earth's Atmosphere Is Found from the Duration of Twilight. An Observer at P for Whom the Sun is Just Setting at S is Carried by the Earth's Rotation to P', the Last Point from Which He Can See the Twilight Effect Produced by the Sun's Rays Shining on the Earth's Upper Atmosphere After the Sun Itself Has Disappeared Below the Horizon. It Has Been Found as a Result of Many Observations That the Angle PEP', Thru Which the Observer Passes from Sunset to the End of Twilight, Is About 18 Degrees and Therefore the Angle PEH, Which Is Half of This Angle, Is 9 Degrees. Knowing the Value of the Earth's Radius R in Miles, It is Now an Easy Matter to Find H, the Height of the Atmosphere That Produces the Twilight Effect. This Comes Out Almost Exactly Fifty Miles. Therefore the Earth's Atmosphere Exists to a Height of Fifty Miles in Quantities Sufficient to Produce Twilight. The Duration of Twilight Depends on the Angle at Which the Ecliptic or Path of the Sun Cuts the Horizon and Upon the Altitude of the Observer Above Sea Level as Well as Upon the Height of the Atmosphere; Therefore It Varies with the Time of Year and with the Latitude of the Obesrver. It Is Shortest at the Equator, Where the Ecliptic Rises Most Sharply from the Horizon, and at High Elevations Where the Quantity of Air Above the Observer Is Less in Quantity and Charged with Fewer Impurities.



It is the tempering effect of these two compounds in the atmosphere that protects us from the great extremes of heat and cold that would otherwise exist on the day and night side of our planet.

About 40 per cent of the sun's rays are reflected away into space by the earth's atmosphere. Of the remaining 60 per cent, one-fifth is absorbed by water vapor suspended in the atmosphere between sea level and an elevation of five miles, while two-fifths are absorbed by clouds lying one or two miles above the surface. *As a result, only 20 per cent of the rays that enter the atmosphere actually arrive at the surface of the earth.* These estimates are the results of measurements of the solar radiation made at sea level and on mountain heights.

The heat-rays that are radiated from the earth's surface also suffer powerful absorption by the water vapor and carbon dioxide in the atmosphere. According to estimates made, fully half the radiations from the earth's surface are absorbed by clouds and three-fourths of the remainder by water vapor and carbon dioxide in the atmosphere, so that barely *10 per cent* of the earth's radiations escape directly into space, tho by continual radiations from one place to another within the atmosphere the heat gradually seeks higher levels and tends to escape.

Were it not for this blanketing effect due almost entirely to the water vapor and carbon dioxide in the atmosphere, preventing too rapid radiation into space, as well as the effect of the atmospheric currents which are a most powerful factor in equalizing the extremes of temperature all over the globe, it is very doubtful whether either animal or vegetable life would be found to any extent upon our planet. It is well known that there are much greater extremes of heat and cold between day and night on the mountain peaks than in the valleys, owing to the greater rarity of the atmosphere and the comparatively small amounts of water vapor and carbon dioxide.

It is also well known that early frosts will not occur when there is much water vapor in the air or when clouds are plentiful.

(Continued on page 691)

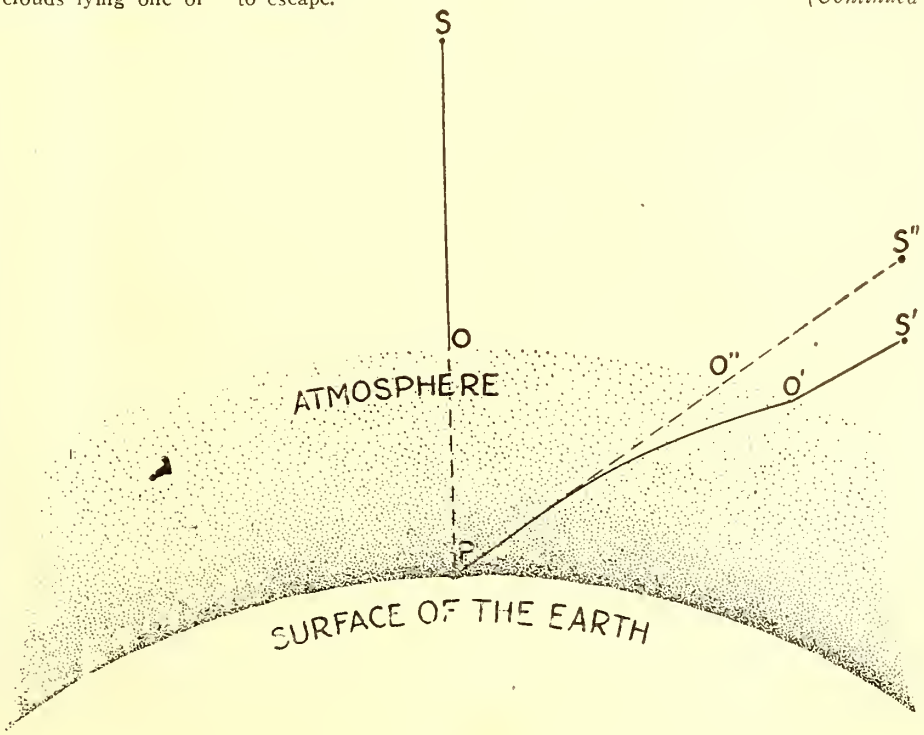


Fig. 1. When Rays of Light Pass from a Rarer to a Denser Medium, as from Interplanetary Space Into the Earth's Atmosphere, They Suffer Refraction, That Is, They Are Bent Out of Their Course in the Direction of the Vertical. Since the Atmosphere Increases in Density Toward the Earth's Surface, the Rays Are Bent More and More from Their Course the Further They Penetrate Into the Atmosphere. The Light from a Star S in the Zenith Suffers No Refraction Because Its Rays Strike the Atmosphere Vertically at O, But the Light from a Star S' Striking the Atmosphere Obliquely at O' Is Bent More and More from Its Course as It Passes on Thru the Atmosphere. The Observer at P Sees the Star S' Not in Its True Direction PO'S', But in the Direction of the Rays at the Time They Enter His Eye, That Is, In the Direction PO"S". The Effect of Refraction Is to Displace the Star from Its True Position and to Increase Its Altitude Above the Horizon. Refraction Is Greatest for Stars at the Horizon, for the Length of the Path Thru the Atmosphere Increases Toward the Horizon. The Line O"P Is Longer Than OP and It Passes for a Greater Distance Thru the Dense Lower Layers of the Atmosphere, Where It is Most Bent from Its Course. Also Stars Shine Most Brightly When They Are Overhead. The Path of Their Rays Thru the Atmosphere Is Then Shortest and They Are Scattered and Absorbed Less by the Atmosphere. The Twinkling of Stars Which Is Due to the Unsteadiness and Changing Density of the Atmosphere Is Also Greatest Near the Horizon.

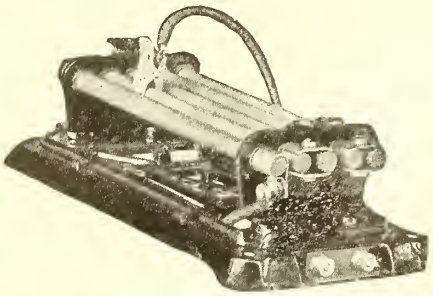
www.americanradiohistory.com

. . . AUTOMOBILE NEWS . . .

VARIABLE CARBON RESISTANCE FOR BATTERY CHARGING.

It is often desirable and necessary to give a long low rate reforming charge to ignition and other storage batteries.

Small batteries for motorcycles, mine lanterns, time clocks, etc., require a low ampere charging rate because of their low



A New Variable Resistance for Battery Charging Composed of High Resistance Carbon Rods Connected in Series. The resistance Is Adjusted by Moving a Slider Along the Carbon Rods.

ampere-hour capacity. In the laboratory where there are a great variety of uses for a variable current in experimental and research work this form of variable resistance proves very useful, and, in fact, indispensable.

When connected in the charging circuit between the rectifier and the storage battery, this rheostat will give any ampere charging rate between a very low rate and the maximum current output of the rectifier by simply moving the spring clip along the carbon rods.

This resistance is non-corrosive and infusible; cannot melt, disintegrate or break from overload or continuous service, claim the makers.

It is constructed of special high resistance carbon rods. It weighs about 5 pounds.

A TOOL FOR REGROOVING PISTONS.

Fitting of piston rings properly requires that the grooves into which they fit be true. The new regrooving tool here illustrated makes possible the easy truing of the grooves. The device is wired to the piston and turned around so that the cutter removes the high spots.

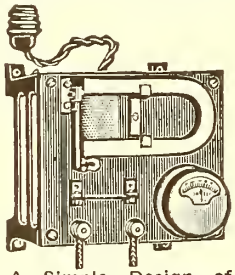


Ever Have to Regroove Your Piston When Fitting New Piston Rings? A Mean Job, Isn't it? Well, Here's a New Tool that Does the Work in a Jiffy. It Cleans Out and Trues Up the Piston Grooves Accurately.

A NEW BATTERY CHARGING RECTIFIER.

Since the demand of low voltage storage batteries for lighting and starting has become so universal there is an ever growing need for a device to keep these batteries fully charged, and especially a low-priced, efficient A.C. and D.C. rectifier. The rectifier here illustrated is very simple as well as inexpensive. They are practically automatic, requiring little or no attention whatever since they operate from 110-volt alternating current, which makes them very convenient to use, as they are portable and can be operated from any convenient lamp socket, each machine being equipt with a cord and screw plug, which can be readily attached to any lamp socket.

A transformer is assembled to each and every machine which steps down the 110 volts to a proper low voltage. This is done by means of two separate windings on the transformer, each winding being well insulated, making it entirely safe and independent of the other. A permanent magnet of the high-grade magnet steel is fastened to the slate base opposite the armature, which causes the armature to vibrate at the same frequency as that of the alternating or line current. To one end of the armature is attached a platinum point, which makes contact with another point of the same material, mounted on an adjustable contact screw. It is automatic in its action, being self-starting. When the current starts up again the rectifier starts up.



A Simple Design of Battery Charging Rectifier.

NEW PLIER-WRENCHES OF CLEVER DESIGN.

A Chicago inventor brings out two new ideas in Plier-Wrenches that will fill the long-felt want in any mechanic's tool kit. These wrenches are quick-acting, self-adjusting, always taking a firm grip on any object that may be clamped in the jaws.

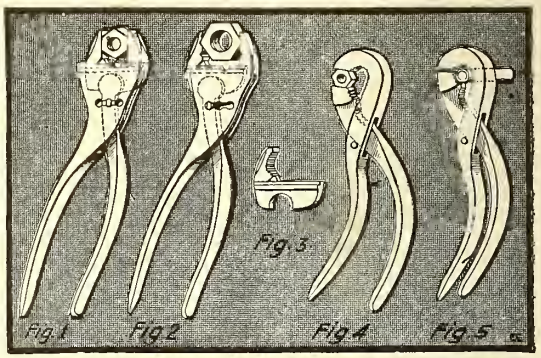
The main features that Mr. Allan, their inventor, claims for these wrenches are: that they are self-adjusting, and that the jaws are always parallel when clamping objects of various sizes, or when the jaws are closed or wide open.

It does not matter whether the jaws are closed or wide open or clamping nuts, pipes or objects of various sizes, the *grip* of the handle is always the same.

Referring to the above cuts, in Fig. 1 the jaws are shown clamping on a medium size nut, while in Fig. 2 the jaws are seen clamping on a large size nut, and the jaws nearly open. If you will carefully notice, you will observe that the handles are in about the same position, irrespective of the jaw opening.

Fig. 3 shows a pipe jaw that is interchangeable with the regular jaw used for nuts, which comes in handy for loosening nuts that have had the corners all rounded off. It also shows that this can be used as a pipe wrench.

Referring to Fig. 4 you will observe this form of a plier gripping a medium size nut. Note that the jaws are parallel, and that the position of the handles do not lose their grip. This plier-wrench has no adjustments. It is absolutely automatic and self-adjusting to any size object, such as nuts or pipes that may be wished to be clamped in the jaw. All that has to be done to operate it is to open the jaws, place the hook jaw on a nut or pipe or any other object wishing to be clamped in the jaws, then simply grip the handle, which will cause the jaws to adjust themselves rapidly to objects of various sizes.



New Plier-Wrenches for Autoists. Fits Round, Square and Hexagon Shapes.

Referring to Fig. 5, the jaws are shown nearly closed and gripping a small size pipe. Note that the jaws are parallel the same as they are in Fig. 4, gripping a medium size nut. On this style of a plier, length 8 inches, it will take in as large as a three-quarter-inch pipe and has a parallel jaw opening that will take in any flat object such as a nut; the flat parallel opening being three-quarters of an inch.

IMPROVED STORAGE BATTERY HYDROMETER.

You can easily test your battery and know that it is receiving proper care by using this improved hydrometer, which contains the following special features:

The rubber collars at each end of hydrometer protect it from striking and breaking, if accidentally dropt. The square collar at bottom prevents rolling off.

The float is always in plain view. There is no plug in bottom to drop out, spilling the acid and breaking the float. All rubber fittings are made of special high-grade stock. The graduations on scale are guaranteed accurate.

This hydrometer consists of the standard hydrometer described above fitted in a glass jar. This jar is to be filled with distilled water or pure rain water, making a safe and handy receptacle for both the water and hydrometer. The large rubber collar on hydrometer fits the top of jar, making it dust and evaporation proof. After testing the battery the hydrometer is placed back in the water and acid is rinsed off.

Instructions for testing the battery and for its proper care during both winter and summer are printed on the label.



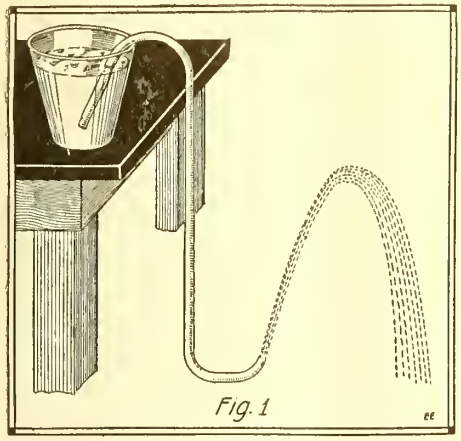
An Improved Storage Battery Hydrometer for Testing Ignition Cells.

www.americanradiohistory.com

Experiments in Physics

By JOHN J. FURIA, A. M.
DEPARTMENT OF PHYSICS, N. Y. UNIVERSITY

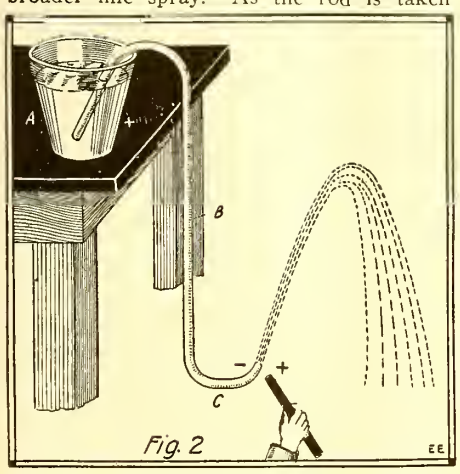
4--Water Jets and Air Jets.



An Ordinary Water Jet Such as Produced When Siphoning Out Water from a Receptacle at a Higher Level. Not Electrified.

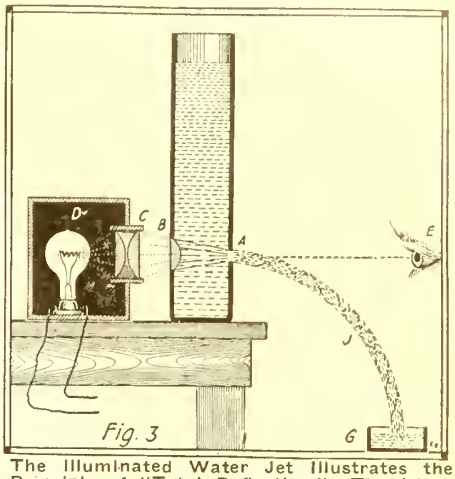
SEVERAL very interesting experiments can be performed with the ordinary water jet. Among the best known are the electrified water jet, the illuminated water jet, and the Bernoulli air jet, each demonstrating a fundamental principle in physics.

The electrified water jet illustrates the principle of *electrostatic induction* (see figure 1). A is a pail of water; B, rubber tubing, and C, a small nozzle. On creating suction at C, we siphon out the water from A in the form of a jet. The jet is inclined at a small angle from the vertical as in the figure, and we find that the stream breaks up into drops a small distance above the nozzle C. Electrify a rod (ebonite rubbed with cat's fur, sealing wax rubbed with flannel or glass rubbed with silk), and bring it near the nozzle as in figure 2. As the rod approaches nearer and nearer to the nozzle, the jet breaks up into a broader and broader fine spray. As the rod is taken away again the stream becomes compact again as in figure 1. The rod, when held near the jet, causes the water to be electrified with the opposite charge just as it breaks up into drops. The drops, since they all have the same charge, repel each other, forming a broad spray. The system from the pail to the jet is electrically neutral when the rod is not near. As the rod approaches the jet, the charge similar to that of the rod is repelled to the pail and the opposite charge is attracted to the jet. This is induction. (The jet becoming charged without coming in contact with the rod.) When the rod is removed, the pail-jet system becomes neutral again (the positive and negative charges distributing themselves uniformly thruout the system). By allowing the spray to fall against an insulated metal plate and then bringing the plate into contact with the electroscope we may test the nature of the charge on the spray. The nature of the charge of the water in the pail can be tested by connecting the water to the electroscope thru a conductor (copper wire).

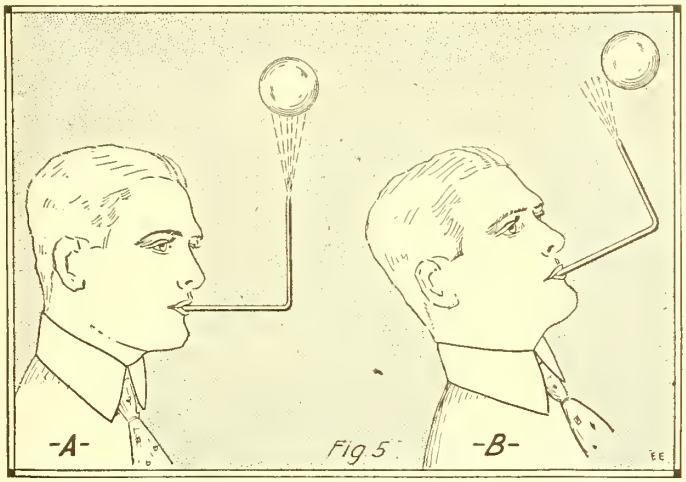


When a Charged Electrode, Such as a Fountain Pen Barrel Rubbed with Cat's Fur, Is Approached to the Water Jet, the Stream Breaks up Into a Broader and Broader Fine Spray, as Here Illustrated. The Water Becomes Electrified.

The illuminated water jet illustrates the principle of *total reflection*. A vessel about 3 feet high, having a circular opening A, about ½ inch in diameter, and a lens B, opposite to it that concentrates upon A the light coming from the condensing lens C, is filled with water. The room is darkened and the stopper removed from A. The water is heard striking the floor but nothing is seen while the lamp D is switched off. When lamp D, enclosed in a light-proof box, is turned on, we see the jet J illuminated, the rest of the space around it remaining dark. Even if the eye is placed at E, directly in line with the lamp lenses and opening, no light is seen. However, if a piece of glass G is placed anywhere in the path of the jet and the eye behind it, a brilliant spot is seen. It is evident, then, that the light from the lamp *travels only in the path of the jet*. The rays of light coming from D are concentrated (on opening A) thru the lenses C and B and strike the jet on the inner surface at an angle greater than the *critical angle*, so that they are totally reflected and none of the rays emerge into the surrounding space. When light strikes a surface so that the angle it makes with the surface is greater than the critical angle, it is all reflected just at is is from a mirror; and just as no light passes thru the mirror, so no light passes thru the jet surface into the surroundnig space.



The Illuminated Water Jet Illustrates the Principle of "Total Reflection." The Light Beam Is Reflected Down the Jet.

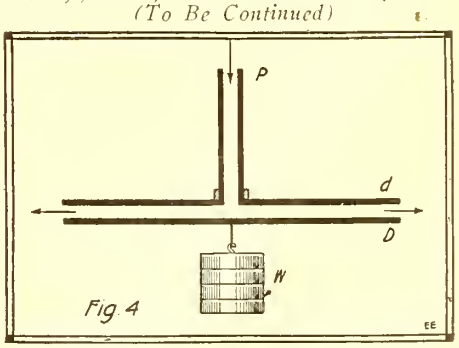


A Similar Phenomenon to That Illustrated by Experiment Shown in Fig. 4 Is That Here Shown. The Rubber Ball Is Held Suspended in Mid-Air by the Air Blast from the Blowpipe.

The Bernoulli jet illustrates the *Bernoulli principle*, which is sometimes stated as follows: In any fluid (liquid or gas) the pressure is least where the velocity is greatest. Figure 4 shows a cross-section of a pipe P, connected to a disk D, thru which a jet of air is being blown under high pressure. D is another disk to which a weight W, is attached. The greater the velocity of the air between the disks, the less the pressure between them and the more they are forced together, and hence, the greater the weight W, which can be supported. On a small scale, a spool may be substituted for pipe P, and disk D, and a small card may be substituted for D and W, the air jet being formed by blowing thru the spool.

The same principle is illustrated in figure 5. At "A" we see a vertical jet supporting a light ping-pong ball up in the air. If, now, the jet is gradually inclined almost to the horizontal, we still find that the jet keeps the ball in the air in spite of the attraction of gravity. The velocity of the air at P_1 is greater than at P_2, and, therefore, the pressure on the ball at P_1 (downward) is less than the pressure at P_2 (upward); hence, the ball remains suspended.

(To Be Continued)



In Any Liquid the Pressure Is Least Where the Velocity Is Greatest. This Device Proves It. If Air, at High Velocity, Is Blown Down Thru the Pipe P, the Two Discs d and D Are Held Together, Supporting the Weight W.

www.americanradiohistory.com

THE CONSTRUCTOR

A Model Electric Theater

By EDWARD K. JEWETT

FEW boys indeed realize the fun and entertainment furnished by building and operating a model theatre. The purpose of this article is to describe the construction of a miniature playhouse and the method of electric illumination used in such a model to produce the wonderful effects seen in modern life-size theatres.

The first step in building the theatre is to procure a strong wooden box, measuring about 1 foot high, 20 inches long and from 10 to 12 inches in depth. A common soap box is just the thing, and in using such an article one has the frame of his theatre ready made and does not have the trouble of making one. The box should stand on its side on the table. The entire bottom is removed, and the back half of the upper side, as shown in Fig. A. A small table-like structure is next built by joining the removed half of the upturned side with a small piece of wood 20 inches long, 2 inches wide and ¼ inch in thickness.

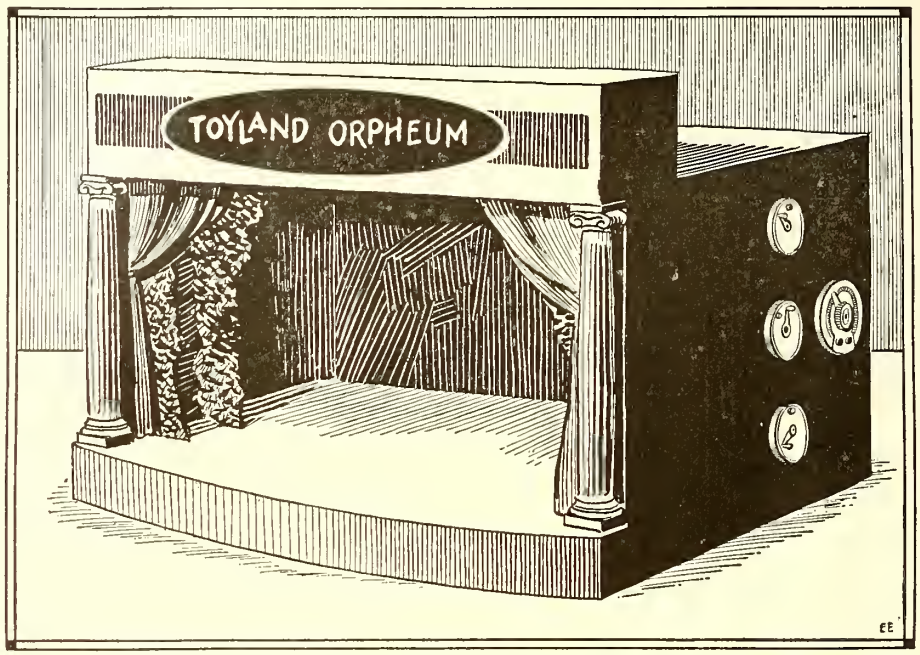


Fig. 1C. A miniature Theater Provides Lots of Amusement and Instruction During the Winter Evenings. Some Experimenters Give Quite an Elaborate Show with One of These Theatres. By Means of Electro-Magnets Under the Floor of the Stage, "Soldiers" Can Be Made to March; Cannons and Tanks Operated by Motors, Etc. The Curtains Can Be Raised and Lowered by Motor and Orchestra Music Supplied Via a Phonograph.

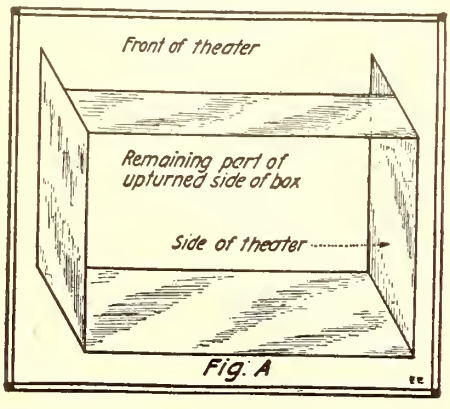
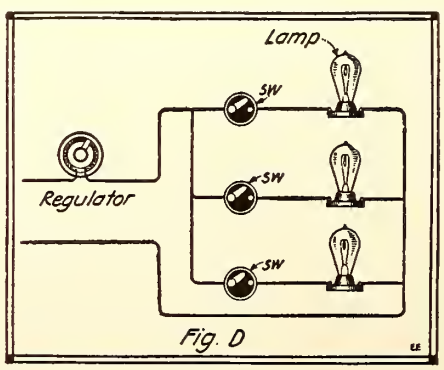


Fig. 1-A. Forming the Frame-Work of the "Home" Theatre. A Good Sized Soap Box Makes a Nucleus for the "Stage."

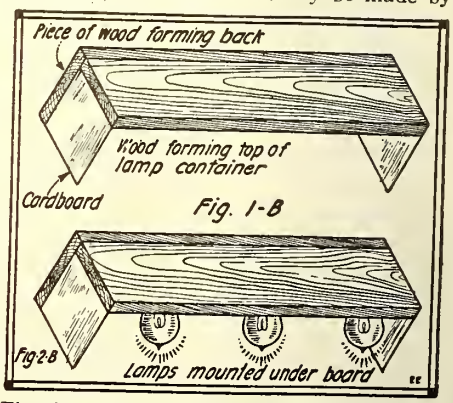
Next, go to a store dealing in electrical goods and buy three small colored incandescent "Christmas tree lamps" and miniature sockets to fit them. The bulbs come in many colors, but the best to choose for the theatre are red, blue and green. Having procured these miniature lamps, screw the sockets on the under side of the upper board forming the top of the table-like structure mentioned above, as shown in No. 2, Fig. B. The next step is to paint the inner walls and floor of the box with some very black substance, such as lampblack, etc. This is done to prevent any reflection of light from the walls and floor when the lamps are turned on. This paint being thoroly dried, begin to wire the instruments and lamps as shown in the lighting diagram D, shown elsewhere. The most convenient location for the instrument is on the remaining half of the upturned half of the box. The instruments are, respectively, one small rheostat or current regulator, and three one-point wood-base switches; by means of these separate switches any single one or any combination of the different lamps may be turned on, and by means of the regulator any degree of brilliancy may be obtained at will.

Having tested the three colored lamps, and having found that they operate satisfactorily and are easily controlled by their respective switches, start building the stage scenery. Let me say here that it is practically impossible to state just what scenes to make; the builder must decide that.

One of the most beautiful types of scenes is the "forest." This may be constructed very easily. For a background, go to some wallpaper dealer or paper hanger and ask him to sell you a yard or two of "forestry" wallpaper. This paper is usually printed with a representation of a forest or jungle on it, and makes a most excellent background for the model theatre. The easiest way to hang scenes in the back of the theatre is to cut the scenery to the exact dimensions of the back of the stage, then take some small sticks of wood (preferably flat pieces) and form them into a square of the same size as the dimensions of the scene, then paste the scene across the "frame" and hang it on the back of the theatre by means of miniature hooks or brads. (Be sure that you hang the scene on the theatre with the "frame" on the *rear* of the scene and not on the *front*, as in the latter case the frame would be visible and would tend to spoil the effect of the scene). Of course, "side scenery" and "ceiling scenery" are necessary, but these can easily be made by cutting them out of the "forestry" wallpaper described above.



Wiring Diagram for the Model Theater. Each Battery (or 110 volt) Lamp Has a Switch and All Three Lamps, Red, Blue and Green, Can Be "Dimmed" by the Rheostat.



The Red, Blue and Green Lamps Can Be Mounted In a Small Box Like That Shown, and Mounted on Top the Stage Frame As In Fig. 1-C.

The side view of the complete theatre is shown in No. 1, Fig. C. The method of making the back scenery is more clearly illustrated in No. 2, Fig. C.

The main scheme in having the different colored lights and switching arrangement for them is to have different "effects" and various intensity of light to correspond with the change in the scenery. For instance, for a "forest" scene in which "dawn" is supposed to be the time, a faint blue, gradually becoming more brilliant, is suitable. For a "sunset" a combination of strong red and faint blue is necessary.

www.americanradiohistory.com

A Fan-Operated Show Window Attraction

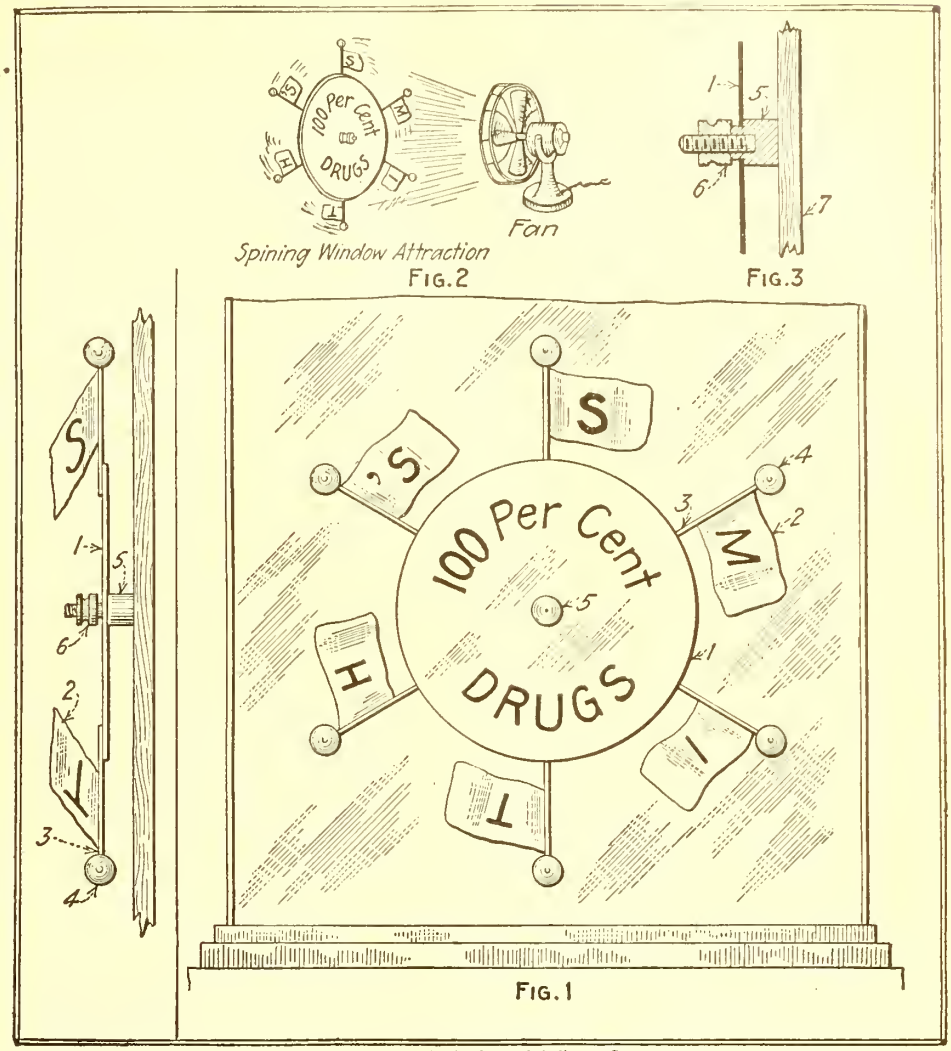
Many store-keepers use their electric fans during the winter months to keep their show windows free from frost, and no doubt an effective animated attraction that is easy to make and will utilize this breeze from the electric fan for its motive power will be of interest. Such a device is described herewith.

It consists of a sheet metal disk upon which the desired advertisement is painted. This is left to the originality of the user, but it is suggested that it should be of few words and the lettering large and arranged in the form of a circle. Bright contrasting colors will help to make it conspicuous. The disk turns on a pivot fastened to the inside surface of the window glass at such a height, that it comes in direct line with the vision of a person walking by on the sidewalk. It is revolved by the current of air against the driving vanes which can be made in any desired form, such as a flag, broad arrow, etc. The pitch of these vanes should be adjusted by trial until the disk revolves at a speed that permits the advertisement to be read easily.

Referring to the drawings Fig. 1 is a front view as the device appears from the outside of window. Fig. 2 is an end view and Fig. 3 is a detailed sectional view of bearing. 1 is a disk of light sheet metal (aluminum) about 8 inches in diameter. 2 is a driving vane in the form of a light metal (1/64" aluminum) flag. 3 is the flag staff soldered to disk. 4 is a small metal ball for a neat finish and is the means whereby the device is balanced. 5 is a binding post forming the bearing for the disk and which is glued to the inside of window glass 7. 6 is the thumb nut of binding post to allow the disk to be quickly and easily removed so that the display can be easily changed from time to time. As shown in detail in Fig. 3, the bearing for the disk is made by turning down a portion of binding post so as to form a smooth projection just long enough so that when the thumb nut is tightened against the end of it there is enough play to allow the disk to turn freely. In operation this bearing should be oiled occasionally.

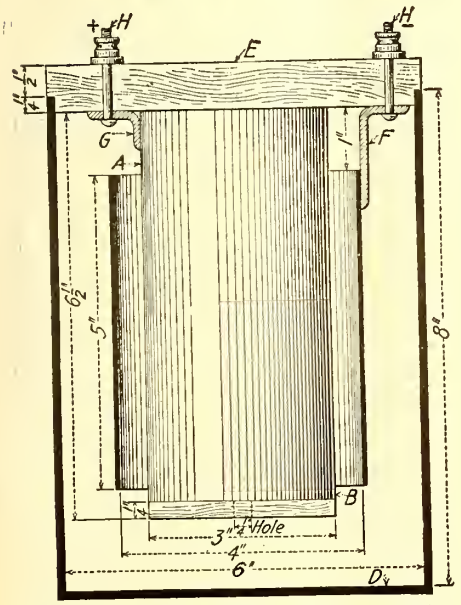
This attraction is very effective even when the source of energy is visible, but when the fan producing the breeze is concealed from view, the element of mystery adds wonderfully to its ability to attract attention.

Contributed by J. A. WEAVER.



A Window Attraction That Revolves at High Speed When Operated by the Breeze from an Electric Fan.

A Home-Made Edison Primary Battery



Home-Made Edison Primary Battery, Using Copper Oxid and Zinc Electrodes in Caustic Potash Solution.

The battery which I am about to describe will give good service and is not expensive to build.

This battery is of the Edison type and consists of a perforated copper pipe A, filled with red oxid of copper as the negative element and a zinc cylinder C as the positive element. (The positive *element* gives the negative *pole* and vice versa.) The exciting fluid is a 25 per cent solution of caustic potash in water, which means one pound of potash in three pounds of water.

The battery container is a glass jar D, which is 6 x 8 inches. E is a cover for the jar, and to this A and C are fastened by the lugs F and G. There are three lugs similar to F, and three to G. They are arranged around the top of the jar at an angle of 120 degrees with each other in the same set. To one of each set of these lugs, which are soldered to A and C, a common dry battery bolt H is fastened, as shown to the terminals.

The negative element A is a copper tube 3 x 6½ inches. It is punched or drilled full of ⅛-inch holes, and the bottom is closed by a piece of wood, B, which has been boiled in paraffin fifteen minutes. This is fastened in by taking a large nail and denting in the tube A on the wood. When you have finished the cylinder solder on the copper lugs F, which can be of copper strip, strong enough to hold up A, place these lugs around the cylinder at a distance of 120 degrees.

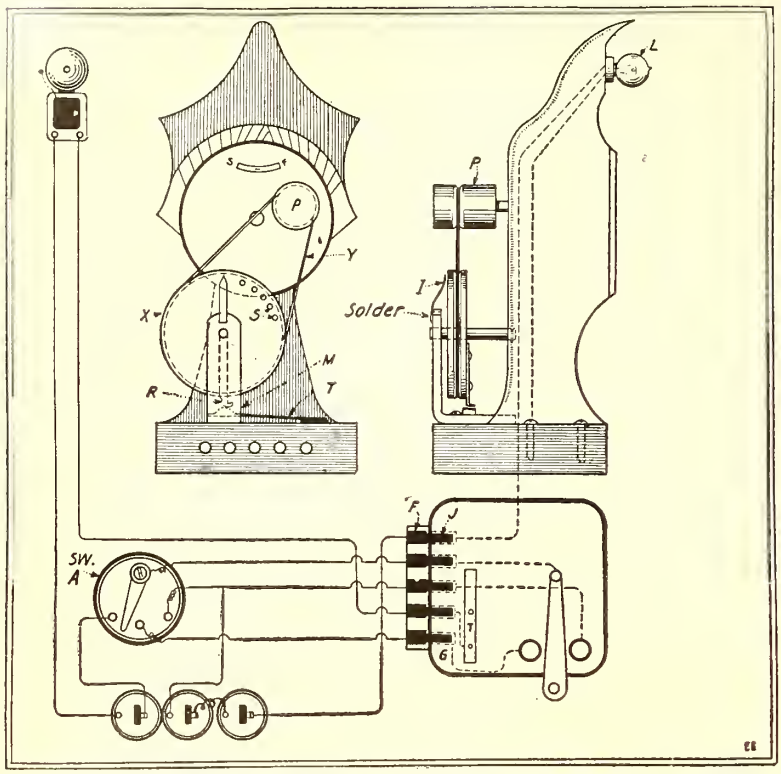
The positive element is made of zinc sheet rolled into a tube 4 x 5 inches. This has lugs F soldered on as shown, and must be well amalgamated, which can be done by rubbing the cylinder with dilute sulfuric acid and mercury.

Make top as shown in drawing of some soft wood. Boil this in paraffin for fifteen minutes, and then assemble the battery. Make a 25 per cent solution of caustic potash (be careful, as one drop might cost you your eyesight) and fill two-thirds of the jar. Now fill the copper element with red oxid of copper or cupron, which is a higher form of the ordinary commercial copper oxid. Then place your elements in and pour a layer of paraffin oil to a depth of ½ inch on top of solution. The battery is then ready to use. The E.M.F. of this Edison-Lalande cell is approximately .7 volt and the internal resistance 0.03 ohm. A 300 ampere-hour cell requires about 2¼ lbs. cupric oxid, yielding 1/5 horsepower-hour.

Contributed by E. E. CROSS.

www.americanradiohistory.com

Converting a Dresser Clock to an Electric Alarm Type



The ELECTRICAL EXPERIMENTER is one of those interesting chaps, who is forever telling us about some new-fangled electrical do-funny. In an earnest effort to make our lives more livable, but one thing he never does forget to tell us about is how to make an electrical alarm clock. But if we do say it ourselves, Mr. Beasley, the author of the present article, has really shown us something new in an electrical alarm clock which he has devised and constructed, so as to be a suitable attachment to any ordinary dresser clock. He also shows us how to rig up a most desirable night lamp on the front of the clock, so that by means of a switch on the base, or else mounted on the wall near the bed, one can turn on the light at any time of the night, so as to note the time, —the lamp serving besides as a bed-room light. The alarm can be set for any hour desired by the simple dial device shown.

The sketch illustrates how to make an electric alarm from a small dresser clock, and circuit for lighting lamp on dial from two different locations regardless of position of other switch; it allows alarm to be turned off from bed without getting up when switch "A" is placed near enough. A small grooved wood pulley "P" attached to the winding key of clock, rotates pulley "X" with rubber band "Y." Pulley "X" is of sufficient size to rotate only once in 24 hours. Alarm can be set for any time by setting marks "S" on pulley "X" to pointer "I." Marks "S" can be numbered if desired with two numbers each, one number to determine time to be set, and another indicating time it will give the alarm. The bell ringing contacts "R" and "T" close when pulley "X" is in position shown. Contact arm "R" is soldered to shaft to insure good electrical connection. Plugs "F" are tips from telephone cords inserted into receptacles "J" made from copper line wire sleeves, allowing clock to be detached from circuit. Wire at "G" is grounded to the clock frame. The circuit is self-explanatory.

The alarm clock device as here worked out, makes a very attractive and at the same time very useful apparatus, which anyone handy with tools can make. It is not necessary to obtain an extra battery for the operation of this alarm attachment; the regular house-door bell battery may be used.

Contributed by B. F. BEASLEY.

An Experimental Motor Generator

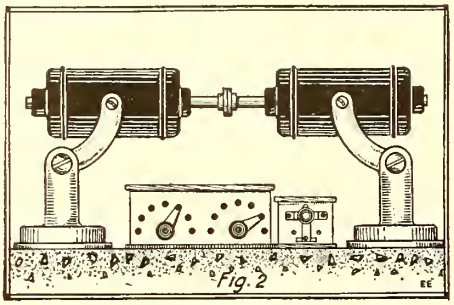
The diagram herewith shows the construction of a small motor-generator set, which may be used to generate direct or alternating current. First I will tell you the advantages of this set. Most all radio amateurs have had experience with spark coils and interrupters used on direct current. With this arrangement you put a heavy load on the 110 volt line, draw an excess amount of current which registers on the meter and increases the electric light bill considerably. Also you may notice that every time the key is prest the lights grow dim, and the larger the coil or transformer, the dimmer the lights will grow. This is very annoying to the other members of the household.

With the set here described you are getting your current from the armature of the second motor and the load on the 110 volt line is always the same. We all know that it takes more current to start a motor than to keep it going, after being started, so when your motor is started you have a constant load on the line, which is smaller than if the coil or transformer was connected in series with the line.

The articles required to build this set are a base 24" x 12" x 1½" and two discarded 110 volt fan motors, which may be bought from any electrical repair shop.

Fan motors are usually series wound. As constant speed is required, the field coils of the motor may be connected in shunt with the armature thru a rheostat. The field coils of the generator may also be connected in shunt around the armature, thus giving us the desired constant voltage.

The speed-regulating resistance found in each motor may be used as a field rheostat, or other resistances may be wound for the purpose. These may be placed in a box with two multiple switches, with desired number of contacts to act as a field rheostat for the motor, and one for the generator. The box may be placed beneath the coupling of the two armatures.



A Home-Made Motor-Generator Constructed from Two D. C. Fan Motors

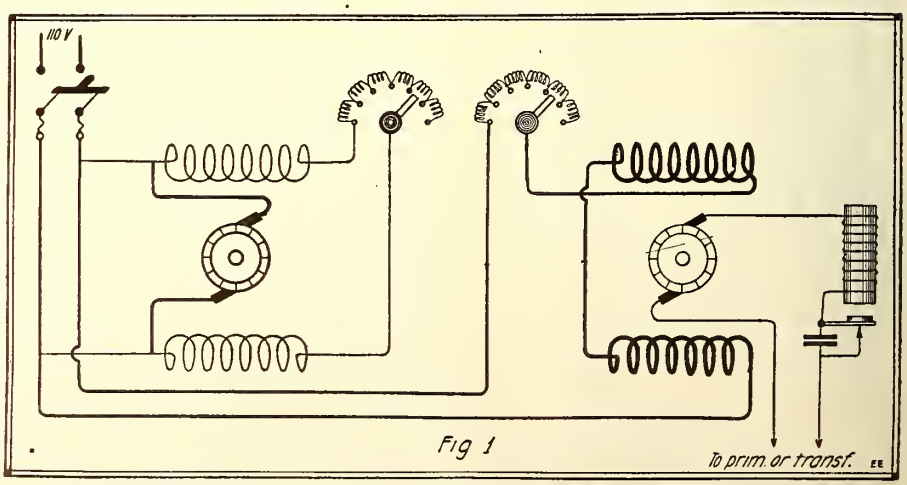
If both are direct current motors and alternating current is required, this may be done by making an interrupter and placing it in series with armature current of the generator.

An interrupter may be used to a great advantage in increasing the frequency, if properly made. A core made of soft iron wire from three-fourths of an inch to one inch in diameter, and about two inches long, with about five turns of number 14 wire, will be sufficient. If the magnet is too large it will act as a reactance or resistance, and also the self-induction will cause a large arc at the vibrator contacts.

The vibrator can be made of a piece of spring steel cut to suit the maker. To be sure of good, durable contacts a piece of silver may be soldered onto the vibrator.

If the set is used on a 110 volt direct current line, the voltage taken off of the generator will be from 65 to 80 volts. If an A. C. machine is used the frequency will be low and may be calculated.

Contributed by "ELECTRICIAN-RADIO," U.S.N.



Connections of Armature and Field Windings of Two Fan Motors Constituting Experimental Motor-Generator. Suitable for Radio, Charging Storage Batteries, Electro-Chemical and Plating Work and Many Other Things

www.americanradiohistory.com

Measuring Resistance in Direct Current Machines

By Gustav E. Jansson
Associate Member A.I.E.E.

IF the resistance of a direct current machine is to be determined, the simplest way is to connect the armature to a source of low potential D.C. Then measure the potential between two commutator segments, each segment located under brushes of opposite polarity, as indicated in Fig 1. The segments are best marked with a punch so that the resistance is always measured between the same segments. The armature should, however, be turned so as to obtain a position to give as near as possible the mean value of the resistance.

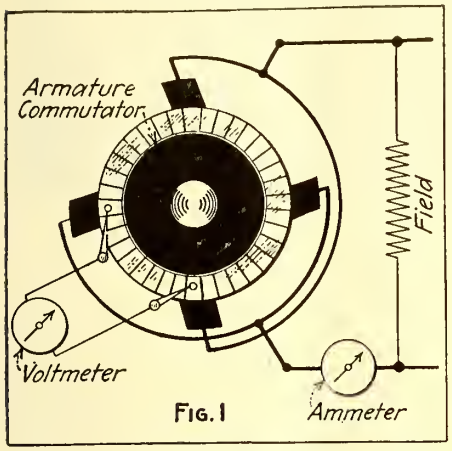


FIG. 1

To Measure the Resistance of a Direct Current Machine, the Current and Voltage May Be Determined by Means of Volt and Ammeter, in the Manner Here Indicated.

If the voltmeter indicates "E" volts and the ammeter "J" amperes, then we have:

$$R = \frac{E}{J} \text{ ohms}$$

and hence if "I" denotes the normal load current then $I^2 \times R$ denotes the copper losses in watts.

If it is not convenient to obtain a low potential source of ample capacity to measure the resistance as per above, then the resistance can easily be obtained in the following way, using a few storage batteries or ordinary dry cells as the source of energy.

Fig. 2 indicates the connection in detail. Now if,

P = Number of poles
P/2 = Number of pole pairs = p
a = Number of circuits in parallel, depending on armature connection (a = p for usual parallel connection, a = I for series-connected armature)
R_m = Measured resistance
R_t = Total resistance of winding
R_a = Actual resistance of armature to imprest voltage on brushes in running (Ohmic resistance only).

$$R_t = \frac{4p^2 R_m}{P - I}$$

$$R_a = \frac{R_t}{4a^2} = \frac{p^2 R_m}{a^2 (P - I)}$$

Now if the average temperature rise of the winding at full load is wanted it can be found as follows:

Let "R_c" be the resistance at a temperature of the surrounding air = t_c. Care being taken that the machine has been standing without load long enough to assume the same temperature as the air.

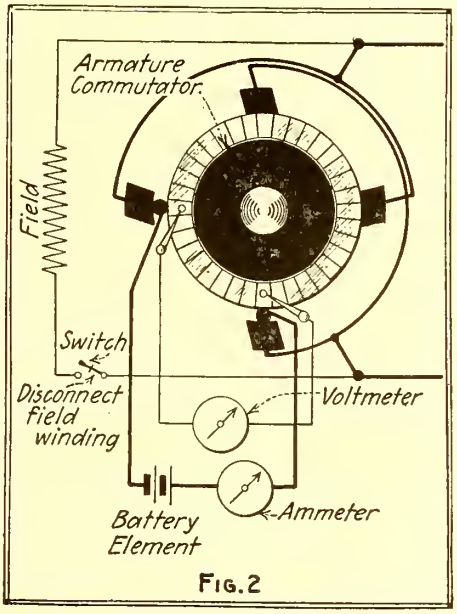


FIG. 2

Measuring the Resistance of D. C. Machinery on a Low Potential Source of Current, Such as a Battery, a Volt and Ammeter Giving the Necessary Readings.

R_h = Resistance of hot machine
t_h = Temperature of hot machine
k = Constant = Resistance increase per degree temperature increase
From equation $R_h = R_c (1 + k (t_h - t_c))$ we get

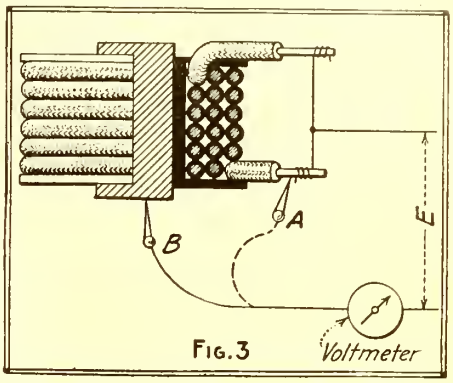


FIG. 3

The Resistance of the Coil Insulation to Iron Core Can Be Measured With An Ordinary Voltmeter of Known Inherent Resistance.

$$t_h - t_c = \frac{R_h - R_c}{k R_c} = \text{The average temperature rise of the winding above the air temperature.}$$

This gives for copper winding about 2 — 1/2 degrees Centigrade or 4 — 1/2 degrees Fahrenheit for each per cent resistance increase.

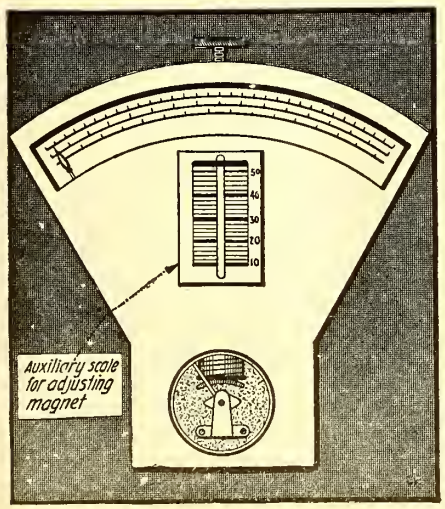
The resistance of the insulation to iron can be measured with an ordinary voltmeter of a known inherent resistance as shown in Fig. 3. Connect one pole of a suitable D.C. source to the winding as shown in figure. The other pole is connected to the voltmeter terminal. Complete the connection first to "A"; we obtain the imprest voltage "E" then connecting to "B" we get the voltage "E_2" and the resistance of the insulation is then

$$R_x = R_v \left(\frac{E - E_2}{E_2} \right) \text{ ohms, where } R_v = \text{voltmeter resistance.}$$

Care should be exercised, however, as a high potential will often arc over a much higher resistance than a supposed safe insulation resistance measured as outlined above.

A Home-Made Adjustable Ammeter

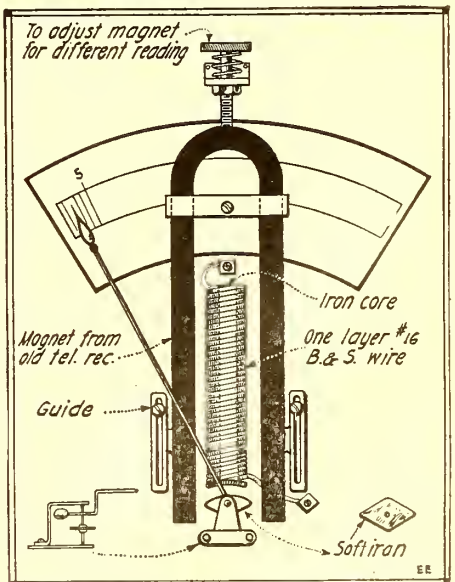
Needing an ammeter recently, I thought I would try to make one that could be adjusted to read any ordinary amperage. To adjust this instrument, all you need to do is turn the thumb nut which moves the steel magnet up or down. The further away from the magnetic vane the magnet is, the greater the sensitiveness of the meter. To graduate this instrument, I used an ordinary pocket ammeter with dry cells. First I screwed the magnet clear down, then connected the meter in circuit with the pocket ammeter which showed twenty-five amperes. This moved the other meter needle about three-sixteenths of an inch. I marked this point and divided the distance between said point and O into five parts, each part representing five amperes, and so on, until I finally had the scale calibrated for *four different readings.*



Front View of Home-Made Adjustable Ammeter.

In many cases the experimenter will find it convenient to utilize the moving element from a discarded pocket volt or ammeter for the instrument here described. With a little care and ingenuity he can thus refit this moving element into his new meter, and when this is done it is usually more satisfactory than a home-made armature and needle.

Contributed by M. G. VAN WAY.



Detail of Mounting in Adjustable Ammeter.

www.americanradiohistory.com

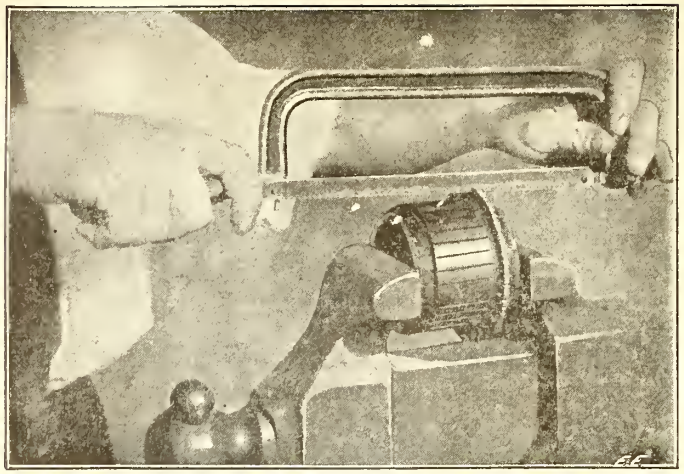


Fig. 1. Slotting the Connecting Lugs of a Commutator with a Hack Saw.

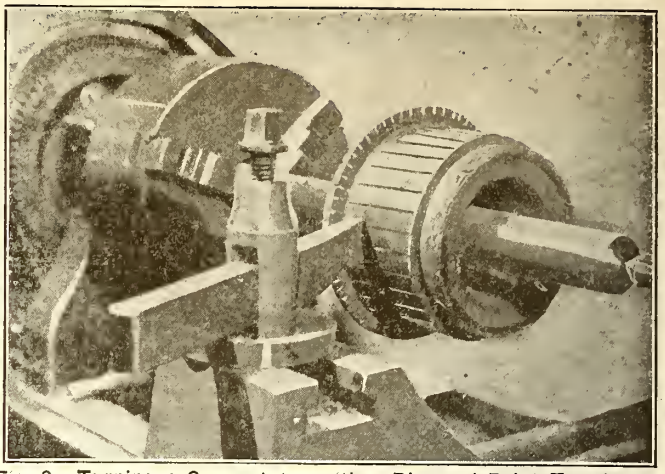


Fig. 2. Turning a Commutator with a Diamond Point Tool in the Lathe.

The Electrical Machinist

By H. WINFIELD SECOR

No. 1 Commutator Work

THE Electrical Machinist' for as such he is generally known to-day, is usually a machinist or electrician who has done a great deal of machine work, and who generally performs his work in an electrical repair shop or a machine shop, which does a certain amount of electrical repair work. One of the most delicate pieces of electrical machinery which the electrical machinist or experimenter who dabbles in mechanics encounters, is the *commutator*.

Fig. 1 shows the simple operation which has to be performed on many commutators, and a handy little wrinkle in this connection, will be mentioned. This consists of slotting the rear extensions or lugs on the copper commutator segments in which the lead wires from the armature coils are to be soldered. On small commutators of 1½ to 2 inches in diameter, a single hack-saw blade will usually give a sufficient width of slot, and this slot need be only about ⅛-inch deep, or sufficient to accommodate the two or more leads which have to be soldered in them. Where a wider slot is necessary on larger size commutators, two or more hack-saw blades are used in the frame of the saw, care being taken to see that all the teeth face away from the saw handle or in the same direction. The Star hack-saw blades which are tempered very hard, are generally used in all machine shop work, and a medium tooth pitch is desirable. If the pitch of the tooth is too fine, then the saw does not work fast enough, and a waste of time will result. If the pitch is too coarse, the teeth are easily shattered and broken out, thus wasting too many blades. The larger commutators, 4 to 5 inches in diameter, have their slots in the connecting lugs, milled out on a milling machine. An improved method for doing this in some shops is to place a milling cutter on an arbor, which is secured in the live chuck on a lathe. The commutator may be mounted on the moving carriage of the lathe, and is preferably secured by a stud and nut thru its center, so that after each slot is cut, the nut can be released and the commutator moved to bring the next segment in line with the milling cutter.

The *turning down* of commutators, illustrated at Fig. 2, is one of the commonest operations performed by the Electrical Machinist, and one which is liable to cause dismay to the embryo mechanic if he is not very careful as to how he sets about the operation. It must always be borne in mind that a considerable pressure is exerted at right angles to the direction of rotation of the commutator in the lathe while being turned, and also that commutators are not always as strong as they look. They consist of a large number of copper segments separated by mica insulating strips which are held under compression by the drum and clamping ring, which together form the commutator *shell*. If too much pressure is exerted by the tool on the commutator perifery, or if the turning

(Continued on page 717)

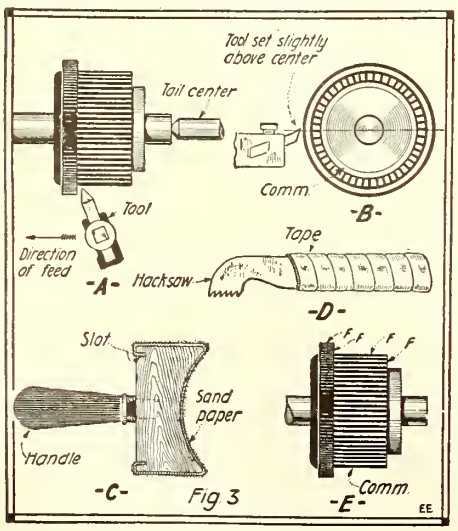


Fig. 3. Several Wrinkles of Value to the Young Electrician and Machinist Are Shown

ANNOUNCEMENT OF NEW SERIES, "THE ELECTRICAL MACHINIST."

For the past fifteen months, the publishers have been running a series of "Experimental Mechanics," which our thousands of readers everywhere who are interested in Machine Shop practice, either in an experimental or vocational way, have undoubtedly found both educational and instructive. This series of articles having now been completed, and in view of the fact that we have received many letters of commendation on our mechanical department in the Electrical Experimenter, and one that is eagerly looked forward to every month, the publishers have decided to start a new series of articles on Mechanics; especially written for the benefit of the Electrical and Radio Experimenter.

A new series of articles will appear, beginning with this issue, entitled "The Electrical Machinist," by H. Winfield Secor. Mr. Secor is an electrical and mechanical engineer of extensive experience, and his series of articles entitled "The Electrical Machinist," will undoubtedly appeal to all classes of readers, who not only are interested in a general way, but, should they intend doing any serious experimental work, MUST become interested in the mechanics of everyday shop practice. The trade of the Electrical Machinist is a recognized one everywhere today, and in the forthcoming articles Electrical and Mechanical shop wrinkles will be woven together so as to render the articles of the utmost practical value to the man who has to do the work. The readers interested in the pure mechanics of modern shop practice, will do well to procure back numbers containing the fifteen original articles entitled "Experimental Mechanics," and there are also a host of valuable books on the market available at nominal prices, which cover the orthodox details of the machinist's trade in a very thoro and complete manner. —THE PUBLISHERS.

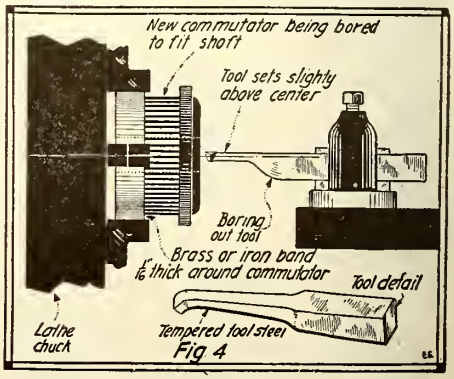


Fig. 4. Sometimes a Commutator Has to Be Bored Out to Fit a New Shaft Diameter. The Hole in the Commutator Is Bored Out with a Steel Tool of the Shape Here Illustrated.

www.americanradiohistory.com

HOW-TO-MAKE-IT

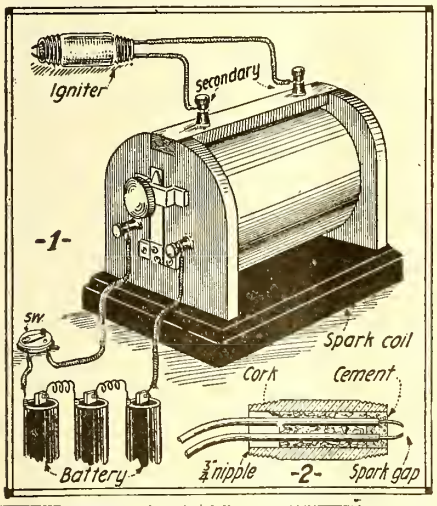
This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 is awarded; for the second best idea a $2.00 prize, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

FIRST PRIZE, $3.00

AN ELECTRIC STOVE LIGHTER.

The above sketches are descriptive of a very easily constructed stove lighter, which is operated from the bedroom some distance away. All that was used were a few batteries, some double insulated wire and a small coil taken from the engine of a discarded motorboat. Fig. 1 shows a layout of the arrangement. Fig. 2 shows the igniter end. This was made out of a long cork driven into a short three-quarter inch pipe nipple. The cork was left about one-quarter of an inch from the point ends of the wire, and the space filled with an incombustible cement. The wires were pushed thru the cork, which afforded a very satisfactory insulation.

It was, of course, necessary to prepare the fire the night before, as shown by Fig.



Useful Home-Made Electric Stove Lighter.

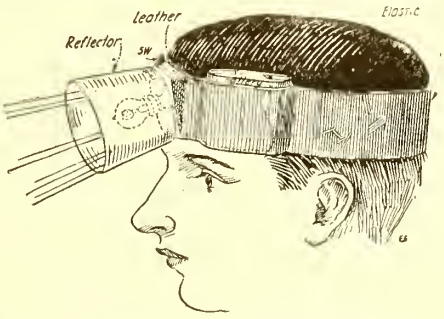
3. The grates were covered with a thin layer of oily waste, a small wisp of which was drawn thru the grate teeth near one of the damper door openings in front. Into this was laid the igniter nipple, around which some of the waste was prest. The coil never failed to generate hot enough a spark to immediately fire the waste in contact with it, which instantly spread to that on the grates above. In turn the wood and the coal were rapidly ignited.

Contributed by
FRANK W. BENTLEY, JR.

SECOND PRIZE, $2.00

MINER'S OR TROUBLE BATTERY LAMP.

This light is very handy where you are continually moving about and both hands are engaged in some kind of work, as it fits over one's head and no matter in what direction the eyes are turned, the object



A Trouble and Diagnostic Lamp.

is illuminated. Best of all, it can be made very cheaply.

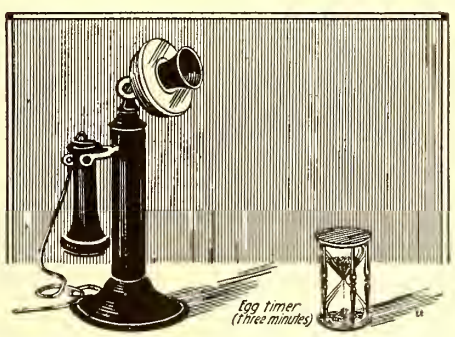
The band around the head is made of leather with a piece of elastic sewed into it, to make it fit firmly and tightly about the head. The piece of wood screwed on the band is to give the light a slanting position, so that the rays of light will shine on the proper spot before the eyes. The socket is screwed to this piece of wood. The reflector is but a piece of shiny tin rolled in the shape of a cone and fastened on as shown. It not only reflects the light, but shades the eyes from the strong light above them. The batteries can be carried in the pocket, but it is more convenient to make a pocket in the head-band which will accommodate one or more flash-light batteries. Also make a switch as shown.

Contributed by
RAYMOND WENSINGER.

USE EGG-TIMER FOR LONG-DISTANCE 'PHONE CALLS.

A very handy timer for the usual three-minute long-distance telephone calls is the common sand-glass or egg-timer. This set on a shelf near the telephone is always ready for use and saves much bother, arguments and overcharges.

Contributed by FREDA POTTS.



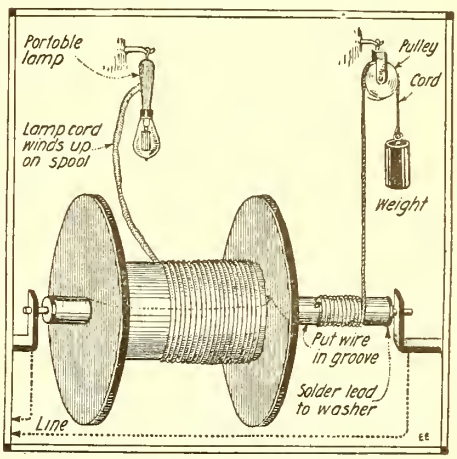
Using the Egg-Timing Sand-Glass for Timing Telephone Calls.

THIRD PRIZE, $1.00

AUTOMATIC REEL TO REWIND EXTENSION LAMP CORD.

The materials needed to make this useful device are—an empty wire reel, about ten inches in diameter, a piece of shade roller about three inches longer than the width of the reel, two shade brackets and two pins from the ends of shade rollers. Place the piece of roller in the reel to act as a shaft and drive the two pins, one into each end, with a metal washer underneath. One end of the roller is made flush, but the other end is allowed to extend. This is to form a place for the string to rewind, which has a weight attached and forms the motive power. The correct length of string can be found by experiment. Two leads are taken thru the reel, one on each side, and soldered to the washers on either end. The circuit is made thru the brackets, which act as bearings. To give this reel a finished appearance, it should be put in a box with holes cut at the proper places for the cord. The string which is used for motive power can be suspended over a pulley to take up some of its length. The diagrams will better explain the constructional details.

Contributed by W. E. CONWAY.



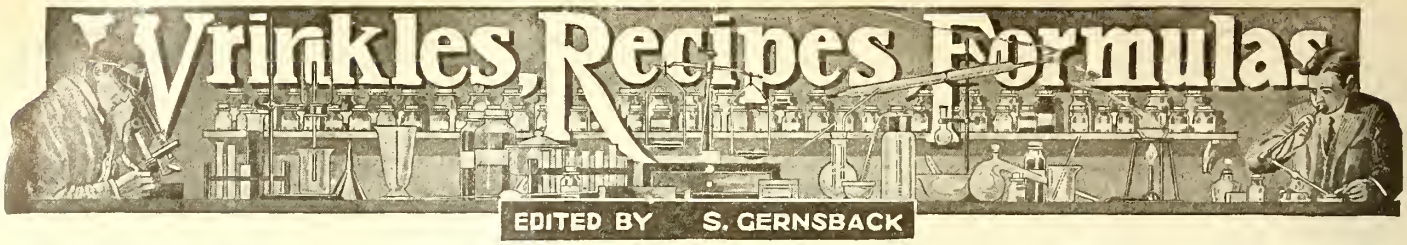
Making Automatic Reel to Rewind Extension Lamp Cord.

MAKING MAGNETIC CHARTS.

A permanent chart of the magnetic lines of force surrounding a magnet can readily be made as follows: A sheet of thin cardboard of suitable size is evenly coated on one side with paraffin wax, and over this is spread an even layer of fine grade iron filings. The magnet is placed against the under side of cardboard and the filings are agitated by lightly tapping the cardboard until their arrangement clearly shows the *lines of force*. Then they are "fixt" by holding over a hot stove or over a gas flame near the wax surface until it softens. When the wax is cool the magnet is removed and the filings, being imbedded in the wax, will retain their position.

Contributed by J. A. WEAVER.

www.americanradiohistory.com



DETERMINING THE MELTING POINT OF SOLIDS.

In accurately obtaining the melting point of some solids it is difficult to determine the exact instant at which the substance goes into a fluid state. This is particularly true when working with fats and crystalline masses.

A simple manner in which to make such a test is to place a small amount of the substance on the bulb of the thermometer. The thermometer is then past thru a cork and in this manner suspended in a test tube which forms an air bath. The test tube may be immersed in water or glycerol while being heated.

The material on the bulb will be clearly visible due to the refraction of the light while in a solid state but as soon as it becomes fluid the bulb will clear up.

Fats and waxes may be scraped with a knife, a few shreds put on the thermometer. Crystals should be powdered and the bulb immersed in the powder so a few grains will adhere to the bulb.

Contrib. by THOMAS BENJAMIN.

SILENT DISCHARGE OZONE APPARATUS.

First procure a Liebig's condenser. After all traces of dust have been removed from the Liebig's condenser a coating of tinfoil is placed upon the outside, two inches from each end, by means of shellac, and also another coating is placed upon the inside surface of the inner tube. If this is found difficult the inner tube may be filled with fine shot or iron filings, which will answer the same purpose as the tinfoil.

The condenser should now be clamped to a support and the secondary of a good induction coil connected to the two tinfoil coatings. An oxygen generator is now connected to the condenser and the coil started.

The working of the apparata is as follows: A stream of oxygen gas is past slowly thru the condenser while the induction coil is in operation, the discharge taking place silently. This gives ozone best, as it does not involve any rise in temperature, which would cause the ozone formed to change to oxygen, as may be seen from the equation:

$$3O_2 \leftarrow 2O_3$$
$$3O_2 \rightarrow 2O_3$$

The reaction being a reversible one.

Ozone, its Properties, Test and Use: Ozone is a gas of deep blue color with a peculiar odor. It is more easily liquefied than is oxygen, and it is more soluble in water. Its density is one-half greater than that of oxygen, as seen by the formula O_3.

Ozone is an allotropic and an unstable form of the element oxygen. It oxidizes the same substances as does oxygen, but more vigorously. It rusts silver to black silver peroxide, Ag_2O_2

$$2Ag+2O_3 \longrightarrow Ag_2O_2+2O_2$$

If ozone is allowed to bubble thru a dilute solution of indigo carmine, a yellow substance of much paler tint known as *isotin* is formed:

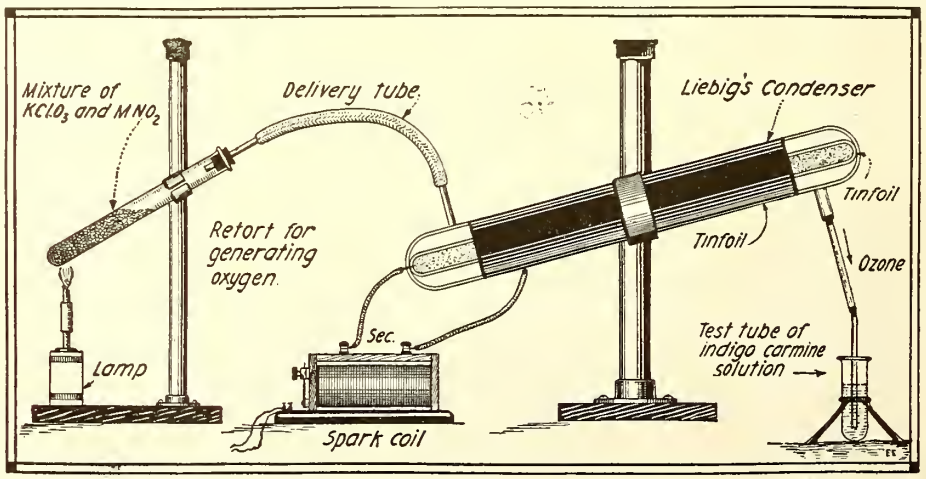
$$C_{16}H_{10}N_2O_2+2O_3 \longrightarrow 2C_8H_5NO_2+2O_2$$
Indigo+ozone———>isotin+oxygen

If a bottle or empty test tube be substituted for the one shown in the drawing, ozone may be collected mixed with oxygen, and various other properties of the gas may be observed.

Ozone is used in some cities, as Paris, Florence and Petrograd, for purification of water. It is used commercially for bleaching purposes.

Ozone oxidizes sulfur dioxide to sulfur trioxide and sulfurous acid to sulfuric acid, as shown:

(1) $SO_2+O_3 \longrightarrow SO_3+O_2$
(2) $H_2SO_3+O_3 \longrightarrow H_2SO_4+O_2$



A Simple Apparatus to Produce a Silent Discharge of Ozone, Easily Constructed by Any Experimenter Who Wants to Study This Interesting Gas.

EXTEMPORIZED FRACTIONAL WEIGHTS.

Weights of small denomination—grains, and fractional parts of a grain or gramme—are generally too small to be conveniently handled, unless one uses a pair of forceps. The writer has found it convenient to make a fresh set of small weights from copper wire of small gauge. It is only necessary to find the exact length of wire required to balance a given weight, when a simple calculation will show the length needed to make weights of any required size. After cutting off the correct lengths for weights of 2, 3, 4, or 5 grains, the wire may be bent into a helix or cylindrical form, the number of turns serving to indicate the number of multiples of a grain. Similarly, a one-grain weight may be made in the form of a ring, while the fractions may be gridiron-shaped, each prong representing one-tenth of a grain.

Contributed by H. G. GRAY.

SYMPATHETIC INKS.

Euchlorin: Add to two or three crystals of potassium chlorat a few drops of hydrochloric acid and heat a moment. When the tube fills with gas add water and shake. This when used as ink and the writing heated will turn a golden yellow. Euchlorine can also be used as a test for iodin—proceed as follows: Make a solution of element to be tested and add some starch and a few drops of euchlorin; the blue color shows the test.

Sympathetic Inks: 1. Make a mixture of 1 part hydrogen peroxid, 1 part euchlorin, and 1 part Barium chlorid solution; when heated, the writing will turn black.

2. Write on a piece of paper with some undilute sulfuric acid and while the writing is wet, heat it in a flame, but do not let the paper get on fire, and the writing will appear in lines like engraving.

Cont. by STEVENS SANDERSON.

SOLDERS FOR ALUMINUM.

The use, serviceability, method of application, and composition of solders for aluminum are discussed in the light of special tests made at the Bureau of Standards on commercial and other compositions of solders. All soldered joints are subject to rapid corrosion and disintegration and are not recommended except where protection from corrosion is provided. Suitable compositions for solders are obtained by the use of tin with the addition of zinc or both zinc and aluminum within wide percentage limits. Solders are best applied without a flux. The higher the temperature at which the "tinning" is done, the better the adhesion of the tinned layer. A perfect union between solder and aluminum is very difficult to obtain, but the joint between previously tinned surfaces may be made by ordinary methods and with ordinary soft solder. Only the tinning mixture need be special. Tables of the composition of many solders are given.—Bur. Stand. Circular No. 78, 1919,

CHEMICAL TESTS OF MILK.

Artificial Preservatives in Milk—Put about 10 c.c. of milk in a beaker and add about 10 c.c. of concentrated Hydrochloric Acid in which a few grains of Iron Chlorid have been dissolved. Heat gently, and stir constantly. If the milk contains some artificial preservative (in this case, Formaldehyd), a purplish color will result.

Fat in Milk—Dip a piece of filter paper in some milk and carefuly dry, allowing no dust to come in contact with it. After it has thoroly dried, soak it in Carbon Di-Sulfid until all the residue is dissolved in it. Pour the liquid onto a watch-glass and carefully evaporate over a water bath. The substance remaining in the watch-glass is the fat.

Contributed by IRVING SIMPSON.

To Render Lamp Wicks "Everlasting" and to prevent smoking steep in a concentrated aqueous solution of tungstate of soda; dry thoroughly in an oven.

www.americanradiohistory.com

RADIO DEPARTMENT

The Submarine's Under-Water Radio

AN American hydroplane, 2,000 feet up, talked recently with a submerged submarine at Fisher's Island, six miles from New London Harbor, off New London, Conn. The conversation from both plane and submarine was listened to by a party of 250 engineers, members of the Edison Society of Electrical Engineers.

As guests of Captain J. R. De Frees, commander of the experimental station, about one hundred of the engineers boarded the destroyer U. S. S. *Blakeslee*, while others boarded a subchaser. The submarine N-6 dived several fathoms, and the water craft established both wireless and wireless telephone communication with her. At the same time a hydroplane established radio communication with the surface craft and with the submarine. The conversations were plainly heard by the engineers aboard the surface craft.

The system of radio communication thru both air and water was worked out at the local station, and will be made a part of the regular naval equipment when final tests are made. *The system enables an airplane, which can see submerged submarines, to direct a friendly submarine to the accurate firing of a torpedo at the enemy submersible.*

The airplane carries on radio-communication by means of an antenna wire, or wires, trailing down from the wing tips or else from the fuselage. These wires have weights at their lower ends, and are generally arranged to be quickly reeled in or out as desired. The aerial on submarine destroyers comprises several wires supported between the two masts.

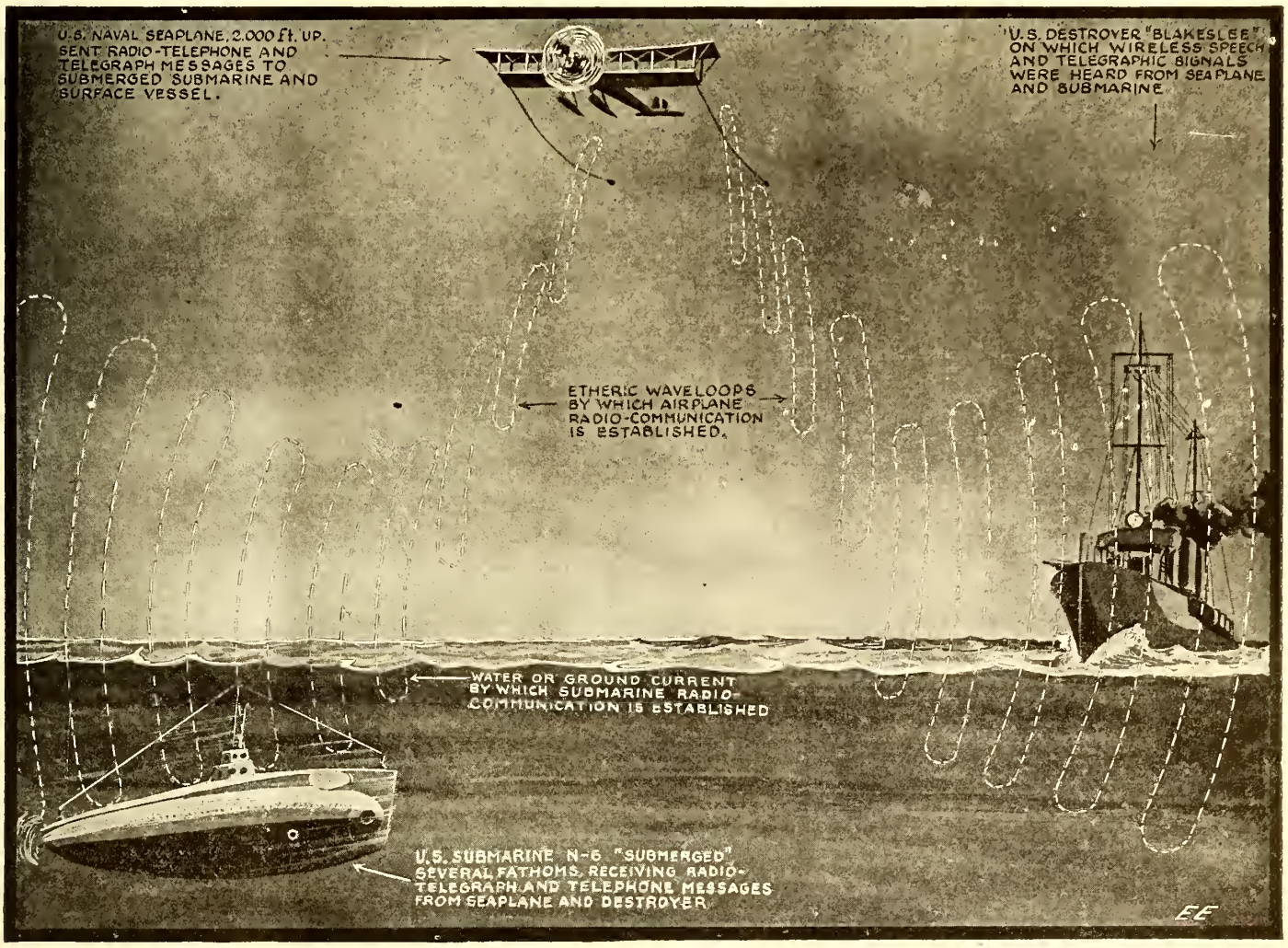
Considerable experimental work has been carried on in the past year with submarine radio, and the tests between the airplane and the submerged submarine marked the culmination of a series of important researches in this direction by the government. The experiments have shown that communication at sea can be carried on under all conditions, more efficiently with an insulated closed loop than with an ordinary antenna now in general use. The loop is of simple construction, requires no mast and therefore does not interfere with submergence. Under storm conditions or during a submergence where the ordinary antenna is useless, communication by means of the closed loop is perfectly practicable. Details and results of the official tests were given in full detail in the *October* issue.

The design and specification of the submarine closed loop antenna are given below:

DETAILS OF SUBMARINE LOOP ANTENNAE.

The loop antenna consists of two insulated wires *grounded* at the extreme ends of hull carried over suitable supports to the bridges, and thence thru radio lead-ins to the apparatus.

(Continued on page 707)



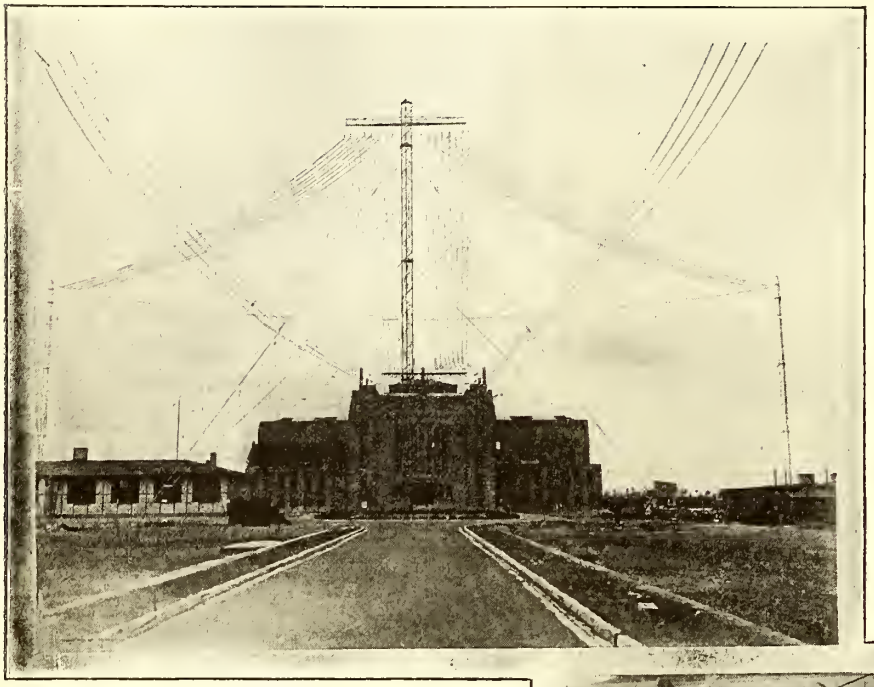
Copyright, 1919, by E. P. Co.

Recently a Remarkable Radio Test was Conducted by the U. S. Navy. A Submerged Undersea Boat Succeeded in Transmitting and Receiving Wireless Signals to and from an Airplane Flying Overhead. The Paths of the Traveling Ether Wave Loops are Indicated by the White Dotted Lines.

www.americanradiohistory.com

Nauen Radio Opened Again

THE powerful German radio telegraph station located at Nauen, Germany, and from which during the war, thousands of messages were sent broadcast, both of an official military nature, and also in the form of propaganda to the outside world, is shown in the accompanying photographs.



The main building is of special brick as may be perceived in the photograph, and is quite an imposing structure. It is of typically German architecture and quite severe in some of its details,—in fact, in some ways it looks more like a fortress of mediaeval style than it does a modern wireless power station. These photographs are

The Vossische Zeitung, Quoting Official Sources, Recently Gave Details of the Arrangements of Wireless Communication Between Germany and America. The Newspaper Says Efforts Will Be Made to Induce the United States to Release Other Wireless Stations Than That at Belmar, N. J., for Service with Nauen. The Imperial Post Ministry Has Established a Special Department to Solve This and Other Wireless Problems Under Herr Bredow as Director. He Will Attempt to Make the Wireless Cheaper Than Cable Communication.

very interesting indeed to us, as they are the first to be taken of the Nauen wireless plant since the declaration of war by Germany in 1914. Visitors to this great radio plant, one of the most powerful in the world, even at the present day, will hardly recognize the grounds or the antenna system, as many changes were made by the ex-Kaiser's radio experts during the war. These changes were made from time to time as new improvements and greater ranges were necessitated by the exigencies of military operations. The Nauen station has a large number of the latest style masts stretching out for a great distance on all sides, from the tops of which there extend vast aerial wire net-works which are connected with the radio station building. Some of the steel masts tower 600 feet into the air, while other masts measure 400 feet in height. These latest style towers rest on massive glass insulators at their feet, and they are guyed in position by one-inch stranded steel cables which are broken up into short sections, by means of large strain insulators, so as not to permit a loss of energy either in receiving or transmitting, due to these different lengths of guy wires being in tune with the fundamental wave length used, or possibly upper or lower harmonics of the fundamental wave.

One of the accompanying photographs shows a very interesting view of the interior of one of the transmitting apparatus rooms of the Nauen Station. As will be noted, the station building which was erected before the war is quite ornate and somewhat resembles the interior of American radio and central stations. The ceiling is covered with glass panels thru which light is transmitted as well as thru the windows from the side walls.

Several motor generator sets, as well as tuning helices and high tension step-up transformers, are shown on the main floor of this room. The floor as well as the side walls are of colored tile, which is a very attractive and sanitary finish for the interior of such a building. The Nauen radio station has employed from time to time different transmitting apparatus, including arcs, quenched gaps and high frequency alternators. At one time the Nauen plant was reported to be using a 200 kilowatt Goldschmidt alternator.

GREAT GERMAN WIRELESS STATION RESUMES COMMUNICATION WITH AMERICA—The Great Wireless Station at Nauen, Germany, the Largest and Most Powerful in the World, Has Resumed Uncensored Radio-communication with American Stations. The Photo at Left Shows a Part of the Gigantic Aerial Wire System Erected During the War at the German Station. The Photo Below Shows the Interior of the Generating Plant of the Nauen Station, Rated at 600 Kilowatts.

The receiving apparatus used at this station is provided with recording as well as very efficient amplifying intsruments, and messages from all parts of the world are daily received and recorded at this station. The amplifiers now in use, and also those employed during the greater part of the war, utilized vacuum tubes similar to the

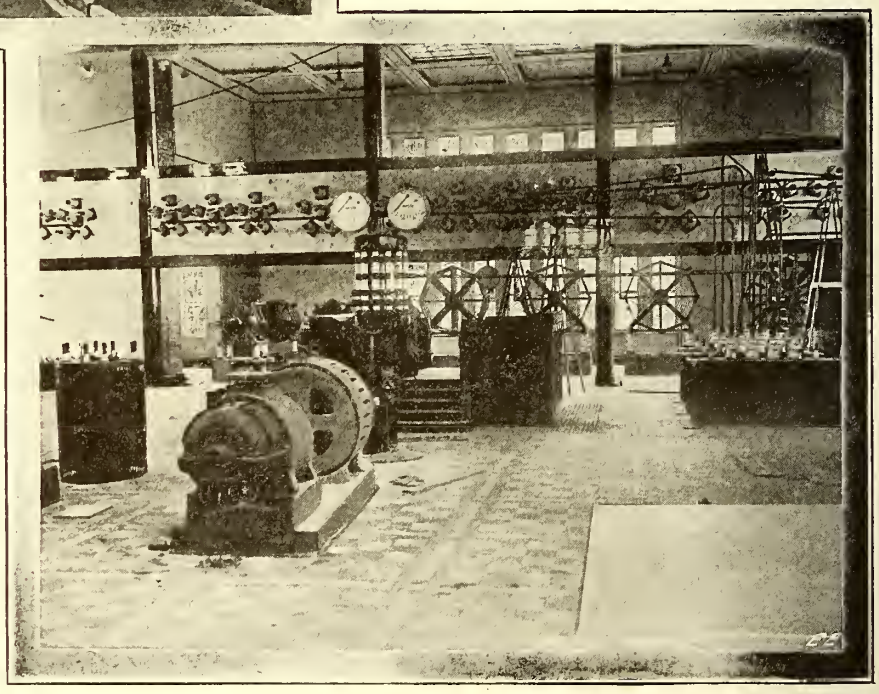


Photo Copyrighted by International Film Service.

De Forest audion, but the electrodes of which are coated with metallic oxides so as to give a very powerful electronic emission when heated. These bulbs were devised by Lieben and Riez, and are claimed to have a very high amplification factor,—in fact, superior to any other vacuum bulb amplifier in the world. But this hardly seems to be the case from the evidence which we have heard against it from time to time, gained from radio experts and officers who have become familiar with the German form of tube. Many of these tubes

(Continued on page 707)

www.americanradiohistory.com

The New Kolster Decremeter and Wave Meter

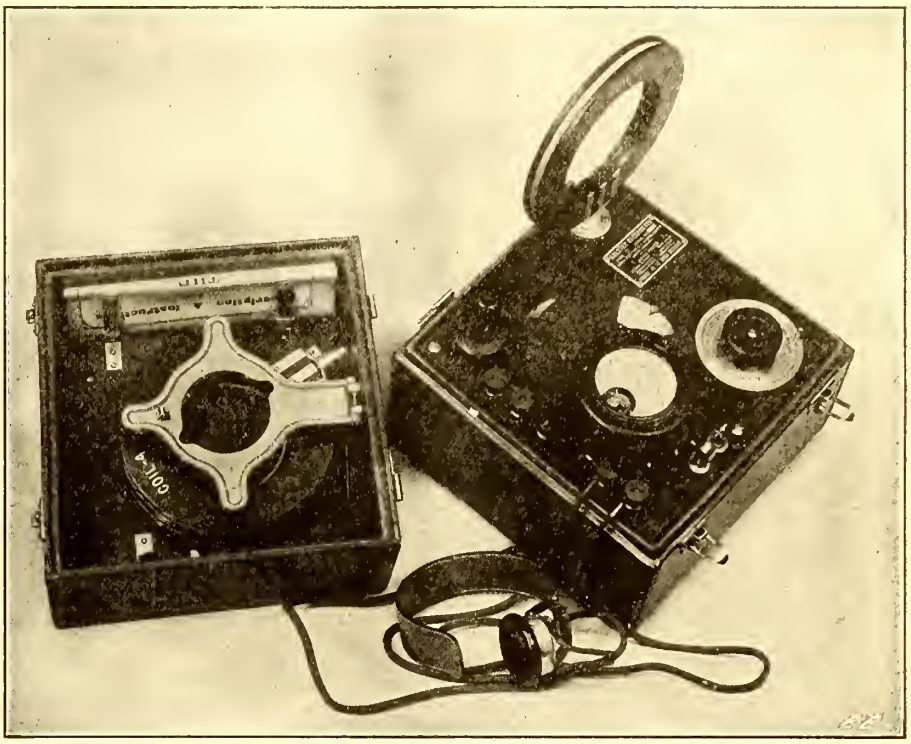
THIS instrument was designed for the purpose of facilitating the measurement of wave length and logarithmic decrement of radio circuits. It is portable and of rugged construction and may be used for field work as well as for laboratory purposes. The instrument is essentially a wave meter consisting of a variable condenser, four inductance coils and a sensitive hot wire indicating device, the readings of which are proportional to the square of the current passing thru it. A crystal detector and head telephone are provided and wave-length measurements may be made either with the crystal and telephone receivers or with the hot wire instrument. A buzzer is attached to the instrument in order, that it may be used as a transmitter for calibrating purposes.

The inductance coils are connected in the circuit by placing them in the holder near the back of the instrument. The condenser may be varied by turning the knob, on the right-hand side of the instrument, care being taken to see that the lock on the opposite side of the case is released. The condenser scale, reading from 0 to 180 degrees, appears in a depression near the back.

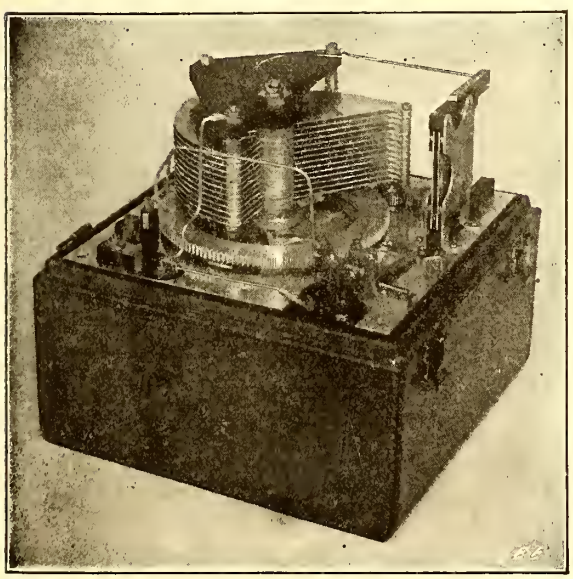
For the measurement of wave length, four scales are provided. The scale which is to be used with a given coil is indicated by a pointer which operates automatically by the insertion of the coil in position.

Beneath the condenser knob is a scale which is marked off to the right and to the left of the zero line from 0 to 0.30. These scale divisions represent the sum of the logarithmic decrement of the transmitter and of the decremeter, $\delta_1 + \delta_2$, δ_1 being the decrement of the transmitter under test and δ_2 the decrement of the instrument. δ_2 is given for each of the inductance coils for various settings of the variable condenser.

There is an index mark 0, which is movable about the knob and which may be rotated until it is in line with the zero on the scale. The hot wire instrument is connected in the circuit by placing it so that its lugs fit into the lugs on the top of the instrument. When the hot wire instrument is removed, its terminals are short circuited so that the wave meter may be used with the buzzer or crystal detector. Extending above the glass of the hot wire instrument is a small screw for adjusting the zero of the instrument.



Lower Case and Cover of New Direct Reading Kolster Decremeter and Wave Meter. The Four Inductance Coils Are Retained in the Lid by a Special Clamp as Shown.



View of Variable Condenser, and Other Parts of New Kolster Decremeter and Wave Meter Obtained by Turning the Lid of Cabinet Upside Down.

Measuring Wave Length.

In making wave-length measurements the instrument should be placed as far away from the coils of the transmitter as practicable, beginning with a minimum coupling, between the wave meter and transmitter, as the hot wire instrument is sensitive and will burn out if too much current is past thru it. When making wave-length measurements, it is not necessary to get full deflection of the hot wire instrument needle and it is best to use as small coupling between the antenna circuit and wave meter as possible.

The wave meter is in resonance with the transmitter when the deflection of the hot wire instrument is a maximum, as indicated by the fact that the deflection becomes less when the condenser is turned in either direction from this position. The wave length is then indicated by the pointer on the wave-length scale.

More accurate measurements of wave length may be made by observing the reading on the condenser when the instrument indicates resonance. The wave length may then be determined by referring to the calibration curves which accompany each instrument.

Separate calibration of the instrument when it is used with the crystal detector and with the buzzer are furnished.

When the instrument is used with the crystal detector, the telephone receiver should be connected to the binding posts so designated and the hot wire instrument and buzzer battery removed. The condenser scale should be observed and reference made to the calibration curve.

Measurements of Logarithmic Decrement.

The well-known Bjerknes method of obtaining the *logarithmic decrement is used.* The task of making experimental observations and the necessary calculations required by the Bjerknes formula is, however, eliminated by the use of this instrument. The sum of the decrements, $\delta_1 + \delta_2$, is read directly from the scale under the condenser knob after proceeding as follows:

1. Before connecting the hot wire instrument to the decremeter set the needle to zero by means of the adjusting screw.

2. See that the detector point is not in contact with the crystal and that the buzzer battery is removed.

3. With very little coupling between the wave meter and the transmitter, adjust the variable condenser until a maximum deflection of the hot wire instrument is obtained.

4. Increase the coupling until the deflection of the hot wire meter is somewhat more than half of the scale, if this is possible without making the coupling too tight. In case the current in the transmitter is small the deflection used must also be small, otherwise inaccurate results will be obtained.

5. Carefully turn the condenser handle in either direction until the needle of the hot wire instrument drops to one-half of the maximum deflection.

6. Rotate the movable index mark around the scale surrounding the condenser handle until the two zero marks are exactly in line, taking care not to change the position of the handle.

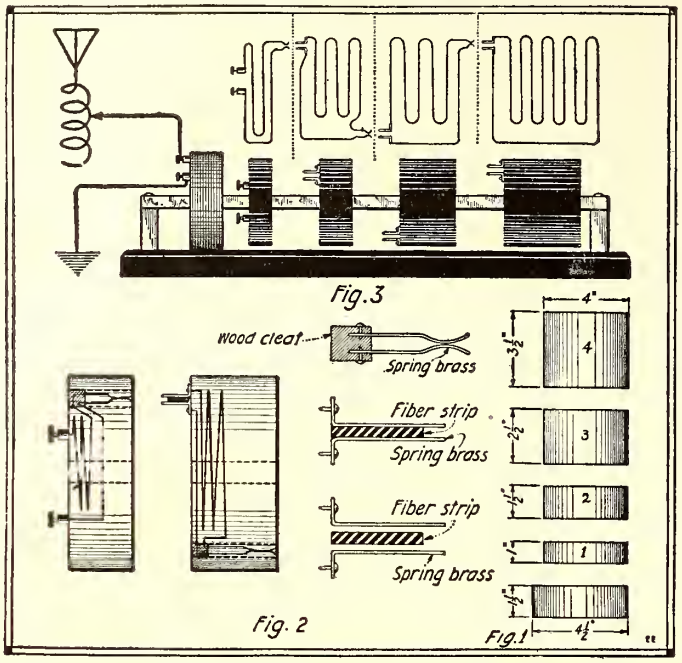
7. Carefully turn the handle back until the needle of the hot wire instrument makes a complete excursion from half deflection thru the maximum and back again to half deflection. The reading on the scale now opposite the indext mark O, will be $\delta_1 + \delta_2$, or the decrement of the transmitter plus the decrement of the instrument.

www.americanradiohistory.com

Improving the Amateur Receiving Set

By EDWARD T. JONES

IN ordinary Amateur Radio receiving sets constructed by themselves the coupling coils which connect the detector and antenna circuits are a great source of loss of power, due to poor design and faulty construction principally. For these reasons I take great pleasure in laying before the everyday experimenter plans and specifications of a receiving set which will undoubtedly mark the line of *Efficiency* thruout its circuits and operation. A few words as to the reasons for such results will not be amiss. Absolutely no sliding contacts should be used, owing to the fact that they are of high resistance, gather dirt, and the filings produced by the sliding process lodge in between turns and short-circuit them. Taps should not be taken off the coils for the purpose of varying the inductance; this produces "dead-end" losses and results in a considerable weakening of the incoming signal. The coils should be wound on separate tubes or spools, as shown in the diagrams. Arrangements are made to connect the coils together when more inductance is necessary, and all windings are of stranded wire (Litzendraht) to minimize the high-frequency resistance.



New Sectional Loose-Coupler for Amateur Work. PRIMARY: Form —4½" diameter, 1½" wide, 1" winding, Turns 30, Feet 35, Six Strands No. 36 S.C.C. SECONDARY WOUND WITH 3 STRANDS OF No. 36 S.C.C. CORE DIMENSIONS—No. 1: 4" x 1"; No. 2: 4" x 1½"; No. 3: 4" x 2½" and No. 4: 4' x 3½". Winding Space—½"; 1"; 2" and 3", respectively.

THE LOOSE COUPLER.

Litzendraht was produced for the primary and secondary in the following manner: Three strands of No. 36 were twisted together for the secondary windings, and six strands of No. 36 for the primary winding. The primary consists of only thirty turns and arrangements are provided in the elementary circuit for cutting in either the loading coils or the variable condenser in series with the same, each at a time, in order to make it possible to increase or decrease the wave length beyond that of the tuner primary itself.

The wooden cores shown in Fig. 1 are the forms upon which the windings are placed, and in the same figure are shown means of connecting them together when necessary.

THE DETECTOR.

The detector is a great energy-consuming and generally a energy-wasting device of the receiving circuit, and can hardly be avoided. Of course if the audion is to be used in place of the crystal rectifiers conditions are greatly changed and amplification instead of loss of received energy is the result. Crystals vary immensely in resistance, but in order to obtain as little loss as possible, low resistance crystals should be used, providing, however, their rectifying qualities are good. Owing to the fact that measurements taken on the Wheatstone bridge will not show anything, because the high-frequency resistance will differ greatly when the crystal is under operation, the only thing to do is to get an assortment of different crystals and try them until a good one is obtained. The crystals should be fastened in the cup with copper-mercury amalgam, and all posts supporting either the cup or point should be strong and firmly held to the base so that when a good adjustment is arrived at there will be little chance of losing energy thru faulty connections.

CONDENSERS.

In the receiving set we have very low voltages, and for this reason our condensers are generally quite efficient. Nevertheless, a few hints as to its operation may be of value. The condensers should be dust and moisture proof to protect them from *short-circuits* and *leaks*. They should be kept away from tuning inductances to avoid losses by induction. The dielectrics used should preferably be those having little hysteresis loss, as in some dielectrics this loss does not depend on the stress under which the dielectric is placed, but is always constant and a source of loss.

TELEPHONE RECEIVERS USED IN RADIO.

The factors of efficiency in receiver telephones are chiefly the following: The diafram should be placed as close as possible to the pole pieces to keep magnetic leakage low; however, space for variation should be provided. It should be as light as is consistent with sturdy construction. Heavy enamel should not be used for painting, owing to its increased weight without increased efficiency. The magnetic field in a receiver is quite weak, and the lighter a diafram is the greater will be the amplitude of its vibration, consequently the louder the tone. Also, the smaller the diameter of the diafram the easier will it move. Every article possesses a natural period of vibration, i.e., the number of times per second an object will vibrate if struck a blow. From the foregoing it will be easy to see that if a force acts upon it which strikes in the same number of times per second as is the natural period of the object (diafram in this case), it will vibrate to a much greater extent than if the period of the force were something else. Since a diafram vibrates in response to an external force (the pulsating magnetic field in the 'phone proper), if the natural period of the diafram is the same as that of the magnetic field, the resulting amplitude of vibration will be much greater than it ordinarily would be.

For instance, if we are receiving a message which is sent on a 500-cycle spark set, which gives a tone of 1,000 sparks per second, and the diafram of the receiver has a natural (vibrating period) of about 1,000 per second, the result will be a much louder note in the 'phones than would result from using a different diafram or one having, say, a vibrating period of 600 or 800.

The sensitivity of a receiver is the smallest current which will give an audible response when past thru it. A good, practical test for this is to tap the two telephone cord tips lightly on the end of the tongue; if they are what is termed *sensitive* they will produce a click in the 'phones, thus detecting a very slight amount of current generated by placing the two tips in saliva. The usual method of testing 'phones for their sensitiveness is to connect a buzzer to the primary of your loose coupler and the receivers to the secondary, making note of the distance which the two coils were separated when practically no signal was audible. The sensitiveness of two different receivers may be measured by the above mentioned method. The receiver which permits the greatest amount of coupling between the two coils is the *more sensitive one.*

CONNECTIONS.

All connections should be stranded wire and well soldered. All switch contacts should be good, especially in button switches, and kept free from oxid and dust. No steel or iron should be permitted in any part of the set (not even steel screws) to avoid hysteresis losses.

In November "Radio Amateur News"

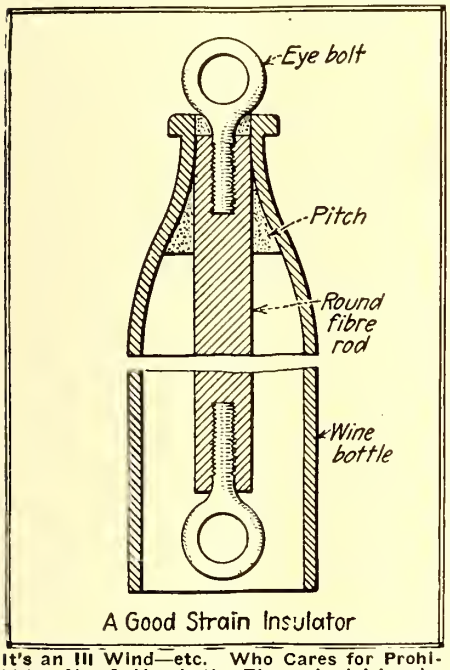
The Hanson Audio-Frequency Wireless Telephone.
By Edgar Terrain Johnstone
Developing Audions for the Amateurs.
By E. T. Jones
Notes on Crystal Detectors.
By C. H. Biron
Destruction of the Goldsmith Station at Laiken, Belgium.
By M. Gallaix—An eye-witness.
Receiving Cabinet of Latest Design.
By Palmer H. Craig
The Third Pill.
By J. K. Henney
San Diego California from London.
By M. Hall
Your First.
By C. H. Pfeiffer
Increasing the Secondary Voltage of Your Transformer.
By F. E. Terman
An Ideal Receiving Set—Second Prize.
By A. C. Burroway
Amateur Ethics.
By Ensign Pierre H. Boucheron
Improved Types of "B" Batteries.
By J. H. Reed

www.americanradiohistory.com

A GOOD STRAIN INSULATOR

This strain insulator is cheap and efficient and easily constructed. Its efficiency is due to the glass petticoat keeping the insulator free from rain and snow. The insulator is a fiber rod ¾ inch in diameter and about 7 inches long, one end of which is turned to a taper to fit in the neck of a wine bottle which are usually long and slender. The bottle having been cut off near the bottom by tying a string around the bottle where the cut is desired, saturating the string with alcohol, igniting, and when flame is extinguished plunging in cold water. Each end of rod is drilled deep and tapt to take a ¼"-20 thread eye-bolt. The eye-bolt used in the tapered end is a little longer than the other, and is screwed in so that the eye just touches the neck of bottle. This holds the bottle in position. Pitch is poured in the space around eye-bolt and also around the fiber rod on the inside of bottle, to make it water-tight and more rigid.

Contributed by J. A. WEVER.



It's an Ill Wind—etc. Who Cares for Prohibition Now? Here's the Finest Aerial Insulator Ever—and It Has a Rain-Shedding Petticoat Made from a Once Proud Claret Bottle.

THE THERMO-COUPLE RADIO AMMETER.

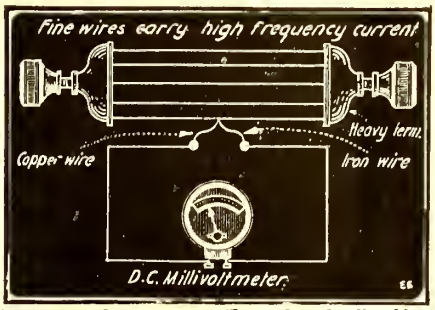
A very important commercialization of an old principle is made in the new thermo-couple ammeter for measuring high frequency currents, such as are met with in wireless work. Its superiority over the old hot-wire instrument is so great that it admits of no comparison.

The indicator used may be any high-grade moving coil-permanent magnet type of meter operating on the D'Arsonval principle, but it must be very carefully designed, for it must give full scale deflection on about 10 millivolts.

The "couple" consists of a straight wire of high resistance, preferably *nichrome*, connected to suitable terminals, and forms the path of the high-frequency current. Welded to the center of the wire and to each other are two fine wires, an iron and a copper, which are connected with their free ends to the meter circuit.

As the current passes, it heats the wire, and consequently the couple. The heat causes the couple to deliver a small direct current voltage, which is proportional to the effective value of the high-frequency current, which deflects the pointer. Consequently the scale may be marked to read in "amperes."

Up to about 10 amperes the resistance strip and couple may be placed inside of the instrument case, forming a self-contained meter, but higher currents are best measured by making the heating or resistance strip in the form of an external shunt. The terminals are of heavy copper, the same as a regular direct-current shunt, but



A Handy Instrument Fact for Radio Men. High Frequency Currents Are Measured by the D. C. Millivoltmeter Connected to a Copper-Iron Thermo-Couple as Shown.

instead of a single heavy conductor several fine wires are stretched between the terminal lugs so that each wire presents the same inductance and "skin effect" to the high-frequency current, thus insuring even division of current and enables the "couple" to be placed on one wire only, which is essential to the quick heating and cooling necessary to make the meter indication follow the changes in current.

The shunts may be made interchangeable to measure various current strengths with the same meter, and are connected to the meter with flexible leads, exactly the same as an ordinary direct-current meter. The accompanying sketch shows how the meter, heater and couple are arranged.

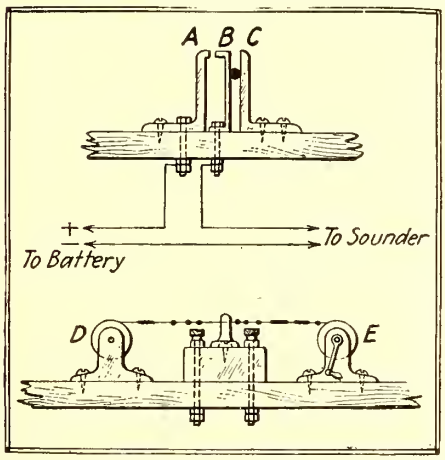
Contributed by VICTOR H. TODD.

CODE TEACHER MADE OF KNOTTED STRING.

A simple yet effective device for learning the telegraph code may be made in the following manner:

Screw two pieces of brass or other metal (A and C) to a block, allowing one screw in A to project thru the block. B is a thin piece of spring metal, fastened to the block with a screw that projects thru the block. Wires from the sounder and battery are attached to the long screws holding A and B. Small reels D and E are mounted on the block.

Take an ordinary white cord and tie knots in it, using a single knot for a dot and four knots close together for a dash. The alphabet or messages may be made in



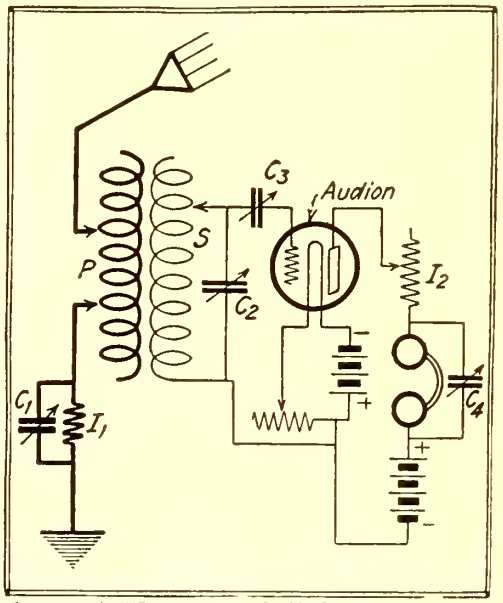
Simple? Well We Should Say So. A Code-Teaching Instrument Comprising a Knotted Cord Drawn Between Contact Making Members.

this way: Roll the string on reel D and fasten the loose end to reel E. Place the string between the B and C contacts and turn reel E. When a small knot passes between B and C, a brief contact is made between springs A and B, closing the circuit and causing the sounder to make a dot. When a group of knots passes the contact remains longer and causes the sounder to make a dash. The reel may be turned at any speed to suit the learner.

Contributed by ALTON D. SPENCER

DAMPED AND UNDAMPED AUDION HOOK-UP.

Since the ban upon radio reception has been lifted I have done a great deal of experimenting with undamped wave reception. I do not know whether this has ever been developed before or not, but for the sake of those that have not seen it before, I would like to make the following suggestion in regard to undamped wave reception. I have never received any results with the Ultraudion, Chambers or any other hook-up as I have always been troubled with the flexibility of the tones, not being able to "hold" a tone that was readable. I am now using this book-up for both damped as well as undamped wave reception, and it



Improved "Damped and Undamped" Audion Hook-Up for Radio Receiving.

is giving me fine results.

PS is the loose coupler.

I1 is a fixt inductance, 3" diam. 56 turns No. 22 S.C.C.

C1 is a variable condenser		.001 mfd.
C2	"	.001
C3	"	.0005
C4	"	.001

I2 is a tuning coil 3" diam. 30" long, No 22 enameled wire; the inductance is varied with a slider which gives minute adjustment. I2 makes the audion oscillate while C1 and C4 change the tone of spark signals. The sizes need not be followed exactly, but if the general scheme is followed I am sure the operator will be delighted with the results. For any further information, write me, fellow "Radio-Bugs."

Contributed by E. GARRATT ARNOLD.

OPERATING AUDIONS ON A.C. 110 VOLTS.

Radio operators, both commercial and amateur, will do well to read the fine article on operating audions on A.C. circuits, prepared by Elliot A. White, former instructor in Radio, Air Service School for Radio Mechanics, Carnegie Institute of Technology, in the July, 1919, issue. The day of expensive high voltage "B" batteries, and the still more troublesome storage cells required for the filament current, is rapidly passing. The efficiency is too low. Better to operate audions from a D.C. or A.C. 110 or 220-volt circuit, even if you have to drive a small dynamo from a water wheel.

www.americanradiohistory.com

A Loose-Coupler Wrinkle

By Thomas Reed

THE freedom of wireless is here—its in the air (where it belongs), and the inmates of the "Radio - Bughouse" are beginning to rave of novelties in loose-couplers, just as the girls, on the approach of Easter, begin to study the fashion magazines and plan yet more bewildering styles.

The loose-coupler is such an efficient and willing little worker that it seems like "painting the lily," as Shakespeare says, to think of bettering it. It's only because we love it so much that we try to improve it still further—as Father used to say when he unrolled the trunk-strap and beckoned toward the shed.

Here's a wrinkle. If it's new, the "Ed." will publish it, and perhaps it'll become the fashion, like last Spring's tight skirts. Who knows?

As we make bigger and bigger couplers to deal with the longer waves, we seem to need some smoother and easier means of moving the coils than the present slide-rods provide. Well, why not make your secondary coil the stationary element, instead of the primary, and move your primary instead? It's the relative position of one to the other that counts, not the moving of either one especially.

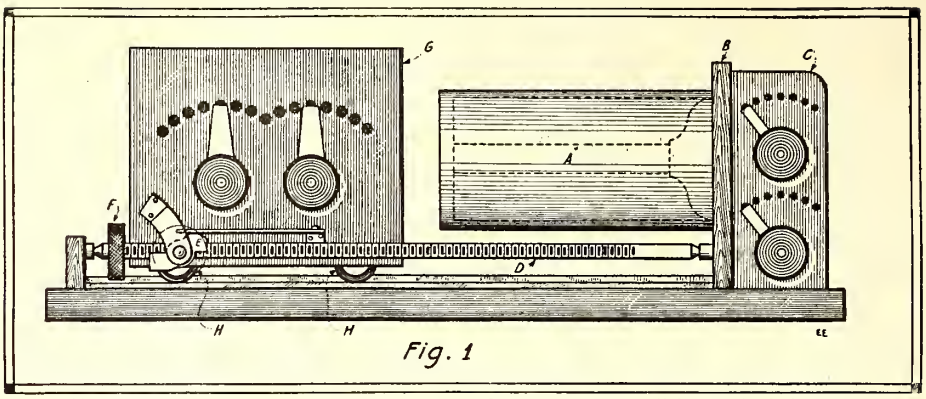


Fig. 1

Why Not Make an Innovation—Slide the Loose-Coupler "Primary" Instead of the Secondary. Sure! Why Not?

But the primary is heavier and more awkward to move than the secondary, isn't it? Yes and no. If you move the primary, you can mount it—coil, box, switches and all—on four grooved wheels, and let it run back and forth on a track, like a typewriter carriage. There's no reciprocating movement easier and more accurate than that, is there? No, he says, reluctantly but with conviction.

Fig. 1 shows a fixt secondary, mounted on a big stiff wooden dowel A, and this in turn on a stout backboard B, braced by the switchboard C. No wobble or sag to that secondary. There is also shown the primary G, running back and forth on the wheel H H. No wobble to that, either, so you can have a pretty *close fit* between your two coils.

But you want a fine adjustment, too? All right, what's more satisfactory than the feed-screw of a lathe? Rig up a miniature feed-screw D (must be brass) with a split nut like E to grip it or not, as you determine. (E has a knurled head attached, not shown in the figure, as it would obscure the clear view of the nut.)

Now you can roll your primary on its wheels into nearly the right position, turn the nut E till it bites the feed-screw, then roll the knurled wheel F back and forth, varying the coupling with extreme *precision*. Or in an instant you can disengage the nut, and without removing your hand, push the primary back and forth with a wide sweep, as you pursue some new and fleeting signal.

Fig. 2 (A, B, C, etc.) shows the action of the feed-nut, and the successive stages of forming it from a block of brass; not too much work, when you once get at it.

What do you think of the idea? As Nora Bayes used to say, "Will we kill it, or leave it live?"

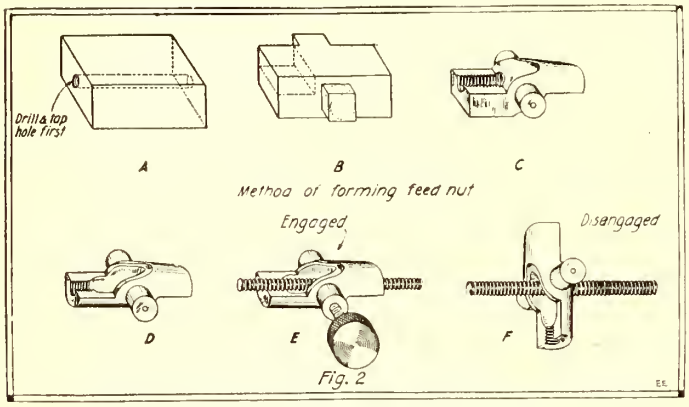
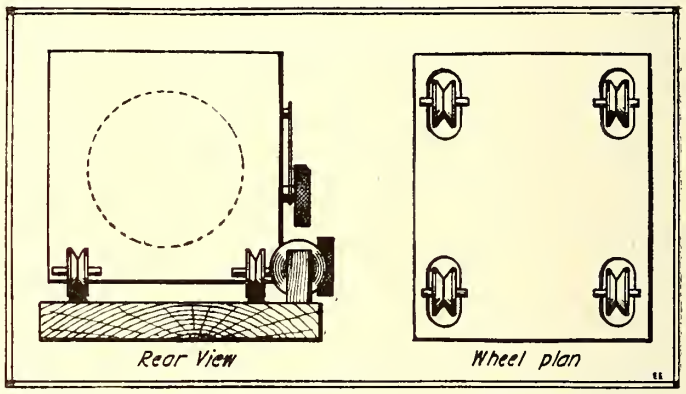


Fig. 2

Clever Disengaging Primary "Slide" Control.



How the "Primary" Is Mounted on Small Wheels and Tracks.

High Tension Condenser Switch

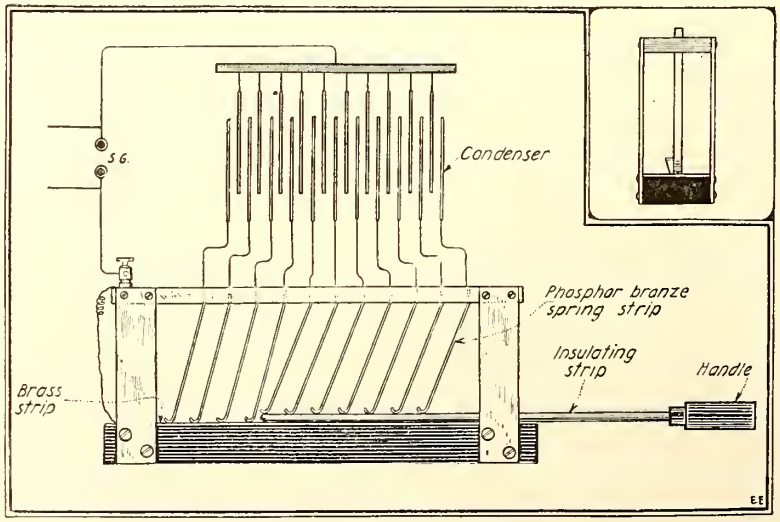
The following little arrangement will provide a means of connecting a (FIXT-VARIABLE) high tension condenser in the manner practiced in the various types of commercial devices.

Phosphor bronze or spring brass strips are mounted so as to rest tightly on the brass strip on the base; a thin strip of fiber or other (insulating) material has a handle and is forced between the spring contacts and the brass strip, thus serving as a means of increasing or decreasing (connecting or disconnecting) the plates of the condenser.

This switch can be used to connect batteries in parallel as well as any other apparatus. It furnishes a simple and efficient type of switch, which is well in the reach of the everyday experimenter, and the readers of the wireless fraternity will appreciate this timely article, where such switches can be advantageously employed to connect the condensers used in audion control panels, et cetera. The type of switch employed by commercial concerns to fulfill this purpose is beyond the average amateur's skill, while the switch described will prove an easy instrument to construct and will at the same time perform its duty efficiently. I have used them successfully in the radio laboratory.

Contributed by

E. T. JONES.



A High Tension Condenser Switch That "Works"!

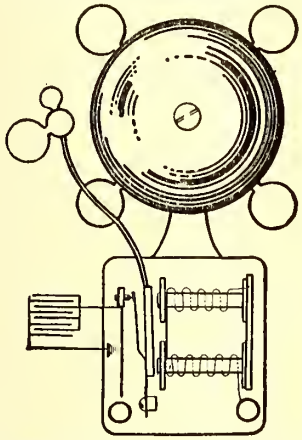
www.americanradiohistory.com

LATEST PATENTS

Variable Tone Bell.

(No. 1,312,610; issued to P. E. Chapman and R. H. Robinson.)

A method of building bells such that the tone of the device can be

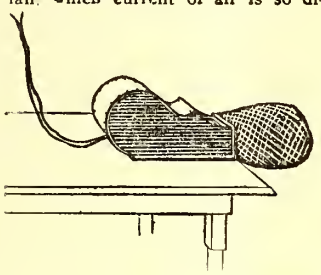


altered at will. The gong may be cast or else punched with several projections as here illustrated, one or more of which can be cut off as desired to give a different tone. The striking hammer is provided with several projections also, so that the degree of "loading" on the hammer can be changed, thus altering the rapidity of the beats.

Suction Fly-Catcher.

(No. 1,313,203; issued to Harry Pakeman.)

A suction type of flycatcher intended to be driven by an electric motor or other means, and providing a scheme whereby a swiftly moving air current is created by a fan, which current of air is so di-

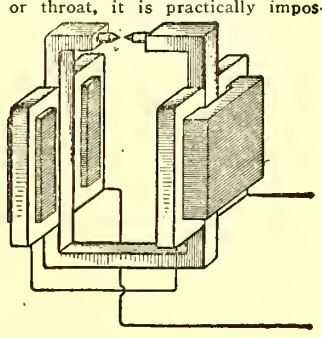


rected as to cause the entrapment of flies in such a way that they cannot escape. The flies are caught in a removable basket, which can be detached and emptied at any time. A bait holder is provided in which molasses, honey, sugar water, etc., or other similar fly bait may be disposed to attract toward the suction distributor millions and millions of the ever-pestiferous fly.

Electric Welding Machine.

(No. 1,312,845; issued to James H. Gravell.)

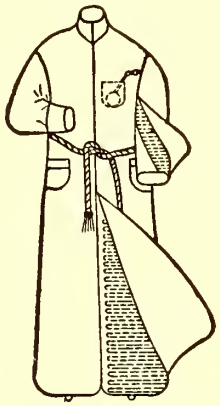
In the ordinary type of electric welding machine, having long jaws or throat, it is practically impos-



sible to secure a satisfactory weld at any great distance in from the edge of the work, owing to the fact the current, flowing in the arms of the machine, tends to produce a magnetic field in the work and space between the arms, which opposes the flow of the heating current. This reduces the efficiency of the welder. In the present design the inventor provides a special primary magnetic winding on an open core frame, which produces a magnetic field between the arms. This sets up a counter-current in the arms, which offsets the self-induction or bucking currents, and this permits the arms of the welder being extended for any length desired.

Electrically Heated Garment.

(No. 1,312,830; issued to Charles E. Camm.)

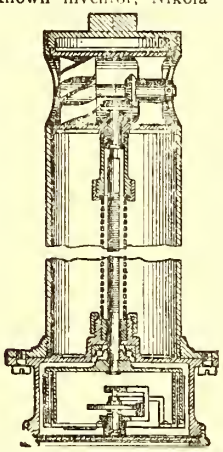


The inventor has devised a clever form of weave for producing a special fabric, in which the electric resistance or heating wires are interwoven. An automatic thermostat is provided in the garment in such a position that it will be actuated and controlled by the temperature of the garment.

Electric Ship's Log.

(No. 1,314,718; issued to Nikola Tesla.)

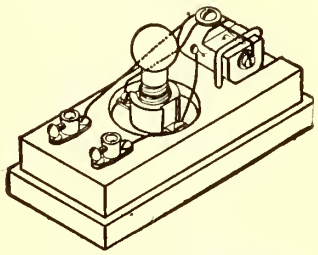
A very clever invention is this latest design for indicating the speed at which a ship is moving thru the water as devised by the well-known inventor, Nikola Tesla.



As the ship speeds along thru the water, a small turbine, mounted at the lower end of a tube extending down thru the bottom of the ship, is actuated, and the faster the boat speeds along, the more rapidly the turbine rotates. The revolutions of the turbine are conducted thru a flexible or other shaft to a revoluble head or drum in the top of the tube, and placed at the deck level, for instance. At this point there is mounted the indicating instrument of the log, with the dial marked in knots or miles per hour. The indicator of the instrument is moved by the friction or viscosity of the air between the shaft-driven drum and a similar shaped drum secured to the indicator and in close proximity to it, there being no direct mechanical connection between the two.

Electric Gas-Detector.

(No. 1,313,323; issued to Milton A. Nobles.)

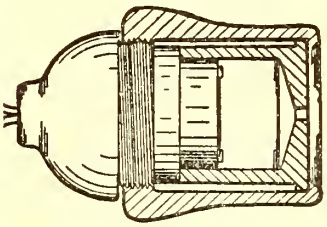


The device will detect and give an unmistakable alarm whenever certain gases are present in predetermined quantities. The construction comprises a lamp operated from a battery, such as the miners' headlight battery, which lamp is blinked on and off whenever gases are present. The complete device comprises a circuit-closing device involving the use of a catalytic element, such as a fine platinum wire and also a thermostatic bar. The instrument is not affected by changes in temperature.

Thermic Telephone.

(No. 1,312,504; issued to Robert Aernout Baron Van Lynden.)

The prior types of this device utilized a very fine platinum wire, which the voice currents

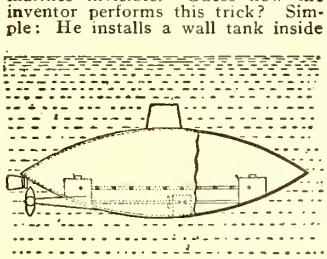


caused to become heated and cooled in correspondence with the voice undulations. But in the present design the conductor is in the form of an "S" and may be formed upon the base electrolytically, or it may be formed of a fine metal sheet or foil laid upon the supporting surface. Also, the conductor may comprise a mark on the porcelain or other support, such as that created by painting or printing the same upon the support surface.

Making Submarines Invisible.

(No. 1,312,595; issued to Henry H. Suplee.)

At last we have the master invention of the war, rendering submarines invisible. Guess how the inventor performs this trick? Simple: He installs a wall tank inside

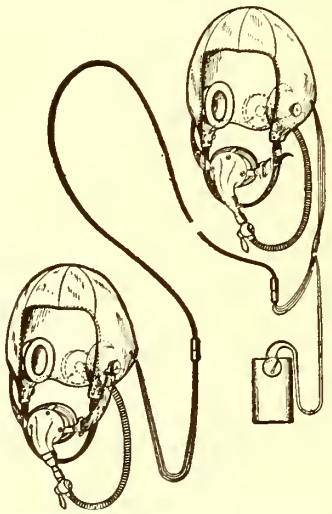


the "sub" from which pipes lead to a series of nozzles placed around the hull. Airplanes and blimps can spot "Mr. Sub" even when submerged 100 to 150 feet. But they will have to try a new one, for Mr. Suplee opens his valves and hides his little hornet by shooting out a colored liquid into the sea water that effectually nullifies the transparency of the water without making a smudge. Nigrosin may be used, mixed with water.

Helmet Telephone Set.

(No. 1,314,819; issued to Charles H. Lehman.)

The speaker's voice does not act on the microphone direct, but is carried thru a mouthpiece and speaking tube to this device, which is placed at the rear of the helmet. The usual telephone receivers are mounted in the sides or ear-flaps of the helmet. In the

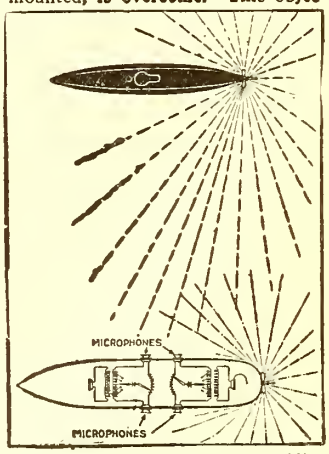


earlier forms of telephone and radio telephone devices of this type, the microphone was frequently mounted on a breast-plate, but when the aviator or pilot turned his head the voice was no longer impinged on the microphone.

Submarine Signal.

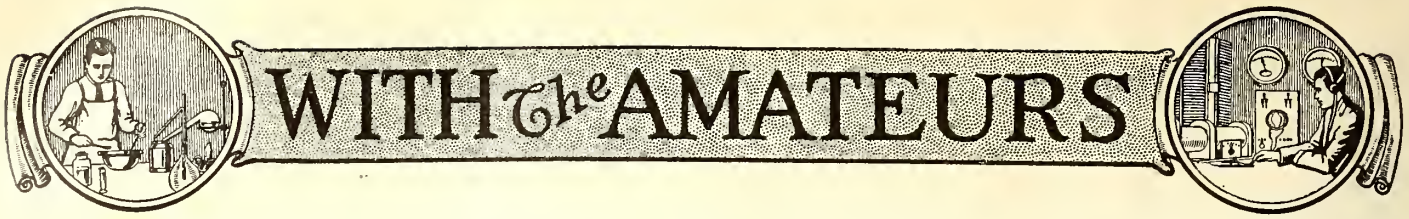
(No. 1,312,809; issued to C. E. Scribner and J. L. McQuarrie.)

Improved submarine signaling system in which the noise or sound from the propeller of the local ship, on which the microphones are mounted, is overcome. This objec-



tion is here overcome by providing two detectors, one of which is relatively insensitive and both of which are differentially related to a common telephone receiver. This makes it readily possible to balance out the noise due to the local propeller, whereas the distant propeller affects the sensitive microphone more than the insensitive microphone, and produces a resultant effect in the telephone receiver.

www.americanradiohistory.com



Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light-toned ones. We pay $5.00 each month for the best photo or photos and $2.00 to each "Honorable Mention." Address the Editor, "With the Amateurs" Dept.

The Editors desire to call to the attention of all owners of "Electrical and Chemical Laboratories" the fact that hereafter the MONTHLY PRIZE WILL BE $5.00 CASH, instead of $3.00. ALSO $2.00 CASH WILL BE PAID TO EACH "HONORABLE MENTION" ENTRY PUBLISHT. We have not received any "Laboratory Photographs" of late. So "go to it" and send us your photo, together with that of your laboratory. If they are particularly good we may list some new and bigger prizes. So get busy, Boys!!! It's up to you. Here's a way to earn some greatly wanted laboratory apparatus at no cost whatever. Don't be afraid to send in too many photos, Boys.

"Amateur Electrical Laboratory" Contest

THIS MONTH'S $5.00 PRIZE WINNER— KENNETH STRICKFADEN

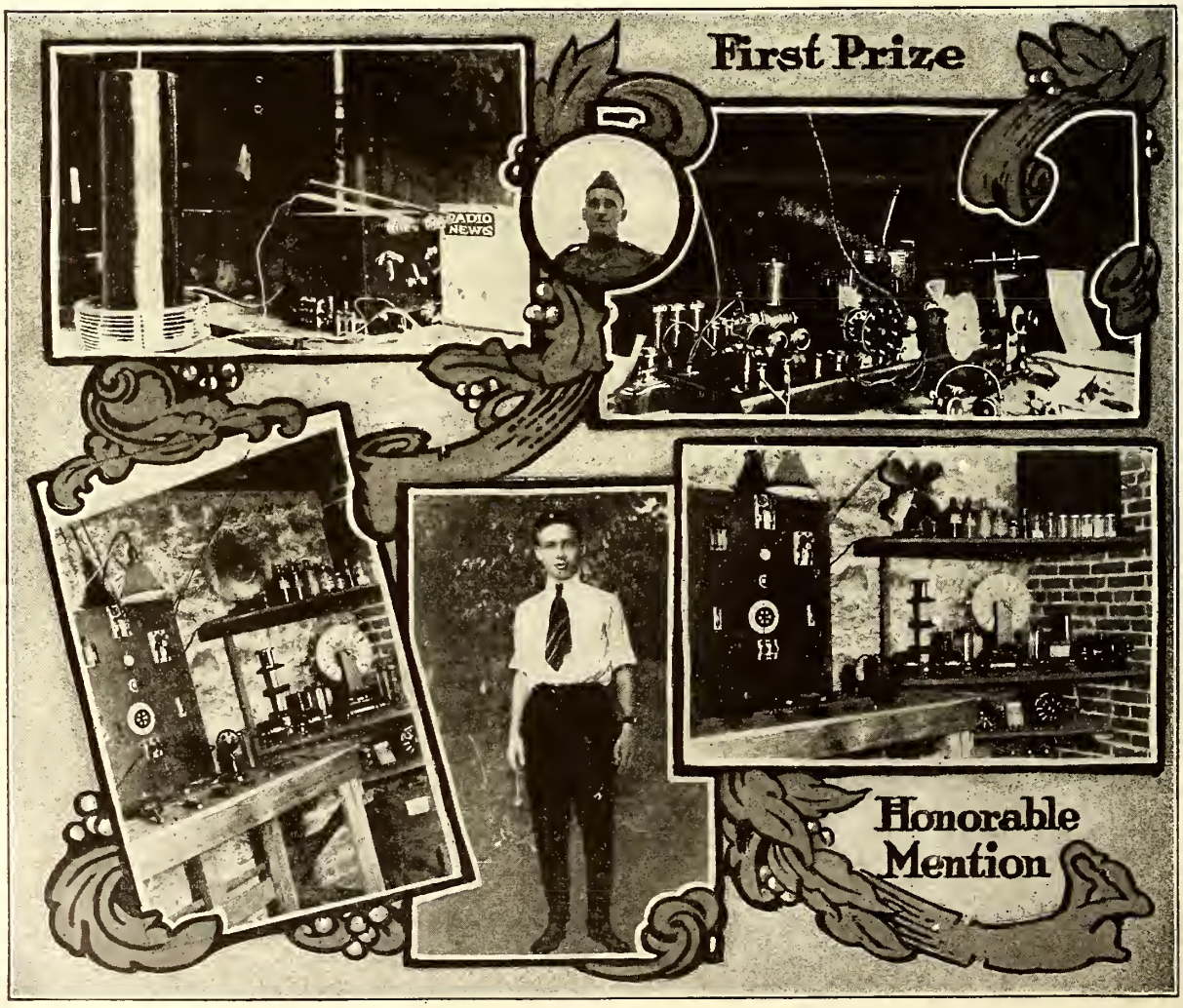
THE photos herewith show my electrical laboratory at Coney Island, New York. It's good to be back again in the good old U. S. A. and my "experiments," after a sojourn in France with the A. E. F. My "layout" at present comprises a photographic dark room, chemical "Lab." and electrical "Lab." One of the photos shows the large Oudin high frequency coil, which is excited by an 18-inch induction coil, seen at the extreme right of the photo. I have a goodly collection of telephone, telegraph and radio apparatus—some home-made and some standard stock. The Oudin coil outfit is excited by the 18-inch spark coil operated by an electrolytic interrupter on 110-volt circuit. A rotary spark gap is used. My radio receiving set includes amplifiers. I have a Ford car, specially fixt up and decorated, in which "Yours Truly" and all the "junk" will attempt to fly across the continent to sunny California, my old home town—Santa Monica.—Kenneth Strickfaden (home address, 1217 11th Street, Santa Monica, Cal.).

HONORABLE MENTION—ELLWOOD R. RUTENBER $2.00 PRIZE PAID EACH "HONORABLE MENTION"

THE accompanying photos show my experimental electrical laboratory. I am sixteen years of age and have been experimenting for more than six years. My laboratory equipment includes the following:

15 V. 10 Amp. D.C. Generator; 6 V. 3 Amp. D.C. Generator; 110 V. 175 Amp. D.C. Motor; 1/20 H.P., A.C. Motors; 1/6 H. P., A. C. Motor; 6 cylinder Auto Magneto; 6 V. 40 Amp. Storage Battery; Combination Volt-Ammeter, 24 V. 50 Amp.; Electric Fans; Home-made Static Machine; Home-made Medical Coil; Switchboard; Ammeter,, 30 Amp. Capacity; Rheostat; Test Buzzer 1½, 6, 8, Volt Transformer.

I have spent many happy hours in this laboratory performing experiments of all kinds with the apparatus here described. I have a variety of chemicals and acids for experimental purposes, also three mining trays and other paraphernalia necessary for the work. I also have a number of small motors, batteries, switches of various kinds, spark coils, bells, and how-to-make-it odds and ends. I have a very useful home-made low-voltage rheostat which I will describe for the benefit of other laboratory owners, at the earliest opportunity, in the columns of the ELECTRICAL EXPERIMENTER.—Ellwood R. Rutenber, 127 N. Washington Street, Marion, Ind.



www.americanradiohistory.com

Science in Slang

By EMERSON EASTERLING

"I SAW in a magazine some time ago some guy's idea about entering into a gab-feast with the Martians, or Martonians, or Marites—or whatever you want to call 'em," remarked one of our crowd as we sat in the Union Depot at Portland, Oregon, waiting for a train to Pendelton.

"Yes," replied Jazz, "I saw that. It struck me as being sort of sensational stuff. I guess it is alright—in some respects—but there is a lot of stuff evidently overlooked."

"How is that?" asked Punk, looking up from his *Police Gazette*.

"For one thing," began Jazz, "did you see the write-up?"

"Oh," returned Punk. "I have seen some of the bird's stuff on the subject O. K.—but all that stuff is so far from home that I never paid much attention to it."

"Well," continued Jazz Stokes, "as I was going to say—the late Percy Lowell gazed up at the Martian bunch of dirt and discovered that it was stript all over with stringy marks. If you had seen them without any explanation you might have pronounced them railway tracks, or road ways — but old Lowell must have been awful 'dry,' or something; so he thunk up the canal idea. It took."

"I thought that a bird by the name of Schiaparelli—a German wop, or something — discovered the canals." put in Bender.

"I believe you are right," returned Stokes. "It was Sarsaparelli that dug up the canals and Lowell that extended the theory and kept them open to the astronomical public.

"Anyway, a Harvard 'Proff' by the name of Pickering got it into his head that we could construct a huge mirror and do flash light stunts on them and take chances on them catching on. and some more on our getting them if they do catch on."

"He was not a proff in finance, was he?" questioned V. Dago Hule, with a sort of a smile.

"Proff Wood (not referring to his head exactly) figured out a plan wherein we would stretch a few hundred acres of black cloth over some blinding sands of the great African desert and have some monster motors to roll and unroll the 'window shades' in such a fashion as to give them an optical impression that we are kidding them into saying 'Hello' to us by some such way. Of course such a stunt would cost the price of a young war—but what's a billion or two to a scientist's young life! Wood himself didn't intend to foot the bill."

Talking with Mars

"Don't you think that that was just a sort of figure of speech? I don't think that he really thought of doing exactly what he said. He probably proposed that as some example of how it could be done—don't you think?" rattled off Bender.

"More than likely—I don't know—besides I don't much care. But both the men are exceptionally intellectual specimens of our modern breed.

"A Frog by the name of Flammarion, a 'proff' in some *La Belle Universite* or something, let's out some of his think tank juice and proposes to have an immense bank of incandescent globes layed out on a dark stretch of land and let some official throw in and out the switch to the tune of 'Do you get us, Mars?'"

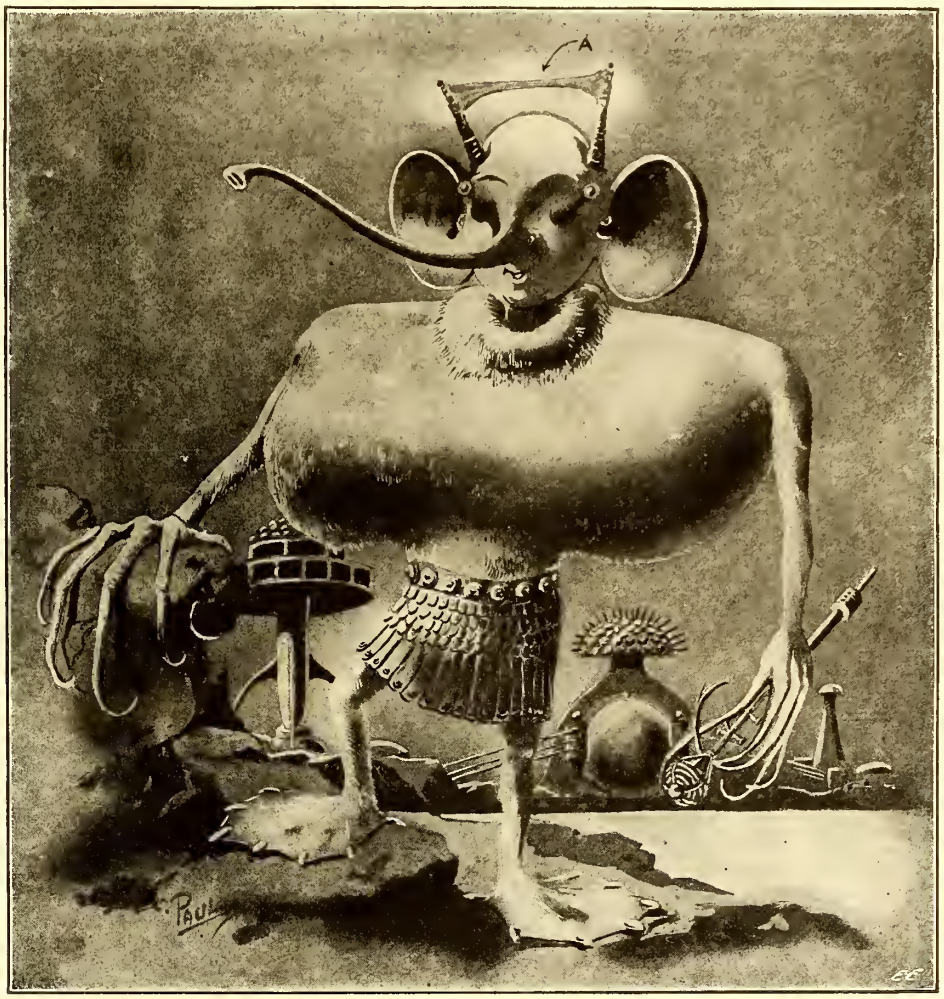
"Well," interrupted Punk, handing his *Police Gazette* to a preacher, "have you any better hunch for our transetherial communication? Why tear down when you can't put up a better castle than you ripped out—even if the one that you propose is warmer than the one you jerked out of commission?"

"Well," replied Jazz, "can't I kid the kids? They are smart men and have a few smart faults They have it all over the rest of us in many ways — but they cannot be perfect in all ways. In one or two respects they have fell down in their hypothetical proposals. Some of us who sit back and find fault with the Peace Treaty and so forth see a weak joint in their pipe dreaming and up with the 'heehaw.'

"Now will you let me rave?

"In the first place how are we to know that the beings that inhabit Mars — if it is inhabited — are gifted with a physical and mental combination that results in what we explain as sight? We don't know but what they have evoluted past us—if we are evoluting—and are getting into their knowledge what we do with sight by some other sense? As the dog, for instance, has its sense of smell developed to a much greater degree than has the human race, so might we have our sense of sight developed to a much greater degree than have the Martians. And are we sure that they have developed up in the same way that we have? Take the different forms of life on our own planet: how different

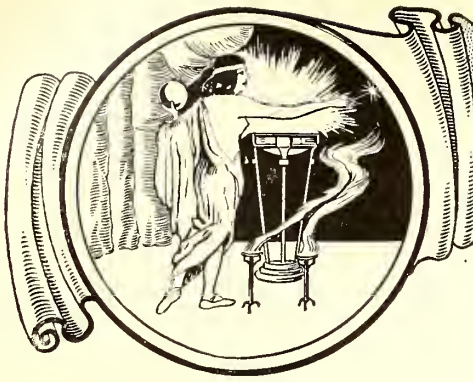
(Continued on page 699)



AS SCIENCE SEES THE MARTIAN.

Due to the very rare Martian atmosphere, the Martian's chest must be enormous to accommodate his ponderous lungs, necessary to supply his oxygen. Rare atmosphere conducts sound very poorly, hence the large ears, required to catch the very weak sounds. Due to the poor atmosphere, it is exceedingly cold on Mars, except at the equator. Hence Martians are covered with a while polar fur from head to foot. A rare atmosphere conducts odors but poorly—hence the elephantine nose, which goes to the odor, as the odor can't come to the Martian. Gravity on Mars being much less than on earth—1 lb. on earth weighs 0.35 lbs. on Mars—the pull on his body is very small. Therefore, his height is from 10 to 12 feet. To support such a tall body where gravity is small, better footing is necessary, hence the big feet. The tremendously civilized Martian always rides or flies from place to place; his legs are thus almost useless, hence devoid of muscles, consequently thin. The Martians stopped all physical work millions of years ago; machines do his work. His arms thus are weak and thin. But the hands and eyes—the Martian's most important organs—are used and worked constantly—therefore are developed wonderfully. As his food is all taken in highly concentrated form and as he does not talk, the Martian's mouth has shrunk to very small dimensions. Talking in a rare atmosphere being almost impossible, the Martian communicates by his telepathic organ, "A," a sort of sensitive skin stretched between antler-like prominences on top of his head. The same organ sends out the telepathic waves.—H. G.

www.americanradiohistory.com



THE ORACLE

The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be publisht. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered. Your correct name and address must be signed.
3. Sketches, diagrams, etc., **must** be on separate sheets. Questions addrest to this department cannot be answered by mail free of charge.

4. If a quick answer is desired by mail, a nominal charge of **25 cents** is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

VOLTAGE DROP IN RAILS.

(1027) Chas. Hora, New York, N. Y., rites us:

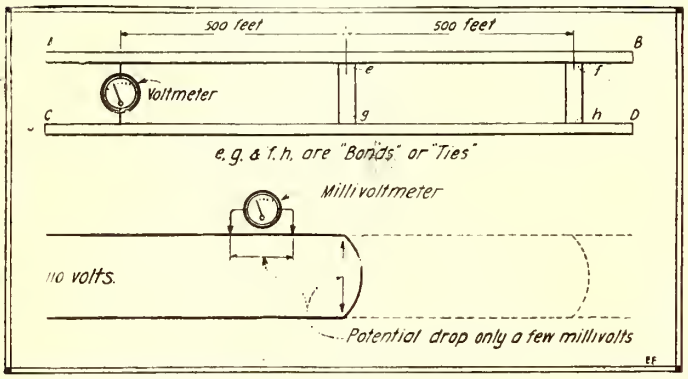


Diagram Showing How Drop in Voltage Across Rail Bonds Is Measured.

Q. 1 The problem I wish you to solve is this: Two rails, A, B,—C, D, are charged with 110 volts; what would be the voltage at e g and f h if the voltmeter is put across these two points? Will it register the same at A C, e g or f h, or will there be a drop in the current, and if so, how much? The rails are 1,000 feet long (such as are used on the Elevated Railroads).

A. 1. If we understand your problem correctly, what you wish to determine is the drop in milli-volts across the two bonds e g and f h on a track system such as is used on the elevated railroad, and which are of the same polarity. We can assure you that the drop along these rails or crossing bond such as e g or f h is very small in any case, and for a three-foot section of track, or measuring across a good bond, the drop should be but a few millivolts. The drop in potential on a 1,000-foot length of track will of course, in proportion, be greater than that measured across a bond or cross-section of, say, three feet of track, but would be quite small in any event.

AUTOMATIC TRAIN STOP.

(1028) E. M. G., of New London, Conn. inquires:

Q. 1. What is your opinion of the "M-V all weather train controller" as shown and described in ELECTRICAL EXPERIMENTER for February, 1918?

A. 1. In answer to your query asking our opinion on the "M-V all weather train control" as illustrated and described in the February, 1918, issue of the ELECTRICAL EXPERIMENTER, would advise as follows:

We have had no chance, of course, to see this invention in actual practise in order to see for ourselves just how it would work out under various weather conditions, but from a theoretical point of view we would say that the device should certainly work out very well. The electrical operating theory of the invention is correct so far as we can see, and an electrical engineer who has done some work along similar lines with magnetically operated train stops, which have been tried out on the Pennsylvania Railroad recently, so we understand, has spent a great deal of time and money working out a device quite similar in principle. Engineering reports which he showed us demonstrated that the device possest considerable merit and some features heretofore not fully realized, or at least their practical significance for such a difficult task as this. This experience has tended to all the more reinforce our opinion as to the practicability of such magnetic train controls.

The device you are interested in would seem to be all right if properly developed and applied. We understand that heretofore, and even now, there are one or two objections to all such automatic train stops and controls of an electrical and magnetic nature, which the railroads object to, and that is that the currents passing thru the rails are liable to conflict or nullify the electric currents operating the block signals.

WANTED!!!

"ODD PHOTOS" AT $1.00 EACH.

Here's what we want! What have you got?

ELECTRICAL PHOTOS—
New photos of Lightning; new and unusual Electrical Apparatus and Machinery; Electric Signs; Electric Autos; Electric Clocks.

SCIENTIFIC PHOTOS—
New Scientific Apparatus; Results; Effects; Motion Pictures; Stunts.

OPTICAL PHOTOS—
Peculiar stunts obtained with various lens arrangements; odd film effects caused by unusual conditions; novel micro-photographic subjects.

ASTRONOMICAL PHOTOS—
New eclipse photos; star and moon effects caught by the camera; comets; shooting stars; progressive moon studies.

FREAK PHOTOS—
Odd double and triple exposure effects; novel and striking effects due to unusual exposures.

MECHANICAL PHOTOS—
Electrical and Mechanical apparatus of unusual news interest.

RADIO PHOTOS—
New stations, both commercial, government, and private. Owners of private or amateur stations will find a special contest for these photos on another page of this issue.

And don't send us plate or film "negatives"; send unmounted or mounted "prints" preferably a light and dark one. Enclose stamps if photos are to be returned.

Address photos to—Editor "Odd Photos", Electrical Experimenter, 233 Fulton Street, New York City.

HUGHES BALANCE CONSTRUCTION.

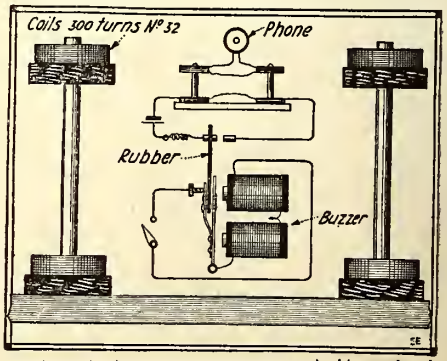
(1029) C. H. Jones, McAllen, Texas, asks:

Q. 1. For data on building a Hughes induction balance.

A. 1. We give herewith diagram showing a Hughes balance constructed with an ordinary buzzer as the exciter.

The coils are wound with No. 32 silk-covered wire. About 300 turns are necessary for each one. This winding must be placed on the spools very evenly, and great care should be taken to have all coils precisely alike. The lower two coils are connected in series with the buzzer, the upper two with a telephone receiver of about 75 ohms. A more sensitive receiver will, of course, give more efficient results. These coils are placed so that the winding opposes that on the coil beneath it on two upright posts, spaced the desired distance apart. The exciting buzzer is now started and the coils above shifted until no sound is heard in the phones. If a metallic object is now placed between the two coils, the phone instantly responds because of the disturbed balance.

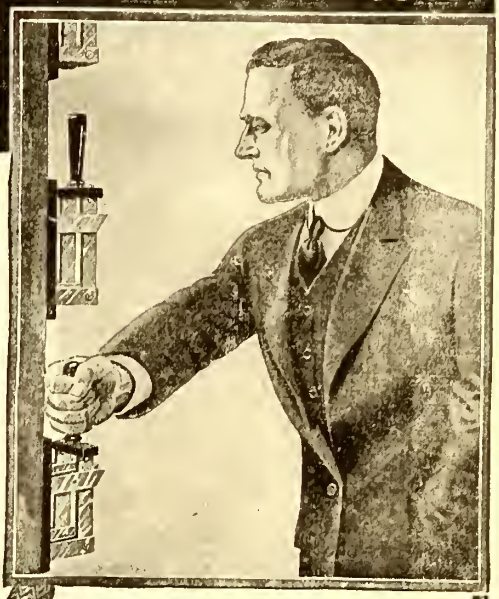
The buzzer is a very simple device, made by riveting a piece of hard rubber to the armature. Said hard rubber has a metal contact, which is connected with another screw, so that the excitation of the coils is entirely dependent upon these two contacts, and only one cell is necessary in this coil circuit, whereas two are used to actuate the buzzer.



Hughes Induction Balance and How It Is Constructed.

www.americanradiohistory.com

Why Electrical Workers Are Needed.



Consider for a moment what part electricity plays in every-day life, in the comfort, convenience, pleasure and even health of the whole civilized world.

Think of having to ride in horse cars again—

of writing a letter every time you now phone—

of waiting days for what the telegraph does in a few minutes—

of no automobiles or moving picture shows—

Electricity takes millions to and from work. Without it the automobile and airplane would be impossible—the telephone and telegraph would be useless. All the civilized world relies on it for light, heat, transportation and communication. In a thousand ways electricity is used in factories, offices and in the homes.

Electricity is almost as essential as the air we breathe. Business would be almost at a standstill if deprived of its energy.

To say that electricity is still in its infancy is no exaggeration. Every-day brings into practical use some new method of controlling it, some new device or appliance for using it. In industrial work there are still scores of operations where electricity will be utilized sooner or later. The day is coming when the railroads will entirely replace steam with electricity. Doctors, dentists and scientists are only beginning to realize the possibilities af electrical energy.

These facts merely touch the high spots, yet they prove beyond a doubt that electricity plays a vital part in business, in our individual lives, and that there is unlimited scope for those who make electricity their life work.

The electrical worker provides other men light to work by, the telephone and telegraph to convey their orders, the power to run their machines and transport their goods. He supplies power in the homes to operate washing machines, vacuum cleaners; for ironing, heating and ventilating. In short, it is the electrical worker who makes it possible for the world to live more comfortably, to enjoy more pleasures and to do a bigger, more profitable business.

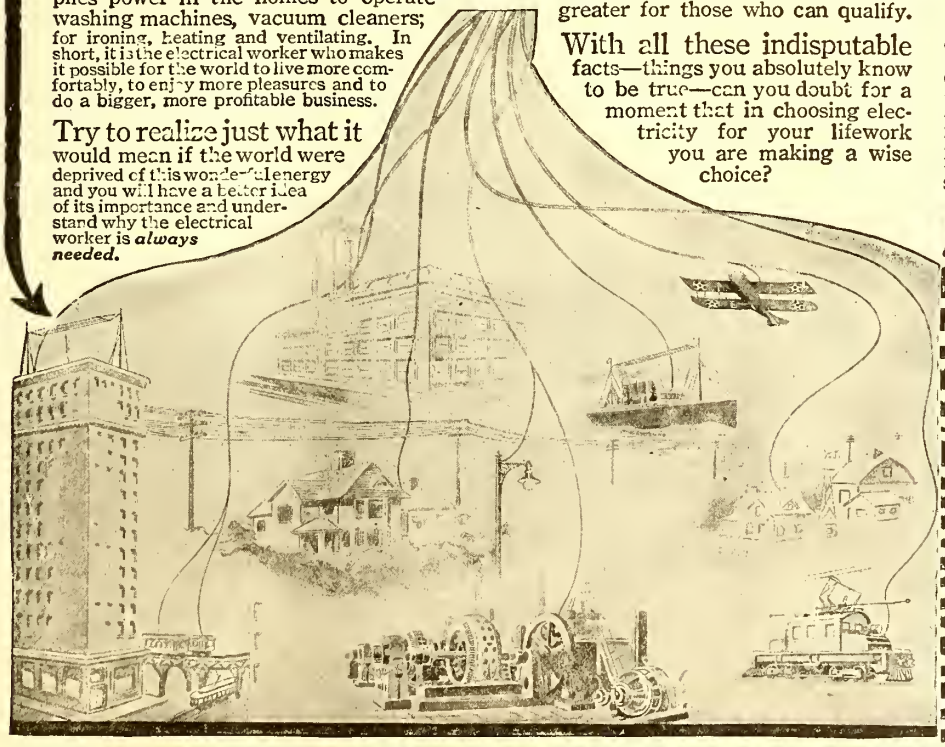
Try to realize just what it would mean if the world were deprived of this wonderful energy and you will have a better idea of its importance and understand why the electrical worker is *always needed.*

What Electricity Offers You

Once you have mastered the A-B-C of electricity you are confronted with unlimited opportunities for advancement. You can specialize in extending and perfecting the wonders already accomplished in the field. You may take up those branches of electrical and mechanical work which cover the design and manufacture of electrical apparatus or start in to qualify for a well-paid position in the designing, construction, operating or consulting branches of the electrical engineering profession, and to fit yourself eventually for a position as Distribution, Operating, Testing, Erecting or Designing Engineer.

In the automobile, airplane, telephone and telegraph lines there is also great scope for the trained electrician. Many wonders of electricity have yet to be unfolded—its uses multiplied—and opportunities still greater for those who can qualify.

With all these indisputable facts—things you absolutely know to be true—can you doubt for a moment that in choosing electricity for your lifework you are making a wise choice?



How You Can Qualify

You don't have to interfere with your present work while qualifying for a good electrical position. The American School can give you just the training you need in your SPARE TIME. Our electrical courses have been specially prepared for home study—are written so you can understand everything quickly—and from your first lesson until you get your Diploma expert instructors coach you. Our training will enable you to get into the game RIGHT.

Read This Guarantee —Then Act

"We guarantee at any time during the first year of your enrollment to refund the entire amount paid if, immediately upon the completion of ten examinations, you notify the School that you are not satisfied with your course."

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. G268 CHICAGO

"TRAINING—THE KEY TO SUCCESS"

Please send me booklet and tell me how I can fit myself for the position marked X

..Electrical Engineer	..Automobile Repairman
..Electric Light and Power Superintendent	..Airplane Mechanic
	..High School Course
..Hydroelectric Engineer	..Architect
..Wireless Operator	..Building Contractor
..Mechanical Engineer	..Lawyer
..Heating and Ventilating Engineer	..Business Manager
	..Certified Pub. Acc'nt.
..Sanitary Engineer	..Accountant and Auditor
..Master Plumber	..Bookkeeper
..Civil Engineer	..Gen'l Education Course
..Structural Engineer	..Com. School Branches
..Western Union Course	..Fire Insurance Adjuster
..Telephone Engineer	..Shop Superintendent
..Draftsman and Designer	..Steam Engineer
..Automobile Engineer	..Stenographer

Name.....

Address.....

.....

www.americanradiohistory.com



Be a Draftsman!

Make $30 to $75 a Week

Your name and address on the coupon brings this great Cyclopedia of Drawing without a penny down. Pay only net shipping charges when books arrive. With these books and a low price "school set" of drawing instruments, obtainable at any store, a man can become master of drawing and earn $30 to $75 weekly.

LEARN AT HOME—Good paying positions open everywhere. Intense activity in manufacturing, railroading, building, etc., calls for more draftsmen.

Shipped on 7 Days' FREE Trial

CYCLOPEDIA OF DRAWING

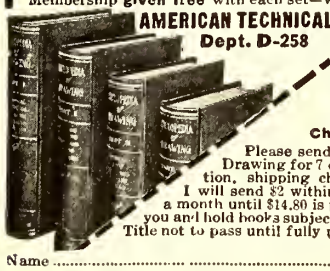
4 Volumes. 1650 Pages. Thousands of Illustrations.

Bound in genuine American morocco. Pages 6½ x 8½ inches. Covers all branches of Drafting—Architecture, Electrical, Structural Steel, Sheet Metal, etc. Teaches pen-and-ink rendering, lettering, free-hand, perspective, shades and shadows, working shop drawings, machine design, etc., etc.

50c a Week Only $2 a month if you keep the books. Coupon explains offer, good only within borders of U. S. and Canada.

Free Membership in This Society.—A Consulting Membership **given free** with each set—worth $12.00.

AMERICAN TECHNICAL SOCIETY
Dept. D-258 Chicago



AMERICAN TECHNICAL SOCIETY
Dept. D-258
Chicago, U.S.A.

Please send Cyclopedia of Drawing for 7 days' examination, shipping charges collect. I will send $2 within 7 days and $2 a month until $14.80 is paid, or notify you and hold books subject to your order. Title not to pass until fully paid.

Name .....

Address .....

Reference .....



½ Price $2.50

SEND NO MONEY

IF You Can Tell it from a GENUINE DIAMOND Send it back

To prove that our blue-white **MEXICAN DIAMOND closely resembles the finest genuine South African Diamond (costing 50 times as much), with same DAZZLING RAINBOW-FIRE, (Guaranteed 20 yrs.) we will send this Ladies Solitaire Ring with one carat gem, (Catalogue price $4.98) for Half Price to Introduce, $2.50, plus War Tax 13c. Same thing but Gents, Heavy Tooth Belcher Ring, (Catalogue price $6.28) for $3.10, plus War Tax 15c. Mountings are our finest 12 karat gold filled. Mexican Diamonds are GUARANTEED FOR 20 YEARS. SEND ON MONEY. Just mail postcard or this ad., state size and we will mail at once C. O. D. If not fully pleased, return in 2 days for MONEY BACK, less handling charges. Act quick; offer limited; only one to a customer. Write for FREE Catalog. AGENTS WANTED.**

MEXICAN DIAMOND IMPORTING CO.
Dept. F-1 Las Cruces, N. Mex.
(Exclusive controllers Mexican Diamonds)

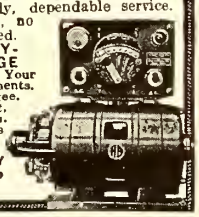
HB BATTERY CHARGING PAYS BIG PROFITS

WINTER BATTERY CHARGING BRINGS YOU $100 to $200 MONTHLY EXTRA PROFIT

Car owners demand reliable Battery Charging service. Get your HB 500 watt Charger NOW. Prepare for BIG WINTER PROFITS. Recharges 1 to 8 6-volt batteries. Cost 10c to 15c each, customer pays 75c to $1.50. No expensive repairs, burnouts or renewals. Steady, dependable service. Easy to install and operate, no mechanical knowledge required.

$15 PUTS THIS MONEY-MAKER IN YOUR GARAGE

Balance in small monthly payments. Your profits far more than carry payments. HB Absolute Money-Back Guarantee. Start to build a *big, permanent, profitable* business. We help you. For full information, tear out this ad and mail NOW.



HOBART BROTHERS COMPANY
Box 111E Troy, Ohio
Successful Mfrs. Since 1898



Springfield-Remington $7.77

Single shot rifle altered and refinished. Shoots cal. 30, model 1906 army cartridge. Weight 7½ lbs., total length 39 inches, U. S. Barrel 23½ inches Remington breech action, blued finish U. S. graduated sight. Price $7.77. **CARTRIDGES $3.50 Per Hundred** packing charge 45 cents.

FRANCIS BANNERMAN SONS 501 BROADWAY, N.Y.

Advertising Talks

NUMBER 5

IN my preceding articles I have tried to show you just why it pays to buy advertised goods—given you real tangible reasons proving that advertised articles are always the best and cheapest and wide-awake concerns who advertise always the most satisfactory firms to do business with.

But there is one point I haven't brought up and I want to take it up now. And that is the fact that the systematic reading of advertisements is an education in itself. If you want to keep abreast of the newest and latest developments in your business, your studies or your pet hobby you cannot expect to do so unless you make a habit of studying the advertising pages of your favorite magazine.

More care is taken and more time and money is spent by advertisers in preparing their advertisements than is expended in preparing even the editorial matter that goes into an everyday magazine. With the volume of advertising that is carried each month in a large magazine like the ELECTRICAL EXPERIMENTER, and the great number of advertisers who compete in offering their products in every issue, each advertisement must be prepared, first, to attract your attention, second, to give you the advertiser's story as easily and quickly as possible, and third, to so convince you of its merits that you will want to know more about the article or offer advertised. This being true, it stands to reason that real advertising must make attractive and educational reading. Attractive because of the short, snappy style used in all high class advertising of today and educational because, while reading the advertisements you are learning about all the newest inventions and developments of science, and actually improving your mind at the same time that you are broadening your knowledge.

I know a bright, intelligent inventor who somehow never could seem to get along. He was always wasting his time on foolish ideas and impractical schemes. One day I called his attention to the ELECTRICAL EXPERIMENTER, then a much smaller magazine than it is now, and asked him why he didn't read the ads carefully and get an idea as to what was successful in his line and what the people wanted. He followed the suggestion and the last time I saw him he had perfected a revolutionizing invention, the idea for which he had received from an entirely different advertisement in the "Experimenter." If I told you his name you would all know him, most of you have probably used or are familiar with his invention.

This just goes to show that you can never tell in what way an advertisement may help you. Make a practice of reading ads—go through the advertising pages of the good magazines as carefully as you do the text. Don't lay this month's issue of the "Experimenter" aside until you have read every line of advertising. Digest the ads—get all the information you can from the advertisers themselves by writing to them. Keep yourself posted on what they have to offer and when you need anything in their line patronize them.

Advertising Manager.

SKINDERVIKEN TRANSMITTER BUTTON

Most Sensitive Microphone



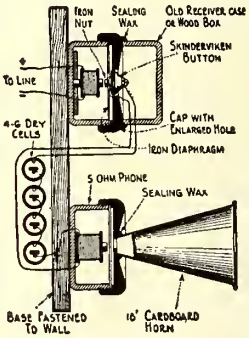
Actual size

for $1.00

You can easily make a highly sensitive detectophone by using a Skinderviken Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. Think of the fun you would have with such an instrument! It's very simple, too, and inexpensive.

You can install an outfit in your home and hear the conversation being held all over the house. You can connect up different rooms of a hotel. This outfit was used by secret service operatives during the War. It is being used on the stage.

One of the main advantages of the Skinderviken Transmitter Button lies in its ultra-sensitiveness. You can place it in any position you like. It is the greatest invention in micro-phones and has won recommendations from men of high standing in the scientific world. It is being used all over the world. You can mount it most anywhere. Card board boxes, stove pipes, stiff calendars and hundreds of other places will suggest themselves to you. The buttons can not be seen by any one in the room, as they are so small and light. Only a small brass nut is exposed to the view.



Full directions for connecting up the button for use as a detectophone are given in booklet which is sent with each button.

The only instruments needed to complete a detectophone outfit, in addition to a Skinderviken Transmitter Button are a receiver, battery, and, if desired, an induction coil.

The same circuit connections apply to all experiments, regardless of how the transmitter button is mounted.

The Skinderviken Transmitter Button operates on one or two dry cells. It often happens that two cells produce too much current and the sounds are deafening. We recommend either one fresh cell or two worn out cells.

Send Us Your Order TO-DAY

We have the utmost faith in this transmitter button. We guarantee satisfactory service or we will refund the purchase price. Boys—young and old—send in a dollar bill RIGHT NOW! You can't lose. If you're not satisfied, you receive your dollar back. Isn't that fair?

JOHNSON SMITH & CO.
Dept. E-13,
3224 N. Halsted Street, Chicago

USE THIS COUPON

Johnson Smith & Co., Dept. E-13,
3224 N. Halsted St., Chicago, Ill.

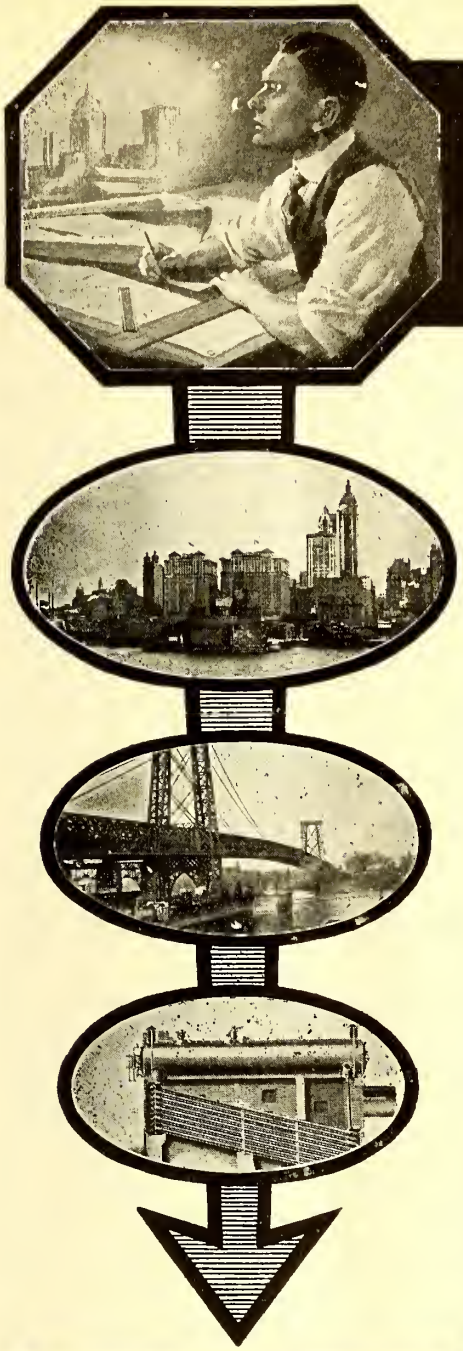
Gentlemen:—Please ship at once to address below ..... Skinderviken Transmitter Buttons, for which I enclose $.....

Name .....

Address .....

City ..... State .....

www.americanradiohistory.com



Be a Draftsman
Raise Your Income

Every Big Construction Job
Must Pass Through the Drafting Room

Do you realize what that means in the way of opportunity with big pay for Draftsmen? Think of the enormous volume of building operations now going forward all over the country with the return of peace—the big engineering, construction and manufacturing projects that must every one first go through the drafting room before the plans are ready for the workmen.

Never before in this country was there such a demand for skilled draftsmen—and this condition is true of European countries in which the destruction of war calls for vast re-building programs requiring the services of an army of draftsmen All this world-wide demand means great prosperity for men who become trained in draftsmanship.

$25 to $100 a Week

All you need is training to be ready to accept a call that should mean $25 to $100 a week easily earned. You have the same opportunity to secure the valuable training in spare time at home or by personal attendance from the Chicago Technical College that many other men had who are now holding fine positions and earning big pay through their knowledge of draftsmanship.

Act Promptly—Now

The longer you wait, the longer you will postpone the time when you will begin to draw a tempting salary as an Expert Draftsman. Manufacturers, Architects, Contractors, Engineers, Builders, Railroads and other big employers of trained draftsmen are ready with the work—when **you** are qualified to handle it.

Come to the College or Train at Home

Whether you decide to take one of the resident courses or to study in spare time at home you will have the personal direction of practical engineers, builders and architects, who give you the benefit of their vast experience and the successful methods they use in their own work. No time wasted. Every minute counts under men like these—every one a specialist!

We train hundreds of men by the most modern methods and see them quickly succeed, because we give them a technical preparation that not only makes proficient draftsmen of them, but also enables them to fill higher executive positions in big construction enterprises. There is no limit to your progress after you have equipped yourself with what the Chicago "Tech" can give you.

Drawing Outfit



No Extra Charge

Every student of the Chicago "Tech" Home Study Course in Draftsmanship receives the drawing outfit—set of instruments in case, drawing board, T square, triangles scale, curve, drawing paper, pencils, etc., or a cash credit in case he already has an outfit. These instruments are of the same make and sizes as used by high salaried experts in drafting rooms of factories, shops, railroads, etc. You use them while learning—then take them right into your practical work.

Easy Payment

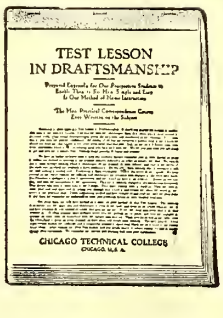
Chicago "Tech" training costs you little compared to the great benefits conferred, and payment of tuition fees may be made in easy installments, if desired. This splendid training will soon enable you to pay for the course from extra earnings.

Below, in the coupon, we list our principal courses. Just mark X in the ( ) to show which subject interests you and we will send you full information free. **Mail Coupon or write today.**

CHICAGO TECHNICAL COLLEGE
CHICAGO, U. S. A.

Free!

Drafting Lesson



The Chicago "Tech" method is the quickest, easiest way to become a skilled draftsman in spare time, without interfering with your present position. But we don't ask you to decide until you know how well qualified you are for this prosperous profession.

Other institutions ask you to pay first—and then find out later what their instruction means to you. We send the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything. And see for yourself just what Chicago "Tech" offers you in training which will bring a ready market for your services and open opportunities which are closed to the untrained man.

Send Coupon

AUTOMOBILE AND GAS ENGINE COURSE

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Splendid opportunities open now.

Learn All This in Spare Time

All about the Principles of the Automobile; Gasoline Engines; Power Plants and Transmissions; Carburetors and Fuel Supply Systems; Lubrication and Cooling; Batteries; Magneto Ignition; Starting and Lighting Systems.

Know How To Fix Troubles

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men.

Write—Send the coupon and get catalog and all information now.

CHICAGO TECHNICAL COLLEGE
1145 Chicago "Tech" Building, Chicago

Without obligation to me, send your Catalog on subject indicated below Also FREE Lesson if inquiry is on Drafting or Plan Reading Mark X opposite work in which you are especially interested.

[ ] Architectural Drafting	[ ] Plan-Reading—Buildings
[ ] Machine Drafting	[ ] Plan-Reading—Shop Men
[ ] Electrical Drafting	[ ] Estimating
[ ] Structural Drafting	[ ] Surveying
[ ] Sheet Metal Drafting	[ ] Autos and Gas Engines
[ ] Builders' Course	[ ] Aeronautics

Name .....

Address .....

City ..... State .....

College or Home Study? State which .....

www.americanradiohistory.com



A Modern King Canute

The people who lived in the good days of the wise King Canute thought he had the power to make the ocean recede at a mere word of command. Today the Bell Telephone Company finds itself in a position not unlike that of the ancient king. Its mere word will not hold back an ocean of expense.

Rigid economy and the most modern methods of operation have made it possible for the Bell Company to keep its rates at a far lower level than that of the commodities which it must use in construction and upkeep. But it has felt the rising tide of costs just as certainly as has every business and every family.

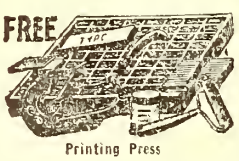
The one source of revenue of the Bell Company is the price you pay for service. If this price fails to cover fair wages and necessary materials, then both you and your telephone company must suffer.

For one year the Bell Company was under Government control. The Government analyzed methods and costs; and established the present rates as just. All the Bell Company asks is a rate sufficient to provide satisfactory service to every subscriber.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy *One System* *Universal Service*

FREE No Money Required WE TRUST YOU



Printing Press

We are giving away thousands of dollars worth of valuable presents, such as Watches, Air Rifles, Guns, Moving Picture Machines, Musical Instruments, Cameras, Printing Presses, Typewriters, Books, Puzzles, Games, Tricks, Toys and Novelties, Rubber Stamps, Household Labor Saving Devices, etc. All you have to do is to send your name and we will send you, without any charge, 20 large beautiful colored pictures or 20 packages of postcards, to sell at 15 cents each. When sold send us the money and we will give you goods of your own selection to the value of $3.00 from our wonderful premium catalog. Remember, you get these goods as a premium for selling the pictures or postcards and sending us the money. You do not have to pay one cent for them.

By continuing the sale of our goods you can earn a magnificent bicycle and many other expensive presents. Send in your application at once, stating whether pictures or postcards are preferred and we will immediately send you the first lot, accompanied by our catalog to select your premium from.



Moving Picture Machine



Sterling Silver Water Set


Simplex Typewriter

Spencer Publishing Co. Dept. 310 Chicago

HELIUM GAS WAS TO AID IN BOMBING ENEMY

Some of the secrets regarding the production of helium, the non-inflammable balloon gas which was developed and produced in considerable quantities during the war, were disclosed recently by a statement based on a memorandum prepared by the Bureau of Steam Engineering. In part the statement says:

"If the war had lasted until Spring, the British and American Governments would have sent helium-filled rigid airships over strategic points in Germany, each capable of dropping a total of ten tons or more of high explosives, either in a single tremendous discharge, or in a number of smaller ones during its passage over a fortress or city. These airships would have carried batteries amply sufficient to repel airplane attack.

"The success won in producing helium has resulted in the War and Navy Departments allotting funds for the production of the gas on a large scale for the use of the military and naval service. It is expected the plant will be in active operation in a few months. It draws its raw material from a natural gas field which is the largest and richest in helium now known in the world. A ten-year lease of this field is held by the Government for practically its entire output. During the war this helium gas was camouflaged under the name of 'Argon.'

"Since helium is noninflammable," said the statement, "an observation or dirigible balloon filled with it cannot be destroyed by incendiary bullets. The only effective method of attack would be by driving an airplane bodily thru the great gas bag. With the fire risk eliminated, the rigid airship or Zeppelin will hence be one of the most powerful weapons known.

"Just prior to the armistice a shipment of 150,000 cubic feet of helium was sent by our Government to Europe. The problem of an ample supply of helium has, therefore, been virtually solved by American energy and resourcefulness. This shipment was made in a relatively brief period after contracts were made for its production.

"The high military value of helium was recognized by the Allies in the early stages of the war, but it was not until the United States began hostilities that methods for obtaining the gas in serviceable quantities could be devised. Helium is a component of natural gases, and the quantity of the richest helium-bearing gases which the British used for their early experiments was relatively very poor, having only one-third of 1 per cent of helium.

"Prior investigation indicated, however, that there were in this country deposits of natural gases far richer in helium than any known to exist in the British Empire.

"The result was that the Bureau of Mines made contracts with the Linde Air Products Company and the Air Reduction Company, both of New York, which were operating organizations producing large quantities of liquefied oxygen and nitrogen, and were hence especially fitted to undertake the production of helium, which is obtained by the liquefaction of the other components of natural gas, leaving the helium free.

"During the experimental period of this work, the Bureau of Mines, assuming that the plants designated by its organization would soon be in successful operation, advised that the experimental work on the two commercial plants should be stopped The War and Navy Departments, and particularly the Naval Bureau of Steam Engineering, which was concerned with the production of helium, insisted upon a continuation of the experimentation of those plants. Their judgment was vindicated within a few weeks, when it was shown that helium could be produced in quantity and at a reasonable price by both these plants.

www.americanradiohistory.com



Free Proof that I Can Raise Your Pay

No matter how much you are earning now, I can show you how to increase it. I have even taken failures and shown them how to make $100—$200, and in once case as high as $2,000 weekly. I am willing to prove this entirely at my risk and expense.

LET'S have a little chat about getting ahead—you and I. My name is Pelton. Lots of people call me "The Man Who Makes Men Rich." I don't deny it. I've done it for thousands of people—lifted them up from poverty to riches.

I'm no genius—far from it. I'm just a plain, everyday, unassuming sort of man. I know what poverty is. I've looked black despair in the eye—had failure stalk me around and hoodoo everything I did. I've known the bitterest kind of want.

But to-day all is different. I have money and all of the things that money will buy. I am rich also in the things that money won't buy—health, happiness and friendship. Few people have more of the blessings of the world than I.

IT was a simple thing that jumped me up from poverty to riches. As I've said, I'm no genius. But I had the good fortune to know a genius. One day this man told me a "secret." It had to do with getting ahead and growing rich. He had used it himself with remarkable results. He said that every wealthy man knew this "secret,"—that is why he was rich.

I used the "secret." It surely had a good test. At that time I was flat broke. Worse than that, for I was several thousand dollars in the hole. I had about given up hope when I put the "secret" to work.

At first I couldn't believe my sudden change in fortune. Money actually flowed in on me. I was thrilled with a new sense of power. Things I couldn't do before became as easy for me to do as opening a door. My business boomed and continued to leap ahead at a rate that startled me. Prosperity became my partner. Since that day I've never known what it is to want for money, friendship, happiness, health or any of the good things of life.

That "secret" surely made me rich in every sense of the word.

MY sudden rise to riches naturally surprised others. One by one people came to me and asked me how I did it. I told them. And it worked for them as well as it did for me.

Some of the things this "secret" has done for people are astounding. I would hardly believe them if I hadn't seen them with my own eyes. Adding ten, twenty, thirty or forty dollars a week to a man's income is a mere nothing. That's merely playing at it. In one case I took a rank failure and in a few weeks had him earning as high as $2,000.00 a week. Listen to this:

A young man in the East had an article for which there was a nation-wide demand. For twelve years he "puttered round" with it, barely eking out a living. Today this young man is worth $200,000. He is building a $25,000 home—and paying cash for it. He has three automobiles. His children go to private schools. He goes hunting, fishing, traveling whenever the mood strikes him. His income is over a thousand dollars a week.

In a little town in New York lives a man who two years ago was pitied by all who knew him. From the time he was 14 he had worked and slaved—and at sixty he was looked upon as a failure. Without work—in debt to his charitable friends, with an invalid son to support, the outlook was pitchy black.

Then he learned the "secret." In two weeks he was in business for himself. In three months his plant was working night and day to fill orders. During 1916 the profits were $20,000. During 1917 the profits ran close to $40,000. And this genial 64-year-young man is enjoying the pleasures and comforts he little dreamed would ever be his.

I COULD tell you thousands of similar instances. But there's no need to do this, as I'm willing to tell you the "secret" itself. Then you can put it to work and see what it will do for you.

A Few Examples

Personal Experiences

Among over 350,000 users of "Power of Will" are such men as Judge Ben B. Lindsey; Supreme Court Justice Parker; Wu Ting Fang, Ex. U. S. Chinese Ambassador; Assistant Postmaster General Britt; Lieu. Gov. McKelvie of Nebraska; General Manager Christeson of Wells-Fargo Express Co.; E. St. Elmo Lewis, former Vice-Pres. Art Metal Construction Co.; Gov. Ferris of Michigan, and many others of equal prominence.

$300 Profit from One Day's Reading

"The result from one day's study netted me $300 cash. I think it a great book and would not be without it for ten times the cost."—A. W. Wilke, Faulkton, So. Dakota.

Worth $15,000 and More

"The book has been worth more than $15,000 to me."—Oscar E. Sheppard, 1117 E. Locust St., Decatur, Ill.

Would Be Worth $100,000

"If I had only had it when I was 20 years old, I would be worth $100,000 today. It is worth a hundred times the price."—S. W. Taylor, The Santa Fe Ry., Milano, Tex.

Salary Jumped from $150 to $800

"Since I read Power of Will my salary has jumped from $150 to $800 a month."—J. F. Gibson, San Diego, Cal.

From $100 to $3,000 a Month

"One of our boys who read Power of Will before he came over here jumped from $100 a month to $3,000 the first month, and won a $250 prize for the best salesmanship in the State."—Private Leslie A. Still, A. E. F. France.

I don't claim I can make you rich over night. Maybe I can—maybe I can't. Sometimes I have failures—everyone has. But I do claim that I can help 90 out of every 100 people if they will let me.

The point of it all, my friend, is that you are using only about one-tenth of that wonderful brain of yours. That's why you haven't won greater success. Throw the unused nine-tenths of your brain into action and you'll be amazed at the almost instantaneous results.

The Will is the motive power of the brain. Without a highly trained, inflexible will, a man has about as much chance of attaining success in life as a railway engine has of crossing the continent without steam. The biggest ideas have no value without will-power to "put them over." Yet the will, altho heretofore entirely neglected, can be trained into wonderful power like the brain or memory and by the very same method—intelligent exercise and use.

If you held your arm in a sling for two years, it would become powerless to lift a feather from lack of use. The same is true of the Will—it becomes useless from lack of practice. Because we don't use our Wills—because we continually bow to circumstance—we become unable to assert ourselves. What our wills need is practice.

Develop your will-power and money will flow in on you. Rich opportunities will open up for you. Driving energy you never dreamed you had will manifest itself. You will thrill with a new power—a power that nothing can resist. You'll have an influence over people that you never thought possible. Success—in whatever form you want it—will come as easy as failure came before. And those are only a few of the things the "secret" will do for you. The "secret" is fully explained in the wonderful book "Power of Will."

How You Can Prove This at My Expense

I KNOW you'll think that I've claimed a lot. Perhaps you think there must be a catch somewhere. But here is my offer. You can easily make thousands—you can't lose a penny.

Send no money—no, not a cent. Merely clip the coupon and mail it to me. By return mail you'll receive not a pamphlet, but the whole "secret" told in this wonderful book, "POWER OF WILL."

Keep it five days. Look it over in your home. Apply some of its simple teachings. If it doesn't show you how you can increase your income many times over—just as it has for thousands of others—mail the book back. You will be out nothing.

But if you do feel that "POWER OF WILL" will do for you what it has done for over a quarter of a million others—if you feel as they do that it's the next greatest book to the Bible—send me only $3.50 and you and I'll be square.

If you pass this offer by, I'll be out only the small profit on a three-and-a-half-dollar sale. But you—you may easily be out the difference between what you're making now and an income several times as great. So you see you've a lot—a whole lot—more to lose than I.

Mail the coupon or write a letter now—you may never read this offer again.

PELTON PUBLISHING COMPANY
30T WILCOX BLOCK MERIDEN, CONN.

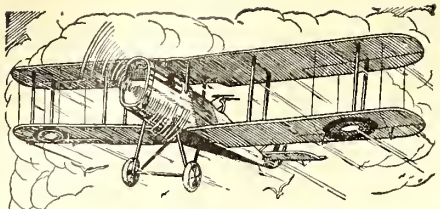
Pelton Publishing Company
30T Wilcox Block, Meriden, Conn.

You may send me "Power of Will" at your risk. I agree to remit $3.50 or remail the book to you in five days.

Name .....

Address .....

www.americanradiohistory.com



Build and Fly An

Ideal Model Aeroplane

...an Accurate Scale-Duplicate of a Famous Plane

You can build a perfect Model of a famous Aeroplane, that will look exactly like the real one, and that will rise from the ground or water by its own power and fly in the air. Build one now; it's the greatest sport you ever had! You can learn a lot about Aeroplanes; how they are built; operated and controlled. Ideal Model Aeroplane Construction Outfits make building easy. They contain all parts, fittings, materials, plans drawn to scale and complete building and flying instructions. You put the parts together and build your Model like a real Aeroplane mechanic.

Pick Your Model from These Celebrated Aeroplanes

You can get from Ideal Dealers Complete Construction Outfits to build scale-reduction Models of any of these well-known machines:

N C-4 (Naval-Curtiss Seaplane). The first 'plane to fly across the Atlantic Ocean. 4½ ft. Model. Shown below.

DeHAVILLAND Battle Plane (DeH-4). The fighting 'plane used by the American Aces in the World War. 3 ft. Model. Shown Above.

Curtiss Military Tractor. The 'plane used to train our Aviators. 3 ft. Model.

Bleriot Monoplane. The first aeroplane to cross the English Channel. 3 ft. Model.

Nieuport Monoplane. A famous French 'plane used in the War. 3 ft. Model.

Cecil Peoli Racer. A racing-type aeroplane with a record for distance flights.

Ideal Model Aeroplane Construction Outfits for building any of the above Aeroplanes are sold by Leading Toy, Sporting Goods and Department Stores. Ask for them at your store. Be sure you get IDEAL Model Aeroplanes because they are the only ones that are true copies of actual Aeroplanes.

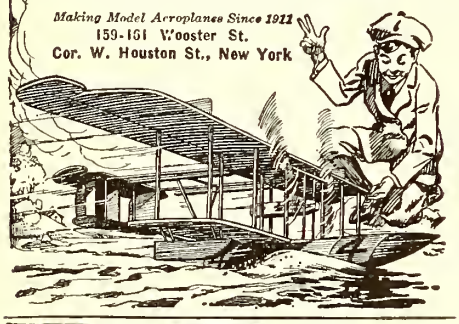
Send for the Ideal Aeroplane Book

Tells all about Ideal Aeroplanes and Flying Toys; gives complete descriptions and prices; contains list of stores where you can get them. Get this 48-page book.

Sent Postpaid for 5c in stamps

IDEAL AIRPLANE & SUPPLY CO.

Making Model Aeroplanes Since 1911
159-161 Wooster St.
Cor. W. Houston St., New York



FUN



Noiseless Target Practice

Fit your .22 with a Maxim Silencer and get no end of fun this winter practicing in your backyard and basement.

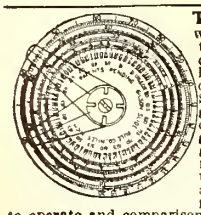
MAXIM SILENCER MAKES YOU A BETTER MARKSMAN

It eliminates recoil and all noise of the report, and steadies your aim. Direct from Dealer or Factory $5.00. Write for Free Book of Stories.

FREE BOOK



MAXIM SILENCER CO.
89 Homestead Ave., Hartford, Conn.



THE MIDGET SLIDE RULE will solve any problem in addition, subtraction, multiplication, division and proportion. A Log-Log Scale gives any root or power of any quantity. Gives Logarithms, Sines, Tangents, Cosines, Cotangents and the decimal equivalents of fractions to six figures. It is grease and water proof and will give years of service. This rule is not to be compared with the paper utility rules which sell for $1.00 and are put together with paper fasteners. It is accurate, simple to operate and comparison shows that it is undoubtedly the fastest and most complete rule made. Our refund guarantee protects you from loss or disappointment. An instruction book 16 pages, 12 illustrations, is sent with each rule. Diameter of rule 4 in. Made in two models: Metal (white coated steel), $1.00; White Celluloid, $1.25. Leather Case 50c extra. Send for catalogue of Slide Rules. Your money back if you are not satisfied.

Gilson Slide Rule Co., Niles, Mich.

TELEGRAPHING PHOTOGRAPHS FROM NEW YORK TO DENVER

If you should ask the man in the street as to whether or not he knew about the new method of telegraphing photographs of prominent people and news events across the United States from New York City to Denver, Colorado, daily, he would probably gasp once or twice and let it go at that. Probably many readers of technical journals are somewhat familiar with the Korn system of telephotography, by means of which it is possible to telegraph pictures of scenes, personages, etc., over circuits 300 to 400 miles in length. This, and several other systems which have been developed in Europe, are not very speedy, however, and they have several drawbacks.

An entirely new system, devised by Mr. LeRoy J. Leishman, of Salt Lake City, Utah, is being used daily *to transmit by regular standard telegraph dispatch* over the Western Union wires, at the usual rates, photos of prominent personages and events, from New York City to Salt Lake City and Denver. By this system the photograph, sketch or drawing to be transmitted has to be *coded*. To do this, the photograph is placed on what is known as a *coding board*, which resembles a small drafting board provided with sliding scales, *graduated with the letters of the alphabet*. It at once becomes evident how a given point on the picture can be thus checked exactly by taking the reading from a scale passing thru the point *horizontally*, and then taking a secondary reading on the same point, by taking another reading on the *vertical* scale. It might be thought that these subdivision lines would be numbered 1 to 10, but it has been found more scientific and expeditious all around to use the letters of the alphabet, which gives theoretically 26 letters. However, only 17 letters are used, owing to the similarity of several of the letters, which might be subject to error in telegraphic transmission. Not only has the Leishman system been worked out to give rapid coding and decoding methods, but there are five different degrees of shade lines transmitted by code, *i. e.*, special letters which are transmitted by the use of index letters, so that anyone familiar with sketching, such as an artist, or even a student at the game, can decode the telegram and reconstruct the picture. The inventor, altho he is not an artist, as he stated in a recent interview, can quickly decode the picture and obtain very excellent results.

To give a clear idea of just how the system works, suppose we have a photograph which is to be coded for transmission from New York to Denver. The photo is mounted on the coding board, and the complete telegram giving the positions of the various component points of the picture, is completely worked out by a fairly expert person in about one hour and a half. Then what you get is a string of words like this—"bxfas dmgdq," etc., etc. The average photograph, for example a likeness of President Wilson, will require a telegram containing about 250 words. This may be sent by day telegram rate or by night letter, in order to gain the lower cost of transmission. The telegram, of course, is transmitted practically instantaneously to the western city or other point, and the picture completely reconstructed in a time period corresponding approximately to that for coding the picture in the first place. It may be thought by the reader that such a picture would be nothing but a scratchy looking pen drawing, which would not preserve the exact features of a person very faithfully. But such is not the case. The original master photograph is mailed from the eastern city, arriving several days after the telegraphed picture has been on exhibition. As soon as the master photograph has arrived, it is placed on exhibit side by side with the telegraphic reproduction, and it is practically impossible to tell one from the other.



Boys! Win an Auto-Wheel

In This Interesting Contest

TO THE BOY who can think of the most interesting uses for the popular AUTO-WHEEL COASTER, for earning money and for play, we shall award one of our large models absolutely FREE. It's a mighty generous prize for a few minutes' work. And the following eleven valuable prizes will be given to those sending in the next best uses: **Camera, Camping Tent, Mess Kit, Scout Knife, Fleetwing Steering Sled, Compass, Ingersoll Watch, Axe, Bank, Electric Flashlight, Poncho.**

INFORMATION ABOUT CONTEST

1. Any boy or girl not over 15 years may compete.
2. Contest will be judged by three men well-known in the Boy Scout organization.
3. Write to Business Idea Dept., Buffalo Sled Co., for pamphlet explaining the Contest, and colored catalog telling all about Auto-Wheel.
4. At end of letter write names of three Coaster Wagon Dealers in your town. If any carry the Auto-Wheel put an "x" after name.

YOU CAN DO IT. Any live boy who knows how to get fun and earn money out of a good, strong coaster wagon, has a fine chance to get the Auto-Wheel as a prize. **Here are a few pointers:** The Auto-Wheel is a wagon for work or play. It's built for strength and speed. Has roller bearings, steel axles and tires, body white ash, maple gear.

If there's an Auto-Wheel dealer near you, he'll gladly let you see the Auto-Wheel Coaster in his store, and he'll give you some good ideas for your letter. CONTEST CLOSES NOVEMBER 30, 1919.

HERE'S YOUR CHANCE. GET BUSY.

Buffalo Sled Co.,
163 Schenck Street,
N. Tonawanda, N. Y.

In Canada:
Preston,
Ontario.





FLIES 500 FEET

Lightning Racer Experimental Model. This is not a toy. It is a practical, scientific flying model, guaranteed to fly hundreds of feet; designed and built from the finest selected materials, by Model Experts. This machine and our famous "Montauk Flyer" are the only Complete Model Aeroplanes guaranteed to fly 500 ft. selling for less than $5.00. This model, shipped with monoplanes detached, ready and guaranteed to fly, $3.75 prepaid. Send stamps for circular describing this wonderful model.

Blueprints of the following models 1-2 actual size 50 cents post paid in U. S.

Bleriot Racer, flies 600 ft. Manhattan Racer, flies 2000 ft. Montauk Flyer, flies 500 ft. 3 ft. Curtiss or De Havilland Biplane, 75 cents each, postpaid.

HEC Flying Boat guaranteed to rise from the water and fly 500 ft. Two sheets blueprint $1.00 postpaid U. S.

HEC AEROPLANE CO., 300 E. 49th St., N. Y. C.

Build Your Own PHONOGRAPH

It's Easy With Our Help

SAVE OVER HALF

A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fine profit building phonographs for your friends.

Write Today for Our Free Blue Print Offer. Agents wanted for our ready built Chorsleons.



Choraleon Phonograph Co.
717 Monger Bldg., Elkhart, Ind

UMAKEM

Airplane Workchest, containing aircraft work table with mitre cutting board and length gauge, steel drill, steel hammer, Model Maker's steel square, screwdriver, sandpaper block, 10" scroll saw, together with finest quality reed and bass wood, aluminum, silk, para rubber, full set of blueprints, directions, and all fittings for building one 36" Bleriot Model flying Monoplane. Price $10.00. Other UmakeM Outfits 50c to $50.

W. R. PRICE, Inc.
No. 2 UmakeM Building, 127 Fifth Avenue, New York

www.americanradiohistory.com



"You've Gone Way Past Me, Jim!"

"Today good old Wright came to my office. All day the boys had been dropping in to congratulate me on my promotion. But with Wright it was different.

"When I had to give up school to go to work I came to the plant seeking any kind of a job—I was just a young fellow without much thought about responsibility. They put me on the pay-roll and turned me over to Wright, an assistant foreman then as now. He took a kindly interest in me from the first. 'Do well the job that's given you, lad,' he said, 'and in time you'll win out.'

"Well, I did my best at my routine work, but I soon realized that if ever I was going to get ahead I must not only do my work well, but prepare for something better. So I wrote to Scranton and found I could get exactly the course I needed to learn our business. I took it up and began studying an hour or two each evening.

"Why, in just a little while my work took on a whole new meaning. Wright began giving me the most particular jobs—and asking *my* advice. And there came, also, an increase in pay. Next thing I knew I was made assistant foreman of a new department. I kept right on studying because I could see results and each day I was applying what I learned. Then there was a change and I was promoted to foreman—at good money, too.

"And now the first big goal is reached—I am superintendent, with an income that means independence, comforts and enjoyments at home—all those things that make life worth living.

"Wright is still at the same job, an example of the tragedy of lack of training. What a truth he spoke when he said today, 'You've gone 'way past me, Jim,—and you deserve to.' Heads win—every time!"

Yes, it's simply a question of training. Your hands can't earn the money you need, but your head can if you'll give it a chance.

The International Correspondence Schools have helped more than two million men and women to win promotion, to earn more money, to know the joy of getting ahead in business and in life.

Isn't it about time to find out what they can do for you?

You, too, can have the position you want in the work of your choice, with an income that will make possible money in the bank, a home of your own, the comforts and luxuries you would like to provide your family. No matter what your age, your occupation, your education, or your means—you can do it!

All we ask is the chance to prove it—without obligation on your part or a penny of cost. That's fair, isn't it? Then mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6206, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

☐ ELECTRICAL ENGINEER	☐ SALESMANSHIP
☐ Electric Lighting and Railways	☐ ADVERTISING
☐ Electric Wiring	☐ Window Trimmer
☐ Telegraph Engineer	☐ Show Card Writer
☐ Telephone Work	☐ Sign Painter
☐ MECHANICAL ENGINEER	☐ Railroad Trainman
☐ Mechanical Draftsman	☐ ILLUSTRATING
☐ Machine Shop Practice	☐ Cartooning
☐ Toolmaker	☐ BOOKKEEPER
☐ Gas Engine Operating	☐ Stenographer and Typist
☐ CIVIL ENGINEER	☐ Cert. Public Accountant
☐ Surveying and Mapping	☐ TRAFFIC MANAGER
☐ MINE FOREMAN OR ENGINEER	☐ Railway Accountant
☐ STATIONARY ENGINEER	☐ Commercial Law
☐ Marine Engineer	☐ GOOD ENGLISH
☐ Ship Draftsman	☐ Teacher
☐ ARCHITECT	☐ Common School Subjects
☐ Contractor and Builder	☐ Mathematics
☐ Architectural Draftsman	☐ CIVIL SERVICE
☐ Concrete Builder	☐ Railway Mail Clerk
☐ Structural Engineer	☐ AUTOMOBILE OPERATING
☐ PLUMBING AND HEATING	☐ Auto Repairing
☐ Sheet Metal Worker	☐ Navigation ☐ Spanish
☐ Textile Overseer or Supt.	☐ AGRICULTURE ☐ French
☐ CHEMIST	☐ Poultry Raising ☐ Italian

Name _____

Present Occupation _____

Street and No. _____

City _____ State _____

www.americanradiohistory.com

$20.00 FOR THIS
Made to Your Measure
ALLWOOL SUIT

We make every suit to your individual measures from the exact fabric you select and according to your exact specifications. We ship it on approval, delivery charges prepaid, for you to try on, to inspect and examine. Unless you are well pleased with your bargain your trial order will not cost you one cent. Write us today—



Choose from 65 Beautiful Patterns

BIG CATALOG FREE

Send us a postal today for a copy of our big new catalog and style book with 65 cloth samples of the very finest, high grade fabrics and latest New York and Chicago styles. Our prices will surprise you. We guarantee to save you 25% to 40% or no sale.

Deal Direct—Save Money

Any member of your family can take your measures. We guarantee a perfect fit. You take absolutely no risk. By dealing direct with us, the manufacturers, you save the unnecessary expenses and profits of agents and obtain the highest grade metropolitan tailoring at a wonderful saving. Write for

Catalog Today — We'll Send It Free!

The BELL Tailors

THE BELL TAILORS
Dept. 276
Adams at Green St. Chicago, Ill.

BOYS! Make Things AT HOME

1. The Study of Electricity for Beginners.
2. Dry Batteries. How to Make Them.
3. Electrical Circuits and Diagrams. Part 1.
4. Electric Bells, Annunciators and Alarms.
5. Modern Primary Batteries.
6. Experimenting with Induction Coils.
7. Electric Gas Igniting Apparatus.
8. Small Accumulators. How to Make and Use.
9. Model Steam Engine Design.
10. Practical Electrics.
11. Inventions. How to Protect and Sell Them.
12. Woodwork Joints. How to Make and Use.
13. The Fireman's Guide to the Care of Boilers.
14. The Slide Valve Simply Explained.
15. The Magneto Telephone.
16. The Corliss Engine and Its Management.
17. Making Wireless Outfits.
18. Wireless Telephone Construction.
19. The Wimshurst Machine. How to Make It.
20. Simple Experiments in Static Electricity.
21. Small Electrical Measuring Instruments.
22. Electrical Circuits and Diagrams. Part 2.
23. Induction Coils. How to Make Them.
24. Model Vaudeville Theatres.
25. Alternating Currents. Simply Explained.
26. How to Build a 20-Foot Bi-plane Glider.
27. A B C of the Steam Engine.
28. Simple Soldering. Hard and Soft.
29. Telegraphy for Beginners.
30. Low Voltage Lighting with Storage Batteries.
31. Lieckfeld Gas and Oil Engines.
33. House Wiring for Electric Light.
34. Magnets and Magnetism.
36. Small Windmills and How to Make Them.
37. Collin's Wireless Plans. Part 1.
38. Collin's Wireless Plans. Part 2.

Price 25 cents each, postpaid

SPON & CHAMBERLAIN
120 G Liberty Street, New York

Turn a Valve and Cook or Heat

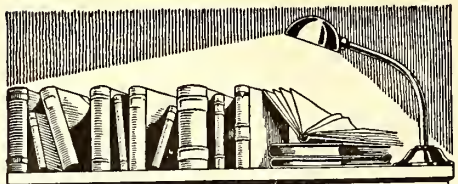


The Oliver Oil-Gas Burner makes any cooking or heating stove a gas stove. Burns coaloil (kerosene). Cooks, bakes better, cheaper. Keeps home warmer. You regulate flame. No fires to start, no dirt. Simple, safe, easily put in or taken out. No damage to stove. Lasts a lifetime. MONEY-BACK GUARANTEE. Free literature tells how two gals. kerosene equals 97 lbs. of coal.

AGENTS WANTED

Oliver Oil-Gas Burner & Machine Co., 1345 N. 7th St., St. Louis, Mo.
Western Shipments From Frisco.

Do away with coal and wood



BOOK REVIEW

Behind the Motion-Picture Screen, by Austin C. Lescarboura. Cloth bound. Over 300 illustrations, 420 pages. Size 6¼ x 9¼ inches. Publisht by Munn & Company, New York City, N. Y. 1919.

The author has attempted to give the motion picture public an interesting and entertaining story of the screen drama and how it is made. The work is elaborately illustrated with scenes taken in various "movie" studios, and practically all the standard types of cinematograph apparatus are illustrated and clearly described. A new and important feature is that there is one picture to every page of text and the story corresponding to each illustration is found opposite it.

The opening chapters tell how the working plans of the motion picture are drawn up, the essentials of a scenario, the photoplay director, the actor, the camera man, how the director coaches the actors. The motion picture camera, the film and the lens. How battle scenes are photographed several miles away. American and foreign "movie" cameras, close-ups, fade-ins and fade-outs, vignettes, double exposures for one film, multiple printing of scenes. An interesting section deals with the scenery and "props" used in making the wonderfully realistic castles, ships, and even whole cities that never existed except in the "land of make-believe." A chapter is assigned to tricks of the "movie" screen, including those "nerve-racking" 'railroad collisions. Then we read just how the motion picture film is developed, printed and checked or censored. The "screen reporter" is an interesting personage—he travels everywhere, in the airplane, motor-boat and on the battlefield. An explanation is given of the talking picture, as well as the cartoon "movie."

Motion pictures taken on the ocean bottom are illustrated and discust, as well as film presentations of fish in action. The motion picture in the home as well as in business receives the importance it deserves, a particularly interesting section describing the various types of "home" cameras and projectors, including those utilizing paper instead of celluloid film. The concluding chapter deals with the future of the motion picture, both for amusement and business. The field of the "movie" is widening daily; the business man and salesman use it to show machinery in actual motion; the scientist and engineer find the cinematograph of inestimable value in studying the many difficult problems.

CENTRAL STATIONS, by Terrell Croft. Cloth covers, 332 pages, 306 diagrams, size 5⅝ x 8¾ inches. Price $2.50 net. Publisht by McGraw-Hill Book Company, Inc. New York.

Mr. Croft has here provided a well illustrated and very clearly explained treatise on central stations, and this work can be confidently recommended to all those interested in central station operation and design. This work is not an exhaustive text book filled with mathematics for the professional engineer, but comprises an exceptionally clear exposition of all the modern factors which influence and concern the design and operation of light and power stations, and the generation and distribution of electric power, whether it is for lighting, heating or other purposes. Some of the first principles treated on in this work are distribution loss and distribution loss factors; maximum demand and demand factors, including demand meters and how they operate, diversity and diversity factors; plant factor and connected load factor; load graphs and their significance—a very interesting and illuminating chapter, written so the layman can understand it at last; the general principles of circuit design, including direct and alternating current circuits.

THE ENGINERS' MANUAL, by Prof. Ralph G. Hudson, S. B. Flexible cloth covers, 316 pages, illustrated with many diagrams, size 4⅞ x 7⅞ inches. Price $2.00. Publisht by John Wiley & Sons, Inc., New York.

A most useful handbook of mathematical formulas and tables covering both electrical and mechanical engineering, for the use of draftsmen, designers and engineers. The first part of the work deals briefly with the various terms and expressions encountered in algebra, trigonometry, mensuration of surfaces, both plane and solid, analytic geometry, differential and integral calculus, differential equations, complex quantities, vectors, etc.

(Continued on page 680)

Get Back Your Grip On Health



NUXATED IRON
Master Strength-Builder Of the Blood

Strong, Sturdy Men and Healthy, Beautiful Women
Helps Make
3,000,000 People Use It Annually

Ask Your Doctor Or Druggist



Set in Solid Gold — Set in Solid Gold

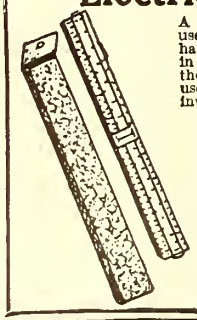
Send Your Name and We'll Send You a Lachnite

DON'T send a penny. Just send your name and say: "Send me a Lachnite mounted in a solid gold ring on 10 days' free trial." We will send it prepaid right to your home. When it comes merely deposit $4.75 with the postman and then wear the ring for 10 full days. If you, or if any of your friends can tell it from a diamond, send it back. But if you decide to buy it—send us $2.50 a month until $18.75 has been paid.

Write Today Send your name now. Tell us which of the solid gold rings illustrated above you wish (ladies' or men's). Be sure to send finger size.

Harold Lachman Co., 12 N. Michigan Av. Dept. T7448 Chicago

Instructions on the Electrical Slide Rule



A set of concise lessons on the use of the Electrical Slide Rule has been prepared by Mr. Burgess in response to many requests from those who desire to take up the use of this instrument which is invaluable to many electrical men.

A High Grade Slide Rule in a leather case and the COMPLETE COURSE OF INSTRUCTION will be supplied at a VERY REASONABLE COMBINATION PRICE. We have selected the rule best adapted for the purpose and the lessons will enable you to thoroughly understand its use. Write for full information.

Burgess Electrical School
745 E. 42nd St., Chicago, Ill.

DOLLAR ADDING MACHINE $1



Adds and multiplies with speed of expensive machines. Seven columns capacity. Remarkably simple in construction. Nothing to get out of order. Weight one ounce. Made of metal and celluloid. The ideal pocket, desk or home machine. Order today. The best way not to forget is to do it now.

L. J. LEISHMAN CO., Dept. 142, Ogden, Utah

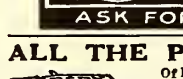
FOR HEADACHE AND NEURALGIA

ANTI-KAMNIA TABLETS

10c & 25c PACKAGES

ASK FOR A-K TABLETS

ALL THE PARTS AND PLANS



Of Plain Model, 75c. Model A, $1.00. B, $1.50
Completed Model, A, $1.60, B, $2.00.
Made like a SKEETER, no other will fly. No other can BEAT it, others soon die. Made in a JIFFY, fly it in the Park. Made very NIFTY, strong as Noah's Ark.
Prepaid—Don't send stamps.

HERE BOYS
NIFTY NOVELTY & TOY CO. Newark, N. J.

WE BUY STAMPS

158 Genuine Foreign Stamps—Mexico War Issues, Venezuela, Salvador and India Service, Guatemala, China, etc. Only 10c. Finest Approval Sheets 50% to 60%. AGENTS WANTED. Big 72-p. Lists *Free*. We Buy Stamps. Established 25 yrs.
Hussman Stamp Co., Dept. 67, St. Louis, Mo.

Learn Watchwork, Jewelrywork and Engraving A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL Department, Bradley Institute, Peoria, Ill., for our latest catalog.

www.americanradiohistory.com

The Cause of Stomach Acidity and Fermentation

How to Remove It in 48 Hours

By R. S. Thompson

IF I were asked to sound a health warning that would be of the greatest possible benefit to mankind, I should say emphatically—"Beware of acid stomach." For acid stomach is the cause of fermentation which, bad enough in itself, is the forerunner of a hundred ills that sap the energy and vitality of its victims. I venture to say that ninety per cent. of all sickness starts with acid stomach. Yet the cause of stomach acidity can be removed in 48 hours!

Nature provides hydrochloric acid as one of the digestive fluids, but too much of this acid causes fermentation, hurries the food out of the stomach, and carries the acid all through the body. As a consequence, poisons (toxins) are formed which are absorbed into the blood, causing autointoxication, nervousness, mental depression, and countless ills of which this is but the beginning.

Every one of the vital organs in time becomes affected—the heart, the liver, the kidneys, the intestines, the nerves, and the brain all decline, for the stomach is the Power Plant of the body. Even the teeth are affected by acid stomach, for the gums recede and pyorrhoea will be the result.

Stomach remedies only neutralize the acid because they are stronger than the acid. This ultimately ruins the lining of the stomach. The acid being neutralized is absorbed into the blood only to come back to the stomach in greater quantities at the next meal.

How much more sensible would it be to attack this disorder at its source. Instead of attempting to neutralize the acid after it has formed, why not prevent it from forming in the first place?

Superacidity is caused by wrong eating, and the remedy must be found in the field of the cause—in eating correctly.

The individual sufferer from indigestion, acidity, fermentation, gas and such disorders has not carried his experiments with food very far. If he had he could easily cure himself, in 48 hours, as Eugene Christian, the famous food scientist, has proved beyond all doubt.

The reason which led Eugene Christian to take up the study of food in the first place was because he himself, as a young man, was a great sufferer from stomach and intestinal trouble.

So acute was his affliction that the best specialists of the day, after everything within their power had failed, gave him up to die. Educated for a doctor himself, Christian could get no help from his brother physicians.

Believing that wrong eating was the cause and that right eating was the only cure, he took up the study of foods and their relation to the human system. What he learned not only restored his own health in a remarkably short space of time, but has been the means of relieving some 25,000 other men and women for whom he has prescribed with almost invariable success, even though most of them went to him as a last resort.

Christian says that all stomach and intestinal disorders, with their countless sympathetic ills, are caused by wrong selections and wrong combinations of food, and that right combinations of food will positively remove every stomach and intestinal disorder by removing its causes.

No one would think of putting salt into an open wound, and yet we do worse than that when we keep putting irritating acid-creating food combinations into our stomachs already surcharged with acid.

The word diet is one which has an unpleasant sound—it makes us think of giving up all the things we like for those we have no taste for. But Eugene Christian's method is entirely different—instead of asking his patients to give up the things they enjoy, he prescribes menus which are twice as enjoyable as those to which the patient is accustomed.

Christian believes in good foods deliciously cooked—the kind all of us like best and which may be obtained at any home store, hotel, or restaurant. He says that most of the things we eat are all right—but that we don't know how to combine or balance them.

Often, one food good in itself, when combined with another food equally good, produces an acid reaction in the stomach; whereas either of the foods alone or eaten in combination with some other food would have been easily and perfectly digested.

Unfortunately, each food we eat at a meal is not digested separately. Instead, all of the foods we combine at the same meal are mixed and digested together. Consequently, if we eat two or more articles at the same meal which don't go well together, there is sure to be acidity, fermentation, gas, and all kinds of digestive trouble.

At Eugene Christian's New York office there is a constant stream of men and women who go to him for treatment after having tried everything else, and rarely are they disappointed in the outcome. Some of the results he has attained read like fairy tales. I know of a number of instances where his rich patrons have been so grateful for their restoration of health and energy that they have sent him checks for $500 to $1,000 in addition to the amount of the bill when paying it.

There have been so many inquiries from all parts of the United States from people seeking the benefit of Eugene Christian's advice and whose cases he is unable to handle personally that he has written a course of little lessons which tells you exactly what to eat in order to overcome the ailment which is troubling you.

These lessons, there are 24 of them, contain actual menus for breakfast, luncheon, and dinner, curative as well as corrective, covering all conditions of health and sickness, including stomach acidity, constipation, and all intestinal disorders from infancy to old age and all occupations, climates, and seasons. They also tell you how to reduce and how to gain.

With these lessons at hand it is just as though you were in personal contact with the great food specialist, because every possible point is so thorough covered and clearly explained that you can scarcely think of a question which isn't answered. You can start eating the very things that will remove the causes of your disorder the day you receive the lessons and you will find that you secure results with the first meal. Many people who have suffered for years from acid stomach find that their ailment vanishes completely in 48 hours.

If you would like to examine these 24 Little Lessons in Corrective Eating, simply write The Corrective Eating Society, Inc., Dept. 16411, 443 Fourth Avenue, New York City. It is not necessary to enclose any money with your request. Merely ask them to send the lessons on five days' trial, with the understanding that you will either return them within that time or remit $3, the small fee asked.

Please clip out and mail the following form instead of writing a letter, as this is a copy of the official blank adopted by the Society, and will be honored at once

CORRECTIVE EATING SOCIETY, Inc.
Dept. 16411, 443 Fourth Avenue
New York City

You may send me prepaid a copy of Corrective Eating in 24 Lessons. I will either remail them to you within five days after receipt or send you $3.

Name .....

Address .....

City .....

State .....

www.americanradiohistory.com

BOYS



Learn Drafting

Employers everywhere are looking for skilled draftsmen. They are offering good salaries to start with splendid chances for advancement.

Drafting offers exceptional opportunities to a young man because drafting itself not only commands good pay, but it is the first step toward success in Mechanical or Structural Engineering or Architecture. And drafting is just the kind of work a boy likes to do. There is an easy delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving boys just the training they need for success in Drafting and more than 200 other subjects. Thousands of boys have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon, then mark and mail it. This doesn't obligate you in the least and will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 6207, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

☐ MECHANICAL DRAFTING	☐ SALESMANSHIP
☐ STRUCTURAL DRAFTING	☐ ADVERTISING
☐ SHIP DRAFTING	☐ Show Card Writer
☐ ELECTRICAL DRAFTING	☐ Sign Painter
☐ ARCHITECTURAL DRAFTING	☐ ILLUSTRATING
☐ SHEET METAL DRAFTING	☐ Cartooning
☐ BOILERMAKER DRAFTING	☐ BOOKKEEPER
☐ BRIDGE DRAFTING	☐ Stenographer and Typist
☐ MACHINE DESIGN	☐ Cert. Public Accountant
☐ ELECTRICAL ENGINEER	☐ TRAFFIC MANAGER
☐ Electric Lighting and Railways	☐ Railway Accountant
☐ Electric Wiring	☐ GOOD ENGLISH
☐ Telegraph Engineer	☐ Teacher
☐ Telephone Work	☐ Common School Subjects
☐ MECHANICAL ENGINEER	☐ Mathematics
☐ Machine Shop Practice	☐ CIVIL SERVICE
☐ Gas Engine Operating	☐ Railway Mail Clerk
☐ CIVIL ENGINEER	☐ AUTOMOBILE OPERAT'G
☐ Surveying and Mapping	☐ Auto Repairing
☐ STATIONARY ENGINEER	☐ PLUMBING AND HEATING
☐ Marine Engineer	☐ Textile Overseer or Supt.
☐ ARCHITECT	☐ CHEMIST
☐ Contractor and Builder	☐ Navigation ☐ Spanish
☐ Concrete Builder	☐ AGRICULTURE ☐ French
☐ Structural Engineer	☐ Poultry Raising ☐ Italian

Name_____

Present Occupation_____

Street and No._____

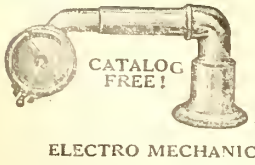
City_____ State_____

MATHEMATICS MADE EASY



The Arcascope—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 85 cents Postpaid. Order today before you forget.

Dept. J. L. J. LEISHMAN CO., Ogden, Utah



BUILD A $100 PHONOGRAPH

Assemble your own Phonograph
Do it yourself easily. Have the finest machine. Astounding saving. We give you the phonograph secrets. Complete instructions 10 cents.

ELECTRO MECHANICAL PARTS CO.
160 N. Wells St. CHICAGO

Book Review

(Continued from page 678)

The section on mechanics takes up the subject of kinetics—velocity, acceleration, circular motion and relations of mass and space. This is followed by excellent tables giving the properties of various plane sections with formulae for computing the moment of inertia, radius of gyration and distance to center of gravity. There is also a very excellent table giving the properties of different solids. Another table and the accompanying text cover the calculation and working stresses in various shaped beams, the properties of standard I-beams, standard angles, channels, etc., with fractional differences.

One of the chapters treats on hydraulics and hydrostatics, and practical working formulae are given for the flow of water thru orifices, pipes and wires. Further sections deal with various properties of steam, steam boilers and engines, refrigeration, heating and ventilation. Thence we come to the section dealing with electricity. Only working formulas are included in this section, so as to make the handbook of the utmost value to the practising designer and engineer, who invariably wishes to look up the formula and not a long explanatory text. This section covers electro-magnetism, electrostatics, direct currents, transient currents, harmonic alternating currents, with the various formulas for computing power factor, impedance, current, reactance, etc. The mathematical relations concerned with the functioning of alternating and direct current machinery are given, as well as those for transformers and induction motors. The work concludes with an elaborate series of tables giving the values of squares, cubes, square root, cube root, etc., of numbers as well as logarithms, sines, co-sines and tangents; weight of materials, weir and orifice co-efficients; channel co-efficients for use in Kutler's formula; properties of saturated and superheated steam; and a very excellent and exhaustive table giving the conversion factors for translating all of the usual and commonly employed electrical and mechanical engineering terms, from metric to decimal equivalents and vice versa.

FINAL DIGEST FOR WIRELESS STUDENTS, by J. Henstock. Cloth covers, 88 pages, size 5 x 7⅜ inches. Price $1.25, postpaid. Publisht by James Munro & Co., Ltd., 15 and 60 Brown St., Glasgow, Scotland.

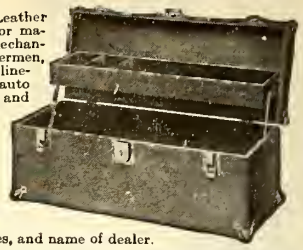
The aim of this manual by Mr. Henstock, which has been written from the English point of view, is to supply wireless students, especially those taking the postoffice examinations in England, with the most pertinent and useful instructions and directions, so as to prepare themselves for the government examination, which is held under the direction of the Postmaster General. During an examination for the Postmaster General's certificate of efficiency, the candidate is often confronted with a radio installation, which a great number of superficial faults have been purposely made in order to test his knowledge, and so by studying such a work as the present one, he may provide himself beforehand with the necessary information so as to be sufficiently grounded in radio matters in order that he may at once perceive what the trouble or difference is in the set placed before him.

It is necessary for all persons operating a wireless telegraph apparatus on board ships registered in the United Kingdom to hold either a first- or second-class certificate of efficiency from the Post-Master General, in accordance with article ten of the regulations annexed to the International Radio-Telegraph Convention. The operator, under such conditions, and holding such a certificate, must be able to send or receive by sound message in plain language in the International Morse Code, at a rate of not less than twenty words per minute, five letters being accounted as one word for a first-class certificate. To hold a second-class certificate, the sending and receiving speed in the International Morse Code is specified at from twelve to nineteen words per minute.

The first part of the book deals with elementary electrical problems, such as magnetism, induction, etc. The author then proceeds to deal with the various salient points in radio-telegraphy installations, such as the power set, its principal component parts and how they function, etc., the method of presenting the work being in question and answer form such as:—What is the main difference between the 5 K.W. and the 1½ K.W. high tension circuit? What does the primary low frequency circuit consist of? etc. Further sections deal with choke coils, fuses, various types of keys, air core chokes, transformers, condensers, jiggers, high frequency or sliding inductances, coupling, aerials, detectors, telephones, emergency set, spark discharger, accumulators, faults in sets, such as:—Q. How do you overcome leaking in aerial due to wet weather? Q. What would happen if the voltmeter were placed in the position of the ammeter in the circuit, and the ammeter transposed to the circuit position normally occupied by the voltmeter?

(Continued on page 682)

NEW UTILITY CHEST



Quartered Oak or Leather covered, designed for masons, electricians, mechanics, plumbers, fishermen, painters, repairmen, linemen, piano tuners, auto mechanics, garage and home use. Kiln dried. Frame joints lock-cornered. Tray with movable partitions that automatically raise when chest is opened. Special lock, twelve key change.

Ask for catalog, prices, and name of dealer.

UNION TOOL CHESTS

Sold on 'Satisfaction or Money-back" guar'tee
Union Tool Chest Co. Inc., 36 Mill St., Rochester, N. Y.

Life's Backbone



The success of your life depends on your **Health and Strength**

In a short time you can **Double Your Strength** and improve your H E A L T H with the **Automatic Exerciser**

(The only one of its kind.)

If you are battling with functional weakness in any form—if you want to acquire **More Resisting Power and Vim** than you ever had. Send for my booklet **Life's Backbone**, which gives full description of the automatic exerciser—how it works, and what it will do for you. Send for it now.

PROF. ADRIAN P. SCHMIDT Suite 308 1951 Broadway, N.Y.



SKINDERVIKEN TRANSMITTER BUTTON

Universal Transmitting element for Telephones, Deaf-phones, Detectophones, Wireless work and experimenting. 14,000 Buttons sold, every one satisfactory. **Price, $1.00 prepaid.** Booklet free.

Satisfaction guaranteed or money refunded. Receivers, Induction coils, in stock at cut prices. Office open 6 days a week from 9 to 5.

J. SKINDERVIKEN
335 Broadway, New York City
Telephone Franklin 4591

LEARN LANGUAGES
AT THE
BERLITZ SCHOOL

28-30 WEST 34th STREET
Brooklyn, 218-230 Livingston Street

Washington, Boston, Philadelphia, Detroit, Chicago, Baltimore, Orange, Havana, Rio de Janeiro, Buenos Aires, Sao Paola, Cordoba, Paris, London, Madrid, Rome, etc., etc.

FRENCH, GERMAN, SPANISH, ITALIAN, &c., &c.

By the Berlitz Method students learn not only to read and write, but especially to understand and to speak the foreign language.
TRIAL LESSONS FREE

35 Miles per hour Is Record of this Car



Boys, Build This Car. This nifty little car driven by gasoline motor, can be built by any boy. Parts are furnished by us and are very cheap. Send 26c for building plans and price list of parts showing how to build this lad's car

SYPHER MFG. CO.
156 Warren Street
TOLEDO, OHIO.

SELENIUM CELLS

Made by entirely new process. Highly sensitive and quick-acting. Suitable for all experiments. From $5 up.

Write for Catalog

Selenium Laboratories
Good Ground, Long Island, N. Y.

www.americanradiohistory.com

ELECTRICAL ENGINEERING

The World's Demand is for Electrical Engineers

You Can Earn From $3,000 to $10,000 a Year

by making yourself a Competent Electrical Engineer.

Our course of training is thorough and most modern, being especially designed for the man whose past education has been limited and who now wishes to make himself a high class Electrical Engineer.

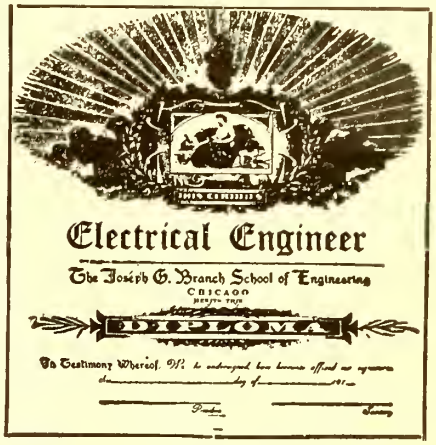
The men who get the **big jobs** are the men who understand the **principles** of electricity and their application.

Our Electrical Course teaches in plain, simple language and with easy lessons how to install and operate electrical machinery and appliances.

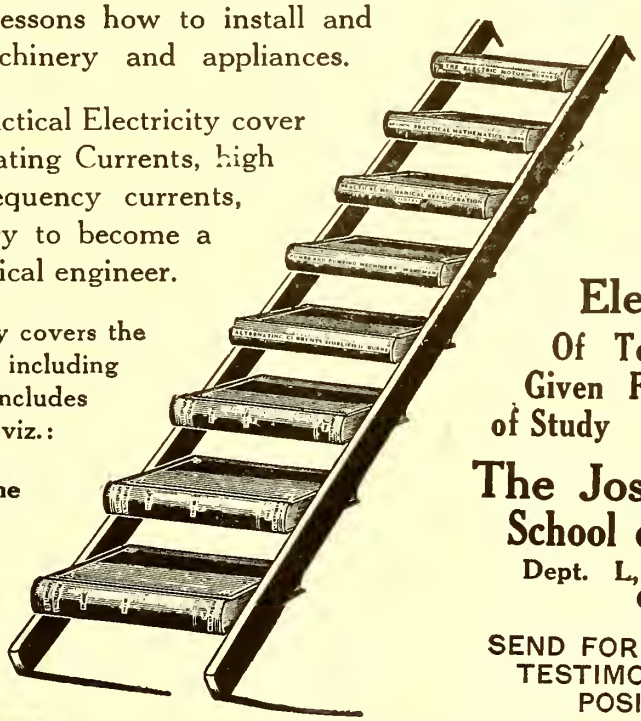
These lessons in Practical Electricity cover both Direct and Alternating Currents, high potential and high frequency currents, and all that is necessary to become a proficient modern electrical engineer.

The Course completely covers the field of modern electricty, including power-plant work, and includes the following subjects, viz.:

Practical Electricity, The Electric Motor, Practical Mathematics, Electric Wiring and Alternating Currents.



Your Diploma



FREE

Complete Electrical Library

Of Ten Modern Books is Given Free with this Course of Study

The Joseph G. Branch School of Engineering

Dept. L, 542 So. Dearborn St.
CHICAGO, ILL.

SEND FOR COMPLETE CATALOG, TESTIMONIALS AND LIST OF POSITIONS SECURED



ADMINISTRATION BUILDING

Complete, Practical Correspondence Courses in

Electrical Engineering
Mechanical Engineering
Stationary Engineering
Mechanical Refrigeration
Drafting
Drawing and Designing
Power Engineering
Power Plant Accounting
Practical Chemistry
Practical Mathematics
Ingenieria Electrica (Spanish Course)
Marine Engineering
Automobile Engineering

THESE BOOKS FREE!

With the Electrical Engineering course, you get, FREE, these splendid text books—All Standard Works These books alone are worth more than the price of the course. Each book by a recognized authority:

Practical Electricity — The Electric Motor — Alternating Currents Simplified — Electric Wiring — Practical Mathematics

USE THIS COUPON

Jos. G. Branch School of Engineering
Dept. L, 542 S. Dearborn St., Chicago

Without obligation you may send me information about your Special Offer on your course checked below:

Electrical Engineering
Mechanical Engineering
Stationary Engineering
Mechanical Refrigeration
Drafting
Drawing and Designing
Power Engineering
Power Plant Accounting
Practical Chemistry
Automobile Engineering
Practical Mathematics
Ingenieria Electrica (Spanish Course)
Marine Engineering

Name ..... Address .....
City ..... State .....
Present Position .....

You benefit by mentioning the "Electrical Experimenter" when writing advertisers.

www.americanradiohistory.com

ARE YOU A PILL FEEDER?



STRONGFORT
The Perfect Man

Are you trying to dope yourself back to health and strength with patent medicine pills and potions? Are you one of the hundreds of thousands of weakened, sickly, discouraged men in the country who have been fooled by lying newspaper ads into thinking they could get honest red blood and virile manhood out of a pill-box?

Don't waste your good money any longer on so-called "remedies" that cost 8 or 9 cents to make and are sold to you at a dollar. There's nothing in it—except for the fat purses of their unscrupulous proprietors—and always the possibility of acquiring some disgusting drug habit that will be worse than your present ills.

Let Nature Restore Your Vitality

Nature is the one great recuperative, revitalizing agent that always can be depended on, if you give her half a chance to get in her good work. She doesn't deal in dope and drugs; she puts up no prescriptions. But she can build you up; free you from your ailments; restore you vigor and vitality—and she will do it, if you will make up your mind to get well and strong again andthen go about it the right way.

Let me show you how the forces of Nature will dig out the causes of the constipation that may be rotting away your body and your brain; how they will relieve you of the dyspepsia, indigestion, billiousness that rake the fuck out of you and make you worthless for any work; how they will develop your muscles, give you the red blood that makes beef and brawn, strengthen all your vital organs, and fill you up again with the vim, vigor and virility that makes life worth living and enables men to DO THINGS in the world.

STRONGFORTISM

Strongfortism is the science of Living Life in Nature's way, and giving the natural forces she has implanted in every human organism the fullest opportunity to get in their healing, rebuilding, revitalizing work. It makes no difference what your condition is now, what brought you to it or how weakened, sickly and discouraged you have become. Strongfortism will take hold of you and build you up. Strongfortism will start you on the road to full-blooded, vigorous, virile MANHOOD. I GUARANTEE to improve your condition 100 per cent, if you will follow my directions for a few months.

Send for My FREE BOOK

The way Strongfortism built me up into the strongest man in the world; the way it has built up and is building up my pupils in every part of the world, is stated in plain, straight-forward talk in my book, **"Promotion and Conservation of Health, Strength and Mental Energy."** It shows you how Strongfortism can and will do for YOU what it already has done for thousands of other men weighed down by chronic ills. You want a copy of this book. You would gladly pay good money for it, if you knew what it contains. IT'S FREE. Send three 2c stamps to cover postage and packing and I will mail you a copy at once.

LIONEL STRONGFORT
Physical and Health Specialist
1076 Strongfort Institute NEWARK, N. J.

TIRE PRICES REDUCED

5000 MILES GUARANTEE



GOOD-WEAR Double Tread Tires represent quality, value, service and satisfaction, and are guaranteed for 5000 miles. GOOD-WEAR Tires do away with tire trouble. The fact that we have over 30,000 satisfied customers, speaks well for the wearing qualities and enduring powers of GOOD-WEAR Tires and Tubes.

Reliner FREE with every tire. Tubes are guaranteed fresh stock.

Size	Tires	Tubes	Size	Tires	Tubes
30x3.....	$6.50	$1.60	34x4	$8.75	$2.60
30x3½...	6.50	1.75	34x4½...	10.00	3.00
31x3½...	6.75	1.85	35x4½...	11.00	3.15
32x3½...	7.00	2.00	36x4½...	11.50	3.40
31x4.....	8.00	2.25	35x5.....	12.50	3.50
32x4.....	8 25	2.40	36x5.....	12.75	3.65
33x4.....	8.50	2.50	37x5.....	12.75	3.75

Send $2.00 deposit for each tire ordered, balance C. O. D. Tires shipped subject to your examination. State whether S. S., C. L. (Q. D.), plain or N. S. is desired. All same price.

GOOD-WEAR TIRE & TUBE CO.
2307 Indiana Ave. Dept. 38 Chicago, Ill.

"Playing the Game"

is a fascinating booklet. It tells how a man accumulated $10,000 in ten years on a total investment of $3,000, putting in an average of $25 monthly.

"Playing the Game" was originally sold at $1.00 per copy, but is now reprinted and we send it free to anyone ambitious to achieve financial independence. It contains nothing for the man who wants to get rich in a hurry, but will be helpful to all who wish to save from $5 to $100 monthly and invest by a safe method.

KRIEBEL & CO.
INCORPORATED
Investment Bankers
141W South La Salle St., Chicago

Book Review

(Continued from page 681)

SECRETS OF THE SUBMARINE, by Marley Fotheringham Hay. Cloth bound, 229 pages, illustrations from photographs, size 7⅝ x 3 inches. Price $1.50. Publisht by Dodd, Mead & Company, New York.

This excellent work is written in non-technical English and tells all about submarines. Readers of all classes may thoroly enjoy it, and at the same time learn the more technical and predominant features connected with their operation and strategy. The opening chapters deal with the design and construction of ubmarines, and give us some very interesting comparison figures as to the buoyancy and also the relative size of the submarines of different navies. Next we learn about the various forms of power plants and motive power which are practicable for submarine operation. Then follows an explanation of the general equipment, including steering gear, diving gear, air system, water piping system, refrigerating system, heating system and navigating appliances.

Chapter five takes up the armament, including torpedo tube and guns and the author discusses these important features in an interesting and non-technical manner. Next we find a discussion on periscopes and methods of range finding; safety devices and how they work; the safety keel as applied to submarines and other features coming under this category, such as the telephone buoy and submarine signaling apparatus, including wireless telegraphy.

EVERYMAN'S CHEMISTRY., by Ellwood Hendrick. Cloth covers, 374 pages, size 5½ x 8¼ inches. Price $2.00. Publisht by Harper & Bros., N. Y.

The author of this popularly written book happily combined an extraordinary gift of writing entertainingly and with authenticity on the matter with which he deals, which is usually the exception and not the rule in text-book writing. On the other hand, the author has shown us that he has the courage of his convictions, in that he was not afraid to carry the student reader rapidly forward as he progresses thru the opening chapters, so that by the time the student reaches the intermediate sections of the work, he will unconsciously have absorbed considerable of chemical lore. Some of the introductory chapters treat of the phases of matter; elements and compounds, chemical names and phrases, inorganic chemistry, air and water; the red-headed halogens; sulfur and sulfuric acid; phosforous, arsenic; sand and clay; lime and magnesia; iron and steel; paraffins and petroleum bodies; olefins; alcohols and some relatives; fats, oils and their products; sugar, starch and gums; aromatic compounds; coal-tar and finished products, etc., etc. The appendix contains a special explanatory table of the elements, which will be of great help to the general reader. It also contains a very useful bibliography of practical chemical books.

AVIATION ENGINES—DESIGN, CONSTRUCTION AND REPAIR, by Major Victor W. Page, formerly of the A. S. S. C., U. S. R. Cloth bound, size 5½" x 8¼", 590 pages, 250 illustrations. Publisht by Norman W. Henley Publishing Co., New York City, N. Y. Price $3.00.

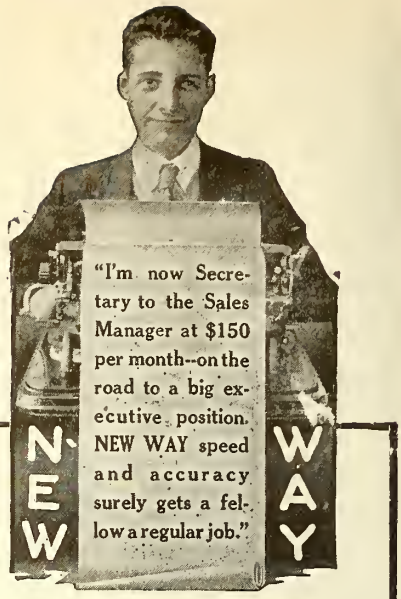
The book is unquestionably one of the finest and most exhaustive treatises of the subject of aviation engines that has ever been publisht. It contains about six hundred pages, full of absolutely valuable data. Not only are the engines themselves discust, but the measurements involved are covered in a masterly and authoritative fashion.

Early in the book, the explanations offered are of great value to the student. Here the essential differences between the single and multiple cylinder engines are explained on a page opposite four illustrations depicting the actions which takes place within the cylinders. This excellent arrangement of reading text and illustrative matter is consistently maintained.

The main portion of the book, however, is what actually makes no apology necessary for the publication of the book. Aviation engines of all makes are here covered by detailed explanations, diagrams and photographs in such a manner that their individual characteristics and methods of function are clear to the aviation mechanic ond the mechanic-to-be.

The Curtiss, Standard, Hall-Scott and other well-known types of airplane motors are described, together with the method of installation, upkeep and repair.

(Continued on page 689)



$25 to $40 Per Week for You

If You are a Really Efficient Stenographer

Expert Typists in Great Demand

Typewrite 80 words per minute or more and you will draw big pay. Wherever you are, increased output of finished work will bring the big money—good promotions—the private secretaryships—eventually the executive positions. Stenographers who are real typists are wanted by employers everywhere. Poorly trained in typewriting means poorly-paid on pay-day. Expert ability means big money—success.

The trouble hitherto has been that stenographers had no way to improve their typewriting. Ordinary methods left them stranded with out a 30 to 40 word ability. There was no way to overcome the handicap.

Now the "New Way" has changed all this—it opens the door for every stenographer to high speed in typewriting—to perfect accuracy—to great ease of operation—to promotions and Big Pay.

Based upon an absolutely new idea—special gymnastic exercises for the definite, cultural training of the fingers *away from the machine!* Marvellously successful. Ten simple lessons, easily completed in spare time. Your daily typewriting improves from the very start. Cost low. Binding guarantee—no pay retained unless expected results are fully realized.

New Way booklet describes this revolutionary new system in full detail—shows you the way to a transformed ability, doubled or trebled salary. Write for it today. FREE.

THE TULLOSS SCHOOL
3531 College Hill Springfield, Ohio

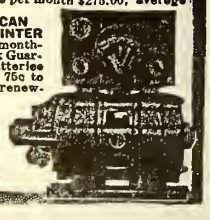
Big Profits Every Month in Battery Charging

MAKE BIG PROFITS In Winter BATTERY CHARGING In Large and Small Garages

Steffes & Steffes Garage, Chilton, Wisc., (pop. 1,500) "Income per month $125.00", cost $15.00—Adams Cooper Sales Co., Ft. Smith, Ark. (pop. 27,000] "Income per month from HB Charger is $120.00—cost $16.00," Alamosa Battery & Starter Co., Alamosa, Colo. [pop. 3 000] "Average income per month $275.00, average bill per month $14.00 for current."

THIS HB 500 WATT CHARGER CAN BRING YOU BIG PROFITS THIS WINTER

Small cash payment, balance on easy monthly terms. HB Absolute Money-Back Guarantee. Recharges 1 to 86-volt batteries for 10c to 15c each, customer pays 75c to $1.50. No burn-outs, no expensive renewals, steady reliable service. Easy to install and operate. No electrical knowledge required. Pin this ad to your letterhead and mail TODAY or information.



HOBART BROTHER COMPANY
Box 1125 Troy, Ohio
uceseful Manufacturers Since 1893

BRANCH MANAGER WANTED

by old established Chicago Concern. We furnish full stock of goods, advertising matter, and equip store completely, in good location, all at our expense. We allow you to draw out $175 a month and will also pay you liberal share of the profits your store earns. Work may be started in spare time. No investment or previous experience necessary. If you are a hustler and want an opportunity to make $5,000 a year, we want you, and will pay you well from the start. Send your application today.

S. LEVY, Manager Dept. 784
—329 S. Franklin Street Chicago, Ill.



Big Band Catalog sent free

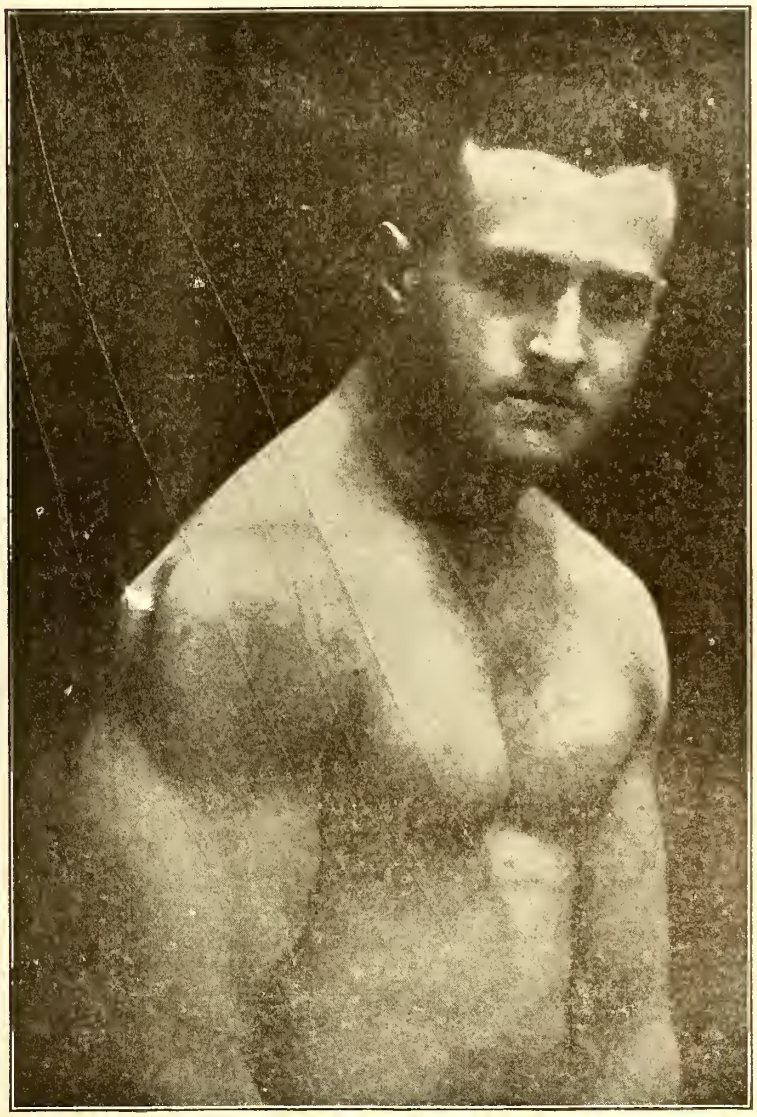
Whatever you need—from a drumstick to the highest priced cornets in the world. Used by the Army and Navy. Send for big catalog; liberally illustrated, fully descriptive. Mention what instrument interests you. Free trial. Easy payments. Sold by leading music stores everywhere.

LYON & HEALY
57-87 JACKSON BLVD., CHICAGO

www.americanradiohistory.com

THE MAN YOU WOULD LIKE TO BE!

He has a commanding appearance, a strong personality and unlimited energy. His strength is supreme and his muscles are splendidly developed. He has broad shoulders, a well-shaped neck, a powerful back, arms of steel and a deep full chest. His muscular legs, untiring, give him the energy and the springy step and the walk of a youth. He possesses everything you lack and admire. He is a master of men.



EARLE E. LIEDERMAN
the Acme of Physical Perfection

WHY NOT BE LIKE HIM?

THE MAN YOU WOULD LIKE TO BE, never has indigestion, but he can eat whatever he likes, for his stomach can assimilate anything. He never suffers from constipation, liver trouble, nervousness, insomnia or any of the common ailments that most of the people have. Neither is he a slave to any habits, but he is master of himself.

ARE YOU MASTER OF YOURSELF?

You cannot expect to control others or command their respect until you can first control yourself.

THE MAN YOU WOULD LIKE TO BE does not heed the temptations placed before him in daily life. He does not waste his best years in dissipation following the ignorant crowd. He takes care of himself and reaps his reward. His offspring are bound to inherit his qualities. His mind and his body are clean. He can do things that others cannot do. **HE IS A SUPERMAN.**

WHY NOT BE LIKE HIM?

YOU ARE JUDGED BY YOUR APPEARANCE. The world sizes you up by your own opinion of yourself—as expressed in your looks, your actions, and the force of your ambition. It is the strong, clean-cut virile man, the man of tireless energy, that gets to the top. You cannot be alert, you cannot have full control of your faculties, you cannot have that inexhaustible supply of vitality and energy that means success in life unless you have perfect health. Your physical condition is the root of your whole life. Build up your body and muscular strength and you build up your mind and vitality and insure success.

Get a good healthy color in your face, feel strong look strong, be somebody—**BE THE MAN YOU WOULD LIKE TO BE.**

GIVE ME A CHANCE TO HELP YOU. I have helped thousands—taken them out of the crowd of physical wrecks and turned them into powerful athletes. I am doing it every day and shall continue to do it, for it is my life's ambition.

I HAVE TRAINED SOME OF THE WORLD'S STRONGEST MEN. My pupils really amount to somebody. You can, too, if you will let me take hold of you and help you make the most of yourself. You don't know what you are missing by not being an athlete. It is a pleasure to feel bubbling over with vitality always—never to feel tired. Think of it! After a hard day's work—and still feeling refreshed!

THE FIFTH EDITION OF MY LATEST BOOK

"MUSCULAR DEVELOPMENT"

HAS JUST COME OFF THE PRESS

I have only 100,000 copies on hand, so if you have not as yet read this interesting and handsomely illustrated book, by all means send for a copy while they last. This book describes my system of training, and contains 20 full page photographs of myself and of some of the finely developed men and boys whom I have trained. After you have received it, you will be mighty glad you sent for it.

I WANT EVERY ONE WHO READS THIS PAGE TO SEND FOR A COPY OF THIS BOOK, for I want to make you the man you would like to be.

Simply tear off coupon and mail to me with 10c, stamps or coin, to help pay cost of wrapping, postage, etc., and you will receive your copy promptly. The sooner you do this, the quicker I can get this book to you, so **TEAR OFF COUPON NOW**—while it is on your mind.

EARLE E. LIEDERMAN
203 Broadway Dept. 214 New York City

EARLE E. LIEDERMAN,
Dept. 214,
203 B'way, New York

Dear Sir:—I enclose herewith 10c for which you are to send me, without any obligation on my part whatever, a copy of your latest book "Muscular Development." (Please write or print plainly.)

Name .....

Address .....

City..... State.....

El. Exp. 11-19

www.americanradiohistory.com



Who wants to be a good Boxer?

Suppose you are walking with your mother, sister, or best girl, and someone passes a slighting remark, won't you be ashamed if you cannot take her part? Well, can you?

Or suppose you remonstrate with a man for striking a smaller man, and the bully turns on you. Can you hold your own? Wouldn't you like to?

Or, if one of your pals says, "Come, put on the gloves and have some fun," can you do it, and get any "fun" out of it?

Less than 2 per cent of all men and boys know anything about the art of self-defense. That means when the test comes, less than 2 per cent are ready. Wouldn't you like to learn to box easily and quickly at half the usual cost?

Marshall Stillman has developed a unique "Shorthand Method" of teaching Boxing. You can learn the fundamentals in six lessons and can outbox older and stronger opponents after two weeks' study. His original principle has enabled him to teach professional boxers difficult blows and guards they could not learn by the old method. Professor Mike Donovan, former middle-weight champion of the world, who taught for thirty years at the New York Athletic Club, endorsed this "Shorthand Method," and helped prepare the lessons we send you. Boxing instructors and Y. M. C. A. physical directors are taking the course to use in their own work. Thousands of men and boys in this country and Canada,—boys as young as 12 and 15, and men as old as 50 and 60 have taken the course both for the boxing instruction and to keep in good physical condition and develop confidence and self-reliance.

It is the first time boxing has been successfully taught by mail, and it is only possible because Marshall Stillman starts with movements you are familiar with—holding out your hand for a coin, the breast stroke in swimming, etc. The first thing you know, he has led you into striking correct blows with both hands, putting the body weight behind them, guarding, ducking, feinting, etc. He teaches you the rudiments in front of your own mirror, before you face your first opponent. When you finally meet an opponent, you know how to hit him, what to expect in return, and how to guard against it.

The special introductory price of the new Home Study Edition is less than you would pay for a single term of lessons by the old method. We will include, until further notice, "Three Rounds of Shadow Boxing," 8 Jiu-Jitsu, or bone-breaking holds and releases, and 8 holds in standing wrestling—how to disarm a man, how to get out of dangerous holds, how to guard against a kick for the stomach, etc.—and also a complimentary copy of Mike Donovan's famous book, "The Science of Boxing." There are 175 illustrations in the course.

Frankly you don't believe that you can learn all these things by mail, do you? All right, we will take you on your own ground, we will send the course on 5-day approval, with the understanding that if you keep it you pay $5, but if you do not want it, you can return it on the fifth day, and end the matter. Simply fill in the coupon—we will do the rest.

Free Approval Coupon

MARSHALL STILLMAN ASSOCIATION
Suite E-11, No. 461 Fourth Ave., New York

You may send me at your risk, on 5-day approval, the complete Marshall Stillman "Shorthand Method" of Teaching Boxing, including all of the instruction described above. I agree on my honor to either return the lessons on the fifth day after receiving same, or else send you $5 on the fifth day in full payment for the complete course.

Name.....

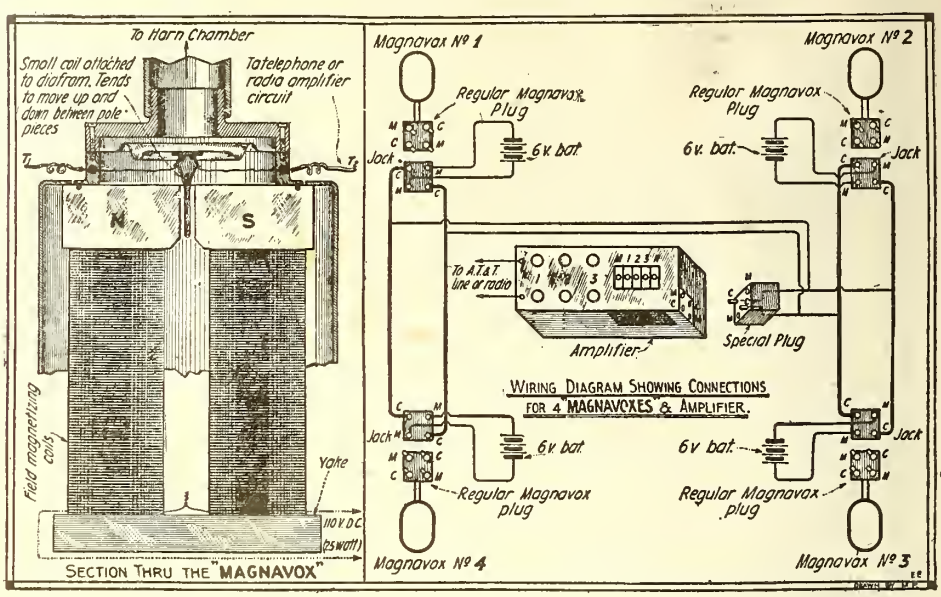
Address.....

Church Sermon Heard Over One-Half Mile

(Continued from page 636)

played on the violin could be heard easily for *half a mile*. Preaching from the pulpit can be heard distinctly for the same distance.

N. Burglund, radio and electrical engineer of the concern manufacturing the Magnavox. Referring to the diagram herewith, we see that this remarkable sound-reproducing instrument is of the *electro-dynamic*



Sectional View of the "Magnavox" Loud-Talking Amplifier.

This installation was a special test conducted by the Signal Corps, U. S. Army, under the personal supervision of Dr. B. W. Burglund.

The amplifier is so constructed that one, two or three steps may be used. The cam switches on the Bakelite panel are as follows: M, master switch, controlling all currents; 1, 2 and 3 are respectively steps of amplification; R, special switch for "cutting in" a radio winding into the first step and cutting out the voice transmitter. Two binding posts are provided for attachment to any radio detector or telephone circuit.

In the circuit diagram are shown the four Magnavoxes (two for each tower) and a small 6-volt storage battery for exciting the magnetic fields of each Magnavox. This is not necessary unless the Magnavoxes are so far away from the amplifier that the drop of voltage would seriously weaken the fields.

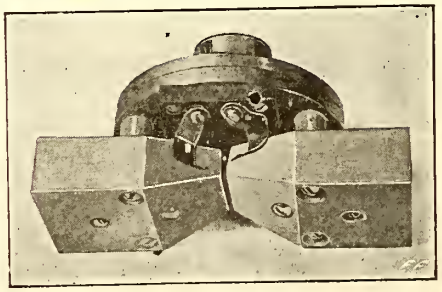
For the sake of portability, special plugs are furnished for connecting to storage battery transmitters and plate battery (600 volts). They are not shown in diagram, but attach to the front of the amplifier.

Description of the Magnavox Reproducer.

The following details of the interior mechanism of the Magnavox reproducer are available thru the courtesy of Dr. B. N. Burglund, radio and electrical engineer of the concern manufacturing the Magnavox. Referring to the diagram herewith, we see that this remarkable sound-reproducing instrument is of the *electro-dynamic* type, and in this respect differs from the usual telephonic devices intended for reproduction of speech. The ordinary telephone receiver operates on the electro-magnetic principle, wherein variations in the magnetic field act upon a flat iron diafram about two inches in diameter, causing the diafram to be attracted and repelled alternately, so as to cause it to vibrate. The vibrations of the diafram in the well-known manner give rise to air vibrations corresponding to the originating voice waves at the transmitter end of the circuit.

In the Magnavox, the principle is *electro-dynamic*, and the diafram is not acted upon directly by the magnetic flux from the electro-magnet. Instead, a minute insulated wire coil is placed in a small air gap about $\frac{1}{16}$ inch long between the pole-

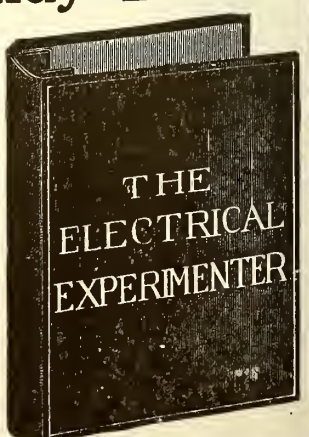
(Continued on page 686.)



View Showing Pole Pieces and Diafram of the Magnavox Sound Amplifier. The Diafram Coil Lies Between the Pole Pieces.

Handy Binder

for the Electrical Experimenter



Holds and preserves 12 issues, each of which can be inserted or removed at will, without tools. Will keep your magazines perfectly for all time or just preserve them like new till you bind them permanently. Made of heavy material, extra strongly reinforced at the back and covered with handsome green cloth, suitably lettered in gold.

65c

Add postage for 2 lbs.

Experimenter Pub. Co., Inc. Book Department 233 Fulton St., N. Y.

www.americanradiohistory.com

Camel CIGARETTES

CAMELS supply in a lavish way everything you ever hoped to find in cigarettes! Camels are so unique in quality, in flavor, in full-bodied-mildness, in refreshing satisfaction that you should not delay your pleasure an instant! *Try Camels out to the limit*—then compare them with any cigarette in the world at any price!

Quality alone would make Camels distinctive. But, behind quality is Camels expert blend of choice Turkish and choice Domestic tobaccos. *This blend is a revelation to cigarette smokers!* You'll prefer it to either kind of tobacco smoked straight, it is so mellow, so delightful.

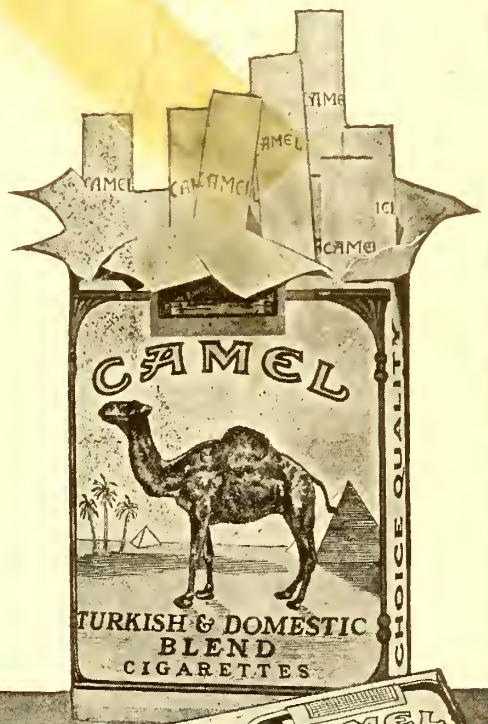
Prove conclusively that Camels are made to meet your most exacting demands; that you can smoke them liberally without tiring your taste! And, know yourself that Camels leave no unpleasant cigaretty aftertaste or unpleasant cigaretty odor!

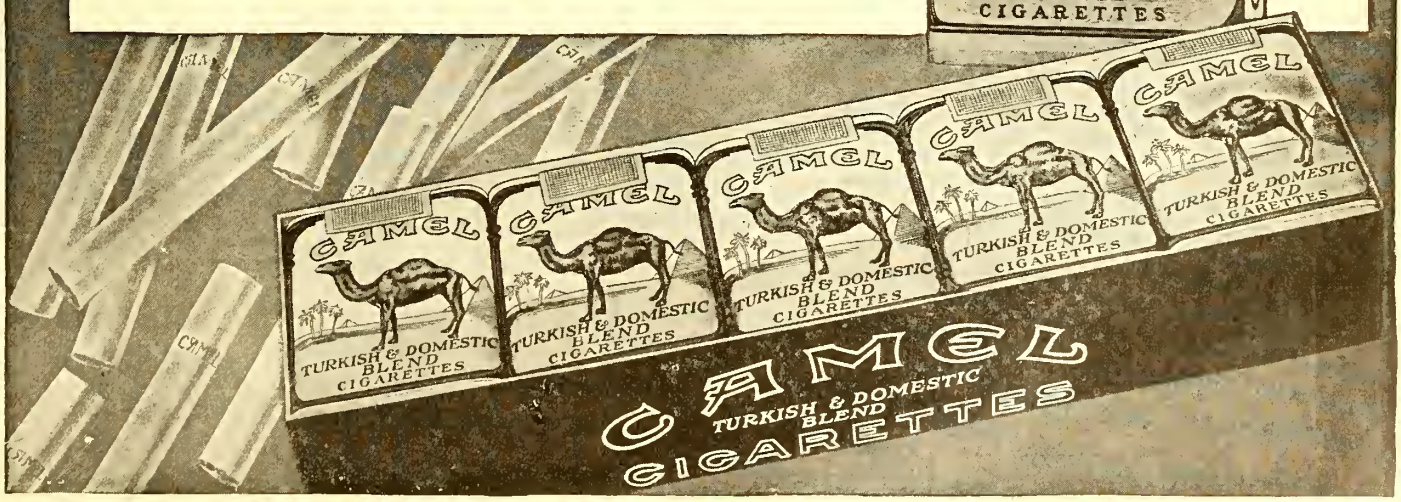
Quality will make you keen for Camels!

R. J. REYNOLDS TOBACCO COMPANY
Winston-Salem, N. C.

18 cents a package

Camels are sold everywhere in scientifically sealed packages of 20 cigarettes; or ten packages (200 cigarettes) in a glassine-paper-covered carton. We strongly recommend this carton for the home or office supply or when you travel





www.americanradiohistory.com

Save TIRES LIKE THESE



I Earned $2200 In Four Months

This is Richard A. Oldham

Mr. Oldham was tel graph operator for the Illinois Central Railroad for twenty years. He is fifty-eight years old. One day he read one of my advertisements and the possibilities of making money in Auto Tire Surgery business. In a few weeks he had purchased and installed a Haywood outfit. A short time afterward he wrote us that his income in four months was as much as it had been in Two and One-Half years as Telegraph Operator.

Be a TIRE SURGEON

Make $2,500 to $4,000 Per Year Giving New Life to Old Tires

A Haywood Tire Surgeon can do more with old tires than was even dreamed before the war. By the **Haywood Method a Haywood Tire Surgeon** can give 4,000 to 5,000 more miles of new life to a tire that two years ago would have been thrown on the junk pile. And it's easy to learn.

HAYWOOD'S TIRE SURGERY

Stations are Needed Everywhere

20,000,000 tires wearing down every day. By Tire Surgery you can quickly repair, rebuild and give new life to tires seemingly all worn out. Cuts, gashes, tears, bruises, broken fabric, every kind of an accident that can happen to any tire, inside or out, you can repair and save for long service. **The chance to make money is simply wonderful.**

$2,500 to $4,000 a Year is Possible

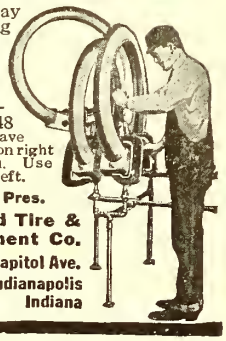
If we told you all the truth you wouldn't believe it. You would say, "it is too good to be true." But you can see what a great field there is for **Haywood Tire Surgery Stations**—for this better way.

WITH THIS HAYWOOD OUTFIT

Send Today for My Free Book

WRITE TODAY

I have ready to mail you the day I get your request, a fascinating book—all about tires—how to repair them by the Haywood Method—how to start in business—how to build up trade—what to charge. In 48 to 72 hours you can have the whole proposition right in front of you. Use coupon at the left.



M. HAYWOOD, President
HAYWOOD TIRE & EQUIPMENT CO.
1210 Capitol Ave. Indianapolis, Ind.

DEAR SIR: Please send me by return mail your free book on the new Haywood Tire Surgery Method and the details of your free school of tire repairing.

Name _____

Address _____

M. Haywood, Pres.
Haywood Tire & Equipment Co.
1210 Capitol Ave.
Indianapolis
Indiana

BATTERY CHARGED AT HOME

Do it yourself. Save money and keep battery at highest eF-Ficiency by getting a

NEW F-F BANTAM BATTERY BOOSTER

This 8 ampere rectifier charges any 6 volt storage battery from 100 to 130 volts 60 cycle, Alternating Current Lamp Socket and at an expense equal to burning an electric lamp for a few hours.

Simple—safe—sure acting. Infusible and long wearing carbon electrodes rectify the current. This new size F-F rectifier already wonderfully popular—light in weight—10 lbs. complete ready for shipment—includes ammeter and battery clips. Get one and enjoy immunity from battery troubles.

Send check for prompt shipment by Express. For parcel post include postage and insurance charges.

Also F-F rectifiers of larger capacities as well as Charging Rheostats that operate from Farm Lighting Plants or Direct Current Service.

Ask for Circular No. 12

$15



THE FRANCE MANUFACTURING CO., Cleveland, Ohio

MODEL AIRPLANE SUPPLIES

Build and fly Model Airplanes ~



Send 5¢ for catalog of complete and knocked-down scale models of new machines, parts, fittings, and supplies.

Wading River Mfg. Co. 672 Broadway, Brooklyn, N.Y

Church Sermon Heard Over One-half Mile

(Continued from page 684)

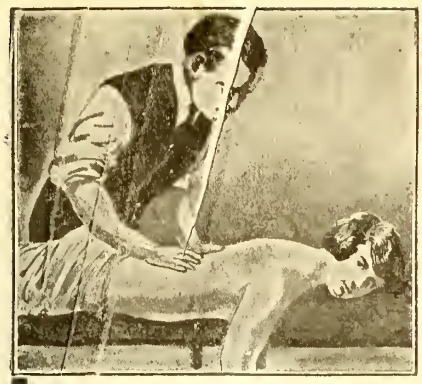
pieces of the powerful electro-magnet, which pole-pieces are magnetized North and South, as shown in the accompanying drawing. No permanent magnets are used in its make-up. As the fluctuating or alternating currents from the microphone at the distant end of the circuit (or else the oscillatory audio-frequency currents coming from an audion amplifier) are past thru this small coil attaching to the diafram, the coil is acted upon by the powerful magnetic field between the pole-pieces in such a manner as to be either *repelled* or *attracted* alternately (up and down) in a rapid manner, and at a rate corresponding to the voice wave pulsations. The movements of the small coil are, of course, immediately communicated to the diafram, and it is attached firmly to the latter, and in turn the movements of this diafram set up powerful air waves which issue from the sound amplifier horn attached to the instrument, and which is shown in one of our photographs. The odd shape of this horn has a special bearing on the acoustic quality and sonority of the sound waves its sponsors claim. The upright poles of the electro-magnet have one-inch round cores of annealed Norway iron, the pole-pieces and yoke members being of similar material. The magnetizing coils consume a very small amount of current, or about 25 watts, and they are supplied to operate on 6, 8 or 18-volt D.C. from battery, as desired or on 110 volts D.C.

Contrary to the general opinion, no noticeable effect is caused in these speech reproducers when the latter current is used, due to the *commutator ripple,* owing to the high impedance of the windings, which smoothes out the pulsation so that they are not noticeable at all. Another very interesting feature of the Magnavox, which its inventors have ascertained after careful research on the acoustics of the instrument, is the *diafram.* As is well known, no phonograph or talking machine with a small diafram can be capable of producing the full sonorous quality of the average voice, such as a baritone, and particularly the music from string or wind instruments of the medium or lower tonal register. This is because of the fact that the smaller the diameter of the diafram the higher the natural period or pitch at which this diafram will vibrate; the greater its diameter, within certain limits, of course, the lower the natural period or pitch of the diafram and the more quality will it give to the average class of music, especially vocal or instrumental reproductions in the baritone or base register, for example. So the experts who have designed the Magnavox found that wonderful results were obtained by using a large diafram; in fact, it measures three and one-half inches in diameter. The diafram is neither of iron nor mica, but of German silver, and, furthermore, it is not flat, but has a double ogee groove or rib prest into its surface a short distance from the outer perifery. This helps to stiffen the diafram, and together with the peculiar properties of the material with which it is made, also tends to nullify any effects of natural period vibrations of the diafram itself.

It may be imagined from what has been said before that the new sound, music and speech reproducer must be used with an audion or vacuum tube amplifier—but such is not the case at all. This reproducer

(Continued on page 688)

www.americanradiohistory.com



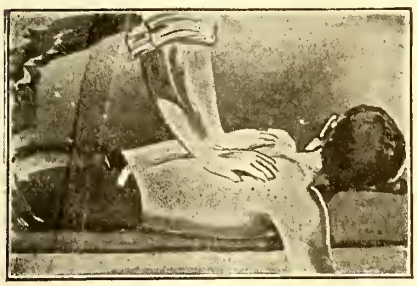
CHIROPRACTIC

THE NEW PROFESSION OF DRUGLESS HEALING

A dignified, pleasant and profitable career awaits you in this new, uncrowded field.

Learn at Home---Earn $3,000 to $5,000 a Year

Here is your opportunity to qualify at home in your spare time to become a Doctor of Chiropractic and make a big income. No matter where you live or what work you are now doing, if you are ambitious our Course in Chiropractic shows you how easily you may achieve financial independence. We give you, right in your own home during your spare time, or in class, just the training you must have to succeed.



Never before has the demand been so great for competent Doctors of Chiropractic. The day of Drugless Healing is here, and the masses of people everywhere are eagerly welcoming Chiropractic, the science of restoring health by means of spinal adjustment, as a natural scientific substitute for the old outgrown system of "dosing" by internal medicines.



Read What These Doctors of Chiropatic Say

"My Charges Are $25.00 for 13 Treatments."

American University:

My practice averages ten patients a day, of which many are women. My charges per course are $25 per 13 treatments. The number of treatments varies from one to two courses in stubborn cases. Minor cases take from 6 to 10 treatments. I have your school at heart and will boost it all I can.—DR. W. H. WEDELL, M.T.D.D.C., N. Y.

Heartily Recommends Course—Charges $2.00 per Treatment.

American University:

I have no hesitation in recommending your course in Chiropractic to anyone contemplating such a course, as it is thoroughly practical, well-written, interesting and valuable to the new student and a valuable adjunct to any drugless healer. I receive $2.00 for all treatments.—DR. ANNIE B. McDERMONTT, N. J.

"I Am Proud of Your Chiropractic Course."

American University:

Our regular price for such work is $2.00. Treat on an average of about eight a day, and give all the way from 12 to 24 treatments, which depends on how obstinate the case is. Some are cured with only five or six treatments. I am proud of your Chiropractic Course.—DR. W. H. WOOD, Missouri.

Average 15 Patients Daily—I Charge $1.00 per Treatment.

American University:

I charge $1.00 per treatment; average fifteen daily. Each patient never takes less than two treatments a week and often one treatment a day for ten consecutive days, and then two or three each week. The cases run from 25 to 100 before considering themselves well. Your Extension Course in Chiropractic has been of great benefit. The lessons are all based on sound scientific principles, and very good.—L. H. ROCHE, D. C.

This Is Your Opportunity

Get out of the rut and qualify now for this splendid profession that offers such remarkable possibilities for making you prosperous and independent. Our Course in Chiropractic will point the way for the attainment of your ambition. Never has there been a more opportune time than now, for never has the demand for competent Doctors of Chiropractic been so great as it is today. Now is the time to get started on the road to success.



Mail the Coupon TO-DAY

Don't delay. Your chances for building a successful career are as great as those of any of the others who are succeeding in the practice of this great profession. Just let us give you all the facts—then judge for yourself. Mailing the coupon places you under no obligation of any kind whatever. All we ask is the opportunity to prove to you that what we tell you is the absolute truth. We have the facts to prove it—facts which you will find mighty interesting. Just send the coupon or a post card for our beautiful new illustrated 72-page book and full particulars of our remarkable Free Charts Offer. Mail coupon or write today SURE.

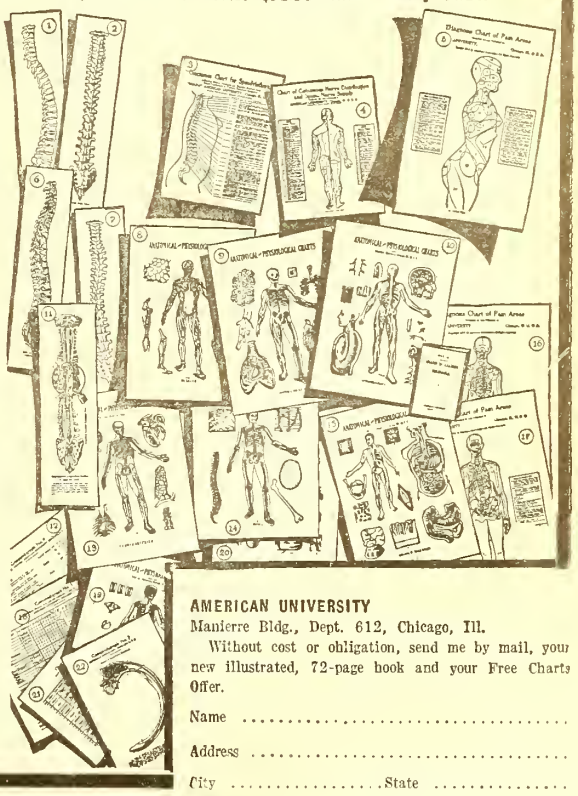
American University
Manierre Bldg., Dept. 612, Chicago, Ill.

Remarkable FREE Charts OFFER

We want men and women seriously intending to take up professional careers in Drugless Healing to have these charts. Their actual value is $31.50. But on our offer they come free. There are 22 in all, printed in colors. Send the coupon below to get all the facts about our offer.

- 8 Anatomical and Physiological Charts (with Bound Manual Key) Handsomely Lithographed in Lifelike Colors.
- 4 Original Compendigraphs.
- 5 Illustrative Spinal Columns.
- 5 Colored Nerve, Pain Area and Concussion Charts.

22 Magnificent Charts—Value $31.50—All absolutely FREE.



AMERICAN UNIVERSITY
Manierre Bldg., Dept. 612, Chicago, Ill.

Without cost or obligation, send me by mail, your new illustrated, 72-page book and your Free Charts Offer.

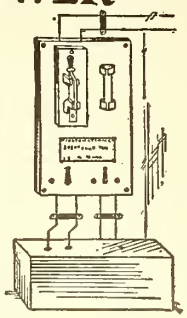
Name .....

Address .....

City ..... State .....

www.americanradiohistory.com

$1.00 INEXPENSIVE ELECTRIC POWER $1.00



The wonder of the twentieth century inexpensive electric power, this is possible with our new electric power system, a new idea in electricity. With the aid of our instruction and chemicals you can make and install a power battery as shown in the illustration, absolutely safe and simple. Stop wasting money on buying batteries, install the new electric power battery. It is not an acid or dry battery, it is a new combination of wet and dry elements which produce electricity. These batteries are powerful and cheap to operate, they produce a direct current of more than 20 volts, cheaper than any other form of battery. They are wonderful for operating all kinds of experimental work, for lighting purposes and for many other uses where electric current is needed. Any user of batteries knows the value of an inexpensive high voltage electric current. These batteries should be in every home, office, shop and factory, no matter how small a current is needed; to reduce or raise the current of the battery, simply move the volt regulator on the switch board. The beauty of these power batteries is, that they do not evaporate or lose current when not in use, therefore, with every day use recharging the battery is necessary about every month or so, it can be recharged at home in a few minutes, no electricity or machinery is required for this operation, recharging material can usually be obtained around your home or can be bought for a few cents. These batteries when charged weigh about 84 pounds and if properly installed will last for years. Each battery making outfit consists of a completely wired switch board, battery connectors, wire, instructions and plan for making, installing and recharging the battery and complete chemicals. Special introductory price, $1.00, prepaid. Outside the U. S., $1.25.

ELECTRIC LIGHT IN YOUR HOME $1.00





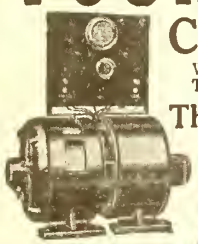
The latest electric light, no batteries to buy or electric bills to pay. Anyone can install and maintain this midget electric light. Safe, simple and inexpensive. No more smoke and smell, no wicks or oil, no chimneys to clean or break, just as safe in the barn, garage and clothes closet as in any open room, always ready for use, day or night. A touch on the switch and you instantly have a bright electric light. No matter where you live this light can be installed. It is not affected by heat or cold. Many homes have installed this electric light in their halls, closets, pantries, barns, sheds, cellars, garages, etc., with good results. It is an extremely useful light which no household should be without. The reason for this bright electric light is that the lighting bulb is fitted with a drawn Tungsten filament wire which is much more efficient and durable, besides giving a 300% increase in light as compared with the ordinary carbon lamp. The power system furnished with this lighting outfit is somewhat similar to the electric power battery described above. Each electric light outfit includes the following: Complete directions and plans, copper wire, insulated wire holders, knife switch, drop light fixture with socket, friction tape, battery protector, maroon shade, national mazda globe. Our dry battery compound, which assists in renewing and supplying the current and our current renewing system with which you can renew the current at home without expense. With every day use one recharge usually lasts two to three weeks. This electric lighting outfit is undoubtedly the most practical and durable electric light of low cost and long service ever devised. Special price to introduce these electric lighting outfits $1.00, prepaid. Outside the U. S. $1.25.

Our Guarantee—It is our intention that every article described above will reach you exactly as described, that it will satisfy you perfectly, that it represents full value for the money you paid or we will refund your money.

Just to introduce our new line of goods we are offering them at these greatly reduced prices. We only have a limited number of the above described goods at these prices. Order now, direct from this ad. We guarantee safe delivery anywhere for additional 10 cents on each item.

A. B. C. PRODUCTS CO. 2 JOHNSON & 13th Sts. **CHICAGO**

YOUR OPPORTUNITY



Canceled Government Contracts

We have secured a large quantity of Small Motors, Generators and Charging Outfits. This material is new, still in original cases and carries the full factory guarantee.

This is Your Opportunity to buy new, guaranteed Electrical Apparatus of Standard Manufacture



1/2 H. P. INDUCTION MOTOR 110 or 220 volts, A. C. 60 cycle, single phase, 1750 R. P. M. $32.50

ALL MOTORS COMPLETE AS CUT



1/4 H. P. 110 volts A. C., 60 cycle, single phase 1750 R. P. M.

WASHING MACHINE MOTOR

Suitable for operating Small Compressors, Coffee Grinders, Bottle Washers, Lathes Drill Presses, etc. $18.50

Battery Charging Outfits

For use on 110 volt, A. C., 60 cycle, single phase current only.

80 watts, 8 volts, 10 amperes . $48.50
150 watts, 30 volts, 5 amperes . $68.50
150 watts, 15 volts, 10 amperes . $68.50
800 watts, 80 volts, 10 amperes . $94.50

All outfits complete with switchboard as cut shown.

Mail $5.00 cash or Money Order. We will send C. O. D. subject to full examination.

MONEY BACK GUARANTEE

WRITE FOR CATALOGUE. BARGAINS IN MOTORS AND GENERATORS. SPECIAL QUANTITY PRICES

220 Volts **POLYPHASE MOTORS** 1750 RPM. 60 cycle, 2 or 3 phase. Complete, pulley and base
1 H. P. $59.50 3 H. P. $ 84.50
2 H. P. $72.50 5 H. P. $102.50

NEW MOTORS

110-220 Volts **REPULSION MOTORS** 1800 RPM. 60 cycle, single phase. Complete with pulley.
1/2 Hp. $44.50 1 Hp. $67.50

MANUFACTURERS' DISTRIBUTER

CHAS. H. JOHNSTON - West End - PITTSBURGH, PA.

"The Eastern" is a Large Achromatic Telescope



MADE UPON NEW SCIENTIFIC PRINCIPLES.

Positively such a good Telescope was never sold for this price before. Eastern Telescopes are made by one of the largest manufacturers of telescopes in America; we control entire production; measure closed 9 inches and open over 3 feet in 4 sections. They are nicely brass bound, with scientifically ground lenses. Guaranteed by the maker. Every sojourner in the country or at the seaside resorts should certainly secure one of these instruments, and no farmer should be without one. The scenery just now is beautiful, a Telescope will aid you in taking views. Objects are brought to view with astonishing clearness. Sent by mail or express, safely packed, prepaid, for only 99 cents. Our new Catalogue of Watches, etc., sent with each order. This is a grand offer and you should not miss it. We warrant each telescope just as represented or money refunded. Send 99 cents by Registered Letter, Post Office Money Order, Express Money Order, or Bank Draft payable to our order, or your newsdealer or store-keeper will order one for you. Whether consumer or dealer, send cash with order. To dealers 6 for Four Dollars.

EASTERN NOVELTY CO., 67. 172 E. 93d STREET, NEW YORK.

Church Sermon Heard Over One-Half Mile

(Continued from page 686)

in itself possesses very remarkable amplifying properties and articulates the spoken word very beautifully. It has satisfied the most exacting test of the U. S. Signal Corps at Washington, as well as many experts of the Army and Navy Departments who have heard the instrument and tested it. The loud talker talks in a very loud and clear manner, with no vacuum bulb amplifiers attached. It is simply connected to a microphone, preferably a special microphone designed to be used with it, and comprising four standard microphone buttons connected in parallel, all enclosed in a single casing. In one test made with the instrument in this fashion, using a 12-volt battery current, a single reproducer was successfully employed to talk to 15,000 people, or covering a sound area equivalent to the average city block. In a test made at the Navy Department building at Washington, D. C., Dr. Burglund successfully transmitted the "tick of a watch" so as to be heard *one-half mile away* by experts who were listening for it. These tests proved very interesting, and also the manner of carrying them out. Dr. Burglund hooked up first one stage of a vacuum tube amplifier, and then successive stages. When he hooked on one amplifier he would ask thru the Magnavox that the listeners stationed about one-half mile away lift their right arms to a horizontal position if they heard the voice clearly and distinctly, and to raise the arm vertically if they heard the voice extra loud and clear, which was the case when he connected two and three stages of vacuum tube amplifiers into the circuit with the Magnavox. The amplifying horn used in these different tests mentioned has been invariably a 24-inch quarter-sawed oak horn of the particular curved form as shown in the photograph of the instrument.

One of the most astounding features of the Magnavox is that, contrary to what the reader may at first believe, it is possible when the instrument is talking loudly to place the head directly into the horn with no uncomfortable feeling of having your ear drums shattered, or any rocking of the head, as is generally caused by a very loud sound, and at the same time you can walk away one-half mile and still hear the Magnavox talking to you clearly and loudly, and on a quiet day much farther than this. This instrument has many hundred uses, and one of the applications to which it is now being applied is for use on shipboard, and the ships being built by the U. S. Shipping Board are to be fitted with it for the purpose of giving orders from the officers' bridge, or chart house, to the engine room below decks. This has always been one of the most difficult features to install on any vessel, especially on war vessels, where it was imperative that orders should be accurately reproduced and heard at all times. Due to the peculiar construction of the balanced Magnavox microphone, which has found wide application in Airplane Radio telephony and the Magnavox itself, either of these instruments can be used where there is a perfect bedlam of noise, such as created by the turbine and dynamo running in the engine room, and the noise of other auxiliary machinery, without there being the least effect on the telephonic transmitting and reproducing qualities of the apparatus. In fact, in one instance, the Magnavox was fastened on the reduction gear case of a turbo-generator on a war ship. This, we must concede, is the acid test of any telephonic device.

www.americanradiohistory.com

Book Review

(Continued from page 682)

PRACTICAL AVIATION FOR MILITARY AIRMEN, by J. Andrew White, major, American Guard. Cloth covers, 198 pages. Profusely illustrated. Size 6¼ x 9½ inches. Price $1.75. Publisht by Wireless Press, New York City, N. Y.

The excellent compilation is designed as a textbook for the student of military aviation, and its arrangement makes it highly satisfactory for the purpose. The opening chapter is devoted to definitions of the various terms which enter into a consideration of aeronautical subjects. This is followed by a description of the principles involved in the design of airplanes for various purposes. The author states that airplane design is restricted by opposing essentials which require the aerofoil (lifting surface) characteristics and velocity to produce either maximum climb or maximum velocity. A compromise between the two is affected in all airplanes, and he proceeds to illustrate these principles in a manner so lucid as to require no further explanation to the reader.

After several chapters of design, construction, and assembly of the various types of machines, the author enters upon the field of gasoline engines with which the airplanes are equipt. This section of the work is treated in a very complete manner, as is the rest of the book. The first of these chapters upon gasoline motors is entitled "Fundamentals of Motor Power," and the statements made thruout are so clear as to make one wonder at the inherent simplicity of motors. These chapters on the engines are worth-while reading for themselves, even if one be not particularly interested in airplanes. Major White carries the reader from the single cylinder engine of antiquity to the ultra-modern, high-powered machine which the modern bombing and battle-plane carries.

After these purely constructional details come the chapters which deal with the fundamentals and tactics of aeronautical manuvering.

LESSONS IN ASTRONOMY. Revised edition. By Charles A. Young, Ph. D., LL. D. Cloth covers, 420 pages, about 350 illustrations. Size 5 x 7½ inches. Price $1.60 net. Publisht by Ginn & Company.

There is, indeed, cause for rejoicing at this new edition of what may be called the most popular book on Astronomy which has ever appeared in the English language. But slight changes have been made in the text of this new edition—changes which were but necessary to bring the book up to the second and in line with the most modern researches which have displaced older theories.

The book, as a whole, however, remains as it always was: an unsurpassedly concise, clear and comprehensive text on a subject which should be known by all who have any pretentions at all to a knowledge of science. The book is particularly adapted to the needs of those who desire an unmathematical analysis of the Universe.

The section on the Moon is particularly interesting—more interesting, in fact, than the wildest romance that was ever written. This section is also of interest at the moment, because of the recent discussion regarding the motion of the moon as prompted by Tesla's startling revolutionary statements. It should be noted that Professor Young's text is based on the strictly logical, conservative theories.

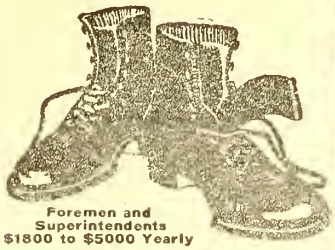
As to the appearance of the Earth from the Moon, Young is quite complimentary to our planet. He says: "It is easy to see that she (the Earth) would be a very beautiful object, on account of the changes which would be continually going on upon her surface—due to snow, storms, clouds, growth of vegetation, etc."

The entire planetary system is treated in a commendable manner. Each planet is thoroly considered in its relation to the rest of the system, and no reader can fail to obtain a thoro survey of the field during the many pleasant hours that may be spent with the book.

The stars, comets and other bodies are also treated thoroly. The phenomena accompanying comets and nebula are given careful consideration. Here it is of interest to notice the divergence of opinion on astronomical subjects by accepted authorities, as demonstrated by the hypothesis advanced by many men for cometary and nebulary phenomenons—which have caused so many foolish predictions and stupid prophecies among ignorant elements of population.

There is a meritorius appendix which includes descriptions of astronomical apparata in use thruout the world. The use of these instruments, their origin and construction, are described. The appendix also includes a description of the method employed to locate a ship at sea, the determination of time at sea, and various other problems which are well within the realm of astronomy. All presented and demonstrated with the same clarity that characterizes the entire book.

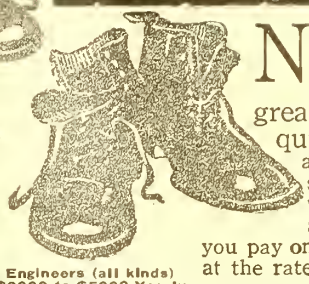
(Continued on page 690)



Foremen and Superintendents $1800 to $5000 Yearly



Office Manager or Auditor $1800 to $5000 Yearly



Engineers (all kinds) $2000 to $5000 Yearly

Learn to Fill Bigger Shoes

NO matter what kind of work you are doing now, a set of these great home study books will quickly fit you for a bigger and better paying job. We will send any set you select for one week's FREE examination, and if you want to keep them you pay only the special reduced price—at the rate of 50 cents a week. This is your opportunity to make more money—grasp it NOW. Use these books and a little spare time and LEARN TO FILL BIGGER SHOES.

Carpentry and Contracting
Five volumes, 2138 pages and more than 400 illustrations. Prepares for Contractor, Building Superintendent and Carpenter Foreman. Regular price, $25.00. Special price, $19.80.

Civil Engineering
Nine volumes, 3900 pages and 3000 illustrations, plates and diagrams. Prepares for Civil or Structural Engineer, Transitman, Estimator, Designer or Chief Draftsman. Regular price, $45.00. Special price, $29.80.

Telephony and Telegraphy
Four volumes, 1728 pages and 2000 illustrations, plates and diagrams. Prepares for Telephone Engineer, Wire Chief, Exchange Manager, Trouble Man or Telegrapher. Regular price, $20.00. Special price, $14.80.

Steam and Gas Engineering
Seven volumes, 3300 pages and 2500 illustrations, plates, diagrams, etc. Prepares for Stationary, Marine or Locomotive Engineer or Fireman. Regular price, $35.00. Special price, $21.80.

Law and Practice
(with Reading Course in 25 bound pamphlets). Thirteen volumes, 6000 pages and 24 illustrations. Prepares for all Bar Examinations. A wonderful aid to business men. Regular price, $72.00. Special price, $44.80.

Practical Accounting
Four volumes, 1840 pages and 800 illustrations, plates and diagrams. C. P. A. questions and practical problems. Prepares for Accountant, Bookkeeper or Cost Clerk. Regular price, $20.00. Special price, $14.80.

Pay Raisers

These books are written by well known authorities—the top-notchers in each line. They will help you make more money. You can't fail to understand them, because they are written in plain, everyday language. Thousands of photographs, diagrams, charts, etc., help to make difficult points as simple as A-B-C.

See our Free Examination—no money down offer below



Ask Our Experts

With these books goes free of all charge a $12.00 Consulting Membership in the American Technical Society. If any question puzzles you—write us. Our corps of experts and engineers will solve any problem. Ask all the questions you want for a whole year. This service is absolutely FREE.

Automobile Engineering
Six volumes, 2600 pages and 2300 illustrations. Prepares for Garage Foreman, Automobile Mechanic or Chauffeur. Invaluable to car owners. Regular price, $30.00. Special price, $19.80.

MachineShopPractice
Six volumes, 2300 pages and 2500 illustrations. Prepares for Machine Shop Superintendent or Foreman, Foundryman, Pattern Maker, Tool Designer or Tool Maker. Regular price, $30.00. Special price, $19.80.

Sanitary, Heating and Ventilating Eng'ring
Four volumes, 1454 pages and more than 1400 illustrations, etc. Prepares for Sanitary Engineer, Heating and Ventilating Engineer, Master Plumber or Plumber. Regular price, $20.00. Special price, $14.80.

Mechanical and Architect'al Drawing
Four volumes, 1578 pages and more than one thousand illustrations. Prepares for Architectural or Mechanical Draftsman. Regular price, $20.00. Special price, only $14.80.

Electrical Engineering
Eight volumes, 3800 pages and 3000 illustrations, plates and diagrams. Prepares for Electrical Engineer, Power Plant Superintendent, Substation Operator or Electrician. Regular price, $40.00. Special price, $24.80.

Fire Prevention and Insurance
Four volumes, 1500 pages and 600 illustrations, diagrams, forms, etc. Prepares for Counterman, Rate Clerk, Inspector or Agent. Regular price, $20.00. Special price, $15.80.

Don't Send Any Money!

Write the name of the books you want on the coupon and mail it today. We will send the books at once, express collect, and you can use them just as if they were your own for a whole week. If you decide you don't want to keep them, send them back at our expense. If you like the books, as thousands of other men have after examination, just send us $2.00. You can send the balance of the special reduced price the same way—$2.00 each month (50 cents a week).

Start right now and learn to fill bigger shoes. There will be a better job looking for you if you do. Be ready to meet it when it comes. *Send the coupon now.*

American Technical Society, Dept. X-258, Chicago, Ill.

American Technical Society, Dept. X-258, Chicago, Illinois

Please send me set of——————for 7 days' examination, shipping charges collect. I will examine the books thoroughly and, if satisfied, will send $2 within 7 days and $2 each month until I have paid the special price of—————— If I decide not to keep the books, I will return them by express at your expense. Title not to pass to me until the set is fully paid for.

Name ——————

Address ——————

Reference ——————

SEND THE COUPON NOW

www.americanradiohistory.com

WANTED - TRAVELING SALESMEN

C. W. Birmingham's earnings for one year were $125 per week in selling. Before that he earned $70 a month as factory clerk. N. S. T. A. Training and Free Employment Service made this possible. We train you by mail in your own home. Salesmen are needed in every business.

EARN $2,500 TO $10,000 A YEAR

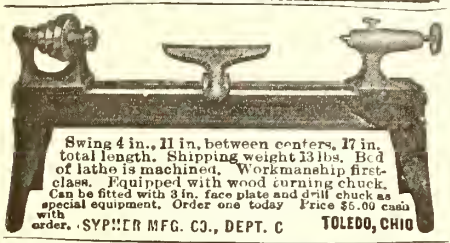
Get our FREE book, "A Knight of the Grip." It tells all about Salesmanship, how we help our members get good positions, how we have successfully taught star Salesmanship to thousands of underpaid men, both young and old.

Write today for FREE book—and line up for a big pay job. Address

NATIONAL SALESMEN'S TRAINING ASSOCIATION

Dept. 42S Chicago, Ill. U. S. A.

BE A TRAVELING SALESMAN



Swing 4 in., 11 in. between centers, 17 in. total length. Shipping weight 13 lbs. Bed of lathe is machined. Workmanship first-class. Equipped with wood turning chuck. Can be fitted with 3 in. face plate and drill chuck as special equipment. Order one today Price $6.00 cash with order. SYPHER MFG. CO., DEPT. C TOLEDO, OHIO

The Consolidated Radio Call Book

The most needed book of the hour.

This book is, literally, the right arm of all organizations and persons directly or indirectly connected with the ever increasing radio field.

Compiled and published for the express purpose of meeting a timely and urgent necessity among radio and steamship companies, professional and amateur radio operators, and those having need of authentic and practical information on radio calls; radio, telegraph and cable rates, special signals and general radio procedure.

Every Vessel and Land Station Listed

Every vessel and land station is represented and listed in this book alphabetically, according to names of vessels or land stations, and according to call letters. Revision of American coastal stations under U. S. Naval control, and their new calls.

That new and great aid to navigation—the radio compass—is explained and is a unique feature of this publication and of special value to masters of merchant vessels.

Contains all calls listed in the new book to be published by the Department of Commerce.

Price 75c Prepaid

Consolidated Radio Call Book Company, Inc.

41 Park Row, Room 1420, New York City

This book also contains the advertisements of practically every leading company in the radio field.

MARCONI'S NEW INTERNATIONAL CODE, publisht by Marconi International Code Company, London, England. Publisht in four different volumes, cloth bound at $19.98, net per volume.

The Marconi Company is now putting out a new International Code in nine of the chief languages of the world. It is as simple as it is complete, condensing messages to a wonderful degree. Not only does it facilitate and cheapen communication with English-speaking races, but it also provides a means whereby intercommunication by letter or telegraphy between people possessing no knowledge whatever of the other's language, for it is sold thruout the world.

The work is remarkable in its simplicity of coding and decoding; it is entirely modern, and par excellence in reliability and secrecy. Great care has been taken in compiling and binding these volumes, so as to reduce to a minimum the possibility of mutilation in transit or use, which experience has taught will frequently happen.

In addition, a system is so arranged that by means of the numbered words a "secret cipher" may be compiled whenever required. Also a complete glossary of all kinds of useful business tables and information is given, including a buyer's guide with a list of the ablest producers of all the best known goods.

Undoubtedly, this new code will find instant favor with commercial institutions the world over, assisting to a great degree in simplifying much of the International correspondence handled at present.

ESSENTIALS OF MODERN ELECTRO-THERAPEUTICS, by Dr. Frederick Finch Strong, M.D. Cloth cover, 150 pages, 118 illustrations, size 6¼ x 9½ inches. Price $2.00. Publisht by Rebman Company, New York.

A new revised edition by the well-known authority on high frequency and electrotherapeutics, particularly the application of high frequency current to human ills, providing a practical handbook well illustrated, which proves invaluable and interesting reading to the electrical student, physician and layman alike. Dr. Strong believes in the first principle, that if one is going to write an article or a book, it should be above everything else made so intelligible that the average student can grasp and understand fully what he is talking about without having to assimilate a whole dictionary of high-sounding medical terms, which is not at all necessary, as a perusal of this interesting manual will at once demonstrate.

In this working manual, which everyone interested in electro-medicine should read, the author explains the modern electron theory of matter, as well as the laws and principles of electro-physics, including induction and the induction (medical) coil. Chapter three treats on the subject of physiology from an electrical standpoint and their inter-relations. Chapter four treats of galvanism and galvanic currents, including the electrolysis of warts and moles, as well as superfluous hair. The succeeding chapters deal with faradic currents and their application to various ailments, electro-diagnosis, static electricity and its application by various modalities, high frequency currents, and their diverse applications for different ailments, the Röntgen ray, dental electro-therapeutics, sinusoidal currents, light rays, vibrassage and ozone inhalation apparatus.

MOVING PICTURE OPERATING

made simple with

"RICHARDSON'S HANDBOOK"

Good paying positions await licensed projectionists.

Send for circular of the standard work on projection.

700 pages, over 300 illustrations

Postpaid $4.00

Chalmers Publishing Co.

Room 600 516 Fifth Avenue

New York City

Don't Wear a Truss



BROOKS APPLIANCE, the modern scientific invention, the wonderful new discovery that relieves rupture will be sent on trial. No obnoxious springs or pads. Has automatic Air Cushions. Binds and draws the broken parts together as you would a broken limb. No salves. No lies. Durable, cheap. **Sent on trial to prove it.** Protected by U. S. patents. Catalogue and measure blanks mailed free. Send name and address today.

C. E. BROOKS, 203C. State Street, Marshall, Mich

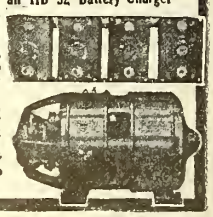
Battery Charging Your Biggest Money-Maker

$500.00 a Month Income with This 32 HB Battery Charger

Eureka Storage Battery Co., Houston, Texas, writes—"The first little machine we bought of you has given us the very best of service. With the new large machine, my income per month from charging is $500.00."

You, too, Can Make Big Profits with an HB 32 Battery Charger

Recharges 32-6 volt auto batteries, or equivalent in 12- or 24-volt batteries, at one time, for 10c to 15c each. Customer pays 75c to $1.50. Figure the profits yourself. No electrical knowledge needed. Uses no valuable floor space. Runs 24 hours a day.



Small investment puts this money-maker in your garage. Balance on easy monthly terms. Outfit easily pays for itself. Absolute Money-Back Guarantee. Write TODAY for full information. Send this ad.

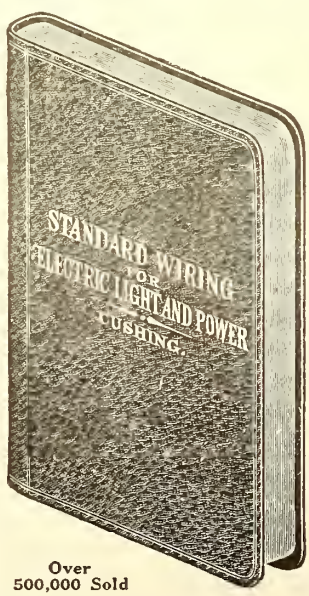
HOBART BROTHERS COMPANY
Box 113 E Troy, Ohio
Successful Mfs. since 1893

THE NATIONAL AUTHORITY ON WIRING FOR TWENTY-FIVE YEARS

STANDARD WIRING

Will Make You an Expert Wireman

EARN $30. TO $60. A WEEK



Over 500,000 Sold

This year's edition, completely revised to date, is the only accurate book on electric light and power wiring and construction, from the Fire Underwriters' standpoint, published.

The National Electrical Code, with all its new rules, is explained and illustrated. 52 of the latest and simplest tables which show, at a glance, just what size of wire is needed for any kind and size of lighting or motor installation, for any voltage, current and drop desired for any system, Direct Current, Alternating Current, single, two or three-phase.

How to install and operate generators, motors and every kind of wiring device with diagrams of connections. Special chapters on illumination, House Wiring, Electrical Units and their Equivalents. The latest lamp data. Proper symbols to use to indicate outlets, etc., etc.

Also a complete directory of the leading manufacturers of officially approved apparatus and supplies necessary for any kind of installation.

350 Pages, Leather Cover, Pocket Size.

Sent to any address on receipt of $1.50

H. C. Cushing, Jr., 12 W. 40th St., New York

www.americanradiohistory.com

Popular Astronomy
Earth's Atmosphere

By Isabel M. Lewis

(Continued from page 651)

Nitrogen and oxygen, which occupy 99 per cent of the volume of the earth's atmosphere, have practically no absorbing effect on the earth's radiations, but they do strongly absorb and scatter the short solar rays in the blue and violet, and, therefore, produce the intense brightness and characteristic blue color of the sky.

When the sun's rays enter the earth's atmosphere they are diffracted or broken up to a certain extent by passing from a rarer to a denser medium. The short blue and violet rays suffer the greatest diffraction and are largely lost in the upper atmosphere, while the long orange and red rays penetrate to the lower depths of the earth's atmosphere.

The beautiful sunset hues and the reddish tinge so characteristic of the sun and moon when rising or setting is due to the breaking up of the rays by the dense lower strata of the atmosphere and the trapping of the blue and violet rays by the atmosphere.

Were it not for the scattering and diffusion of sunlight by the atmosphere the sky would always be inky black and the stars and solar corona would always be visible in the daytime. All shadows would be harsh and as black as the inky sky.

Without the atmosphere there would be no winds, no clouds, no rainfall, no rainbows, no twilight, no beautiful sunsets, no living beings. The dry and barren surface of our planet would be constantly pelted with the meteorites and meteoric dust that are now almost entirely consumed by friction with the atmosphere, and only in exceptional cases reach the earth's surface. The extremes of temperature between day and night would be intense. The blistering heat of a torrid day would be followed by the frigid cold of an arctic night.

In our satellite, the moon, we see the earth as it would appear without a protecting and life-supporting atmosphere—a dry and barren waste.

One effect of the atmosphere on our planet is to gradually wear down and disintegrate the rocks and mountains thru the action of water vapor and air-currents. This disintegration of the rocks is continually setting free gases that are to a certain extent increasing the atmosphere of the earth. Moreover, many stray molecules of gas exist in interplanetary space and are swept up continually by the earth's atmosphere in our journeys around the sun. These are probably equaled in number by the molecules that escape from the earth's upper atmosphere, so that, on the whole, the atmosphere is probably neither increasing or decreasing appreciably.

The auroral displays, known as the northern and southern lights, are electrical phenomena of a nature not yet clearly understood that are associated with the rare gases of the earth's upper atmosphere. They are rarely seen outside of certain belts in northern and southern latitudes in the vicinity of the north and south magnetic poles of the earth, where they occur in great intensity. The lower streamers are at altitudes of about one hundred miles or less, and the upper streamers reach heights of five or six hundred miles. The aurorae are in some way intimately associated with the sun spot cycle and never occur except when there is unusual activity on the sun in the form of sun spots or prominences.

There is, indeed, a close connection between the conditions of the sun and many atmospheric effects, such as temperature, rainfall, cloudiness and magnetic storms.



Learn Public Speaking
10 LESSONS FREE

Write — quick — for particulars of this extraordinary offer; an opportunity you will never forget if you take advantage of it. Ten lessons in effective public speaking absolutely FREE to those who act promptly, to introduce our course in localities where it is not already known.

We teach you by mail to become a powerful and convincing speaker—to influence and dominate the decisions of one man or an audience of a thousand. We have trained hundreds and helped them to increase their earnings and their popularity. Learn, in your spare time at home, how to overcome "stage fright" and conquer fear of others; how to enlarge your vocabulary; how to develop self-confidence and the qualities of leadership; how to RULE others by the power of your speech alone; how to train your memory. Our

WHAT THE COURSE TEACHES YOU.

How to talk before your club or lodge;
How to address board meetings;
How to propose and respond to toasts;
How to make a political speech;
How to tell entertaining stories;
How to make after-dinner speeches;
How to converse interestingly;
How to write better letters;
How to sell more goods;
How to train your memory;
How to enlarge your vocabulary;
How to develop self-confidence;
How to acquire a winning personality;
How to strengthen your will power and ambition;
How to become a clear, accurate thinker;
How to develop your power of concentration;
How to be the master of any situation.

New Easy Method

perfected and taught only by Prof. R. E. Pattison Kline, former Dean of the Public Speaking Department of the Columbia College of Expression, can be learned in 15 minutes a day. Prof. Kline is one of the foremost authorities in the country on public speaking and mental development. Do not let this chance escape you.

Offer Limited

Send This Free Coupon Now

This Special Offer of TEN LESSONS FREE is made strictly for advertising purposes and will be withdrawn without notice. Write now, before it expires, and receive full particulars with enrollment blank by return mail. No obligations of any kind. Just tear off and mail this free coupon—or a postal will do.

FREE LESSONS COUPON

North American Institute,
7448 Manhattan Building, Chicago

I am interested in your course in Effective Public Speaking and your offer of ten lessons free. Please send particulars. It is understood that this request places me under no obligation of any kind.

.....

.....

www.americanradiohistory.com



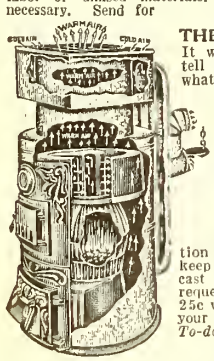
BURNS LESS COAL

With an improved, all-cast pipeless furnace you can cut your coal bills in two. This efficient, basement installed heating plant heats and ventilates the entire home It burns any grade of coal more economically than a stove. It needs no expensive piping or other equipment. Any one can install it in a day. They are described at our wholesale prices in our Handy Man Book. Send for it.



DO Your Own Plumbing and Heating by the Cut-To-Fit-Method

By our new plan anyone can install a complete plumbing or heating plant in his own home. Send us a rough sketch with measurements. Our engineers will draw your plans, furnish information and see that the supplies you order come CUT-TO-FIT your needs. No waste of time, labor or unused materials. Only a few simple tools necessary. Send for



THE HANDY MAN BOOK

It will show you how. It will tell you just what to order and what it will cost at our wholesale prices. It contains plans and useful information for every builder, property owner or contractor. It will convince you. It will increase the value of your property 50%. You can do the work yourself.

We have spared no effort or expense in the preparation of this valuable book. To keep from sending it broadcast to uninterested persons we request a temporary deposit of 25c which will be refunded with your first order. *Send for it To-day.*

The Service of

HARDIN-LAVIN COMPANY

Is guaranteed by 40 years' business at

4510-20 Cottage Grove Ave., Chicago

DIAMONDS on Credit



X54 Tiffany Belcher Ring, set with one perfectly cut blue-white diamond. $35.

X55 Solid gold Tiffany style ring, one exquisite diamond. $50



X56 One SWEET sparkling diamond, set Tiffany style in solid gold mounting. $75.



X57 Gentlemen's solid gold tooth ring, set with one superior diamond. $65.



X58 Gentlemen's massive seven-diamond solitaire cluster ring. $75.

Genuine, blue-white perfect-cut diamonds. Your choice on APPROVAL. Pay one-fifth AFTER EXAMINATION; balance in 10 payments. SWEET'S POLICY: You must be satisfied or no sale. PROFIT SHARING PLAN: 7½% yearly increase in exchanged value on every diamond purchased from us. **Liberty Bonds accepted at Face Value.**

Beautiful de Luxe Catalogue FREE

We are Maiden Lane's Greatest Credit Jewelers. Write today for catalog of precious gems, watches, etc. Lowest Prices. Highest Quality.

Ten months to pay on everything. Address Dept. 579-S.

"THE HOUSE OF QUALITY"

I.W. SWEET & CO. INC.

2-4 MAIDEN LANE, NEW YORK

NATIONAL TRADE DENTAL SCHOOL

506 S. Wabash Ave., Chicago, Ill.

LEARN MECHANICAL DENTISTRY—DEMAND UNLIMITED

A paying professional trade: You will be a trained dental mechanic and receive our diploma when competent. Students given advantage of thoroughly up to date laboratory, and services of graduate Dental Surgeons on practical cases. No effort spared to place graduates advantageously. No age limit. Day or Evening. Individual instruction. No educational requirements. No book or home study. Easy terms. Highest references. Especially attractive proposition to those who write at once for catalog H.

and such progress is now being made in the investigation of the effect of changes in solar activity upon the atmosphere that it is expected that before long certain of the weather effects dependent on the sun spot cycle will become largely predictable in advance.

The earth's atmosphere shares the earth's motion of rotation on its axis, moving eastward with the same speed as the surface; that is, at the rate of 1,017 miles per hour. At high elevations, however, there is a strong tendency for the higher atmosphere to lag behind the solid surface of the earth and lower atmosphere.

Were it possible for an aviator to travel *eastward* in an airplane around the earth at the equator with the speed of the earth's rotation, 1,017 miles per hour, he would circumnavigate the globe and return to the same point on the earth's surface in twenty-four hours, but since he would travel in the direction of the earth's rotation, the sun would apparently move westward at *twice* its usual rate and would rise and set for him *twice* in the twenty-four hours. If, on the other hand, he should take a *westward* course at the *same rate,* he would, as before, return to the same point on the earth's surface after twenty-four hours; but since the earth is now turning in a direction *opposite* to his direction of flying, and *at the same rate,* the sun will move westward at the same rate that he is flying and will, therefore, appear to remain immovable in the sky during the twenty-four hours.

Were it possible for our aviator to pursue his journeys *outside* of the earth's atmosphere under the same conditions, but freed from the effects of the earth's rotation, he would find, if he traveled *eastward,* that he would make one rotation with respect to the sun in twenty-four hours, but the same place on the earth's surface would remain immovable beneath him all the time since the earth would also rotate eastward at the same rate.

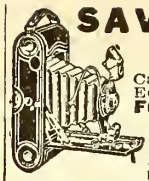
If, however, he should turn and travel westward he would make, as before, one rotation with respect to the sun in twenty-four hours (only in the opposite direction), but points on the earth's surface would speed past him at the rate of 2,034 miles per hour and he would pass the same point on the earth's surface twice in twenty-four hours.

Interplanetary Communication

By Dr. C. S. Brainin, Ph. D.

(Continued from page 641)

still another point of view from which we must examine our knowledge of Mars—its physical condition. Mars is so much further away from the sun than the earth that it only receives about *forty per cent* as much solar energy per unit of area. Then, too, calculation shows that its average surface temperature, therefore, must be well below zero, as compared with 60° F. on the earth. There is evidence of the existence of an atmosphere, tho extremely tenuous, for small clouds are seen at rare intervals and sometimes the entire disk is obscured by a haze. It is of the greatest importance to ascertain whether this is water vapor, as on the earth, or not. The presence of water vapor on a planet is the *sine qua non* of our kind of life. The evidence here is again contradictory. The two famous American astronomers, Keeler and Campbell, have failed to discover any traces of it with their spectroscopes, but more recently Lowell's successor at Flagstaff has announced affirmative evidence. We must bear in mind that negative results are never as certain as positive ones, but in any case the amount of water vapor necessary to produce the polar cap phenomena



SAVE 25% to 60%

on slightly used

GRAFLEX-KODAKS

Cameras and Lenses of every description Equal to new. Save money. Write now for **Free Bargain Book and Catalog** listing hundreds of money-saving bargains in slightly used and new cameras and supplies. All goods sold on 10 days' Free Trial. Money back if not satisfied. You take no chances dealing with us. We have been in the photographic business over 16 years. Write now.

CENTRAL CAMERA CO., Dept. 17D 124 S. Wabash, Chicago



GO INTO MOVING PICTURE BUSINESS

Small Capital Starts You

Our Catalog FREE. Show you how to earn $25.00 to $50.00 per day

on our easy payment plan. Begin now and get your share. We sell everything. Write today.

Atlas Moving Picture Co.

Dept. 50 538 S. Dearborn St., Chicago

Learn the Sign-Show Card Business



Big field—unlimited possibilities—increasing demand for men with creative ideas. Our course develops ability and originality. Work intensely interesting.

EARN $25. TO $75. WEEKLY

You can do it if ambitious. Successful graduates everywhere. Our course covers every phase of work completely and thoroughly. Our graduates command big salaries. Write for catalog, samples, guarantee and Free Outfit Offer.

DETROIT SCHOOL OF LETTERING, 691 D. S. L. Bldg. Detroit, Mich.

Fun, Magic and Mystery!

56 Feats in Magic, 250 New Jokes, 21 Puzzles, 1 Fortune Telling Tablet, 52 Money-Making Secrets, 15 Card Tricks, 71 Toasts, 58 Verses in Comic Poetry, 10 Funny Readings, 41 Epitaphs, and 11 Parlor Pastimes. You get all the above-mentioned and our big illustrated Catalog of 125 Magic Tricks for only 10 cents. Write today.

MYSTIC MFG. CO.,

909 Springwells Ave., Detroit, Mich.

SECURE A MOTOR-CYCLE AT LOW COST



by putting a RELIABLE STEFFEY MOTOR on your wheel. Easy to attach. Costs less to run than an expensive motorcycle. Write at once and secure low factory prices.

STEFFEY MFG. CO.

Dept. E, 5025 Brown St., Philadelphia, Pa.



$3 AND $4 a month WILL BUY

A Beautifully Reconstructed

TYPEWRITER

With Every Modern Writing Convenience

WRITE TODAY FOR ILLUSTRATED CIRCULAR Explaining Try-Before-You-Buy Plan

HARRY A. SMITH, 738-218 North Wells St., Chicago, Ill.

How to Get Rid of Moles



A simple, safe home treatment—15 years' success in my practice. Moles (also BIG growths) Dry Up.

Ask for Free Booklet of Full Particulars

WM. DAVIS, M.D.

4140 State Street Perth Amboy, N.J.

Dollars in Hares

We pay $7.00 to $9.50 a pair and express charges. Big Profits. We furnish guaranteed high grade stock and buy all you raise. Use back yard, barn, cellar, attic. Contract and Illustrated Catalog Free.



STANDARD FOOD & FUR ASS'N

303Z Broadway New York

WOULD YOU KNOW WHAT TO DO?
TO HAVE YOUR WISHES COME TRUE?
TO BE HAPPY AND SUCCESSFUL?
TO FEEL THE THRILL OF NEW POWERS?
TO HAVE A WINNING PERSONALITY?

Our system of Personal Development has shown thousands. It can show YOU. First lesson in SUCCESS, and your Personality Sketch for 10c and birthdate.

THOMSON-HEYWOOD CO.

Dept. 350, Chronicle Bldg., San Francisco, Cal.

You can be quickly cured, if you

STAMMER

Send 10 cents coin or stamps for 70-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering for 20 years.

Benjamin N. Bogue, 760 Bogue Bldg., Indianapolis

TRICKS, PUZZLES, JOKES, TOYS,

games, novelties, doll and cane racks, plays, wigs, stage supplies, escapes and illusions. Large 1919 catalogue free.

OAKS MAGICAL CO.

Dept. 549 Oshkosh, Wis.

www.americanradiohistory.com

which have been observed on Mars is very small, indeed, at the low temperature which prevails there and might be absolutely inadequate to support human life; the spring decrease in the polar caps may be due to sublimation and not to fusion.

The final possibility is Venus. Here we know that water vapor is present in abundance, for the planet is always wrapt in a heavy, cloudy atmosphere, the nature of which the spectroscope has divulged. The surface itself cannot be observed. There is some doubt as to whether the daily rotation period is about the same as the earth's or equal to Venus' year. In the latter case, it would always turn the same face toward the sun and there would be a great difference in temperature between the two faces, while along their boundary there would undoubtedly be a region with a moderate, habitable climate. In the case of the shorter rotational period the conditions on Venus would be much like those of the earth, but the average temperature would be higher.

It seems to be the opinion of most astronomers that of all the fellow planets of the earth, Venus is the most likely planet to support life, but, certainly, no evidence of it exists. In the case of Mars, we can only say that IF the observations of the "canals" should be established beyond the preadventure of a doubt, we would be safe in drawing the conclusion that life really exists there. As the matter stands to-day, there can be no doubt in the mind of anyone who will take the trouble to investigate the question that the chances in favor are next to zero. It makes a great sensational story but is far away from the truth. On the other hand, there may be life on Mars, of a kind entirely unknown to us, in spite of the fact that the "canals" are an optical illusion.

We turn now to the second phase of the subject: If there is life on Venus or Mars, can we get into intelligent communication with the inhabitants, particularly thru a wireless method? Our guess is yes. In the case of these planets it would be only a matter of a few minutes between the sending and the receipt of the message, so that the difficulty noted above with planets of other systems does not hold here. We must assume, further, that the Martians or Venereans, as the case may be, have attained the degree of scientific development represented by the possession of wireless, which is by no means a necessary conclusion. A great many more or less detailed plans have been proposed for opening such interplanctary conversations, but it seems to us that they all depend too much on the assumption that these foreign plantearians must necessarily be something like us Earthians. We would suggest, therefore, that if some rash soul makes the attempt, the basis of the code should be something which would of necessity be the same for the other planets as for the earth, *i. e.*, some astronomical phenomenon. In the case of Mars it might be something connected with the satellites, and this is probably the only sure way of getting upon common ground.

Some have suggested gigantic lights as the best way of opening communication between two planets, in the belief that foreign planetarians would be enough like us to have organs like our eyes, sensitive to the same rays to which our retina is attuned. But this does not follow at all; our imaginary neighbors might have "eyes" sensitive to ether waves which "see" ultra-violet infra-red or electromagnetic waves of lower frequency such as are used in Radio. Of course, those who believe firmly in the existence of Martian inhabitants, discarding all the contrary evidence and evading the absence of affirmative proof, are perforce led to the conclusion that these are greatly

Learn Mechanical Drafting

Earn $35 to $100 a Week

"Get into the profession of big pay and Rapid Advancement with the help of the school that has started hundreds on the Road to Success. I am ready to help you." Roy C. Claflin, President, Columbia School of Drafting.



Learn At Home in Spare Time

You don't have to stop work or leave home in order to become a trained Draftsman. Through our practical Home Study Training we teach you in your own home, and enable you to qualify as a practical Draftsman.

No Previous Training Required

Owing to the comprehensive nature of our course, you need no previous training in the subject. Though you have never done any kind of drawing before, you can become a thorough Draftsman by following our instructions.

Can Learn in Short Time By Our Methods

Our course can be mastered in six to ten months. The reason for this is that we eliminate unnecessary theoretical work and concentrate upon the PRACTICAL problems such as confront the professional Draftsman. We do not require you to spend months of your time on "preliminary" work, but start you on REAL DRAFTING at once. That is one reason why our students "make good" so readily.

Our Graduates Get to the Top

The universal success of our graduates as Professional Draftsmen, many of whom have advanced rapidly to positions of Chief Draftsmen, is evidence of the REAL VALUE of the training given by the COLUMBIA SCHOOL OF DRAFTING. Large numbers of our students have secured excellent positions even before completing their courses. We gladly cooperate with our students and graduates in securing desirable positions, which has been easy for us owing to the many demands upon us to supply our "product" for these positions.

Draftsmen Get $35 to $100 a Week

Our graduates have shown their ability to reach high salaries RAPIDLY, owing to their practical training. They secure excellent salaries AT THE START, as high as $2,000 a year. The usual pay of Draftsmen is $35 to $100 a week.

The Demand is Greater Than the Supply

The demand for properly trained Draftsmen has always been greater than the supply, but this is more so today than ever before, owing to greatly increased construction and mechanical development. The Draftsman is an essential connecting link in all engineering work. This great demand is indicated by the long lists of want ads for Draftsmen in the daily papers, especially those of industrial centers.

Not Merely a Corespondence School

The COLUMBIA SCHOOL OF DRAFTING not only trains Draftsmen by mail but is a large local institution of the highest standing. For many years it has been the leader in SPECIALIZING on the teaching of DRAFTING. This is an obvious advantage over teaching Drafting only as a side issue.

Drawing Outfit Furnished

We supply all our students with a drafting outfit for use throughout the course. There is no extra charge for this, and it becomes your personal property when the course bas been paid for in full.

Book of Particulars Sent FREE

If you are interested in becoming a practical Draftsman through the thorough training of the COLUMBIA SCHOOL OF DRAFTING, whereby you can enter a Profession in which your services will always be in demand, you are invited to write us for our free book of particulars, which describes our school and methods. (We employ no solicitors.) For your convenience you can fill out and

Mail This Coupon To-day

COLUMBIA SCHOOL OF DRAFTING,
14th and T Sts., N. W., Dept. 1065,
Washington, D. C.

Without obligation to me, please send me full particulars of your practical home study training in Drafting.

Name .....

Address .....

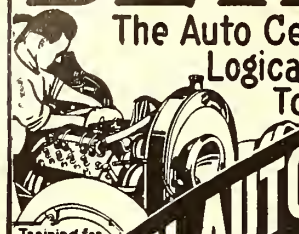
City..... State.....

www.americanradiohistory.com

DETROIT

The Auto Center is the Logical Place To

LEARN AUTO AND TRACTOR BUSINESS



Young Men of today are fortunate to live in the age of the Auto and Tractor Business. It is the greatest business in the world. Never before has there been such a wonderful future for ambitious men.

Big Demand For Trained Auto Men

Think of it!—Six million automobiles in use and thousands more being sold daily. Factories are rushed to the limit. Trained automobile men are wanted everywhere. The demand exceeds the supply. That's the business you can learn here at our school,—and such is the opportunity that awaits the trained automobile man.

Earn $100 to $400 Monthly

It is not at all difficult for a trained man to earn those salaries. Hundreds of our graduates are doing even better than that. Auto Factories, Garages, Service Stations and Tractor Factories are continually calling on us for graduates to fill responsible positions. Many of our graduates go into business for themselves. There are thousands of places where good garages and the services of competent, trained men are needed. These opportunities are unlimited.

Money-Back Garantee

We guarantee to qualify you for a position as chauffeur, repair man, tester, demonstrator, auto electrician, garage man, automobile dealer, or tractor mechanic and operator, paying from $100 to $400 monthly or refund your money.

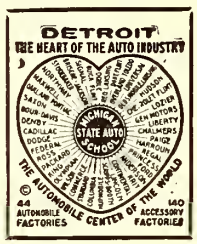
Complete Tractor Course Included

Complete instruction on the care, repair and maintenance of tractors is also included in our regular Auto Course. Tractor manufacturers give full co-operation. International, Moline and Emerson-Brantingham Co.'s have placed machines with us for the benefit of our students.

Brazing-Welding and Tire Repairing Taught in Separate Courses. Big Money Earned by Trained Competent Men in These Lines.

Big Factories Endorse Our School—In fact they assisted in the arrangement of our present Course. They know our equipment and our methods and heartily recommend our School.

Free Catalog—Gives complete information with views of school and equipment, also actual letters from satisfied graduates. Write for it. Better still, jump train and come as hundreds do. Our guarantee protects you.



MICHIGAN STATE AUTO SCHOOL

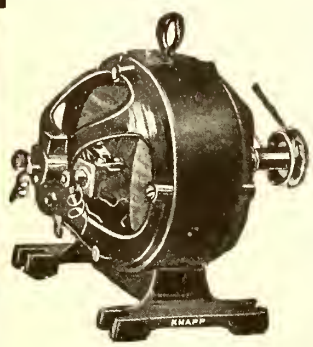
"Most Progressive Auto School in America"—"In the Heart of the Auto Industry"

Auto Building, 671 Woodward Avenue DETROIT, MICH., U. S. A.

DEPENDABLE KNAPP ELECTRIC SPECIALTIES

Motors and Electrical Specialties Are Best

Knapp Goods have stood the test for 29 years. No detail in construction has been spared to make them the best that money can buy. The complete Knapp line includes Toy and Power Motors, Generators and Dynamos. Specialties and Novelties that amuse and instruct. Fans, Rheostats, Compasses, etc. And Knapp prices are always lowest. Always insist on Knapp Goods.



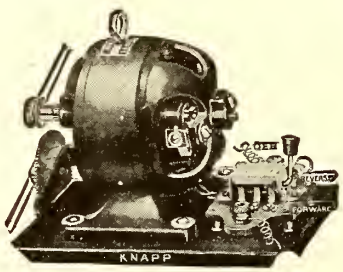
KNAPP DYNAMO MOTOR

Will electroplate, charge storage batteries, run lamps, motors, train of cars, induction coils,—in fact, the number of experiments it can be used for is unlimited. Runs on 4 to 6 Volts or can be connected to run on 110 Volts through a transformer.

Price, Complete, $8.00

KNAPP "LEADER"

An efficient and reliable motor that greatly resembles the big motors of real power plants. Drives from either pulley. Two speeds and reverse. A motor that you will be proud to own and one that will give you unlimited service.



Price, Complete, $4.00

Order to-day. Or your dealer can secure them for you. DESCRIPTIVE CIRCULAR and CATALOG of celebrated **KNAPP MOTORS** *and Electrical Specialties from 10c up mailed FREE on request.*

KNAPP ELECTRIC & NOVELTY CO., 523 West 51st Street, New York City

SMOKE IT BEFORE YOU PAY FOR IT

Order on your Business Stationery



To introduce this new and better way to make a pipe we make this extraordinary offer, we will let you smoke this pipe before you pay for it. More than 10,000 BANKERS HAVE BOUGHT BY MAIL. Genuine French Briar, solid Vulcanite mouth piece. Its simple construction makes cleaning easy. Try it. If it is not satisfactory you may return it. Price $1.50. Straight or Bent Models. You breathe, not pull through this excellent pipe and we guarantee satisfaction.

THE CALUMET CO.
CINCINNATI, OHIO
(Mail Sales Division Dept. A)



TYPEWRITERS

$10 AND UP. ALL MAKES. SAVE $25 TO $50 on rebuilt at the factory by the well-known "Young Process." Sold for low cash—installment or rented. Rental applies on purchase price. Write for full details and guarantee. Free trial. YOUNG TYPEWRITER CO., Dept. 824, Chicago



FINLAY Engineering College Kansas City, Missouri

Only School of the Kind in the West

Electricity, Steam, Gas, Armature Winding, A. C., D. C. Auto. Intensive training, courses, six weeks, three and five months, year and two year. Day and night. Enroll any time. Write.

advanced over us in scientific attainments, as is proven by the wonderful "canals." If that were the case, we should also be justified in assuming further that these Martians have far surpast us in their development of Radio in all its branches. In fact, as we discard the limits of the science of astronomy why should we put any check on our pleasant speculations? No doubt, then, the Martians possess a perfect unidirectional sending and receiving outfit, and one which is so sensitive that they can easily pick up signals from the earth in spite of the great diminution of energy which these would undergo on their way thru space. And no doubt they can send out signals with sufficient energy to be picked up by us. Some people have announced the reception of mysterious signals which they were convinced were not of terrestrial origin. We do not feel competent to discuss the electrotechnical phase of the interplanetary communication problem. It seems that the most difficult part of the game would be the first conscious interchange of probably meaningless signals; intelligent speech would soon follow.

Often science is more astounding than the greatest romance spun by the most vivid imagination, and sometimes she is a destroyer of pretty dreams. We may conclude with this unsatisfactory statement: There undoubtedly is life on planets of stars other than the sun, but communication with their inhabitants is at present certainly out of the question; in the solar system itself, where interplanetary communication is not without the realms of possibility, no evidence of extra-terrestrial life has been found, tho its existence is not precluded.

HOW WE COULD TALK TO MARS BY RADIO.

In connection with Dr. Brainin's above article in which the professor advocates the use of the radio to bridge the gulf between the Earth and Mars, it is pointed out that in 1919 already Mr. H. Gernsback advanced such a plan. His article which was printed in the May 1910 issue of *Modern Electrics* magazine shows that the idea is not only feasible but eminently practical. In those days it was not possible to cover by radio one thousand miles, unless we had a power of at least 2 kilowatts at our disposal. Today with our sensitive vacuum tube amplifiers, it is possible to bridge one thousand miles with a ½ K. W. with ease, and in exceptional cases ¼ K. W. will bridge the distance. It should be borne in mind that this distance is thru the earth's atmosphere which greatly impedes propagation of radio waves. If radio waves are a manifestation of the lumiferous ether, and few scientists doubt that it is, then the earth's atmosphere not only greatly restricts the sending impulses, but cuts them down enormously.

Take a ray of light, as any astronomer knows the stars overhead are always seen best for the reason that in this case the light ray only passes thru thirty or forty miles of atmosphere. On the other hand when stars are observed low down in the horizon where the ray must pass thru hundreds of miles of atmosphere, it is very difficult and somtimes impossible to see the stars at all. It is a well-known fact that light rays and electro-magnetic waves (such as radio waves) belong to the same family and only differ in respect to wave length.

For that reason, it should be possible to send radio waves thru interstellar space with much greater facility than thru the terrestial atmosphere. Where it takes today one half or one quarter K. W. to transmit radio waves over one thousand miles of Earth, there is no doubt that this distance can be increased ten or twenty fold in the outer space, providing always that it is possible to propagate the waves on the *outside* of our atmophere, which fact we do not know as a certainty. It is a specula-

www.americanradiohistory.com

tion among scientists today if the radio waves can pass beyond the atmosphere at all.

Inasmuch as the light rays pass thru the Earth's atmosphere with ease, however, there seems but little doubt that radio waves will act in a similar fashion. Once we grant this truth, it should be simple for us to telegraph or telephone to Mars. If we figure at the rate of ½ K. W. per thousand miles on Earth thru our atmosphere, it should be possible to telegraph over the space of 35 million miles which separates the Earth from Mars at the time of oppostitution by using anywhere from five to eight thousand K. W.

In his article in May 1919, Mr. H. Gernsback proposed using 70,000 K. W. to telegraph from the Earth to Mars. At that time it was figured that this tremendous energy would be required as then it was necessary to figure at the rate of 2 K. W. per thousand miles. Mr. Gernsback proposed at that time to use all existing radio stations in the United States and Canada, *operating them* simultaneously by means of telegraph lines connecting all the stations together and working them from one central point.

In other words, a station in San Francisco and another one in New Orleans was to be operated from a central key at Washington. This idea would accomplish two things. In the first place it is even today impossible to operate a station of four or five thousand K. W. capacity. No station could hope to handle such a tremendous energy. But by using separate stations, the object can be readily realized providing these stations can be operated simultaneously.

Connecting such stations together by means of a land wire, however, is only a theoretical consideration and is not practical. The reason is that electricity in passing thru a long land line of several thousand miles takes a good deal of time in transmission, sometimes as much as three quarters of a second. For this reason if the key was pressed in Washington, the station at San Francisco *would lag behind* for a fraction of a second from the one in New Orleans. For this reason, except if signals were being sent out at a very slow rate, the scheme would be impractical. In our illustration shown elsewhere, this difficulty has been overcome by connecting these stations together not by means of a wire, *but operating them by means of radio control.* This is a thing not very difficult of accomplishing these days when distant control by radio has been tested out. The scheme would work thus:

An operator seated in Washington would press his master key. This key in turn would operate his own radio station. The impulses sent out from this station will cover the entire globe practically instantaneous, and reaching the various high power stations, *will operate these stations the same as if an operator were seated at each one of these stations.* In other words, instead of using land wires, radio would be used. The advantage of this system is that all stations can be operated simultaneously down to the smallest fraction of a second, and the important part of this scheme is that it costs practically nothing or only a relatively small sum to put the idea into operation any time when we are inclined to make the experiment. The important other consideration is of course that all the stations would have to be tuned to a certain wave length so that all of them would work in unison, the same as if there were only one single huge station. We have enough power in existing stations in the United States and Canada today to bridge the 35 million miles between the Earth and Mars.

K. I. Shorthand hastened his promotion from stenographer to executive; now he depends upon it more than ever



You Need K. I. Shorthand Whatever Your Calling

The wonderful thing about K. I. Shorthand is the way it helps people in all walks of life. Engineers, chemists, contractors, clerks, mechanics, professional men and women, and farmers have learned K. I. Shorthand and are enthusiastic in its praise. At last **you** can learn shorthand **so quickly** and **so inexpensively** that it **is worth your while.**

— **This new, amazingly simple stenography will enable you to put down conversations rapidly as spoken,** take messages verbatim, record board-meeting facts, jot down business-getting ideas, and stand ready to help you every time anything important must be written down fully and instantly. **You do not have to study months to do this.** Just five evenings at home is all that is necessary. Greater speed comes quickly with practice. Learn K. I. Shorthand because it will be the biggest little investment of your life.

You Can learn in 5 evenings

K. I. Shorthand is the ideal system for stenographers or secretaries. You can prepare yourself for a position in weeks as compared to months by the old-fashioned systems—there is so much less to learn and remember. It is the most practical, concise and readable system in the world. Notes years old can be transcribed as readily as when fresh—just like longhand. Would you not give best satisfaction to your employer with a stenographic system that enables you to do that?

30 Days' Approval

Do not doubt for a minute that you can learn K. I. Shorthand in five evenings even though you may not know the first thing about stenography. It is not a bit remarkable for anyone to learn all the lessons in the system that quickly.

Why put in months of grinding study at some difficult old-fashioned system? Save time! Save money! Learn **K. I. Shorthand,** the new easy as A-B-C method of speed writing.

The cost of the course is lower than it has ever been possible to purchase a stenographic education. Everyone can afford it. K. I. Shorthand is used in government service and courts as well as public corporations and private businesses. Preferred for highly technical matter because of its remarkable accuracy and legibility.

Simplified K. I. Shorthand dispenses with all special positions, light and heavy shading and other confusing and speed-retarding rules of old systems. You will be delighted.

Try 2 Lessons FREE

You learn K. I. Shorthand in your own home by our mail tuition course. The lessons are fascinating. Experts guide you in acquiring proficiency quickly. **Send for two free lessons and complete information. You may then continue the entire course on a month's approval.**



"Go ahead! I'm getting it all in K. I. Shorthand"

Here is a complete course—not merely a text-book. Remember, there is no system to compare with K. I. Shorthand in brevity and practicability — and no course giving correspondence instruction obtainable at anything like our price.

We give you a positive guarantee that you can learn or no cost to you. King Institute is incorporated in New York State $100,000.00 authorized capital. Mail the coupon or write a letter asking for free lessons and complete information. Be sure to mention "Electrical Experimenter."

Used In Professions—"I am now past 83 and use K. I. Shorthand for my professional work in making records of cases. I like K. I. Shorthand System very much, indeed, and have recommended it to some who I think will enroll."
A. P. DAVIS, M.D.

In One Week!—"I learned K. I. Shorthand within five hours and in one week afterwards I was able to write 90 *words per minute.* I set down all my notes in K. I. Shorthand and can read them weeks afterwards. I believe that everybody should learn K. I. Shorthand as it is simple and also inexpensive. It is worth ten times what is asked for it. You have done everything you promised."
BYRON W. CREW.

A Pleasure to Learn—"It was a pleasure to learn K. I. Shorthand. Within three hours I could write any word. I can now write over 100 *words per minute* and am positive that by a little more practice I could speed up to 150 words a minute. It is easy to read one's notes in K. I. Shorthand."
(Miss) JOY WADSWORTH.

Professional Stenographer—"Until recently I knew absolutely nothing of shorthand. To-day I am holding a position as stenographer in the office of Inspector of Buildings where the terms apply almost wholly to building construction. I think this sufficient recommendation of your system."
(Mrs.) E. M. FULTON.

Used In Big Business—"I learned your system of shorthand to save time in making notes while passing about the plant. After only slight study I can take down ordinary conversations. K. I. Shorthand is *practical, time-saving* and *simple.*"
S. B. ROPER

MAIL THE COUPON OR WRITE

King Institute

EN-300, Station F, New York, N. Y.
or 8 S. Wabash Ave., EN-300 Chicago, Ill.

Please send me the first two lessons in K. I. Shorthand FREE, also full information.

Name .....

Address..... EN-300

www.americanradiohistory.com

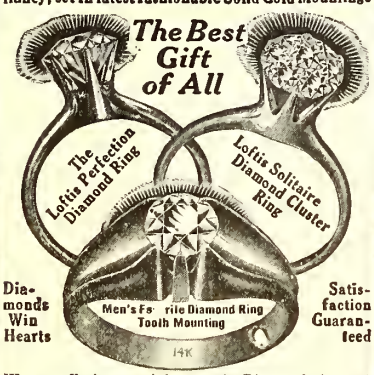
Loftis Bros. & Co.

DIAMONDS WATCHES ON CREDIT

ESTABLISHED 1858

Select Christmas Gifts from Our Catalog. Send for it Today.

Our Diamonds are distinctive in beauty, of great brilliancy, set in latest fashionable Solid Gold Mountings



Diamonds Win Hearts

Satisfaction Guaranteed

We are offering special values in Diamond rings at $25, $50, $75, $100, $125. Credit terms, one-fifth down, balance in 8 equal amounts, payable monthly.

Suggestions for Presents

Diamond Rings, Solitaire	$25 up	Diamond Lockets	$10 up
Loftis Solitaire Diamond Cluster Rings	100 up	Diamond Cuff Links	5 up
Diamond La Vallieres	10 up	Diamond Scarf Pins	6 up
Diamond Brooches	7 up	Wrist Watches	22 up
Diamond Ear Screws	25 up	Watches, gold filled	18 up
Diamond Studs	10 up	Cameo Rings, Diamond-set	12 up
		Vest Chains, solid gold	12 up

Send for Catalog, make selections and have as many articles as you wish charged in one account. Liberty Bonds accepted.

EVERY ARTICLE IN OUR CATALOG is specially selected and priced unusually low. Whatever you select will be sent prepaid. You see and examine the article right in your own hands. If satisfied, pay one-fifth of purchase price and keep it; balance divided into eight equal amounts, payable monthly. Splendid bargains in 25-year guaranteed Watches on credit terms as low as $2.50 a month. To the Cash Buyer: While our prices are lower than the cash prices quoted by other concerns, we make a discount of 8 per cent for cash in full in advance, or on delivery.

We Have Been in Business Over 60 Years

LOFTIS BROS. & CO.

THE NATIONAL CREDIT JEWELERS

Dept. F 108 N. State St., Chicago, Illinois

Stores in Leading Cities

NO CARBON—MORE POWER—LESS FUEL

Price 50c up



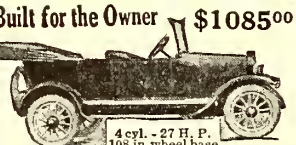
On market 5 years. Over 10,000,000 in use. Every set guaranteed. Popular thru service. Don't rebore cylinders. "NO-LEAK-O" makes good when others fail. Made different. Give results no other ring can. Write for booklet. Order from nearest Jobber, or write direct

NO-LEAK-O PISTON RING CO., Baltimore, Md.

Beware of Imitations. See that NO-LEAK-O is on EVERY PACKAGE

The Seneca MOTOR CAR

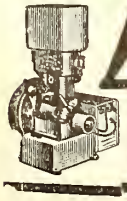
Built for the Owner $1085.00



Simple, Sturdy construction. Low cost of up-keep and operation. Cantilever springs in rear. Comfortable E-Z riding

Dealers Wanted Immediate deliveries. Fifth successful year. Increased output. Liberal newspaper advertising in dealers' territory. Wonderful opportunities. Write or Wire NOW.

THE SENECA MOTORCAR CO., 51 Seneca F't'y, FOSTORIA, OHIO



SMALL ENGINES

Perfected Gasoline Engines—½, 1 and 1½ h. p.—for Farm and Shop use. Price, $27.50 and up. Also,

WASHING MACHINES

We ship on trial. Send for Booklet and Special Offer.

SIEVERKROPP ENGINE CO.

1401—19th St., Racine, Wis.

STARTER for FORD CARS

New Arc Rivals Sunlight

(Continued from page 627)

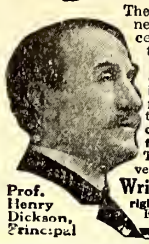
markable feature is the fact that colors can be matched in this light. The quality of the rays is such that when they are analyzed by means of a spectroscope, the spectrum is almost identical with that of sunlight, except for the fact that there is a trifle more ultra-violet. This color is invisible, but photographs may be taken by its means, and hence it is more ideal than real sunlight for the taking of motion pictures. A very small lens opening may be used in the motion picture camera, as the light is always intensely brilliant, and the pictures turned out give a better definition and a sharper focus. It is also fitted with a special diafram by means of which several spot-lights may be thrown into different parts of the room. Another of its marvelous features is the fact that this spot-light can be thrown *without a beam.*

One unit consumes 15 K.W. or 150 amperes. Expensive? No, not at all, when we take into consideration the light produced by this unit and an equal amount of light produced by other units. It would take thirty-two 30-ampere arc lights to produce as much light as one 150-ampere Sunlight Arc lamp; thirty-two 30-ampere arc lights use 960 amperes, compared with 150 amperes of the Sunlight Arc—a saving of 80 per cent. The Sunlight Arc is very appropriately named, inasmuch as the main part of its illumination is produced by a very intense white flame vapor, which is found in the deep crater formed in the burning end of the positive electrode, which electrode as we have said is revolved slowly by an electric motor. As a result of concentrating such a tremendous candle-power in a space as small as the crater in the end of a ⅝-inch carbon rod, there is a brilliancy of 800 candle-power to every portion of vapor therein confined the size of a pin head. This vapor has the great advantage of making the arc non-flickering, and slight drafts will not affect it. In other words, it is the same practically as the vapor surrounding the sun, and as tho we had actually taken a pinch of the sun and thrown it into the lamp to do its duty.

One will realize at once the intense amount of illumination which is necessary in order to take 160 to 200 pictures per second with the *Novagraph* slow movie camera. In one of the photographs is shown the Novograph camera taking motion pictures of the heart-beat of an animal. The camera has its lens focust downward, while the two arc lights, one on each side, are sending their beams down upon the rapidly beating heart of the animal. In taking these pictures, the animal is first chloroformed, then artificial respiration is carried on, so that blood circulation is not stopt or altered, enough chloroform or ether being given to produce complete anesthesia. The thorax is then cut open and held in position by blunt hooks, while the camera grinds out its thousands of feet of film. The pictures produced in this way were remarkable, and absolutely no hitch occurred while the Sunlight Arcs were in operation.

We have already referred to the picture of Miss Marguerite Clark. Examine this picture again and notice the wonderful sunlight effect, the beautiful definition of shadows and the softness of tone. There is none of that vague frightened look which stars generally have under other forms of illumination. She seems perfectly comfortable standing by the window, while the "sunbeams" play on her. Only one arc was used on this occasion. Hence the rays, almost parallel, produce shadows which rival sunlight as no other lamp does.

Stop Forgetting Memory the Basis of All Knowledge



The Key To Success

The secret of business and social success is the ability to remember. I can make your mind an infallible classified index from which you can instantly select thoughts, facts, figures, names, faces. Enables you to concentrate, develop self-control, overcome bashfulness, think on your feet, address an audience. Easy. Simple. The result of 20 years' experience developing memories of thousands.

Prof. Henry Dickson, Principal

Write Today for free booklet "How to Remember" and Copyrighted Memory Test, also how to obtain my FREE book, "How To Speak In Public."

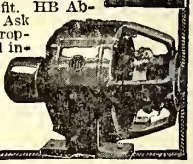
Dickson School of Memory, 101 Hearst Bldg., Chicago, Ill.

PROFITS for YOU Charging Batteries Making Electric Lights

Make your electric lights for as low as 2c per KW and at the same time get profits of $100 to $150 per month charging batteries. The HB Lighting and Battery Charging Set does it for you. Sturdy, dependable, economical to operate from line shaft or engine. No electrical experience required. BIG MONTHLY PROFITS.

Small Payment Puts This Money-Maker In Your Garage or Shop

Balance on easy monthly terms. Profits quickly and easily pay for outfit. HB Absolute Money-Back Guarantee. Ask our Service Department about proper size for your needs. For full information, pin this ad to your letterhead and write NOW.



HOBART BROTHERS COMPANY

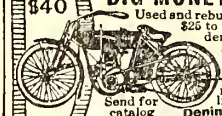
Box 116E, Troy, Ohio

Successful Manufacturers Since 1893

ENINGER WILL SAVE $40

BIG MONEY SAVINGS FOR YOU

Used and rebuilt motorcycles, single and twins, $25 to $100. Used bicycles, $5.00; tandems, $10. All machines guaranteed in good working order. New bicycles and motorcycles at Factory prices. You save dealers' profits. Motorcycle and automobile tires too, $3.00. Complete line of parts and supplies.



Send for catalog Deninger Cycle Co., Rochester, N.Y.

YOU 25 TO 50 DOLLARS

FREE! Sonora



These phonograph needles replace steel needles, play many times and are used on ALL MAKES of steel needle records. Economical, convenient, sweeten tone, and preserve records. 25c per card of 5, 40c in Canada. Write today for FREE sample.

Semi-Permanent Silvered NEEDLES

Sonora Phonograph Sales Company, Inc.

GEORGE E. BRIGHTSON, President

279 Broadway, Dept. C, New York Toronto: Ryrie Bldg.

POPULARITY FOLLOWS THE UKULELE





If you play quaint, dreamy Hawaiian music or latest songs on the Ukulele you will be wanted everywhere. We teach by mail 20 simple lessons; give you free a genuine Hawaiian Ukulele, music, everything—no extras. Ask us to send the story of Hawaiian music. You will love it. No obligation—absolutely free.

The Hawaiian Institute of Music

1400 Broadway, Dept. 5K, New York

The ROGERS

Violet Ray, High Frequency Generator

Does not burn out. No sparking—therefore all shocks are eliminated. An ideal outfit, fully guaranteed as to material and workmanship.

PRICE COMPLETE With One Surface Applicator $25.00

Send for free descriptive Booklet

The Rogers Electric Laboratories Co.

Dept. B, 2056 E. 4th St., Cleveland, Ohio

Bliss Electrical School

ELECTRICAL ENGINEERING

Condensed Course—Complete in One Year. Sound, scientific, practical—without frills. For young men of energy and character. 26th year opens September 25th. Write for new catalogue.

220 Takoma Avenue, Washington, D. C.

Subscribe to

RADIO AMATEUR NEWS

$1.50 a year

EXPERIMENTER PUBLISHING COMPANY,

231 Fulton St., New York City

www.americanradiohistory.com

"Old Phonograph Record" Contest.

(Continued from page 646)

turbine can be made with any size records. When finished it may be coupled with a small dynamo. First slip a threaded iron rod thru a record, slip on a washer, then a record, etc. I used five "Little Wonder" records and obtained satisfactory results. When the records are on, screw a nut on the ends to keep them from wobbling. Now make the box. Make it just large enough to fit over the records. It may be made round, but it is easier to make it square and fill in the corners with wood as in the figure. Bore two holes in the sides and put a piece of pipe in firmly to make good bearings for the shaft. On each side put washers and a nut. A pulley can be put on or just couple it with a dynamo, etc. Put two pipes in the housing, one to lead the water in and the other to serve as an outlet.

Contributed by W. P. Jones, 176 Mutual Street, Toronto, Ont., Can.

FOURTH HONORABLE MENTION.

An Electric Egg Tester.

This is an idea for making an electric "Egg Tester" from a 10-cent record. A holder is cut from a piece of tin or brass with a hole in one end to fit on to the neck of an electric light bulb, and fastened to the record as shown. Then a hole is made, either round or egg shape, in the center of the *record*. The light is turned on, and the egg is held over the hole. The record is black and the light coming thru the hole makes the egg show up, and in this way indicates if it is good or bad.

Contributed by Lawrence Bean, Lock Box 7, AuSable Forks, N. Y.

FIFTH HONORABLE MENTION.

Radio Compass Antenna.

The Radio Compass Antenna described on page 328 of the August *Electrical Experimenter* may be constructed by procuring two 10-inch old phonograph discs. On one disc draw diameters at right angles. Cut a perfect square, whose side is 4½", from white paper and draw diagonals. Paste the square on one disc so that the center of the square will be over the center of the disc's circle.

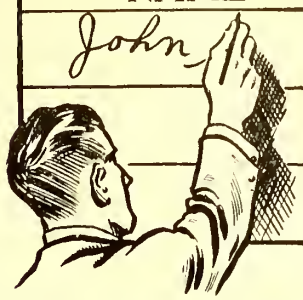
One-sixteenth inch "in" from each corner of the square, drill the holes A, B, C, D, Figure 1, with a No. 27 drill. Bisect each side of the square and drill holes E, F, G, H. Clamp the discs together and drill the second one the same way, using the first as a guide.

Eight 1¼", 6-32 screws are now procured and put thru the holes in the first disc and fitted with fiber tubes ¾" long and just large enough to fit over the screws. The second disc is then placed on and fastened with 6-32 nuts.

This completes the form. A coil consisting of 240 turns of S. C. C. wire is wound on the form. This aerial, properly connected, should prove very useful to those unable to erect a large outdoor antenna.

Work of this antenna as a Radio Compass: Such an antenna, under certain conditions, when properly connected, as is shown on page 328, of the August issue, will operate the radiodynamic "Ionic Machine" described by the writer in the May 1917, issue. In my above mentioned article, the binding posts of the "Ionic Tuners" are shown directly above the "Ionic Tuners" (and rectifiers), which are themselves shown at "7" and "8," Figure 1.

It is to these binding posts that the leads of the "Radio Compass" antenna should be connected. The buzzer of the "Ionic Machine" will then start, as soon as the coil

NAME	POSITION	SALARY
	AUTOMOBILE ENGINEER	$125 A WEEK
	REPAIR MAN	$50 A WEEK
	CHAUFFEUR	$30 A WEEK

Put Your Name On This Pay-Roll

Men like you are wanted for big-pay positions in the fascinating field of automobile engineering. We have made it easy for you to fit yourself for one of these positions. You don't have to go to school. You don't have to serve an apprenticeship. Fifteen automobile engineers and specialists have compiled a spare-time reading course that will equip you to be an automobile expert without taking any time from your present work.

AUTO BOOKS

6 Volumes Shipped Free

Now ready for you—an up-to-the-minute six-volume library on Automobile Engineering, covering the construction, care and repair of pleasure cars, motor trucks and motorcycles. Brimming over with advanced information on Lighting Systems, Garage Design and Equipment, Welding and other repair methods. Contains everything that a mechanic or an engineer or a motorcyclist or the owner or prospective owner of a motor car ought to know. Written in simple language that anybody can understand. Tastefully bound in American Morocco, flexible covers, gold stamped, 2,650 pages and 2,100 illustrations, tables and explanatory diagrams. A library that cost thousands of dollars, to compile but that comes to you free for 7 days' examination.

Partial List of Contents

More than 100 blue prints of wiring diagrams
Explosion Motors
Welding
Motor Construction and Repair
Carburetors and Settings
Valves, Cooling
Lubrication
Fly-Wheels
Clutch
Transmission
Final Drive
Steering Frames
Tires
Vulcanizing
Ignition
Starting and Lighting Systems
Shop Kinks
Commercial Garage Design and Equipment
Electrics
Storage Batteries Care and Repair
Motorcycles
Commercial Trucks
Glossary

Only 7c a Day Not a cent to pay in advance. First you see the books in your own home or shop. Just mail coupon and pay express charges when books arrive. You can read them and study them for seven whole days before you decide whether you want to keep them or not. If you like the books send only $2 in seven days and $2 a month until the special introductory price of $19.80 has been paid. (Regular price $30.00.) Along with the set goes a year's consulting membership in the American Technical Society. (Regular price $12.) This great bargain offer must soon be withdrawn.

Send No Money Now

Don't take our word for it. **See the books without cost.** There is so much profit in this offer for you, that we urge you to waste not a moment in sending for the books.

Put the coupon in the mails today. Send no money—only the coupon!



FREE!

With every set is included—FREE—a Consulting Membership which gives you the privilege of submitting your perplexing problems to a corps of experts for an entire year. This Consulting Membership regularly sells for $12.00.

American Technical Society
Dept. A258, Chicago, Ill.

American Technical Society, Dept. A258, Chicago, Ill.

Please send me the 6-volume set, Automobile Engineering, for 7 days' examination, shipping charges collect. If I decide to buy, I will send $2 within 7 days and the balance at $2 a month until the $19.80 has been paid. Then you send me a receipt showing that the $30.00 set of books and the $12 Consulting Membership are mine and fully paid for. If I think I can get along without the books after the seven days' trial I will return them at your expense.

Name .....

Address ..... Reference.....

www.americanradiohistory.com

Ten Reasons

WHY YOU SHOULD BECOME A

Doctor of Chiropractic

1. Because Chiropractic is the foremost drugless profession of the day.
2. Because Chiropractic brings results quicker and with greater frequency than any other healing method now known.
3. Because Chiropractors invariably enjoy greater financial prosperity than practitioners of any other method.
4. Because YOU cannot hope to achieve economic independence and the feeling of security that you desire by working for others.
5. Because YOU thereby become one of the pioneers of a profession than which there is none more promising today.
6. Because Chiropractic is in line with evolution of Science, and is in accord with natural laws.
7. Because Chiropractors are gradually winning, universal recognition thru their achievements.
8. Because the Chiropractic field is absolutely unhampered by competition.
9. Because the demand for Chiropractors is nationwide, and is growing with tremendous strides.
10. Because YOU owe it to YOURSELF and to society to be of maximum benefit to both, potentially and actually.

Do not accept our word for the above.

Write for Booklet X and details, or call personally.

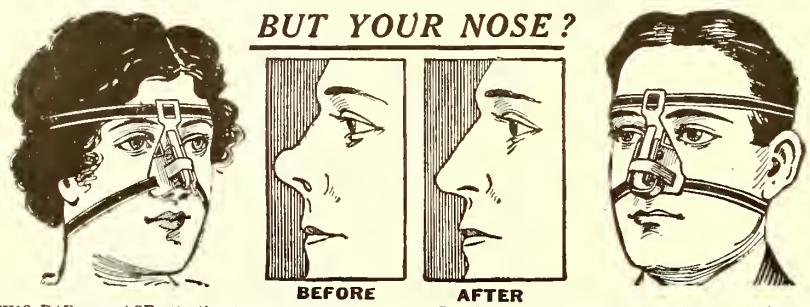
Second fall class registers Nov. 1-15.

The New York College of Chiropractic

1416 Broadway **New York City**

YOU HAVE A BEAUTIFUL FACE

BUT YOUR NOSE?



BEFORE **AFTER**

IN THIS DAY AND AGE attention to your appearance is an absolute necessity if you expect to make the most out of life. Not only should you wish to appear as attractive as possible, for your own self-satisfaction, which is alone well worth your efforts, but you will find the world in general judging you greatly, if not wholly, by your "*looks*," therefore it pays to "look your best" at all times.

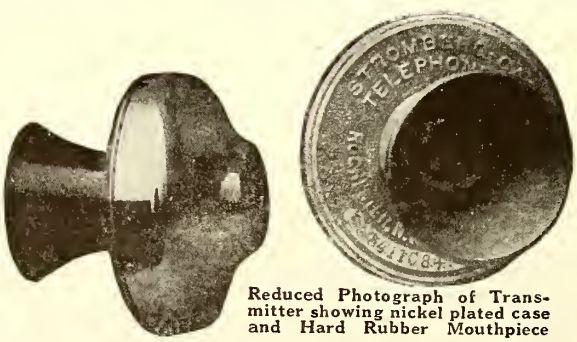
Permit no one to see you looking otherwise, it will injure your welfare! Upon the impression you constantly make rests the failure or success of your life. Which is to be your ultimate destiny? My new *Nose-Shaper*, "TRADOS" (Model 24) corrects now ill-shaped noses without operation, quickly, safely and permanently. Is pleasant and does not interfere with one's daily occupation, being worn at night.

Write today for free booklet, which tells you how to correct ill-shaped noses without cost if not satisfactory

M. TRILETY, Face Specialist **1283 Ackerman Bldg., Binghamton, N. Y.**

SPECIAL SALE!

We have on hand 2,000 Carbon Grain Transmitters as per photograph. They are first-class instruments and may be used for all kind of experiments, especially for wireless telephone sets, where a heavy current is to be passed through. Slightly used, but in perfect working order. Money refunded if not satisfied. A real bargain. Order one or more today.



Reduced Photograph of Transmitter showing nickel plated case and Hard Rubber Mouthpiece

$1.00

ONLY

Postage extra.

Ship. Weight, 2 lbs.

Diameter, 3¼ ins.

THE ELECTRO IMPORTING CO., 231 Fulton St., NEW YORK

of the antenna becomes by rotation directly in line with the plane of the propagation of the wave radiated from any station which is sending.

I thought that it might be interesting to know that the "Radio Compass Antenna" is capable of directional radiodynamic control.

Contributed by Otto E. Curtis, 84 St. Stephen Street, Boston, Mass.

SIXTH HONORABLE MENTION.
Cylindrical Records for Oudin Coil.

The old cylindrical Edison records make a fine form to wind coils on, as the grooves hold the wire in place. Such forms can be used for a small Tesla or Oudin coil, primary or secondary for small loose couplers, tuning coils and loading coils. They give far better insulation than cardboard tubes, which often shrink and then the wire slips or loosens.

Contributed by G. Edwin Smith, Wanchula, Fla.

SEVENTH HONORABLE MENTION.
Transformer Section Translators.

I give nerewith a sketch of a practical use for old phonograph records—for insulating between the "pies" or sections of transformers or spark coils. The drawing, I think, is self-explanatory.

A square hole is cut in the center of the record to receive the core and they are placed one between each pie.

Contributed by Benedict V. K. French, 225 Allen Street, Buffalo, N. Y.

EIGHTH HONORABLE MENTION.
Radio "Loading Coil."

Herewith is a diagram of how to make a "loading coil" out of old phonograph records. You take two 10-inch records, a piece of wood 2" in diameter and 2" thick and then shellac (or bolt) them together as shown. Then wind No. 28 cotton insulated copper wire on it, until there is only one inch space left on the records, take out a tap every layer or so, and bring to a switch point on top of the record. Put on a switch arm and hook it up. I have used this for some time and it works as well as a regular purchased one.

Contributed by Howard B. Bogue, 812 N. Ainsworth Avenue, Tacoma, Wash.

NINTH HONORABLE MENTION.
Sharpening Razors with Old Records.

First take an old record, sandpaper it with coarse sandpaper, then with a fine sandpaper, and finally moisten the record and put a little kitchen cleanser on and with a block of wood rub it until a fine surface appears. When fully cleaned and dry, put it on the Victrola and let it run and hold the razor against it. If razor is very dull put a little "Bon Ami" on and it will sharpen with ease.

Contributed by Jos. Ruhland, Oconomowoc, Wis.

(Our office boy "Fips," who saw this suggestion, barked out thus: Suppose Mr. Ruhland sandpapers the *reverse* side of the record and leaves the music side alone. Then let him cover his Victrola turn-table with leather. Insert the razor between the record and turn-table and one side of the razor will be sharpened, the other stropped! Then don't neglect to play the music on top of the record *at the same time.* I'll apply for patent on this rinktum at once! Bad, eh?)

WIRELESS TAPPING DONE BY BELA KUN.

By "tapping" the wireless exchanges between Paris and Gen. D'Esprey, with the powerful wireless plant at Caepel, Bela Kun, the Bolshevik dictator of Hungary, was enabled to foretell every move made by the Rumanians in their contemplated offensive or by the counter revolutionary government in Hungary.

Bela Kun has been enabled to read cipher messages by means of a code book which was stolen from the Allies.

www.americanradiohistory.com

Science In Slang

By Emerson Easterling

(Continued from page 669)

are they; and cousins, we might say. How about the life forms on the other planet? A different compositional environment would produce a different sort of beings, wouldn't it? You know that Man was manufactured out of the dust of the Earth. Well, Mars has a little differently compounded dust—not much, I guess, but somewhat different—sufficient to make a different being. Of course that is just my idea of it—but all of this Mars stuff is mostly *idea*.

"If we concede that Mars is on the lookout for some expression from us, or is waiting for some response to some of their signals that past over our heads; what do you think that they dream we are trying to tell them by the evidence given in the way of smoke and surface altering in our past battles—especially the last European shooting match? Don't you think that they could see us making the big smoke and everything? Of course, accepting that they can see."

"I don't suppose that they could hear us—thru all that thirty-five or forty million miles of ether," put in Bender.

"They may have their sense of hearing developed like a dog's smell," said Punk sardonically.

"Talking of the optical demonstrations that are proposed to attract Mars' attention, what do you suppose they think of our volcanos? I suppose they understand them, probably know more about such things than we do———"

"Prohibition and the sex question included," snapt in Punk, licking his lips and not even looking at the pretty young woman that past by our crowd and almost turned the subject.

"I suppose that their time intervals are the same as ours—being that that goes in as one of the basic creative fundamentals—if you know what that means, I don't, hardly. In that respect we are homogenous—if there is any one at the other end of our proposition to make a *we*.

"The telegraph idea will probably make the gap better than the ash and darkness stuff. The etherial disturbances are more than likely better adapted to the Martians' receivability. Perhaps they have not developed along that line tho. Perhaps they have not the natural resources in the electrical line, due to different mineral composition or planetary relation. However, I don't think that that would make any difference, tho.

"Anyway we will sit tight and watch such guys as Marconi, Tesla, Wood and the like and see what turns up with Mars at the other end of the line. We are *doing* things today in that line. We, the world in general, will not be more surprised at finding that we have neighbors on Mars than were we at the discovery of the force of electricity, the air-ship, the telephone, wireless, or the shimmie.

"Our train is ready to get on its way to Pendleton," spoke up Punk, "Row-de-dow!"

"Here's to talking to Mars over the back yard fence," said Stokes, as we walked out thru the gate to our waiting train. "We may pick up a paper tomorrow and read that some one has just received a message from Mars."

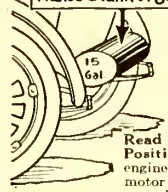
"Yes," replied Bender, "and it might be a false alarm too."

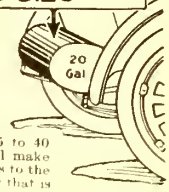
3¢ Worth of Miracle Motor-Gas Equals a Gallon of Gasoline

A Wonderful Chemical Discovery that Increases the Power of Gasoline fully One-third

Big Money Saver for the Motorist. Eliminates Carbon, Makes Engine run Smoother, Saves Gas and greatly increases mileage

Miracle Motor Gas Makes a tank of gasoline this size **Equal in Service** to a tank of gasoline this size





YOU will be surprised at the way it multiplies the power of your gasoline. Hundreds of letters from customers who have made many tests show that MIRACLE MOTOR-GAS gives from 15 to 40 per cent more mileage from every gallon of gas. Many even claim greater results than that. But even at 20 per cent it is a good investment.

MIRACLE MOTOR-GAS Guaranteed Absolutely Harmless

Read This Positive Guarantee MIRACLE MOTOR-GAS is guaranteed to increase mileage from 15 to 40 percent, eliminate and prevent carbon, greatly reduce cost of fuel and make engine run smoother. Contains no Acid, Alkali, Ether or other chemicals in any way injurious to the motor or any other mechanism of a car. We will make good any injury or damage to any car that is caused by the use of Miracle Motor-Gas.

HERE'S WHAT USERS OF MIRACLE MOTOR-GAS SAY ABOUT IT

"I was very doubtful about the ability of your MIRACLE MOTOR-GAS to do what you said it would do. After using it I find the car works much smoother, the amount of gasoline is very much less and the CARBON deposits in the engine are a thing of the PAST, which fact alone more than pays the cost of your product. As you know, I was a hard customer to convince but I have been thoroughly convinced and satisfied."—Dr. D. W. McKenna.

"I am well pleased and satisfied with the results obtained by the use of your MIRACLE MOTOR-GAS. Where I used to get 18 miles to the gallon of gasoline, I now get 25 miles; an increase of over 40 per cent in mileage, besides the car runs smoother, picks up quicker, and positively removes all CARBON. Seven hundred additional miles at a cost of one dollar is certainly satisfactory."—I. T. A. Lewis.

AGENTS WANTED EVERYWHERE—300% PROFIT

One of the greatest Money Making opportunities ever dreamed of is offered you right now. Live, hustling sales agents are wanted to sell Miracle Motor-Gas in every town and county of the United States. Think of the millions of car owners and every one a good prospect. Practically every auto driver will buy when once you have explained what Miracle Motor-Gas will do. It is one of the biggest Money Makers you can find. Your field is unlimited. There are thousands of autos all around you and you can help to make every one of them run more efficiently with Miracle Motor-Gas.

EASY TO SELL! PROFITS COME FAST! RESULTS WILL SURPRISE YOU!

Once you get started selling Miracle Motor-Gas you will be surprised to find how easy it sells. Just show our Guarantee to some auto owner and ask what he would give for a product that would do what we guarantee it to do, Read again those letters from users, —they tell the story. We have hundreds more just like them. As soon as Auto owners find what Miracle Motor-Gas will do, they scramble to get a supply. You don't have to sell it. You only need to convince a few;—the others will follow. Sales come so fast that you can't help but make money. One agent felt like pinching his own arm to see if it was really himself who was making so much money. It isn't at all unusual for our men to make $10, $25 and $50 per day. Some even do better than that.

ONE MAN MADE $210.00 IN ONE DAY. READ THESE LETTERS.

These are extracts from actual letters received from sales agents. They tell the story better than we can. Here's what O. V. Darling wrote us:—

"Made a test of Miracle Motor-Gas today on a 103 mile trip. Had two Fords. The one with the Miracle-Gas used only 3¼ gallons of gasoline; the one without Miracle-Gas used 7 gallons." As a result of this test he sold Miracle Motor-Gas like hot cakes. In one day he sold enough to make a clean profit of $210. We have his letter to that effect.

Next comes this letter from Dave Isom: — "My whole heart and soul are in this work. The Commercial Club of 4,000 members is boosting for me. Everyone is well pleased. Have two more men working for me. Send me 800 more packages by express. I can't afford to be waiting for goods. Sold 90 packages yesterday." (That's over $50 profit.)

And then read this one just received from R. Vollbrecht:— "Miracle Motor-Gas a big success. My 6 dozen were gone in two hours. Ship 50 dozen by return express. Will have to order in carload lots soon. Miracle Motor-Gas is a wonderful proposition."

HUNDREDS MAKING BIG MONEY—WHAT ARE YOU GOING TO DO.

Are you going to "get in" on this opportunity,—are you going to be one of the big money makers. Why work for a bare living when you can make hundreds every week. Don't let this chance slip by. Sit right down now and write us. Show the kind of stuff you are made of,—show folks that you too can make big money. Anyone with ambition and a willingness to work can make good with Miracle Motor-Gas. Read all those letters again. They prove you take no chances. Or, wire our bank. They'll tell you how we stand.

GET BUSY! DON'T WAIT!

Don't make the mistake of being a doubter and losing the opportunity. Our guarantee protects you. Or, better still, if you order two packages at the 50c trial price, and after testing them you aren't satisfied, send back the unused goods and get your dollar back. Miracle Motor-Gas is a proven proposition. It has demonstrated what it will do and now we want hundreds more good live agents to sell it. So get busy—get your order to us at once and tell us what territory you want. But you'll have to act quickly. Better get the Coupon on the way to us by return mail. Wire if you want terms for exclusive rights in your State.

CHAS. A. BUTLER & CO.,
193 Wayne Bldg., TOLEDO, OHIO
Reference: Home Savings Bank, Toledo.

CHAS. A. BUTLER & CO.,
193 Wayne Bldg., TOLEDO, OHIO.

If your proposition is all you claim for it, would like the exclusive agency for..... County. Send full particulars.

Enclosed is $1.00 for two packages of Miracle Motor Gas. (Retail price $1.00 each.) If I am not satisfied after I have used them, it is understood that you will refund my dollar.

Name.....
City.....
State.....

A $5.00 Electric Toaster-Stove for $2.50 Postpaid

A SPLENDID GIFT

TOASTS, FRIES, BOILS



Toasts bread as fast as you can Eat It. Attach to your lighting circuit and it is ready for use.

We furnish the parts. You do the assembling and save $2.50. Nothing complicated, anyone can assemble it in 15 minutes. No knowledge of electricity required.

Frame made of Steel, Nickel plated and highly polished. Size 10" long, 6" wide and 3¾" high. Furnished with 6-foot cord and plug.

EMPIRE ELECTRIC SPECIALTIES CO., Not Inc., 2212 Sedgwick St., Chicago, Ill.

CORE WIRE

At Pre-war Prices, 20cts. lb.

We have been fortunate in securing thru auction several tons of guaranteed pure, double annealed **Norway Iron Core Wire** and are selling this wire to "Experimenter" readers at 20c lb. This wire is just the thing for spark coils, transformers, etc., and it is, of course, a very much more superior product than the usual iron wire. We have only one size left:

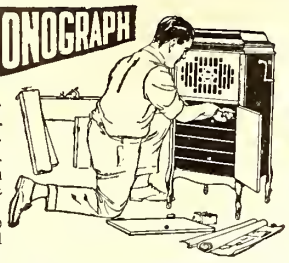
24 INCHES LONG. Thickness about No. 21 B and S

If this size should be too long we advise cutting the wire down yourself by means of shears. As long as the supply lasts we offer this wire as described above to our customers at the very low price of 20c a pound. Add postage or we will ship express collect. Order at once.

ELECTRO IMPORTING CO., 231 Fulton Street, New York City

www.americanradiohistory.com

MAKE A PHONOGRAPH



Save over half the regular cost. Enjoy your own handiwork. You can make a splendid talking machine that plays all records. Blueprints with full instructions. **Extra-Special introductory offer.** Double spring motor, 12" turntable, Universal tone arm reproduces all records and all other necessary metal parts, together with three 10" double-faced records, furnished complete for $11.85.

Write for catalogue. Send 25c for blueprints only. **$11.85**

PROTECTO EXPLOSION AUTOMOBILE WHISTLE



A pleasant, distinctive warning signal—more effective than a horn. THIS TYPE OF SIGNAL USED ON U. S. MAIL TRUCKS AND AUTOMOBILES. Self installed in two minutes on any machine or motorcycle; wrench only tool required. Cannot get out of order—NO WIRING. Money-back guarantee. $2.50 complete. **$2.50** Complete

Order NOW!

Marvel Curtain Windows



Bevel plate glass, nickel trimmed. High Quality. Insert them yourself in back or side curtains in 2 minutes. No mechanical skill or special tools required. Improves the appearance wonderfully. Various sizes and shapes shown in catalog. Priced according to size at **$1.00** and up



$3.00 complete set of 3 lights for 1917-18-19-20 Fords.

The MARVEL CO.
333 S. Dearborn St.
Dept. E2E, Chicago, Ill.

DEALERS — Agents, Garagemen, write today.

Armature Winding and Motor Generator



repair and operation can be quickly and thoroughly learned in the shops and laboratories of the School of Engineering of Milwaukee.

SPECIAL 6-MONTH COURSE

designed to fit students for important and remunerative positions in this great profession.

"Earn While You Learn" if you wish. Secure actual practice under wage-earning conditions.

Send NOW for special booklet and full particulars.

School of Engineering of Milwaukee
125-373 Broadway Milwaukee, Wis.

School of Engineering of Milwaukee,
125-373 Broadway, Milwaukee, Wis.
Gentlemen:
Please send me full information concerning your Armature Winding and Motor Generator Course.
Name .....
Address .....
Age .....Education.....

New Electrical Gyro Compass

(Continued from page 639)

Gyro Compass two wheels are used, so that both wheels combine their effect in fixing the meridian. When the ship rolls one of these rolls opposes the forces thereby set up, while the other holds and indicates the *true north.*

Figure 1 shows the binnacle stand with the glass dome cover taken off and the lower case dropt down, so as to show the two sensitive elements. Each wheel is mounted within a case which is suspended from a main frame and spider, as shown in figure 2. Following the standard practise of the U. S. Navy, the compass card is marked in degrees, instead of points of the compass, as formerly used by navigators on the old magnetic compasses.

The cross-section drawing, Fig. 2, shows the method of suspending the wheels from the framework, and also indicates the trolley, which is merely a very sensitive contact for detecting any movement of the wheels. It forms a pilot contact of a secondary system, whereby the compass card and other parts of the compass are operated by means of a motor, so as to relieve the wheels of all duty other than indicating the *true north.* As shown in the plan view, figure 3, the *azimuth motor* accomplishes the work of moving the card. It is a very small electric motor geared to a continuous rack under the compass card.

On the opposite side of the compass from the azimuth motor is a *transmitter.* This transmitter consists of three fingers which have electrical contacts, and are operated by means of a small cam shaft acting in under each contact. As the card is moved by the azimuth motor the same rack also operates the pinion that is connected to the cam shaft of the transmitter. Contact on the three fingers is made in such sequence as to connect in various pairs of poles in a step-by-step motor, mounted in the *repeater,* Fig. 5.

The main *Master* Gyro Compass is placed down below deck so as to protect it from weather and sea, as in Fig. 4. It has *repeaters,* however, that show its exact reading at any instant. A similar and familiar application of the repeater principle is that used in hotels and public buildings, where a master clock operates a number of repeater clocks. As stated above, a step-by-step motor is contained within the repeater, operated from a transmitter on the Master Gyro Compass. The step-by-step motor operates the card of the repeater mechanically, and its movements shadow those of the Master Compass. A number of repeaters are used on the ship, such as on the bridge, the Master's Cabin, on the stern deck, pilot house, and at all auxiliary steering stations.

The workmanship of a Gyro Compass must be of the very best. It will be seen how necessary this is when it is considered that each of the twin gyro wheels revolve at 12,000 revolutions per minute, or 200 r.p. second. Each wheel is driven by a small three-phase, induction motor.

A switchboard panel for controlling the ship's supply current, usually 120 volts, is also furnished. The ship's supply current is usually direct current and is converted by means of a motor-generator set to three-phase electricity for spinning the gyro wheels.

In case of failure of the ship's supply current the compass will still operate for a period of two hours, as a storage battery is connected in on the line and is automatically cut in when the emergency occurs.



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle massage. Can be used with or without electric current.

All users of the Lek-Tro-Shav speak well of it

A barber says—"Have shaved for years and have never used any shaving device near its equal."
A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."
No. 1 Made for use from Light Socket.
No. 2 Made for use from Dry Battery.
Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.

VIBRATING ELECTRIC RAZOR CO.
Dept. 122. Omaha, Nebr.

INVARIABLY

Four-months-for-a-dollar subscribers renew their orders for

THE PHOTO PLAY WORLD

because they find this high class publication indispensable for their library every month.

If you are not a regular reader, a dollar will bring you the next four numbers, each bigger and better than ever. When your subscription has expired you'll want the Photo Play World regularly.

The yearly subscription is $3.50—35 cents on newsstands.

Sample copy on request.

THE DOWNS PUBLISHING COMPANY
Bulletin Building Philadelphia, Pa.

U.S. BABY TANK It goes with real Yankee Pep—by its own power
MADE OF METAL, IN CAMOUFLAGED COLORS OR GRAY



Most remarkable Toy ever invented. By drawing the Tank backward, either with the hand or over the floor or table and then placing it down, it will crawl along, overcoming all obstacles, in the same life-like manner as the larger Tank that proved so deadly in the great war. What makes it go is somewhat of a mystery, for there is no mechanism to wind up as is usually understood with mechanical toys, yet this tank will keep plodding along ten times longer than the ordinary run of toys. It will perform dozens of the most wonderful stunts: it will go backward or forward at will, and altogether will give you more fun and amusement than any other toy yet brought out. 2½ inches long. Each packed in colored box. **Price only 35 cents prepaid, three for One Dollar, or $3.00 by the dozen, postpaid** to any address in the world. Johnson Smith & Co., Dept. E13, 3224 N. Halsted St., Chicago, Ill.

Telegraph Pictures
BY ELECTRICITY



Complete sets of two machines of this marvelous equipment at ridiculously low prices. Instructive, mystifying and useful. This picture of President Wilson was telegraphed by these machines. Will transmit pictures, maps, drawings and hand writing. Picture telegraphing is the coming science. Write today.

J. LEISHMAN CO., Dept. T Ogden, Utah



PARCHEESI

Our Grandparents played Parcheesi. Our Parents played Parcheesi. Our Children want Parcheesi. Sold by Department Stores, Toy and Stationery Stores.

Manufactured by
SELCHOW & RIGHTER CO., N. Y.

www.americanradiohistory.com



In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries addrest to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are publisht here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

Automatic Release Air Valve.

(350) T. A. Ayes, Ilion, N. Y., writes:

Having applied for a patent on an "Automatic Release Air Valve," am writing you to get your opinion as to its merits, aad whether you think it advisable to try to commercialize it or not.

The idea of the valve is to release the remaining pressure from the air hose after the valve has been closed, and do it automatically, not leaving it to the trainman to do it or not, and by the use of such a valve you are reducing the chances of wrecks and accidents by doing away with the cause of such accidents.

There are hundreds of accidents (and wrecks) caused by air hoses bursting while the train is in motion, and in every case it can be traced to a weak air hose; and what caused the air hose to be weak? It was all O.K. when it was put on the train, because the railroads will not have anything but the best in air hose, knowing the responsibility resting on it. Then what made it burst? One thing, and only one thing, and that is the very thing my valve does away with, which is: pulling the hose apart when an uncoupling is made, while the pressure is still in the hose. With a pressure of 85 lbs. it takes quite a pull to part two hose, and the pull either bursts them at once or it strains them so that the jar and vibration of the running motion of the train causes them to burst, with a consequent wreck, with loss of life in lots of cases.

The valve used at the present time is the cause of it all, for the reason that it will not release the pressure from the hose when turned, and the trainmen will not run the risk of uncoupling the hose by hand, as they run the chance of getting hurt every time they do so. So in either case my valve is cutting down the chance of accidents either to the trainmen or train.

Another incident: A week or so ago, at Dunkirk, N. Y., a train ran into the rear of another train because the airbrakes refused to function, for the reason that a tramp stealing a ride on the train had (accidentally or otherwise) turned one of the air valves (or cocks), so that when the engineer applied the brakes they only worked on the engine and tender, because the line was cut at the valve turned by the tramp. Now, if that valve had been one of mine, the accident would never have occurred from that cause, for the simple reason that as soon as the valve had been turned by the tramp the brakes would have been set either on the train or on the engine, according to whichever value he turned.

I am only asking you as to what you think of the idea, as I have a working model and know it will do everything claimed for it, and will cost but very little more than the present valve.

A. If our correspondent's release air valve works in the way he claims, he certainly should have a valuable patent, and we are sure that the railroads would welcome such an improvement on their airbrake system, which improvement is badly needed. We would advise our correspondent to get in touch with a patent attorney.

Automatic Sign.

(351) Robert N. Rose, Queens, L. I., has this to say:

I would like to ask your advice concerning a new idea of mine and hope to see the answer in a near issue of your magazine.

Perhaps you have noticed on some of the subway stations electric signs which announce the destination of the trains as they come into the station. I have devised an automatic way of lighting these and it would cost but a small amount to make them.

About a foot above the rails from the beginning of the station to the end I would run several copper strips a few inches above each other. On the train would be a metal wedge fastened to a rod which runs up on the car, and say the lowest strip was to operate the sign reading "This train for Van Cortlandt Park." The conductor would then move the rod to where on the dial it said the above station (or to some other station) and when the train would come into the station the wedge would connect the circuit and the sign would light. There are also some other features, but this is the principle.

A. There is nothing fundamentally new in a device of this kind, and there have been ingenious patents issued along similar lines before, but somehow or other traction companies have never been kindly disposed toward such devices.

Cold Air Device.

(352) Irving Simpson, Brooklyn, N. Y., advises us:

I enclose a drawing of an idea which occurred to me while thinking of the methods of cooling the atmosphere in the home and elsewhere during the hot days of summer. The common electric fan does not cool but merely "stirs up" the air.

It is a well-known fact to scientists that when a current of electricity is passed thru a bar of Bismuth and a bar of Antimony and both bars touched to each other, the temperature at the points at which the bars touch is sufficiently low to freeze water. This "cold" generated is the principle of my idea.

A sheet of Bismuth and a sheet of Antimony (which are specially prepared so that they are perforated and that the space between the perforations are raised to points), are placed in a case so that the points of both plates touch. The current is turned on and a fan is placed in back. The current of air coming from the fan passes out thru the screen into the surrounding air.

A. The idea set forth by our correspondent is certainly worth trying, but we do not know offhand what success it will have. While the Peltier effect is well known and has been described at length in this magazine, very little is known as to what happens when a plurality of contacts are made between the two metals. The experiment is surely worth while trying. We think a patent can be obtained on this device should it work.

Electric Alarm Clock.

(353) George Daniels, Hamilton, Ontario, Canada, writes this Department, with sketch, proposing a novel and simple electric ringing attachment for alarm clocks, and asks our advice as to its patent aspects.

A. Your scheme is certainly very simple, and should work satisfactorily with any standard form of alarm clock on the market. The editor has experimented a great deal with electric alarm clock attachments, and has often considered the commercial possibilities of manufacturing such an attachment, but he has come to the conclusion that very few people will invest in one of these devices unless they can be purchased for a very small sum—certainly less than $1.50 or $2.00, the usual price for the simplest electric alarm clock attachments available.

U.S. PATENTS



Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

LANCASTER & ALLWINE

253 OURAY BLDG.,
WASHINGTON, D. C.

PATENTS

TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
164 Owen Building, Washington, D. C.
2276-8 Woolworth Bldg., New York City

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE ON CONCEPTION." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention we will give our opinion as to its patentable nature. Electrical cases a specialty.

Our illustrated Guide Book, "HOW TO OBTAIN A PATENT," sent Free on request. Highest References Prompt Attention Reasonable Terms.

FREE COUPON VICTOR J. EVANS & CO., Patent Attorneys

Chicago Offices: 1114 Tacoma Bldg. Pittsburgh Offices: 514 Empire Bldg. Philadelphia Offices: 135 S. Broad St. New York Offices: 1001-1007 Woolworth Bldg.
MAIN OFFICES: 779 NINTH, WASHINGTON, D. C.

Name..... Address.....

www.americanradiohistory.com

? HOW TO MAKE

MONEY WITH YOUR PATENT
HOW TO SELL
HOW TO KEEP CONTROL
HOW TO ORGANIZE
HOW TO RAISE MONEY

These and hundreds of other vital questions the inventor must know to make his invention a financial success, fully answered in

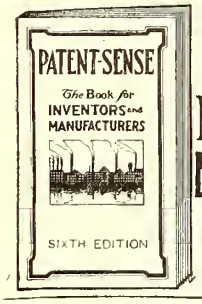
The Inventors' Manual of Valuable Information

$1.00 per copy, postpaid

If you have a patent or are thinking of taking out one, protect yourself by getting all the information this valuable book contains.

Write for free circular and table of contents.

G. E. Perry Company, Publishers, 1324 Broadway N. Y.



"The Book for Inventors and Manufacturers"

SIXTH EDITION.

By return mail FREE. Write LACEY & LACEY Dept. K, Washington, D.C.

Competent Patent Service

By a Former Examining Official of the U. S. Patent Office

NORMAN T. WHITAKER

Lawyer and Engineer

480 Whitaker Bldg. Washington, D. C.

Branch Office, 87 Nassau St., New York City.

INQUIRIES INVITED

Free Book on PATENTS

Write today for a Free Copy of "How to Obtain a Patent." Contains valuable information and advice to inventors. Tells how to secure Patents. Send model or sketch of your invention for opinion of its patentable nature—Free. (20 years experience.) Talbert & Talbert, 4287 Talbert Bldg., Washington, D. C.

How to obtain a Patent

PATENTS

Inventors Invited to Write for Information and Particulars

Highest References. Best Results. Promptness Assured.

WATSON E. COLEMAN

Patent Lawyer

624 F Street N. W. Washington, D. C.

PATENTS

Hand Books on Patents, Trade Marks, etc., sent free. Our 70 years of experience, efficient service, and fair dealing, assure fullest value and protection to the applicant. The Scientific American should be read by all inventors.

MUNN & CO., 622 Woolworth Bldg., N. Y.

Washington Office, 622 F St., Washington, D. C.

Patents Promptly Procured

Send sketch or model for actual search of U. S. Patents. Highest references. Personal service. Moderate fees. Write for Free Patent Book.

GEORGE P. KIMMEL, Patent Lawyer
99-Z Loan & Trust Bldg. Washington, D. C.

STAMPS

50 diff. Belgium (large bi-color), China, Jamaica, Portugal, Venezuela, etc., 10c; 100 diff., nice packet, 20c; 1,000 well mixed, 40c; 100 var. U. S., 50c; 1,000 hinges, 10c; Agts. wanted 50%. List free. I buy stamps. L. B. Dover, Overland, Mo

Patent Advice

(Continued)

However, you might do very well in endeavoring to obtain a patent on your scheme, and to this end you should take the matter up with a patent attorney, a number of reliable ones advertising in these columns. As soon as you place the drawing and specifications of this device in the hands of your patent attorney, he will immediately make a search of the patent office records to ascertain whether or not there are any conflicting patents, and will notify you one way or the other.

In closing, we might suggest that to successfully commercialize this electric alarm attachment, it should be simplified and made as cheap as possible, utilizing a flashlight battery instead of a large size dry cell, and also using as cheap a bell as is available, or even designing a very simple and cheaply manufactured bell for the apparatus.

Electric Motor.

(354) J. P. Morgan, Pliny, W. Va., writes us, showing a sketch of a simple D. C. rotating field motor, as he calls it, and wants to know if it would be worth patenting. It employs oppositely disposed pairs of field poles, which are successively excited so as to drag around a pivoted iron armature.

A. The scheme you show with the motor field composed of a series of electro-magnets, which are excited in pairs successively by direct current in order to drag around a simple iron armature having no windings upon it, is quite old, indeed. You will find such motors of several different and very ingenious types described in many of the books on electric toy making. In fact, the earliest electric motors, dating back 35 to 40 years or more, were constructed on this simple, yet inefficient principle.

Unless you have something novel in mind in regard to the design of this small motor, which you do not disclose in your description of the device, we do not believe you can obtain a patent on it. However, the best thing to do is to take the matter up with a reliable patent attorney, and we can recommend any of those advertising in these columns. The patent attorney will make a search of the U. S. Patent Office Records and ascertain the nearest similar patents which cover ideas identical to or closely resembling your proposal.

Simplified Electric Motors.

(355) C. W. Halligan, Lewisburg, Pa., writes as follows:

"I should like your advice on this idea: It consists essentially in a radically different design of electric motor, and would, no doubt, find its principal application in toy motors.

"Referring to the drawing, Fig. 1 shows an end view of the essential parts. A single magnetic coil is provided with a hollow core. An iron shield surrounds one-half the interior of this space, as shown. The shaft is at the center of the solenoid, and is provided with a cam extending the whole length of the shaft and shaped as shown.

"In Fig. 2 the brush mechanism is shown. The cam, continued beyond the end of the solenoid, provides a means of making and breaking the circuit at the correct time.

"In operation, if the solenoid be energized, the cam will tend to assume the position indicated by the dotted lines in Fig. 1, following a well-known law in physics. At this time the current is broken and is again made after one-half revolution by the brush shown in Fig. 2. In this way rotation is effected.

"In Fig. 3 an alternative construction is indicated. In this case the shield is omitted and the axis of rotation is eccentric to the axis of the solenoid. The principle is the same: The iron will tend to assume a position such that the distribution of magnetic flux is symmetrical, the same as in the magnetic vane type of volt and ammeter. A suitable flywheel must be provided on the shaft to insure an even rotation.

"Please advise me as to the commercial value of the idea and its patentability as soon as convenient."

A. As you suggest, the theory of the operation of this motor is correct, and undoubtedly it will develop quite an appreciable amount of power if a very powerful electro-magnet coil is used. We presume you have done some experimenting already and determined just what proportions the various parts need to have, in order to work most efficiently for a given voltage and amperage.

We do not remember having seen anything just like this in the form of an electric motor for toy purposes, and believe that you can obtain a patent on it. Its simplicity should make it quite worth while for commercial development, so long as the design is confined to a small motor, as, of course, a large motor built on this principle would be very wasteful of energy. We would suggest that you put this in the hands of a patent attorney and have him make a search in the U. S. Patent Office for any conflicting patents. He will notify you directly whether or not there are any such patents which would interfere with the granting of a clear title patent for you on this invention.

PATENTS

If you have an invention and desire to secure a patent, send for our Free Guide Book, HOW TO GET YOUR PATENT. Tells our Terms, Methods, etc. Send model or sketch and description for our opinion of its patentable nature.

RANDOLPH & CO.

Dept. 172 Washington, D. C.

PATENTS C. L. PARKER Formerly Member Examining Corps, U. S. Patent Office. PATENT LAWYER McGill Bldg. Washington, D. C.

Patents, Trade Marks, Copyrights, Patent Litigation

Handbook for Inventors, "Protecting, Exploiting and Selling Inventions," sent upon request.

INVENTORS HAVEN'T YOU SOME IDEA that you can't just work out?

Give us the idea—we will develop it for you. Mechanical and electrical ideas developed. Experts in model and experimental work and in perfecting inventions. Designing and building labor-saving machinery a specialty. Get in touch with us—we can save you money.

ELK MFG. CO., INC.
1926 Broadway, New York

LEARN WATCH REPAIRING



You can learn by our modern and original system of instruction every part of the Watch Repairing Trade at home as good or better than at a shop. You can earn money while learning and secure a well paying position or start in business after completing our course of instruction. Good watch repairers are always in demand and earn from $20 to $35 per week. For particulars apply to the

Milwaukee School of Watchmaking 166 Mason St., Milwaukee, Wis.

Become a
MOTION PICTURE OPERATOR

Prepare yourself for an all-year-round, steady, well-paying position; salary $30 weekly and upward; cost of instruction, $15; $5.00 will start you. Day and Evening Classes. No charge for positions secured.

Moving Picture Operators School
644 8th Ave., Near 42d St., New York

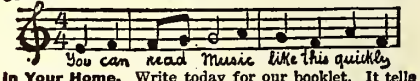
BE HAPPY ! !
YOU NEED NOT
STAMMER

Many have been cured by my system. Complete cure in from four to five weeks' treatment. Terms according to arrangements.

Write or call for details and references.

CHARLES PFERDMENGES,
25 E. Washington St. Chicago
Tel. Rand. 3431

MUSIC TAUGHT FREE



In Your Home. Write today for our booklet. It tells how to learn to play Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced pupils.
American School of Music, 57 Lakeside Bldg., Chicago

Electricians Get up-to-date in HOUSE WIRING! See TIME, MONEY, LABOR and MATERIAL by using our 98 GENUINE BLUE PRINT DRAWINGS, containing all the latest diagrams and connections known in house wiring—every diagram and connection up-to-the-minute as used by first class electricians for wiring BELLS, BURGLAR ALARMS, LIGHTS, ANNUNCIATORS, FIRE ALARMS and ELECTRIC GAS LIGHTING. These drawings are bound in the form of a flexible book (9 x 12) for convenience in using on the job. Send for them, and if they don't make you more efficient as a wireman and save you many times their cost as a contractor, return them and money will be refunded—you can't afford to be without them. ONE DOLLAR postpaid. Send for circulars on other sets of drawings.

PATENT SPECIALTY COMPANY
P. O. Box No. 583 San Francisco, Cal.

Music Lessons UNDER MASTER TEACHERS At Home — **Complete Conservatory Course by Mail**

Wonderful home study music lessons under great American and European teachers. Endorsed by Paderewski. Master teachers guide and coach you. Lessons a marvel of simplicity and completeness.

Any Instrument Write naming course you are interested in: Piano, Harmony, Voice, Public School Music, Violin, Cornet, Mandolin, Guitar, Banjo or Reed Organ —and we will send FREE CATALOG. SEND for it NOW!

University Extension Conservatory, 6112 Siegel-Myers Bldg., Chicago



Send for a Complete Catalog of
MASONIC BOOKS Jewelry and Goods
REDDING & CO.
Publishers and Manufacturers
Dept. 5 200 Fifth Avenue, N. Y.

www.americanradiohistory.com

Sun Signals for Fighting Forest Fires

(Continued from page 628)

est Service to extend heliograph communication to the work of discovering and extinguishing fires.

It is pointed out by Arthur L. Dahl that in order to test the adaptability of the heliograph to the fire patrol conditions some experiments were tried in the California National Forest in the northern part of California. A competent instructor was secured and seven men were chosen from among the rangers to learn the art of signaling. None of these seven men had any previous knowledge of the instrument, but they quickly learned the technical part of their work and became proficient operators in a very short time. When the experiments were begun the only apparatus available was the standard heliograph instrument used by the Signal Corps of the Army.

There are a number of these instruments used by the forest men. The instrument consists of two four-inch square mirrors and adjustable frames, a mirror bar, a sighting rod, a shutter and two hardwood tripods, to the top of which the whole outfit is attached. The equipment is rather bulky and weighs approximately twenty pounds. The principle of the heliograph is the reflection of the sun's rays steadily in a given direction, provision being made for alternately exposing and obscuring the mirror so as to transmit a series of long and short flashes. This device is set up at a point from which can be seen the station to be signaled. By means of the sighting rod and the tangent screws the instrument is sighted on the receiving station. The mirror is then so adjusted that the reflected ray is projected directly toward the station. The circle of illumination created by the mirror has a diameter *which increases approximately fifty feet for every mile of distance from the mirror.* For example: If the receiving station is six miles distant, the space at that spot within which the flash can be seen would be 300 feet wide. As the shutter is placed directly in the path of the reflected rays, flashes are transmitted by opening and closing the shutter. The actual manipulation is very similar to that used in telegraphing. The best code for heliograph communication is the Myer code, used as a standard by the Signal Corps.

It is stated that in some cases the Morse code has been used for this purpose, but since it was created primarily for audible signaling rather than visible signaling, it is not adapted for heliograph work. The Morse alphabet is based on a combination of ones and twos. For instance, the letter A is represented by 22, the letter L by 221, and the letter P by 1211. The one in the Myer code is represented by a short flash. This means holding the shutter open for about one-half second. The two is represented by two shorter flashes in quick succession. Spaces between words are represented by a long flash of about two seconds. It is of the utmost importance that uniformity in the mechanical movement of the shutter be cultivated, as lack of rhythm in the signals of the sender entails unnecessary concentration on the part of the receiver.

It is maintained that it is easier to send than to receive messages, and one of the difficulties to be overcome by the forest rangers was to secure perfect team work between the men, as the men at first sent their messages too fast to enable the "receiver" to decipher them. When the men had been taught the code, and were able to send messages, a definite system was laid out for the forest. There were within the experimental area two prominent peaks al-

To cut down the cost per cut the blade

A Matter of Teeth

The efficiency of a hack saw blade depends almost entirely upon the rake, the "set," and the pitch or number of teeth to the inch.

There's no overhanging "hook" to the teeth on a Starrett blade. With proper adjustment of weight or pressure, they'll cut just as fast on the last cut as on the first. The teeth are uniform in shape, "set" and spacing. That's why every blade in a box of Starrett saws cuts alike.

Starrett Hack Saws are made in varying pitches or number of teeth to the inch, from 10 to 32, according to the work they are intended for.

Different kinds and shapes of metal need different blades for economical cutting. Get Starrett blades, use them according to the Starrett Hack Saw Chart and watch your cost per cut decrease. Write for Catalog No. 21 "L E" it's free.

THE L. S. STARRETT CO.
The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.



Use Starrett Hack Saw Blades

42-963

$100 TO 400 PER MONTH
FOR AUTO AND TRACTOR EXPERTS

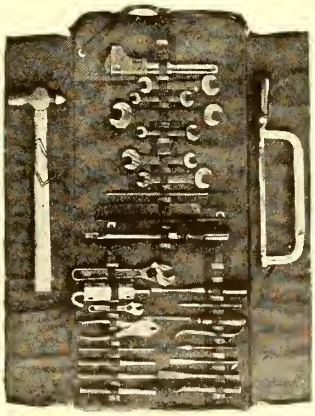
Learn at the School That Is Thorough

You and every man or boy who is interested in automobiles, trucks and tractors can positively learn to be a motor expert at The Milwaukee Motor School. Why? Because this school is so thorough—the instruction is so simple and clear that anyone who wants to can learn this profitable trade here. For over eight years this big school has been successfully teaching boys, men and young men to be motor experts and today our efficient instructors cannot be excelled for their ability to teach you anything you should know to earn big money as a motor-mechanic, chauffeur, garage owner, auto salesman, repair man or factory worker.

AN UNUSUAL SCHOOL

Men who have attended other schools come here to complete their training. Some of our graduates are employed by other schools as instructors. We make you an expert. We assure your success.

FREE TOOLS



SPECIAL OFFER

Everyone who enrolls now will receive a new kit of 29 tools without any charge whatever. These are not loaned but are actually yours to take home with you when you leave the school. There are no strings tied to this offer. This fine set of tools and kit bag are worth fully $17.50.

Low Tuition if You Write Today

Send for our new free book entitled "Making You Master of the Auto." Learn how we teach all the everyday problems concerning automobile and tractor engines—ignition, starting and lighting systems, magnetos, carburetors, etc.

Mail the coupon today

Milwaukee Motor School
Dept. 1158,
555 Downer St.,
Milwaukee, Wis.

Please send me your free book and full particulars of your Free Tool Kit offer.

Name .....
Address .....
State .....

FREE SEND FOR OUR FREE BOOK AND SPECIAL OFFER NOW

MILWAUKEE MOTOR SCHOOL
Dept. 1158 555 Downer Street, Milwaukee, Wis.

www.americanradiohistory.com

THE BEST

Yes, the best and only the best is cheapest in the end. Then why not apply this rule when taking a course in wireless? Our correspondence course is simple, easy to master, up to date and consists of 15 lesson books prepared by our expert theory instructors. All practice and transmitting apparatus for mastering the code is furnished free.

We Operate the One Big

radio school of the world, and this correspondence course is an extension of our activities, a Post Graduate Course in our Washington School being given you free, if you desire. You see we are not *A RADIO SCHOOL*, but actually and absolutely *THE RADIO SCHOOL*—the top one, the biggest one—the one that *HAS BEEN* and *IS* turning out the *WINNERS* every week. You can't compare us with any other school, because we are head and shoulders above all—the very top. You get the idea? You can't get a better or higher course, we are the final—the finish. Act now. Get a grip on yourself—take the big important step. Settle your career today. Our new catalogue, just out of press, will tell you how. Send for it.

SERVICE RADIO SCHOOL

Dept. E, 900-2 Pa. Ave. Washington, D. C

CARNOTITE

(Radium Mineral.) The American Pitchblende found in Colorado, from which *Radium* is extracted.

A generous piece, enough to conduct experiments, such as affecting photographic plates thru opaque material (similar to X-Ray pictures), first made by Sir W. Crookes and Mme. Curie, is furnished in neat, wooden box. **URANIUM ORE** (*Radio-Active*)

Containing about 35% of pure Uranium; also Radium and Vanadium. One of the most rare and interesting minerals. Twenty milligrams are furnished in glass vial protected by lead cover.

One box of *Carnotite* and one vial of *Uranium Ore* as described above 50c sent prepaid.

FORMULAS

Luminous Paint—Silver Plating Powder—Liquid Court Plaster—Soap Bubble Liquid—Straw Hat Bleach—Collapsible Tube Tooth Paste—Resilvering Mirror Liquid—Polish for Tan Shoes—Dressing for Tan Shoes—Paint to make Oil Cloth.

These Ten Recipes in sealed envelope for 50c. Sent prepaid.

SIDNEY SPECIALTY CO., 233 Fulton Street New York City

ready equipt for fire lookout work.

It is noted by Mr. Dahl that both peaks were connected by telephone with the Forest Supervisor's office and with the nearby rangers' cabin. In addition to these two principal peaks, there were five smaller ones, also connected by telephone. The first two points were made the central stations, and two of the best men were stationed there. The other five points were designated as substations. These substations reported to the nearest central station, and since each forest officer was furnished with all locating instruments it was merely necessary for the substation to report the degree angle of the fire from its point and add a short statement of local description.

A typical heliograph message would read: "Smoke bears 26 about seven miles on Rattlesnake Creek, near Bloody Rock. Just started. Burning in bush." If the same fire was discovered by several operators each would send a report. and by plotting the angle lines given in these reports would give the location of the fire, which would be at the point of intersection of those angles. The average speed attained by the operators was four words a minute. It will be noted that as the average message need not exceed twenty words, that after discovering a fire a good heliograph man can notify headquarters within five minutes, whereas under the old conditions he would have to ride for an hour to reach the nearest telephone. The range over which heliograph signaling may be effected on favorable atmospheric conditions is almost unlimited. By actual test *it was found that perfectly visible messages could be flashed for a distance of 45 miles and read without the a'd of a field glass.*

It is held that the only serious drawback to the use of the instrument is that on a cloudy day it is useless. When it had been determined that the heliograph was valuable to the forest officers, the next step was to secure a more portable and less awkward outfit. After much experimenting the ideal instrument for the use of the forest men was designed. The instrument proper is made of aluminum alloy with certain parts of bronze. It fits into a small leather case approximately the size and shape of a 3A kodak case, which very conveniently fits into the saddle bags on the horn of a patrolman's saddle. Instead of two heavy tripods, as in the case of the Army instrument, the new Forest Service instrument fits entirely on the head of one small tripod about 20 inches long 2 inches in diameter.

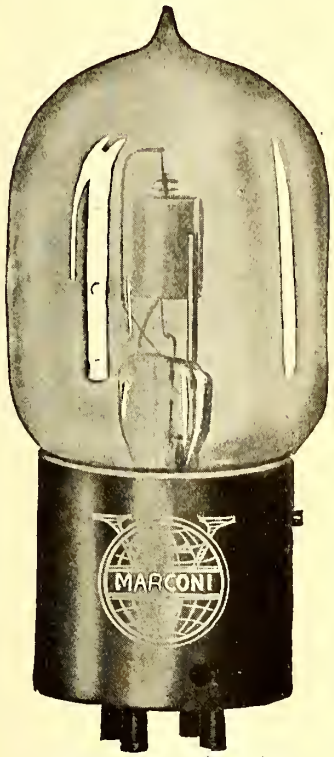
The entire equipment, including tripod and instrument, weighs about one-fifth of the standard instrument, and in bulk it bears the same relation. It was also found that by reducing the size of the mirror from 4½ inches square to 3 inches square no appreciable difference was made in the brilliancy of the flash. This afforded the opportunity of reducing the size of the whole instrument accordingly. As fast as the rangers on the different California forests can be taught to use the heliograph, they will be furnished with the new instruments, and on their rides through the mountains, if a fire is discovered, they need only proceed to the highest available point and flash their signal to the proper points where the "fire fighters" are notified their services are required.

Chicago has more telephones than all France, and a single office building in New York contains more than there are in the whole of Greece.

Siam's telephone service is owned and operated by the government, and Bangkok, the capital, is the only city with an exchange.

www.americanradiohistory.com

THE HEART OF THE WIRELESS



Fleming Pat. No. 803684
De Forest Pat. Nos. 841387-879532

An Amateur Station Without a Vacuum Tube is Years Behind the Times

MARCONI V.T.

$7.00 each

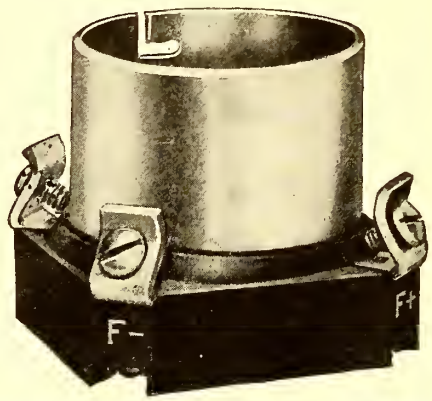
Under agreements recently effected the Marconi V. T. is the only vacuum tube, or audion, which may be sold to amateurs, laboratories, schools of instruction and experimenters.

The approximate operating life of the MARCONI V. T. is 1,500 hours.

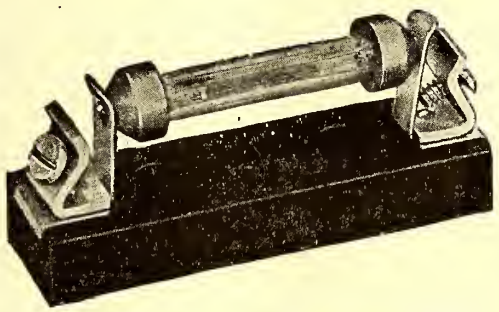
Class I.—Designed for use as a detector; operates with plate potential of 20 to 60 volts.

Class II.—Designed for use as an amplifier; plate potentials from 60 to 110 volts may be applied.

Tubes in either class may be used for detection or amplification, but those of Class I are best as detectors, and Class II tubes are superior as amplifiers.



Standardized Socket $1.50 additional



Standard Resistance, Complete $1.00

The Marconi Resistance, connected in the circuit between the grid and the filament of the Marconi V. T., is made in the following standard sizes:

½ megohm, 1 megohm, 2 megohms, 4 megohms, 6 megohms.

Resistances of any special fractional values up to 6 megohms can be supplied.

Send all remittances with order to COMMERCIAL DEPARTMENT

MARCONI WIRELESS TELEGRAPH CO. OF AMERICA

235 BROADWAY, NEW YORK

RETAIL OFFICE AND EXHIBITION ROOMS—25 ELM STREET, NEW YORK

Sole Distributors for De Forest Radio Telephone & Telegraph Co.

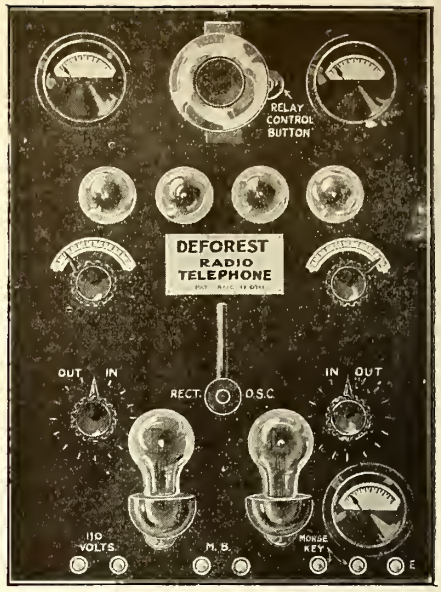
BRANCH OFFICES:

Schofield Bldg., Cleveland, Ohio
American Bldg., Baltimore, Md.
Insurance Exch. Bldg., San Francisco, Cal.
136 Federal St., Boston, Mass.
301 Commercial Bank Annex, New Orleans, La
109 South 2nd St., Philadelphia, Pa.

www.americanradiohistory.com

DE FOREST
Wireless Telephone

The Newest Development in the Radio Field



A Wireless Telephone that plugs into a lamp socket. A genuine DE FOREST UNDAMPED WAVE RADIOPHONE (and telegraph) OPERATING DIRECT FROM YOUR 60 CYCLE, 110 VOLT HOUSE CURRENT. NO MOTOR-GENERATOR REQUIRED. JUST PLUG IN AND TALK—SIMPLICITY ITSELF.

A greater invention than wireless telegraphy. Absolutely silent in operation. Trouble-proof, fool-proof and **only one adjustment required,** after which the instrument "stays right." Couldn't possibly be simpler to operate. Practically simultaneous transmission and reception by means of electrically operated relay transfer switch. Marvellous, snappy, clear speech. Voice quality superior to that over a wire. Absolutely stable in operation. Utmost selectivity. No decrement. The panel is divided into three divisions—rectifier, filter and oscillator. The rectifier employs two bulbs, thus taking advantage of both halves of the cycle. The filter of inductances and capacities smooths out the ripple, freeing the speech from distortion. The oscillator of four tubes comprises a new circuit of high efficiency both in power, output and modulation.

Tested Ranges { Telegraph 50 to 75 miles Depending upon aerial
Telephone 10 to 20 miles height and terrain.

Our actual experience with this set indicates that these ranges can be greatly exceeded.

Price Complete Including Bulbs $200.

You will eventually use this type of transmitter, now recognized as the most efficient of all low-power systems. Investigate this new De Forest production now. Order immediately to insure early delivery; either thru your regular dealer or direct from us.

DE FOREST RADIO TELEPHONE & TELEGRAPH COMPANY

Inventors and Manufacturers of Amateur and Commercial Radio Apparatus

1415 SEDGWICK AVENUE, NEW YORK CITY

EXPERIMENTERS! Get a SKINDERVIKEN Transmitter Button

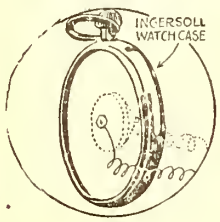


Fig. 1



Fig. 2

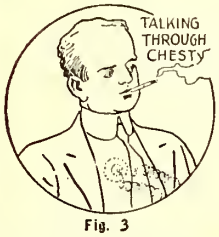


Fig. 3

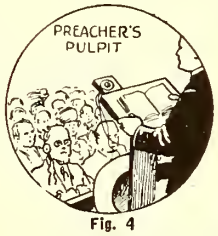
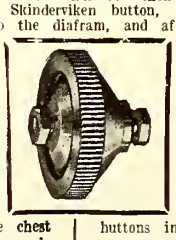


Fig. 4

THE SKINDERVIKEN TRANSMITTER BUTTON presents the latest advance in microphones and marks a revolution in transmitter construction. It works on an entirely new principle, takes up practically no room, and marks the end of all telephone transmitter troubles.

The SKINDERVIKEN TRANSMITTER BUTTON can be placed in any position and it will talk loudly and distinctly and is at the same time extraordinarily sensitive. It was primarily designed to replace the old damaged or burnt out transmitter. Simply unscrew and remove the telephone transmitter front, disconnect the two inside wires, unscrew and remove the bridge and the old electrode. There remains only the diafram. These wires are then connected with the Skinderviken button, the latter screwed to the diafram, and after screwing the old transmitter housing together again the telephone is ready for work.



ELETRICAL EXPERIMENTER readers will be particularly interested in all the different experiments that can be performed with the Skinderviken Button. Fig. 1 shows the Skinderviken button attached to the back of an Ingersol watch case. When speaking towards the inside of the case, it will be found that the voice is reproduced clearly and loudly. Fig. 2 shows another interesting stunt. By attaching the button to a tin diafram about the size of half a dollar, and by holding the diafram at the side of the throat, as shown, speech can be transmitted with surprising clarity. Fig. 3 illustrates the same arrangement placed on the chest as shown. In this position the transmitter will talk clearly and loudly. Fig. 4 shows an arrangement wherehy the Skinderviken button is attached on a thin wood board at the preacher's pulpit. His voice is clearly transmitted so that people hard of hearing can readily hear the sermon. Fig. 5 shows an interesting stunt, whereby a hole is drilled in the side of a thin glass water-tumbler; the sides of the glass thus acting as a diafram, the voice is clearly transmitted. Fig. 6 shows a simple match box Detectophone. The Skinderviken button is concealed inside of a box, only the small brass nut showing on the outside. This can be camouflaged as well. This device talks well. Fig. 7 shows how to transmit phonograph music at a distance merely by drilling a small hole in the phonograph arm and attaching the Skinderviken button; a very favorite experiment with all experimenters. Fig. 8. shows how a very sensitive Detectophone can be made by placing one of the buttons in the center of a lithographed cardboard picture, so that only the small brass nut shows. The large surface of the picture acts as a big diafram, and the voice is well reproduced.



Fig. 5

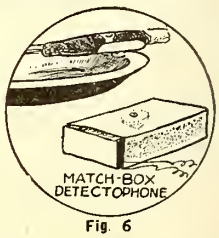


Fig. 6



Fig. 7



Fig. 8

Electrical Specialty Co.
Dept. S. 128 So. Eleventh St.
Philadelphia, Pa.

Gentlemen:
Enclosed please find $..... for which send immediately, prepaid, ... Skinderviken Transmitter Button.

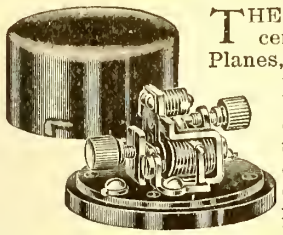
Name .....
Address .....
City .....State.....

ORDER TO-DAY
Price $1 Prepaid
Immediate Shipments
Electrical Specialty Co.
Dept. S, 128 So. Eleventh St.
PHILADELPHIA, PA.

www.americanradiohistory.com

Mesco Radio Buzzer

With Shunt Resistance
U. S. Navy and U. S. Army Standard



THE Radio Officers of the NC Planes, after testing all other buzzers, decided to use the "Mesco" on their radio equipment. The R-34 was equipped with two Mesco Radio Buzzers.

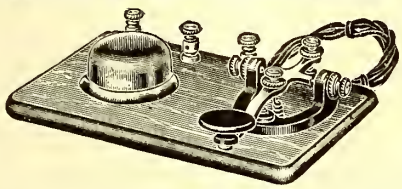
Why? Because of its reliability and constancy in operation; greater output efficiency; ease of adjustment; unaffected by extreme variations in weather conditions; exposed wires eliminated.

Sparking is almost entirely eliminated, so that the energy lost in light and heat in the operation of other buzzers is here conserved and radiated in the form of oscillating energy.

This buzzer maintains a constant note and is recommended as an exciter for checking wavemeters where pure note and ample energy are required.

List No. 55, Mesco Radio Buzzer
Price $2.05

MESCO WIRELESS PRACTICE SET

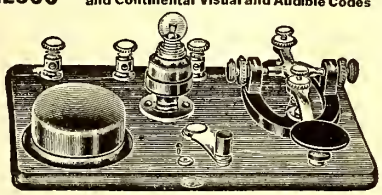


The Practice Set comprises a regular telegraph key without circuit breaker, a special high pitch buzzer, one cell Red Seal Dry Battery, and four feet of green silk covered flexible cord.

The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes.

List No. Price
342 Telegraph Practice Set, with Battery and cord.....$3.24
Weighs 4 lbs. packed.
Price does not include postage.

MESCO Combination Practice Set for Learning the Mo and Continental Visual and Audible Codes



This outfit is the only reliable instrument which will enable students to become proficient operators in the U. S. Naval Service, because it is equipped with a buzzer and miniature lamp enabling the user to master both the visual and audible signals quickly.

List No. 52—Practice Set with Red Seal Battery and Cord.....$4.05
Weighs 4 lbs. packed. Price does not include postage.

We carry a Large and Complete Line of Standard Wireless Material Recognized by Experts as such with Competent Experienced Wireless Attendants in Charge

Send for the New Edition of Our Catalog W28

It is pocket size, contains 264 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Wireless Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

Manhattan Electrical Supply Co., Inc.
17 Park Place, New York, N.Y.
CHICAGO 114 S. Wells St.
ST. LOUIS 1106 Pine St.
SAN FRANCISCO OFFICE: 604 Mission St.

Radio Links Airplane and Submarine

(Continued from page 661)

Wire.—Seven strands of No. 14 B. & S. phosphor bronze wire, covered with 40 per cent Para rubber, to a total outside diameter of ½".

Supports.—Two substantial masts, triangular or oval in cross-section, 3 feet high with insulators at the top, erected at either end of the boat and braced to withstand considerable strain.

Stanchions.—Two stanchions insulated at the top placed high enough to support the wire at least 1 foot above the bridge.

Radio Insulators.—An extra radio insulator similar to the one already installed, placed in the space now occupied by the antenna mast (or in any convenient place at least 3 feet away from the other insulator), and extended vertically thru the hull.

Water-tight Sleeves.—(To prevent the sea water from working up under the insulation on wire.) Brass stock 3" long bored to outside dimensions of insulated wire for 2¾" and drilled dimensions of bare wire for ¼". The wire is stript of insulation for a few inches and is slipt thru the sleeve, the insulated portion being smeared with white lead and the stript portion being soldered to the brass.

Grounded Connections.—Lugs on end of wire grounded to hull by bolts.

Lead-in Joints.—Junction of insulated wire and radio conductor is made watertight by marine glue poured in a cylindrical mold.

Wire-tightening Device. — (*a*) Turnbuckles may be placed at the end of each wire next to ground connections; or (*b*) in order to take up slack on both wires equally it is preferable if construction of boat permits to place one insulated turnbuckle between stanchions on bridge.

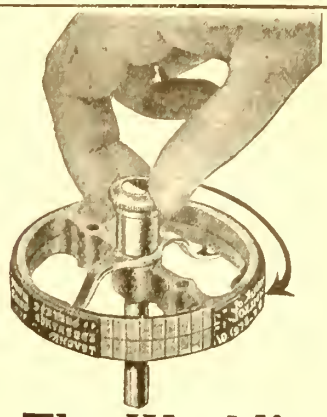
Receiving Apparatus.—Tuner capable of receiving wave lengths of 300 to 16,000 meters, and oscillation audion detector and three-stage resistance type amplifier of French design. (The Navy standard audion control box type SE 1,000 two-step amplifier cannot be used unless placed in a noise-proof and inductive-proof compartment.)

Transmission Apparatus. — Regular quenched spark set, preferably the 1 KW. size. Terminals of loop antenna are connected to the antenna and ground connections, respectively, with a .0005 microfarad condenser in series with the loop. The ground connection on the set being removed.

Nauen Radio Opened Again

(Continued from page 662)

were captured during the war, of course, and we may presume from those captured, that the bulbs used in practically all the Teutonic radio stations were similar or nearly so, and that if the German experts had devised any wonderful new bulb, that they would have put these bulbs into their field sets, by the very nature of the wartime conditions, and particularly those used in the large base radio stations, several of which were captured during the latter months of the war. In a test with these bulbs as compared with the French vacuum bulbs and the American types, such as the De Forest and Western Electric amplifiers, the German bulbs showed up as good, but not better, under careful tests which were carried out in conformity with U. S. naval specifications for the device. A radio engineer of the U. S. Navy Department recently informed us to this effect, and we also heard the same opinion voiced by officers of the French and British Armies, who had the opportunity of carefully testing a



The World's most wonderful Typewriter—

Here's a polyglot machine that writes all languages from Eskimo Indian to Kata Kana Japanese and over 365 different type-sets. The type is instantly interchangeable—two different languages or type sets are always on the machine. You just turn the knob—to change language or type.

Hammond MULTIPLEX

"MANY TYPEWRITERS IN ONE"

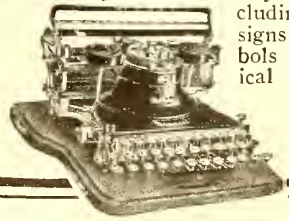
Sounds like an Arabian Knights story but the machine itself is very practical, very real. It is the typewriter President Wilson uses personally — the typewriter he took with him when he visited King George. It's the typewriter King George's mother, Queen Alexandra, and many other Queens and Kings use.

The Multiplex has revolutionized typewriting—has changed it from monotonous commercial work to the beauty of fine printing and engraving.

No Other Typewriter Can Do This:

MULTIPLEX HAMMOND'S
Instantly changeable type
Many styles, many languages
Two types or languages always in the machine
Just Turn the Knob to change

Write for booklet showing the many languages and type sets of the Multiplex—there's a type for every profession, every business, every science, including technical signs and symbols and chemical keyboard.



Hammond Typewriter Co., 589 East 69th St., New York

Gentlemen—Please send your **Free Book** and pamphlet, **"The President and His Typewriter."**

Name.....

Address.....

Occupation.....

www.americanradiohistory.com

AMPLIFY YOUR RADIO SIGNALS

With the new DETECTAGRAPH-TRANSMITTER, the amateur can amplify radio signals to such an intensity that he can hear the signals about his station without the need of the telephone head set.

By the addition of a loud talking telephone he is able to hear the messages many feet away from the instrument.

The super-sensitive DETECTAGRAPH-TRANSMITTER herewith shown is two and three-eighths inches in diameter, five-eighths of an inch thick and weighs less than three ounces. It is the most sensitive sound detecting device ever brought before the public.

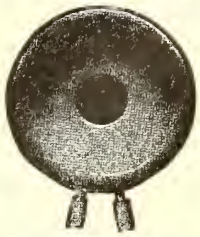
The manner in which the amplifying process is attained is by attaching with tape the DETECTAGRAPH-TRANSMITTER to the regular wireless receiver.

Not only is this instrument applicable for amplifying radio signals, but it can be used with equal satisfaction for magnifying other sounds. Phonograph music can be transmitted from one place to another by means of this instrument, and those who are afflicted with deafness will find enormous benefit by using this transmitter. It is the greatest device for building your own loud talking telephone, detectagraph and other devices. Can be used for any purpose where a sensitive detecting instrument is required.

SUPER-SENSITIVE Detectagraph MICROPHONE DEVICES



Our Super-Sensitive Detectagraph Transmitter. Price, $7.00 Complete



Our Special No. 25 Loud Talking Receiver. Price, $4.00 Complete



Detectagraph Rheostat, especially made for amplifying circuits. Price, $2.00 Complete



Super-Sensitive No. 40 Receivers to be used in connection with Detectagraph-Transmitters, $10.00



The Detectagraph Junior Deaf-Phone $15

Equal to any $35 instrument made. Outfit consists of Super-Sensitive Transmitter with cord connector; Super-Sensitive Ear Piece with small black cord; Black Single Headband; Black Case and Two Batteries.



Model "B" Horn, with Loud Talking Receiver, Cord Plugs and Desk Stand Base. Price, $12.00 Complete



Model "C" Horn, with loud talking Receiver, Cord Plugs and Wall Base. Price, $12.00 Complete



Detectagraph $15 This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord, Receiver, Headband, Case and Battery.

Order direct from ad.

Or write for free descriptive circular.

G. BOISSONNAULT COMPANY

26 CORTLANDT STREET NEW YORK CITY

Makers of Super-Sensitive Microphone Devices

Read All Signals That Reach Your Station

With the ordinary receiver many signals never become audible. Those stations you've wanted to hear can now be brought in with surprising intensity if you connect into circuit a



Type RORB, Price $45

Two-Stage Audio-Frequency Amplifier

This Amplifier is designed to eliminate howling due to resonant feed-backs, without impairing its amplifying efficiency. The cover is hinged, affording accessibility to all parts. The sockets accommodate the standard four-prong tube and perfect contact is secured through strong phosphor-bronze springs.

The wiring and mechanical construction are characteristic of Grebe workmanship. Better be sure *your* Amplifier is a Grebe.

Write for free bulletin describing Grebe Amplifiers; complete catalog sent upon receipt of 10c.

A. H. GREBE & CO.

70 Van Wyck Boulevard Richmond Hill, N. Y.

LEARN WIRELESS TELEGRAPHY

Fascinating and Educational Work—Big Salaries—Prepare Now

The United States Shipping Board is making heavy demands upon us for **Dodge-trained** wireless operators. Travel all over the world, secure, free, unsurpassed living accommodations and earn a big salary.

We Also Teach Morse (Wire) Telegraphy and Railway Accounting

School established 45 years. Endorsed by wireless, railway and telegraph officials. Low rates. Students can earn living expenses while attending school. **Catalog Free. Write Today.**

Dodge's Telegraph and Wireless Institute 22nd St. Valparaiso, Indiana

KNOW COSTS **ACCOUNTANCY**

Be a Cost Expert. Earn $3,000 to $10,000 yearly. C.P.A.'s teach you thoroughly in a few months by our New Home study system. Low Cost-FREE BOOK

International Accountants Society, Dept. 29L, 1020 S. Michigan Ave. Chicago.



FREE BOOK ON AVIATION

Learn of the great opportunities in this new $1,000,000,000 industry. Thousands of men needed. Learn by mail—free book tells how. Write at once

Nat. Aero Inst., Dept. 7448, 916 S. Mich. Ave., Chic.

large number of bulbs of all makes, before and after the signing of the Armistice.

Two large antenna systems are provided—the larger being of T-shape, and the smaller in the form of an elevated horizontal triangle with the down leads from the apex, says the *Wireless World*. Simultaneous transmission on two different wavelengths is thus possible. The two main masts, of lattice construction, are 260 meters high, and are bedded on an insulating ball at the base. Additional insulation is provided at 150 meters from the ground. The supply alternator, single phase, can deliver 800 horse-power, and after multiplication of the frequency by static frequency raisers, furnishes 24,000 cycles current to the aerial. The wave-length is thus 12,500 meters. Transmission at 200 letters per minute can be carried on. The overall efficiency is claimed to be 65 per cent from alternator to aerial at 12,000 meters wavelength.

The following table gives an interesting comparison with the installation in use in 1908:

	1908	1918	
		Small Aerial	Large Aerial
Masts	1 of 100 m.	2 of 150 m.	2 of 260 m.
		1 of 135 m.	4 of 120 m.
Antenna area sq. metres	31,000	77,500	155,500 sq. m.
Primary ouptut K. W.	50	175	600
Aerial energy K. W.	12	100	400
System	slow spark	quenched spark	H. F. Alternator C. W.
Range Kms.	3,600	8,000	20,000

THREE LAND RADIO STATIONS FOR AIRPLANE MAIL.

The Post Office Department has contracted for the erection of three high-power radio stations, the first of a chain of wireless communicating centers in various cities to be used primarily for the direction of mail-carrying airplanes handicapped by fog, it was announced recently by Emil J. Simon, the well-known New York radio engineer.

Stations will be established at Bellefonte, Pa., and Cleveland, Ohio, with a third at some point on Long Island or Newark, N. J. Appropriations for them already are available. Others will be erected at Washington and Chicago as soon as Congress provides funds.

Each station will be equipt with steel towers 200 feet high and 300 feet apart and will have a range of approximately 400 miles to *mail airplanes* and approximately 700 miles between stations, the difference in range being due to the lesser sending ability of airplane wireless equipment.

The station at Bellefonte were completed about the middle of October, while the other two definitely decided upon were expected to be ready early in December.

Establishment of the radio stations will enable the Post Office Department to maintain communication between cities having air post delivery independent of telegraph and telephone services in the event of a disruption of service by storms or other causes.

Lieutenant Clark A. Edgerton, formerly of the army aviation service, in charge of the air mail experimental work at Washington, will direct the activities of the radio stations.

www.americanradiohistory.com

"Cold Fire"

By H. Gernsback

(*Continued from page 633*)

(standard 110,000 volt insulator for 60-cycle work, such as is used in electrical power transmission equipment) equipped with a "corona" or flux distributing shield. This flash-over is occuring at 234,000 volts and 51,000 cycles per second. Without the corona shield, corona will form on the metal cap of the insulator and flash-over will occur at voltages slightly less than 100,000 at a frequency of 51,000 cycles per second.

SEVEN ZEPPELINS WERE LURED TO DEATH BY RADIO.

This is the tale of the seven Zeppelins. Do you remember the last big raid over England after which most of the flock of ungainly birds came flopping down into the fields and forests of France, while one met its fate in the Mediterranean?

People in London told one another all manner of tales about frozen motors and gasoline icicles. As well to let it go at that in those days, but now that I know the Germans know all about it, here is what happened, says Gordon Stiles in a press report from Berlin.

A certain French radio officer had been very diligent during the war. When America came in some wireless experts from over there joined forces with him. Among other things they studied the German method of wireless control of aircraft.

The Allies had known for a long time the Zeppelins were guided by instructions sent from powerful wireless stations in Belgium and Germany. When its cargo of bombs had been disposed of the airship would flash back, "Where am I? And what course shall I take to reach home?"

This call would be received by several German stations, indicating the direction from which it came. Thus by using formula which involved mathematical calculation dealing with intersections and the like the position of the Zeppelin could be exactly determined. The rest was easy. The compass course to be taken went thru the ether to the Zeppelin.

By patient work the French radio officer had compiled a vocabulary which embraced more than 400 German code words. With the help of mechanicians he had built a wireless set which had all the characteristics of the German apparatus, even to "flaws."

On the night of the raid in November 1917, this set was read for use. Fate was with the Allies, for when the Zeppelins were floundering at a dizzy height over London, the signaled replies from the German stations did not reach them. Static disturbances prevented the message carrying.

The French stations were very busy. "Come this way." "Take this course." "Steer so many degrees east by south." These were the messages flashed over the new sending apparatus.

From the Zeppelins, one after another came "O. K." And they came. They came so accurately that the French actually telephoned the various anti-aircraft stations the exact minute when they might expect a Zeppelin over their position. Allied night fliers were sent up in swarms to demolish those which the guns did not claim.

We know their success. The big gas bags came tumbling into France or sailed wildly about, damaged and limping, until the airplanes finished them.

Another dent in Fritz's wild war-dream.

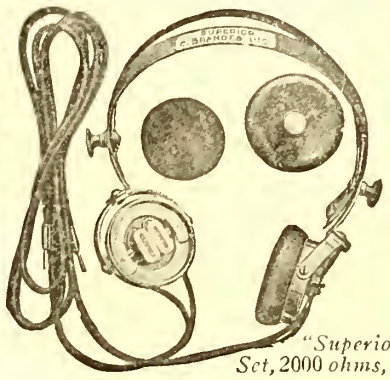
"ASK ANYONE WHO HAS USED IT"

Said Denver, Col. to Valley Stream, L. I.:—

One of our most enthusiastic customers communicates by wireless from his home in Denver to a friend on Long Island. He uses a Brandes Headset—after exhaustive tests and comparisons. (Name on request.)

BRANDES WIRELESS HEADSET

CLEAR TONE
LIGHT WEIGHT
DEPENDABLE SERVICE



"Superior" Set, 2000 ohms, $7

Score 100% efficiency in actual use. Sharp, Unblurred, Readable Signals assured by

"BRANDES MATCHED TONE"—

Exactly matching the tone of both receivers in each set and thus eliminating all confusion due to unmatched harmonics.

TRIAL OFFER

Buy a Brandes Superior Headset and use it critically for ten days. Then, if it doesn't come up to our claims or your expectations, return it and your money will be cheerfully refunded. Test it—compare with others—for sensitiveness, clearness, distance. Prove for yourself the fine quality, the "matched tone." The two diaphrams, toned exactly alike, strengthen the signals and prevent blurring. Used by many U. S. Government experts, and experts abroad; by colleges and technical schools; and by professional and amateurs everywhere.

SEND 4c FOR CATALOGUE E.

C. BRANDES, Inc.
Room 814
32 Union Square
New York City, U. S. A.

WIRELESS RECEIVER SPECIALISTS

Complete Line of Brandes Receivers for those in Canada. Send stamp for Pamphlet "E"
Radio Electrical Supply Co., 43 McGill College Avenue, Montreal, P. Q., Can.



TEL. BACK BAY 5964

699 Boylston St. Boston - Mass.

RADIO — Splendid opportunities now in the Merchant Marine for Wireless Operators. Big salaries! New Schedule: Junior operators, $100 per month; Chief operators, $125; food and quarters besides. Equivalent ashore from $40 to $50 a week. Graduates in all parts of the world as Inspectors, Instructors, Engineers, Operators, etc.

The oldest, largest and best equipped radio school in New England. Recommended by Marconi and Government officials. DAY AND EVENING CLASSES. START ANY MONDAY.

RADIO APPARATUS

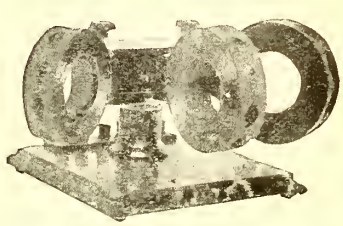
Distributors of All Prominent Makes:—
De Forest, Wireless Specialty, Murdock, Grebe, General Radio, Clapp-Eastham, Brandes, etc., etc.

Largest and Best Stock of any House in New England.

For real prompt delivery send us your orders. For Honey-Comb Coils, Unit Panels, Vacuum Tubes, Baldwin Telephones, Murdock 55's, Grebe Developments, etc., etc.

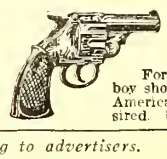
F. D. PITTS CO.
DEPT. D
12 PARK SQUARE BOSTON, MASS.

TYPE LC-101 INDUCTANCE COIL MOUNTING



Are You Listening to Hawaii?

"The Ellis Music Master Reproducer"
made for all phonographs. Pleases the most exacting music lover. Eliminates twang. Perfect harmony of accompaniments, individuality of artists voices and instruments reproduced from records in life like reanimation. It sells on its merits. Send 10c for booklets E, "Hints to Music Lovers" and "Music Masters." Agents wanted. **J. H. ELLIS, P. O. Box 882, Milwaukee, Wisconsin**



BLANK CARTRIDGE PISTOL by mail prepaid **ONLY 50c**

For protection and sport every man and boy should have one. Order at once. Get an American flag FREE. Money refunded if desired. **E. L. LEWIS CO., 1400 B'way, N.Y.C.**

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

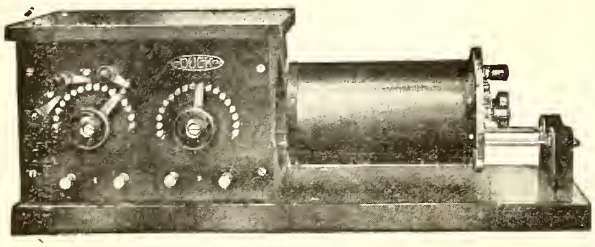
www.americanradiohistory.com



DUCK'S New Big 264-Page Wireless and Electrical Catalog Just Out—Now Ready

It is mailed for 12c in stamps or coin which may be deducted on first order of $1.00. Catalog not sent otherwise.

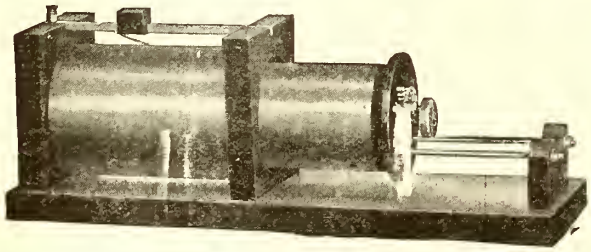
We regard this catalog as our greatest effort. It embraces everything in wireless worth while. 172 pages with no waste space devoted exclusively to wireless instruments. Your amateur friend will tell you that there never has been any wireless catalog to take the place of catalog of this company and above all that you can absolutely depend on our goods. There is no need for any other catalog when you have this big catalog.



NEW MODEL 5BB. NAVY TYPE RECEIVING TRANSFORMER

A big improvement over our former model. Primary divided into two sections, with three dead end switches, greatly improving selectivity.

Secondary divided into three sections, with two dead end switches, eliminating harmonics. By changing the construction of the end piece, there is also greater loose coupling. It is a wonderful improvement over our old model both in performance and appearance. Only $23.50.



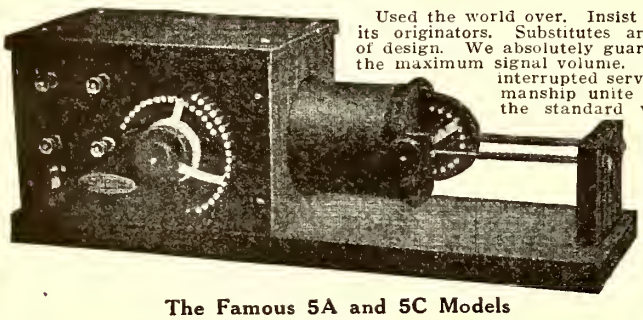
OUR IMPROVED ARLINGTON RECEIVING TRANSFORMER

The secondary on our new type Arlington is divided into three sections with two dead end switches, eliminating dead end effect and harmonic and giving greater selectivity. The end support similar to that on our Navy type permitting of greater loose coupling. It is a beautifully finished instrument and will be sold by us at the same price as the old model. $9.00.

THE WILLIAM B. DUCK CO., 240-242 Superior St., Toledo, Ohio

TRACO QUALITY

RECEIVING TRANSFORMERS



Used the world over. Insist on the genuine, built by its originators. Substitutes are expensive, irrespective of design. We absolutely guarantee our tuners to give the maximum signal volume. Delicate refinement, uninterrupted service and high class workmanship unite to make TRACO tuners the standard whereby all others are judged. If you Dealer does not handle them, order direct from us.

LIBERTY DETECTOR VALVES, RADIO AMPLIFYING PHONES, type used by the **UNITED STATES, BRITISH and FRENCH GOVERNMENTS,** now in stock, for sale.

Send stamps for bulletins.

The Famous 5A and 5C Models

THE RADIO APPARATUS CO., Pottstown, Penna., U. S. A.



CHANGE OF PRICES

With Quantity Production and adoption of Automatically Wound Coils, we are glad to announce a Reduction in prices of our Amplifying Transformers as follows:

Type A-2 fully mounted with Aluminum Supports, Engraved Bakelite Dilecto Panel, and Nickel Plated Bind Posts.....$7.00

With Supports, but without Panel and Bind Posts $5.00

Assembled, but Unmounted.....$4.50

Although originally designed for use with VT-1 Tubes, these are now being used extensively and with excellent results with Marconi V. Ts.

ACME APPARATUS CO., 28 Windsor St., Cambridge, Mass.

DENMARK PLANS BIG RADIO STATION

Official announcement that Denmark is making plans to open wireless communication between Copenhagen and the United States was made recently by the Danish Legation. This statement was made public:

"Information to the effect that regular wireless connection has been established between Denmark and Great Britain has just been received by the Danish Legation here. Plans are now being worked out by the Danish Ministry of Traffic for erecting a great transatlantic radio station near Copenhagen which will put Denmark in direct wireless communication with the United States.

"Danish newspapers complain that their telegrams for some time have been greatly delayed because of the crowded cables. The Danish papers express the hope that the still important plan for a great transatlantic station will soon be realized. The Danish press is anxious to get into direct communication with America, so as to be able to obtain news from over here at first hand and at reasonable rates.

"The Danish wireless station at Lyngby is at times able to hear the American station at Arlington talk to Rome, but is not powerful enough to send messages over the Atlantic. The plan now under consideration by the Danish Government call for the erection of a transatlantic wireless station to cost 2,000,000 kroner."

JAPAN WANTS $16,000,000,000 PACIFIC CABLE.

The Marconi Company, it was said, had proposed a wireless system between America and the Far East, at a cost of about $6,000,000. But the members of the council declared that wireless would not be satisfactory owing to static conditions and other disadvantages which would make transmission impracticable for more than seven hours out of twenty-four.

RADIO-CONTROLLED 'PLANES WERE TO BOMB BERLIN, SAYS JACK BINNS.

At the very moment when the armistice was signed a squadron of super-Handley Page bombing airplanes were awaiting orders to bomb Berlin, says Jack R. Binns, the well-known radio expert, late instructor in the wireless school of the Royal Air Force. These giant machines were equipt with wireless in such a way that the German wireless station at Nauen would have unwittingly navigated them in a direct line to Berlin.

It has made inter-communication between airplane and airplane possible over a distance of 400 miles, with less power than is used by a ship at sea to communicate 200 miles.

It has made aerial navigation possible irrespective of weather conditions. It has made the transmission of human speech between the occupants of one plane to the person on another plane possible over a distance of 25 miles.

Of these its effect upon aerial navigation is the most recent and most phenomenal of the developments arising out of the welter of war.

On all the great Handley Page and super-Handley Page airplanes of the British Air Force the so-called Chanffer "direction "finder" has been equipt. This is one of the most closely guarded secret inventions of the war.

With its aid the navigator of one of these giant machines can pin down upon a chart the exact latitude and longitude of the airplane within five minutes of commencing the observation. Moreover, this navigational work can be done while the machine is in a dense fog.

The most remarkable thing about this invention is the fact that the large aerial

www.americanradiohistory.com

which makes a wireless station such a conspicuous landmark is entirely missing. In its place two moderate sized coils of wire are fitted into the nacelle of the machine.

I have located the exact position of a Handley Page while flying above dense clouds over the North Sea in less than ten minutes.

The manner in which these observations are taken is as follows: One of the two coils on the machine is movable thru a complete circle. This coil is moved until it receives signals from some well-known wireless station in Europe. The direction of this coil gives the true bearing of that particular station after allowances have been made for certain well known and charted errors, such as magnetic deviation of the compass and quadrantal error of the airplane.

The angle of the station to the bearing of the machine is then worked out on a chart, and the resulting line drawn clear across the chart. When this is completed the coil is turned around until some other well-known station is heard. The same process is completed, and the point where the two lines cross is the exact location of the airplane in latitude and longitude above the earth. The whole apparatus, with the exception of the coils, can be carried in one hand; and the coils, while bulky, have very little weight.

Another remarkable feature of this invention was its application to the big bomb-dropping airplanes that raided German cities. In this case there was a variation in its utilization. The coils were fixt rigidly in the machines, which then pointed themselves bodily at a wireless station situated at the point where they wished to go.

In other words, German wireless stations directed British bomb-dropping airplanes to their cities without knowing it, and over the shortest possible route. The wireless stations back of the British lines took care of their return.

Next to the direction finder the development of the wireless telephone on aircraft has been the greatest achievement of the radio experts during the war.

All the day and night bombing squadrons were fitted with it. Its utilization brought success to bombing raids by eliminating all confusion and enabling the squadrons to retain their formation under all conditions.

The squadron commander sitting in his machine would issue orders in an ordinary tone that was easily heard above the roar of the powerful engines, while the machines were rushing thru space at the rate of a mile every thirty seconds.

If, thru unforeseen circumstances, a machine got separated from the squadron, it could rejoin by means of instructions given thru the air by the human voice up to any distance within twenty-five miles.

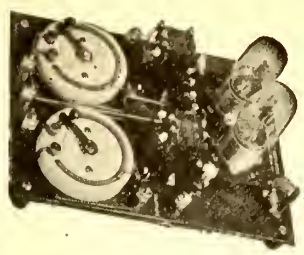
This wonderful invention was also utilized in scout work. All the Bristol scouts were equipt with it.

They would sit above the clouds watchfully waiting. Immediately a German scout appeared the artillery co-operation machine would radio the fact to the aerodrome. The operator on duty at the 'drome would then talk into a telephone transmitter, and ten seconds later the Bristol would swoop down thru the clouds upon its unsuspecting prey.

One of the 1918 developments was the long distance wireless telegraph sets for aircraft. With these machines engaged in patrol work hundreds of miles back of the German lines could communicate instantly with headquarters any distance up to 400 miles. Not only this, but they could receive special instructions instantly from headquarters.

The moment the German command began to move troops in the back areas, the fact was known in all headquarters in the British army.

All this was done from a speck in the sky, from an airplane large enough to carry only two men.



TWO STEP AMPLIFIER

TYPE TRIODE E

This unit was designed to facilitate experimenting by making all wiring and connections visible and accessible It is a compact unit of the resonance low frequency type, and provides a maximum of amplification. The design of this instrument is such that it will not "squeal," "howl," "fry" or "roar," as is the case with so many amplifiers now on the market. Particulars and price on application.

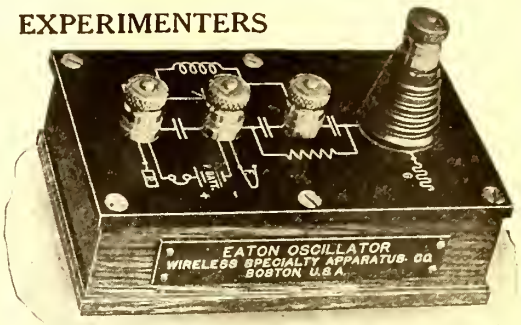
THE EATON OSCILLATOR

FOR EXPERIMENTERS

This instrument, in conjunction with a loose coupler, a single variable condenser and a vacuum tube, makes a complete system for receiving all undamped signals.

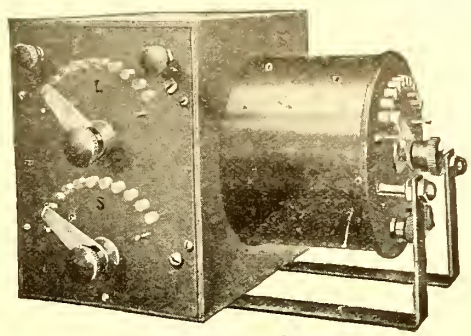
It will oscillate over a wavelength range of 200-25,000 meters, and requires no adjustments of any kind. It employs the Eaton Circuit, standard with all U. S. Navy receiving equipment.

The simplest and cheapest way of receiving undamped signals.



PRICE $14.90 Immediate Delivery

WIRELESS SPECIALTY APPARATUS CO.
ENGINEERS, DESIGNERS, MANUFACTURERS
Boston, Mass., U. S. A.



Type-Y673-Coupler

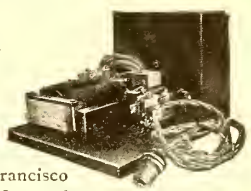
TYPE Y673 Coupler
200 to 3000 meters
Price $12.00

Camb. Rectifier, for storage battery charging
Price $22.00

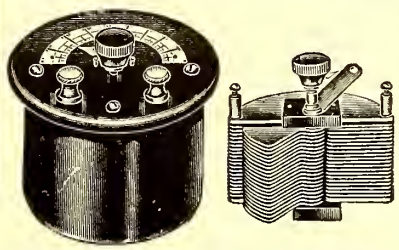
Three-cent stamp brings bulletins of both these instruments

CLAPP EASTHAM CO.
131 Main Street, Cambridge, Mass.

Pacific coast representatives: Remler Radio Mfg. Co., San Francisco
Canadian representatives: Radio & Electric Supply Co., Montreal



Rectifier



BEEKO VARIABLE CONDENSER
Size, 3¼x4¼ inches.
Price each
Mounted (postage weight 2 lbs.).....$5.40
Unmounted (postage weight, 1 lb.)..$4.60

Manufacturers and Distributors of
HIGH GRADE
Amateur Wireless Apparatus
Send Stamp for Catalog 40E
J. H. Bunnell & Company
32 Park Place
New York City, New York

www.americanradiohistory.com

Become An Artist In Spare Time

Wonderful New Method

By our wonderful new method of teaching by mail, you can learn Illustrating, Cartooning and Commercial Art right in your own home—and in your spare time. Hundreds of successful students and graduates are now making splendid incomes. Get into this fascinating work yourself and make from $50 to $125 or more a week! Our method makes it easy for anyone to learn. The study is fascinating. Only a few minutes a day! Personal instruction given you by WILL H. CHANDLEE, one of America's foremost commercial artists. You can have your own studio—or secure high salaried position. Many students have earned more than the cost of the course while they were learning!



No Talent Necessary

Just as you have learned to read and write, we can teach you how to draw. Everybody has the ability. True, some have more than others, but that is because that ability has been developed. You start with straight lines—then curves. Then you learn to put them together. Now you begin making pictures. Shading, action, perspective, and all the rest follow in their right order, until you are making pictures that bring you from $50 to $500 or more! Many artists receive as high as $1000 for a single drawing!

Big Demand for Commercial Artists

There are thousands of big-paying artists' positions open **right this minute.** These positions are actually **going begging** for the lack of trained artists to fill them. Magazines, newspapers, advertising agencies, and business concerns are all looking for men and women to handle their illustrating. With the tremendous expansion of both foreign and domestic trade, commercial art is more in demand than ever—and that demand is increasing every day!

Write for Free Book

Mail coupon NOW for our valuable book, "How to Become an Artist." Contains full particulars of our Free Artist's Outfit, and special terms for a limited number of new students. Also contains many interesting drawings by our students, showing their amazing progress. Book just full of valuable information to you. Send for it NOW!

WASHINGTON SCHOOL OF ART, Inc.
1460 H Street, N. W., Washington, D. C.

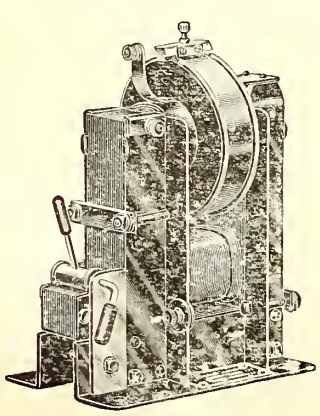
FREE COUPON

WASHINGTON SCHOOL OF ART, Inc.
1460 H Street, N. W., Washington, D. C.

Please send me, without cost or obligation on my part, your free book, "How to Become an Artist."

Name.....

Address.....



RADIO AMATEURS

Do you want your radio station listed among the "long distance" amateurs? Our new type "R" 1 K. V. A. 25,000 volt Wireless Transformer will make your station efficient for "long distance" relay work. Write for our catalog 20 T describing complete transmitting apparatus.

Thordarson Electric Mfg. Co.
501 S. Jefferson St. Chicago, Ill.

Will These Perpetual Motion Schemes Work?

By John D. Adams

(Continued from page 649)

be a very marked effect at this distance, but the main thing to note is that there will be no back pressure. From the point "d" the free North pole will then proceed to point "a," as every point along that leg of the triangle is nearer to the attracting South pole than to the repelling North pole of the horseshoe magnet. This completes the path, and, if the reader will now apply the same line of reasoning with the other two horseshoe magnets in place, it will be seen that the operating force is very greatly increased, as each of the three magnets may be considered separately with the same result. As the free North pole leaves the point "a" under the repulsion of the North pole of the left-hand magnet, it is also attracted by the South pole of the right-hand magnet.

The above merely describes the device in its simplest form. If such a machine were to be designed for power purposes, the power could be greatly increased, it would seem, by providing a great many bar magnets, and if they were arranged on a belt at the top and bottom, three similar horseshoe magnets, with polarity reversed, could be applied to the upper or South poles, thus *doubling* the power.

FRENCH TO HAVE 12,500 MILE RADIO STATION

The new wireless station to be erected at Croix-d'Hins, near Bordeaux, will have a sending radius of 12,500 miles. It will be one of the most powerful wireless stations in the world, with five times the strength of the Eiffel Tower station, three times that of Lyons and twice that of Nauen. The station will have a capacity of 72,000 words daily, and will reach all of the French colonies thruout the world.

"PLAN-T"

By John White

(Continued from page 648)

Stevenson's face showed his open disappointment and consternation as the radiogram proved, not a key to the message on hand, but a puzzle; quite as difficult, if not more so, than the "personal."

However, on pondering the matter, he wondered if it were not probable for this message to have a direct bearing upon the newspaper excerpt. It was decidedly possible, else why should Larnelle have postponed this message last evening when by an obvious mistake a duplicate of the "personal" had been transmitted, unless he feared that the uninitiated receiving the two with such proximity should discover the relation between them. This being the case, the solution must be of the utmost simplicity.

Crossing the room, he compared the message just received with the personal. The truth dawned upon him! The message and the personal were but the alternate words of a complete communication! *A code impossible to solve except for the slight, very slight, chance of one stumbling upon the two halves, each transmitted thru radically different mediums.*

Quickly and methodically Stevenson matched up the communication, one word from the "personal" and the next from the radio message, translating as he proceeded, until the deciphered code was before him in full.

www.americanradiohistory.com

It read, capitalized and punctuated:

"Larnelle:—Watkins and Short have delivery ready. Send all four on the fifth. Danger and directions taken up here. S. S. Unsuspecting. Bordinage."

It was evident that a "Larnelle" and "Bordinage" were the *recipient* and *sender* of the message, respectively. Stevenson plausibly assumed that "Send all four on the fifth" was a conveyance in which to transport the "delivery." The "danger and directions" gave the idea that the work was illegitimate. His interpretation of "S. S." varied. It might well be intended for steamship, but from the context he was of the opinion that it was more appropriately "Secret Service."

Stevenson, with his former experience as a government detective, considered that there were plans being formulated, if not already complete, which would culminate in illegitimate business. His ignorance of the kind of work and lack of sufficient evidence prevented his informing the proper authorities. He decided that it would be impossible for him to do other than await developments.

Stevenson unhooked the telephone book from his desk and ran his forefinger down the 's.....Warlick, Washburne," and then his search was rewarded with...."Watkins and Short, paper manufacturers, 36 East Cliff Street."

"Paper manufacturers," thought Stevenson, "that apparently is above board, unless—"

For the next month the air gave no sign of Larnelle, nor was his activity displayed in the personal columns.

Stevenson decided that the transaction, of which he had but the faintest conjecture, were being directed by one Bordinage in the very safe manner described. The complete message was doubtless written out in full, and, on two separate sheets divided into alternate words, a copy of one being sent to the publication while the other was transmitted by radio. By mistake or absentmindedness on the first evening, Bordinage had sent the wrong half.

Some five weeks after the first insertion, Stevenson again found reference to Larnelle in the personal columns. It ran:

"Larnelle: fast with s. wary on may shortly. Bordinage."

The same evening, Stevenson, intent upon his instruments, threw in two-thousand, five-hundred meters wave length.

Occasionally, a high-powered station would chime in, but he was far too high for the common gossip. As ten o'clock approached he feared that Bordinage and Larnelle had varied their wave, but shortly his anxiety was put to nought by the strident screech ...."Larnelle Larnelle Larnelle..."

"....work but caution s. direction removal follow Bordinage," it continued in the clear-cut notes of the experienced operator.

There was silence and Arlington ticked out ten o'clock. Stevenson, with receivers still elasped to his ears, compared the message with the "personal."

When pieced together the communication read:

"Larnelle:—Work fast but with caution. S. S. wary. Directions on removal may follow shortly. Bordinage."

Again, and with more certainty, he interpreted, "Secret Service wary." It was also apparent that Bordinage, Larnelle and Co. were contemplating a change of base of operations if the danger increased.

Removing the headset he walked to the desk 'phone and called Washington by Long Distance.

"Hello, Secret Service?.....Chief Langford, please.....Lang.....How's the boy? Stevenson speaking....Hope to be with you again soon. Say, is there any 'queer' in circulation now?"

"Yes, some. In fact, to you, Steve, I'll confess there's quite a bit."

1919 ATLAS WITH LATE WAR MAPS FREE

To the readers of *Electrical Experimenter* who take advantage of this offer made in connection with

Webster's New International

THE ONLY GRAND PRIZE

(Highest Award) given to dictionaries at the Panama-Pacific International Exposition was granted to Webster's New International and the Merriam Series for superiority of educational merit.

WORDS OF RECENT INTEREST

Anzac, ace, barrage, Bertha, blighty, Boche, Bolsheviki, camouflage, Lewis gun, Liberty, bond, Sammy, soviet, tank, war bride. These are but a few of the thousands of late words—all clearly defined in this great work.



"The Supreme Authority"

The *Merriam* Webster

A Complete Reference Library in Dictionary Form—with nearly 3,000 pages and type matter equivalent to a 15-Volume Encyclopedia, all in a single volume, in Rich Full Red Leather, or Library Buckram Bindings, can now be secured on the following remarkably easy terms.

THE ENTIRE WORK (WITH COMPLETE 1919 ATLAS)

DELIVERED *for* $1.00

and easy payments thereafter of only a few cents a week (in the U. S and Canada)

ON SUPERIOR INDIA PAPER

Reduced About One-Half In Thickness and Weigh

INDIA PAPER EDITION

Printed on thin, opaque, strong, superior India paper. This edition is only about one-half the thickness and weight of the regular edition. Size 12⅜ in. x 9¾ in. x 2¾ in. Weigth 8⅜ lbs.

REGULAR PAPER EDITION

Printed on strong book paper of the highest quality. Size 12⅜ in. x 9¾ in. x 5½ in. Weight 15¼ lbs. Both editions are printed from the same plates and indexed.

Over 400 000 Vocabulary Terms and in addition 12,000 Biographical Names, nearly 30,000 Geographical Subjects, besides thousands of other references Nearly 3,000 pages. Over 6,000 Illustrations. *The only dictionary with the New Divided Page, characterized as "A Stroke of Genius."*

"To have this work in the home is like sending the whole family to college"

The ATLAS is the 1919 "New Reference Atlas of the World" containing nearly 200 pages, with 128 pages of maps beautifully printed in colors with marginal reference indexes, late Census figures, Parcel-Post Guide, Late War Maps, etc., all handsomely bound in red cloth, size 10¼ x 13⅝.

To those who mail this coupon at once

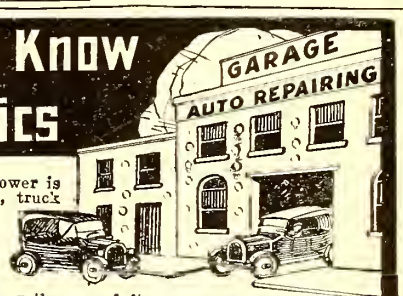
G. & C. MERRIAM CO.
Home Office Dept. S. Springfield, Mass.
(Publishers of Genuine Webster Dictionaries for over 70 years)

Please send me free of all obligation or expense a copy of "Dictionary Wrinkles" containing an amusing "Test in Pronunciation" (with key) entitled "The Americanization of Carver," also "125 Interesting Questions" with references to their answers, and striking "Facsimile Color-Plate" of the new bindings. Please include specimen pages of India and Regular paper with terms of your Electrical Experimenter free Atlas offer on Webster's New International Dictionary.

Name .....

Address .....

YOU Have Got To Know Motor Mechanics



—No matter what business you enter, motor power is fast replacing all other types of power. Auto, truck and tractor factories are working overtime—1,500,000 new cars and thousands of trucks and tractors will be put in service in cities and on the farm this year. Men are needed everywhere to repair and operate them. Big wages are paid competent men who know how. You returned soldiers and sailors who want jobs bigger than you left—you young men everywhere—your opportunity is right here. Don't sit and dream of success—make it.

Make $2,000 to $5,000 a year Prepare yourself for this big, growing, money-making business. Opportunities wait you every where. Every village has or needs its garage. Big city shops are calling for more trained men. "White collar" jobs no longer get the good pay. Auto mechanics always have good jobs and get big pay. Your opportunity as a trained auto or tractor man is bigger RIGHT NOW than ever before.

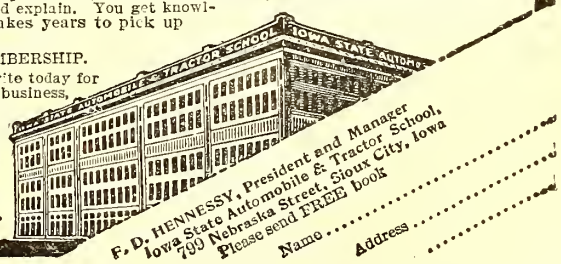
My Course Teaches You Thoroughly and Completely in 7 Short, Busy Weeks Come here, learn this business—then go out and make good as thousands of other IOWA STATE graduates are doing. Here you learn step by step, slowly—surely—simply, every phase of auto, truck and tractor repair and operation—starting, lighting, ignition systems—vulcanizing, welding, machine shop practice. Tools are placed in your hands, not books, with a competent instructor always at your side to help and explain. You get knowledge here in 7 weeks that takes years to pick up on the outside.

FREE Y. M. C. A. MEMBERSHIP.

Don't wait a day longer. Write today for my big FREE book on the business, showing actual pictures of equipment you work on, etc.

Mail the Coupon Now.

FRANK D. HENNESSY, Pres. and Mgr.,
Iowa State Auto & Tractor School
799 Nebraska Street, SIOUX CITY, IA.



F. D. HENNESSY, President and Manager
Iowa State Automobile & Tractor School,
799 Nebraska Street, Sioux City, Iowa
Please send FREE book
Name .....
Address .....

MONEY for YOU Add to your Salary—Make extra Pin Money
Start a lucrative business of your own.

Spend an hour each day taking subscriptions for the "Experimenter." We'll pay you well and you'll enjoy the work. Write for full particulars. Circulation Dept., ELECTRICAL EXPERIMENTER, 233 Fulton St., N. Y. City

www.americanradiohistory.com

POSITIONS GUARANTEED

TO EVERY GRADUATE OF OUR SCHOOL

By FOUR LARGEST RADIO CONCERNS

$125 per MONTH PLUS ALL EXPENSES

MODERN EQUIPMENT—SPECIAL SHORT COURSE

INDIVIDUAL INSTRUCTION

FINEST STAFF OF TEACHERS AVAILABLE

DORMITORY — SWIMMING POOL

CALL OR WRITE FOR ILLUSTRATED BOOKLET

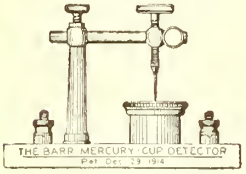
Y. M. C. A. RADIO SCHOOL

Department R

152 East 86th St. New York, N. Y.

"BEST RADIO SCHOOL IN THE EAST"

THE BARR
Mercury-Cup Wireless Detector



The most efficient Detector on the market. Tested by the United States Government and Marconi Wireless Telegraph Co.

Increases the efficiency of every wireless receiving set by making the signals clear, sharp and distinct.

Instantly adjustable at a constant pressure.

For full information and price—write

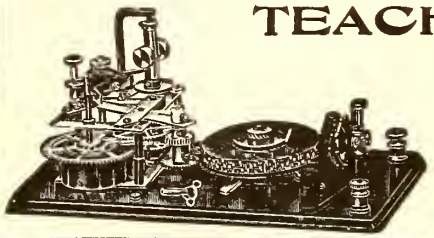
The Barr Mercury-Cup Detector, Dept. A. The Wyoming, Washington, D. C

"THERE'S MONEY IN IT"

AT HOME **LEARN TELEGRAPHY** AT HOME

MORSE AND WIRELESS

TEACH YOURSELF



In half the usual time, at trifling cost, with the wonderful Automatic Transmitter. **THE OMNIGRAPH.** Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would.

Adopted by U. S. Gov't. 4 styles. Catalogue free.

OMNIGRAPH MFG. CO.

39L Cortlandt St. New York

20000 meter long wave tuner

Works on any aerial overhead or loop. Involute coils machine wound. Five taps P. & S. round or square pattern. Weight, 2 lbs. Formica top, nickle plated parts. Wiring diagram on bottom. No delicate tuning, throw the switch and copy all the arc stations. Tunes from 4000 M. up. Coils set in special wax. Works through worst static. Foreign orders solicited. Price $15, delivered to you anywhere in the world.



TRESCO

Davenport, Iowa



BOYS

How would you like to have this ghastly warning hanging in your room? It will make your station or den look big and command respect. It is the neatest sign made. Printed in bright red with big bold letters on stiff cardboard. 7¾" x 11½". Price 20c, 3 for 50c, postpaid anywhere. Don't miss this opportunity.

LEONARD BECK

102 Beach 65 St., Arverne, N. Y.

"Source New York?"

"I have an idea that it is. But it is being distributed rather widely by agents. But what's the idea. How'd you....?"

"Have you got Watkins and Short under suspicion?" broke in Stevenson.

"Yes, but how the devil'd you know. Is there a leak?"

"No, your department's O. K. But I think I'll have a bit of information for you shortly. Well, so long for the time, and remember me to the boys."

Then again followed weeks of silence between Bordinage and Larnelle. Stevenson experienced fears that they had intercommunicated thru other channeds and that, whoever they were, they had fled.

However, his fears were dispelled when a few days later, amid the agony columns, appeared the following code to Larnelle:

"Larnelle to ignorant to of Europe possible plan followed at with goods nine tomorrow arranged. Bordinage."

Stevenson decided that the "S" was the first part of a reference to the Secret Service, and with his knowledge that the law was closing in upon the probable counterfeiters, it was doubtless to enlighten Larnelle of the increasing danger. "Europe possible plan followed," if the foregoing were true, tended to show the contemplated method of escape. The completion of the message in the evening would, of course, verify his conjecture, but if the conspirators were then told to disembark by a previously arranged plan designated by a letter or numeral, it would be impossible to intercept them.

Again calling up Washington the ex-secret service man communicated with Chief Langford.

"Hello, Lang, old boy? How about that 'queer' you and I talked about. Contemplating arrests, aren't you?"

"Yes, but we can't find exactly where under the sun they're working from. It also seems that somehow or another they're on to us. I haven't the slightest idea where they get their information. But where'd you get yours? How the deuce!"

"How are your directions sent to your deputies in this city?" inquired Stevenson.

"Special delivery and wireless; but that's not it; it's all in code."

"Oh," murmured the radio man, comprehensibly. "Well, have a squad of men up here at nine P. M. to-morrow and I think you'll get them all with the possible exception of the leader. But you'll have to get me permission to use the Brooklyn Navy Station this evening. It is the only way you can get any of them. They'll be gone by to-morrow. Can't explain any more on the 'phone."

"What! Well, I'll take your word for it, but it is beyond me. No mistakes now, Steve. The permit'll be there before you. And, say, I'll be in the city myself."

Stevenson hung up, and with pencil and paper worked long and zealously at the "personal." When he raised his pencil an hour later, there was before him a supplement similar to that sent by Bordinage *via* the aid, but *one, which, when placed with the personal, would convey Stevenson's orders to Larnelle.*

The same evening his face glowed with appreciation as his fingers clasped the key at the Navy Yard's station, to which Langfords' permit had gained him quick admittance.

A half-hour before the usual time of the Bordinage messages, he called "Larnelle Larnelle Larnelle." His wave length was two-thousand, five-hundred meters—that previously employed by Larnelle—and the slightly subdued quenched tone of the navy's roar was so similar to that of Bordinage's that anyone but a professional operator would fail to detect the difference.

"Bordinage Bordinage," he signed, and shortly came the amateurish reply from Larnelle.

www.americanradiohistory.com

These Up-to-Date Books Will Save You Money



No. 5—WIRELESS CONSTRUCTION AND INSTALLATION FOR BEGINNERS describes in detail **with working drawings,** how to make simple but efficient sending and receiving sets at lowest possible cost. 73 pages. 66 illustrations.



No. 3—LESSONS in WIRELESS TELEGRAPHY should be owned by every amateur. 35 clear lessons covering all principles from aerials to end losses and audions, so you can understand how they work.



No. 6—EXPERIMENTAL WIRELESS CONSTRUCTION with **working drawings** and detailed instructions for building spark coils, transformers, tuners, couplers, condensers, detectors, etc. (More advanced than No. 5 book.)



HOME MADE ELECTRICAL APPARATUS (in 3 parts), with details and **working drawings,** taken from real apparatus. Vol. 1—Static machines, batteries, storage cells, rectifiers etc., etc. Vol. 2—Voltmeters, ammeters, telegraph and telephone instruments, shocking coils, spark coils, experiments, etc. Vol. 3—Dynamos, motors, electric engines, miniature lighting, wireless, Tesla coils, electroplating, etc.

Get Them Now—Price May Have to Advance Any Day

Price now 30c each. Postpaid

COLE & MORGAN, Inc.
Publishers
Dept. 4, 19 Park Place, New York, N. Y.

Announcement

Leo J. Meyberg Co.

Announce they have bought the business of

Haller Cunningham Electric Co.

428 Market St.
San Francisco

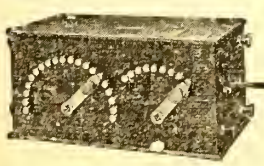
and that they have no connection with any other concern.

Send 4 cents for our catalog of Amateur Wireless Apparatus

AMERICAN ELECTRO TECHNICAL APPL. CO.
235 Fulton Street, N. Y. City **Tel. Cort. 3153**
BATTERIES—SPECIAL TYPE FOR AUDIONS



Detectors, Condensers, Variometers, Loose Couplers, Tuners, Bakelite, Brandes Head Sets, Army Head Bands, Binding Posts, Knobs, Levers, Sliders, Contact Points, Switch Knobs, etc. De Forest's High-Class Mfg. Radio Parts on hand.
"Catalog delayed beyond our control. It will be sent to those who have asked before the 1st of October."



Going Up!
It gives dandy results and is worth much more than $10.50. Order one now. Send 2-cent stamp for bulletin.
COLBY'S TELEGRAPH SCHOOL, AUBURN, N. Y.

"Shut down wave length to two-hundred meters and keep it there," ordered the apparent Bordinage. There was but one danger, namely, that the genuine Bordinage, listening in, should overhear the orders given to his confederate. But this was not the case.

With the wave as short as the present one, the danger of Bordinage's receiving the following message from Stevenson was nil, and it would be equally impossible for Larnelle to copy the *bona fide* communication from Bordinage in the old wave length.

Stevenson tapt out:

"S. on doings as method communication not now as be 840 w. 80 at P. M. all Bordinage." The "840 W. 80" being the residence of Stevenson.

When combined with the personal of that day, the full message read:

"Larnelle: S. S. onto doings. Ignorant as to method of communication. Europe not possible now. Plan as followed: Be at 840 W. 80 with all goods at nine P. M. All arranged. Bordinage."

As he threw in his switch for receiving, the "O. K. Larnelle" ticked in his ears, followed, as he returned to the former meterage, by a crashing, high-pitched call for the Brooklyn Navy Yard from a Canadian Station at Q——. In the midst of the communication the sender quit abruptly and apparently from t same station came the call, "Larnelle Larnelle, Bordinage."

Stevenson switched to a rotary gap, and, running it slowly, answered in the uncertain manner of Larnelle. The message from Bordinage followed:

"....s. on business as method communication only safety T be landing all at A. M. as Bordinage."

When Stevenson O.K.'d the message as Larnelle had done in previous times, the Canadian station returned and continued the message where it had left off. Its tone and wave length were identical with that of the Bordinage station.

At the completion of the communication, Stevenson handed the 'phones to the regular operator and compared the Bordinage message with the personal. Decoded it read:

"Larnelle: S. S. onto business. Ignorant as to method of communication. Europe only possible safety. Plan "T" followed: Be at landing with all goods at nine A. M. as arranged. Bordinage."

His conjecture was correct; they intended to flee.

As Stevenson made his way homeward, a possible explanation for the interruption of the Canadian station occurred to him. Upon reaching his quarters he immediately got in touch with the New York Branch of the U. S. Secret Service.

"Hello...Langford arrive yet?...No?... Well, as soon as he gets in, send him over to Stevenson's.... yes, important."

Early that morning, Langford, tired from a sleepless journey on the Washington flier, arrived at Stevenson's dwelling.

The friends shook hands and Stevenson inquired:

"The men, will they get here this evening?"

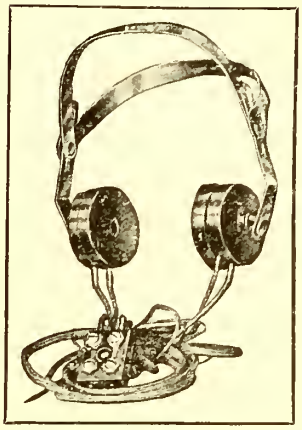
"Sure, they'll all be here, but what's this something 'important' you want and then me for your bed."

"This is it: I think that we can get hold of the leader also. Here is my whole plan...." and he recounted to the amazed Langford how he had first caught on to the drift of things.

"But how under the sun could they have deciphered our codes?" demanded the secret service man.

"A person of sufficient ingenuity to formulate a cipher of the cleverness that Bordinage employed should have no trouble in decoding those of yours which he received thru the air.....But for the last part of the plan. Have extradition papers ready

MURDOCK No. 55



2000 Ohm Set.....$4.50
3000 Ohm Set..... 5.50

WHY PAY MORE?

Here are receivers that will respond to the feeblest signals. They are unquestionably

SENSITIVE

Here are receivers so rugged in construction that they will keep their sensitive adjustment longer than any others made. They are unquestionably

DURABLE

Here are receivers fitted with every accessory tending to comfort and convenience. They are unquestionably

COMFORTABLE

Here are receivers designed to have 100% perfect appearance. They are unquestionably

GOOD LOOKING

They fill every requirement in every respect, at prices considerably under any obtainable anywhere.

WHY PAY MORE?

The demand for our receivers and other MURDOCK apparatus has been so great that we advise early orders if you wish to secure prompt service.

Bulletin 19B sent free on request

WM. J. MURDOCK CO.

55 Carter Street, Chelsea, Mass.
509 Mission Street, San Francisco

Star Storage Batteries
More Dependable
Lower in Price
The BEST Guarantee
Liberal discounts to dealers; write for particulars.
THE
STAR STORAGE BATTERY CO.
Manufacturers of
Automobile Starting and Lighting Batteries
Muncie, Ind. **U. S. A.**

STUDY HUMAN NATURE Learn to recognize the marks that nature has stamped all over the human form. Look through and beyond the deceptive smile. Know the strong and weak points of those you meet. Send 5 cents in stamps for "PERSONAL POWER", a little book that tells how. Address F. A. Koss, Secretary Progress League, 31 Union Sq., N. Y. City

www.americanradiohistory.com



HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY HANDICAPPED if you lack High School training. You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE This Course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and *meets all requirements* of a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY

Most people *idle* away *fifty* hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within *two years*. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

YOU RUN NO RISK So that you may see for yourself how thorough and complete our training is, we invite you to take *ten lessons* in the High School Course—or any course of specialized training in the coupon below—before deciding whether you wish to continue. If you are not then satisfied, we will refund your money in full. *We absolutely guarantee satisfaction.* On that basis you owe it to yourself to make the test.

Check and mail the coupon NOW for full particulars and Free Bulletin.

AMERICAN SCHOOL
OF CORRESPONDENCE
Dept. H-268 Chicago, Illinois

TRAINING—THE KEY TO SUCCESS

Explain how I can qualify for the position checked.

.....High School Graduate	.....Lawyer
.....Electrical Engineer	.....Business Manager
.....Elec. Light & Power Supt.	.....Certified Pub. Accountant
.....Hydroelectric Engineer	.....Accountant and Auditor
.....Telephone Engineer	.....Bookkeeper
.....Telegraph Engineer	.....Stenographer
.....Wireless Operator	.....Fire Insurance Expert
.....Architect	.....Sanitary Engineer
.....Building Contractor	.....Master Plumber
.....Civil Engineer	.....Heating & Vent. Engineer
.....Structural Engineer	.....Automobile Engineer
.....Mechanical Engineer	.....Automobile Repairman
.....Shop Superintendent	.....Airplane Mechanic
.....Steam Engineer	.....General Education Course
.....Draftsman and Designer	.....Common School Branches

Name .....

Address .....

from Canada for one Bordinage, and also a squad of Canadian plain-clothes men watching the wireless operator at Q—— ready to arrest him the minute you telephone the word. Of course, I'm not sure he's the man; but if so, by to-night I'll get hold of sufficient evidence to demand his arrest."

"Why not, after the capture of the criminals, get the men themselves to tell the whereabouts of Bordinage? That seems the simplest way," argued Langford.

"Because," returned the radio man, "I doubt if they really know who or where he is. He has played one of the safest games in the annals of crime. And also I will require the use of the Brooklyn Navy Yard station for the whole day. You remain here to direct the capture of the men."

Before noon, Stevenson again journeyed to the Navy Yard, where Langford's influence gained him control of the key.

He had scarcely seated himself, when the operator at the Canadian station at Q—— signaled an outgoing ship. Stevenson threw on his sending apparatus and called "Bordinage, Bordinage, Bordinage, Larnelle." There was no danger of Larnelle hearing for the wave was in the upper hundreds and Larnelle, in obedience to the orders of apparently, Bordinage, had reduced to two-hundred.

There was no response to his call of "Bordinage."

A few minutes later the same Canadian operator transmitted the weather reports relayed from the astronomical station at St. Johns. Again Stevenson made a futile attempt to call Bordinage.

Thruout the afternoon and evening, except when the navy station was operated for government use, and *only when the Canadian operator was busy*, the hobbyist vainly endeavored to reach Bordinage.

Shortly after nine, Langford entered and announced that the active members of the gang, including Larnelle, coming to Stevenson's home, had been arrested with little difficulty. They had brought the "goods," *five boxes of tightly packed ten-dollar bills.* Stevenson had been correct. They profest ignorance as to the whereabouts of their leader.

The radio man motioned for quiet and again listened to the Canadian operator in communication with an Atlantic vessel.

"How about this Bordinage," broke in Langford.

"I'm going to get him now," responded Stevenson.

A moment after the man at Q—— had completed his orders to the ship, Stevenson prest the key with:

"Bordinage, Bordinage, Bordinage."

It was the first time he had flashed the call *when the Canadian operator had not been transmitting.* "Larnelle Larnelle" he signed.

Silence for the moment.

Then back crashed the acknowledgment in the high-pitched tone of the Q—— station. "Larnelle Larnelle, Bordinage."

A coincidence was impossible! By a process of elimination the operator at Q—— and Bordinage *were the same!*

The light from the powerful nitrogen bulbs flooded the trans-Atlantic station at Q——, and, reflected from the polished instruments, dimmed the pale glow of the Audions into almost obliteration.

One of the two men in the outer office noiselessly replaced the Long Distance 'phone upon the desk.

The radio man moved nervously in a swivel chair, as for the fifth time in half as many minutes, he had screeched out to the unresponsive Larnelle.

Feeling a hand on his shoulder, he whirled in his seat and faced—a representative of the Canadian Secret Service.

(The End.)

WIRELESS OPERATORS *are in* *Great Demand*

BIG salaries paid to trained men. Our course of instruction will qualify you rapidly for an excellent position. Unusual opportunity to see the world. Autumn classes just starting. Enroll now. Terms moderate. Easy payments.

Eastern District Y. M. C. A.
179 Marcy Avenue
Brooklyn, N. Y.
Telephone Williamsburg 3800

Memorize Continental Code Almost Instantly
My method is the short cut. Complete Chart and full instructions 10 cents.
C. K. DODGE
MAMARONECK, N. Y.

WIRELESS TELEGRAPHY
Make your own "Wireless," also Dynamos, Batteries, Motors, Telegraph, Telephone, Lights, Bells, Alarms, Coils, Current Reverser, Electric Engines, etc. Book with 75 Illustrations; by experts so anyone can understand it. With Catalog. **All 10c, 3 for 25cpp**
J. C. Dorn, 705 S. Michigan St., Dept. 22, Chicago, Ills.

Arnold **Loose Couplers**
Combination Loose Coupler Parts and accessories.
Send 3c stamp for literature which is sure to interest you.
J. F. ARNOLD 2082 Lexington Av. N.Y. Established 1910

Universal Radio System
Up to the minute radio apparatus for progressive users who can recognize quality.
Send stamp for catalogue.
Universal Radio Mfg. Corp.
Dept. W Elmira, N. Y.

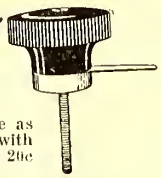
Sale on Dry Cells
We have in stock a quantity of slightly used batteries which we are closing out at **$1.25 PER DOZ.** These cells will be shipped by express only. Send money order or cash in registered letter—no stamps accepted. Five cents will bring our illustrated catalogue showing other bargains in the electrical line.
ELECTRICAL SPECIALTY CO.
Dept. E., 128 So. 11th St., Philadelphia, Pa.
Dept. E., 48 So. Front St., Columbus, Ohio

SEND TO-DAY
For Catalog for Complete Line of
Receiving Apparatus
REMLER RADIO MFG. CO.
163 Sutter St. San Francisco, Calif.

www.americanradiohistory.com



WIRELESS!



KNOB AND SWITCH LEVER—Mounted on brass bearing and shaft, threaded 6-32, two inches long. Lever securely fastened to knob. Each 40 cents, postage 4 cents.

KNOBS as illustrated above as used on switch 1¼x¾ with hole for mounting, each 20c postpaid.

Consolidated Radio Call Book, postpaid, $1.00

CONTACT POINTS 7/32x7/32 Brass with screw for mounting. Postpaid 25c per doz.

Bakelite-Dilecto panels, about

9½ x 19 x ¼	Black XX	$4.00
19 x 19 x ¼	Black XX	8.00
9½ x 19 x 3/16	Black XX	3.00
19 x 19 x 3/16	Black XX	6.00

Send 5 cents in stamps for our catalog and get on our mailing list for future bulletins.

A. H. CORWIN & CO.
924 Kinney Building Newark, N. J.

Get Our Prices

on the Wireless Apparatus you need, before buying.

We handle new and second hand instruments on which we can save you money.

All Second Hand Instruments guaranteed to be in perfect working order.

WHAT DO U NEED?

Send us your list now

Radio Equipment Co.

630X Washington St. Boston, Mass.

PRE-WAR PRICES

Large Stock — Immediate Shipment

No.	Switch Points	Doz.	50	100
626—	¼"x⅜" tapped 6-32	$.30	$1.00	$1.75
627—	¼"x¼"x½" shank 6-32	.36	1.25	2.00
628—	¼"x¼" tapped 6-32	.30	.90	1.50

Above prices plain brass finish. Nickeled points 50% advance. Postage extra.

Send card today for Circular G

Shotton Radio Mfg. Company

Successors to
Maguire & Shotton, Albany, N. Y.
P. O. BOX 3, SCRANTON, PA.

RECO QUALITY

SUPERLATIVE RADIO EQUIPMENT
THE BEST KEY IN THE COUNTRY
10 Amp. $7.75—20 Amp. $8.25
A three cent stamp will bring bulletins of this and other higher grade apparatus.

The Radio Engineering Company

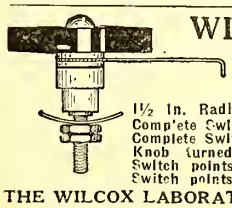
22 St. Paul St. BALTIMORE, MD.

NEW - ORLEANS

WIRELESS SUPPLIES AND MINERALS OF ALL DESCRIPTIONS
Send 6c for Catalogue

L. A. ROSE

4323 MAGNOLIA STREET
NEW ORLEANS, LA.



WILCOX PANEL SWITCH

"The Best"

1½ In. Radius

	Postpaid Price
Complete Switch, polished brass finish	50c
Complete Switch, nickel plated finish	60c
Knob turned and polished	25c
Switch points, brass finish	2c
Switch points, nickel plated finish	4c

THE WILCOX LABORATORIES, Lansing, Mich.

NEW 24-CYLINDER LIBERTY MOTOR.

The War Department has developed a 24-cylinder Liberty motor which has just been successfully tested at McCook Field. Originally the Liberty motor was designed for eight cylinders, then enlarged to twelve cylinders. The engine used in the test at McCook Field was built of standard Liberty twelve ports. The changes were few, consisting chiefly of the use of two regular crank case upper halves, one of which was somewhat altered, and special design connecting rods.

The following table compares the Liberty 12 and experimental Liberty 24:

HORSE POWER (NORMAL).

Liberty....24 673 Liberty....12 400

POUNDS PER H. P. (DRY).

Liberty....24 1.97 Liberty....12 2.11

GAS CONSUMPTION (POUND) PER H. P. AN HOUR.

Liberty....24 .55 Liberty....12 .51

The experimental Liberty 24 compares favorably with successful tests of foreign motors of approximately the same power. An engine of this power, if run at the normal speed, would enable the use of a comparatively large slow-speed propeller without gear reduction, thus increasing propeller efficiency.

The following table compares the Liberty 24 and various high-powered foreign motors:

Motor and Country of Mfg.	H.P.
Dedion, France	800
Liberty 24, United States	*673-738
Fiat A-14, Italy	600
Rolls-Royce "Candor," England	600
Anzani 20, France	600
Renault 12-M, France	550
Salmson 18-Z, France	500
Napier "Lion," England	450

*Experimental, not rated.

The Electrical Machinist

By H. Winfield Secor.

(Continued from page 658.)

down operation is not carefully watched, the tool is liable to "hog-in," and before you know what has happened, there is one grand bang, and there are commutator segments in sixty-four different parts of the machine shop. Practical experience has proven that the best tool for all ordinary commutator work up to 6 to 8 inches in diameter, is a ¼-inch to $\frac{5}{16}$-inch piece of self-hardening steel, ground carefully to a diamond point with a good clearance. This tool should measure about 1½ to 2 inches long, being supported in an Armstrong or other patent tool holder of the clamping type. A left-hand tool holder should be used in turning a commutator. If the commutator is to be machined, then the armature is invariably placed in the lathe with the commutator facing the tail-stock center. This means that the tool will be fed from right to left across the commutator, taking a fine cut, the depth of which can best be judged by actual experience in turning a few commutators of different sizes. As will be readily appreciated, great care must be exercised to quickly release the tool carriage *feed*, as the tool approaches the rear end of the commutator where the connecting lugs are, or it will "hog in" with disastrous results so far as the mechanical job is concerned. On small commutators it is the best practice unless you are a skilled Electrical Machinist, and used to turning commutators, not to use the automatic feed on the lathe carriage and screw, but to traverse the carriage and tool along

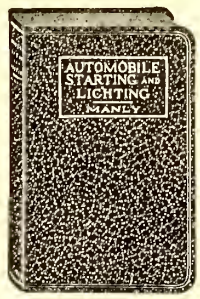
FIT YOURSELF FOR THE BIG JOB

Don't hesitate any longer. There is a greater demand for trained men now than ever before—greater opportunities—bigger pay—more rapid advancement. It's training that counts now—accurate knowledge—a complete grasp of your trade.

Drake's Practical Mechanical Books

FOR HOME STUDY pave the way to the fat pay envelope. Written in non-technical language that any man can grasp. Send the price of any book listed below. We will send the books postpaid—you keep them five days—if not entirely satisfied return the books and your money will be refunded in full.

AUTOMOBILE BOOKS



Brookes' Automobile Handbook. 1919 edition, by L. E. Brookes, pocket size. Leatherette $2.00

Automobile Ignition. By H. P. Manly. Pocket size. Leatherette $2.00

Automobile Starting and Lighting. By Manly. 1919 edition. Pocket size. Leatherette $1.50

The Ford Motor Car and Truck and Tractor Attachments. By Manly. Leatherette $1.50

Automobile Catechism and Repair Manual. Pocket size. Leatherette. $1.25

Practical Gas and Oil Engine Handbook. By Brookes. Pocket size.....$1.50

Traction Farming and Traction Engineering. Cloth. $1.50

ELECTRICAL BOOKS
(All Leatherette binding)

Electric Motors, Direct and Alternating.....$1.50
Wiring Diagrams and Descriptions.....$1.50
Armature and Magnet Winding.....$1.50
Modern Electrical Construction.....$1.50
Drake's Electrical Dictionary.....$1.50
Drake's Telephone Handbook.....$1.50
Alternating Current.....$1.50

STEAM ENGINEERING

Swingle's Handbook for Steam Engineers and Electricians .....Leather $3.00
Complete Examination Questions and Answers for Marine and Stationary Engineers Leatherette $2.00

RAILWAY BOOKS

Locomotive Engineering.....Leather $3.00
Locomotive Engine Breakdowns, with Questions and Answers.....Leatherette $2.00
First, Second and Third Standard Examination Questions and Answers for Locomotive Firemen Leatherette $2.00

SHOP PRACTICE BOOKS

Sheet Metal Workers' Manual.....Leatherette $2.00
Sheet Metal Work and Pattern Drafting..Cloth $1.50
Oxy Acetylene Welding and Cutting Cloth $1.00, Leatherette $1.50
Modern Blacksmithing.....Cloth $1.00

PAINTING BOOKS

Scene Painting and Bulletin Art.....Cloth $3.00
A Show at Show Cards.....Cloth $3.00
Sign Painting.....Cloth $3.00

CARPENTRY AND BUILDING

Modern Carpentry.....2 vols., Cloth $2.00
The Steel Square.....2 vols., Cloth $2.00

GENERAL INSTRUCTION AND REFERENCE BOOKS

Elementary Chemistry, Self-Taught.....Cloth $1.00
Complete Courses in Civil Service.....Cloth $1.50
Practical Handbook for Millwrights.....Cloth $2.00



Just Out!

FRENCH
SPANISH } Without a teacher
GERMAN

By Professor Philip Schuyler Allen, University of Chicago. An entirely new home-study series of modern foreign languages. Simplest, easiest-to-master language method ever devised.

French, Spanish or German, pocket size, cloth each.....$1.25

Drake books are for sale at all leading book stores. Do not accept Substitutes.

Mail the Coupon NOW

Order on our five day money back plan.

FREDERICK J. DRAKE & CO.,
1909 Michigan Ave., Chicago, Ill.

Enclosed find ($.....), for which please send me prepaid the books checked in this adv. (or list attached). It is agreed that I may return same in 5 days if not entirely satisfied, and money will be refunded in full.

Name .....

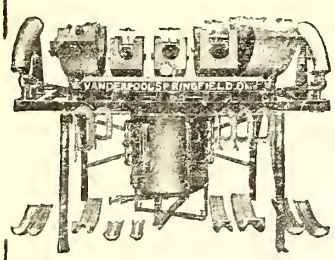
Address .....

www.americanradiohistory.com

Could You Handle $100 a Day?

Repair—Rebuild—Retread Tires the Vanderpool Way

Profits 100% or more. Small investment. We are the pioneers in the manufacture of vulcanizers that guarantee absolutely PERFECT work. Business pours in. Work easy to learn. If others have been successful, so can you be. Write today for full particulars.



In answering address Dept. U 18

WM. VANDERPOOL CO.
Springfield, O.

BE AN EXPERT



Auto and Tractor Mechanic Earn $100 to $400 a Month

Young man, are you mechanically inclined? Come to the Sweeney School. Learn to be an expert. I teach with tools not books. Do the work yourself, that's the secret of the

SWEENEY SYSTEM

of practical training by which 5,000 soldiers were trained for U. S. Government and over 20,000 expert mechanics. Learn in a few weeks; no previous experience necessary.

FREE Write today for illustrated free catalog showing hundreds of pictures men working in new Million Dollar Trade School.

LEARN A TRADE
Sweeney
SCHOOL OF AUTO-TRACTOR-AVIATION
66 SWEENEY BLDG. KANSAS CITY, MO.



SLIGHTLY USED STANDARD MAKE TIRES

Size	New Tube	Price	Size	New Tube	Price
30x3	$1.85	$ 4.50	35x4½	$3.00	$10.25
30x3½	2.00	5 00	36x4½	3.50	10.50
31x3½		5.50	35x5	3.75	11.00
32x3½	2 25	6 00	36x5		11.50
31x4	2.75	6.50	37x5	4.00	12.00
32x4	2 40	7.50			
34x4	2.70	8 50	Special—Brand New		
34x4½	2.85	10.00	32x3½ Cord		$12.25

Order now. Shipment made the same day. $1 deposit required with each tire order, balance C. O. D., subject to your examination. Specify whether you desire to have clincher or straight side tire.

Special cash discount of 5 per cent if full amount accompanies order.

CENTRAL TIRE & VULCANIZING CO.,
2309 S. STATE ST., Dept. E. E. CHICAGO



Says the Master Mechanic. The Greb Automatic Grip Puller is a One-Man Puller—Quick-acting, strong and simple in the extreme. May be locked in any desired position. A combination of two or three arms. Heavy Duty Size capacity 1" to 18"—Junior size capacity 1" to 7". Two sets of jaws furnished with each size.

Ten Days' Trial If your dealer or jobber does not have them we will send you one. Try it ten days. If not satisfactory, return to us and we will refund your money. We also make the GREB RIM PULLER.

THE GREB CO., 239 Slate Street, BOSTON

the commutator by hand. The commutator should revolve at medium speed, it usually proving the best practice to shift the belt on the lathe to the center cone on the stept pulley. Be sure to oil the tail-stock center, or both centers, if the armature or shaft supporting the commutator is supported at two centers instead of gripping the rear end of the shaft in the live chuck; also watch the tail-center closely, making sure that it is kept tight, and does not slowly loosen, or the armature may fly out of the lathe and be badly damaged. There are two ways of supporting the armature or shaft in the lathe;—in the *first* method a *dog* is secured to the rear end of the shaft which engages with one of the slots in the face plate mounted on the lathe spindle. In the *second* method, the commutator end of the shaft, as shown at Fig. 2, is supported on the tail center, while the rear or pulley end of the shaft is gript in the lathe chuck. Care must be taken to accurately center the shaft in the chuck if it is an independent 3 or 4-inch jaw chuck, and of course, if it is an automatic self-centering chuck, then the shaft will be centered without trouble, at once. Do not under any consideration, allow the chuck jaws to close down on the shaft directly; a piece of thin brass or copper is placed around the shaft and the jaws of the chuck are allowed to press on this, so as not to damage the shaft.

Finishing the commutator: After the commutator has been turned down, until all of the burnt spots or *low areas* have been cleared up and a new even surface is seen all around the commutator, it is ready to be finished or polished. It is good practice to start finishing the commutator (the tool of course being backed away from the commutator, or in fact removed from the tool post), by gently applying a fine cut file. This means a single cut file and not a double cut one, and also one having a fine pitch. After the rough surface has been pretty well drest down by a light application of the file applied over the rotating commutator as evenly as possible, it can then be finished with fine sand paper. Some machinists use first a medium coarse sand paper, and then finish with a fine sand paper. *Emery cloth must never be used on any commutator, under any condition whatsoever.* Particles of emery lodge in the mica between the commutator bars, and tend to conduct the current, thus short-circuting the bars. Sometimes bad spots will develop in the mica; thoroly clean out this spot until the white mica is seen, and all charred portions removed; this hole is then filled with a few drops of water glass (sodium and potassium silicate) and this is allowed to harden. This is a very good insulator, and has saved many commutators from breaking down electrically.

Such holes or grooves can be easily cleaned out by means of the small steel tool shown at Fig 3 D. These tools are carried by all electrical and motor men, and they are usually constructed from the ends of broken hack-saw blades, taped up along the handle portion.

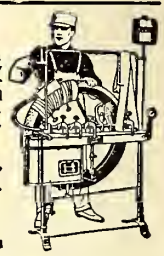
At Fig. 3, several interesting wrinkles in commutator machine work are shown. At A, the position of the diamond point tool is illustrated from above. This tool should be placed at an angular position as shown, and so ground that when it comes up in line with the lugs on the commutator bars, the side of the tool will not touch before the point does. Sometimes it is necessary to take a cut or two over the radial face of the commutator segment lugs, and even the edges of these lugs are frequently turned down. The usual surfaces finished on a commutator are shown at 3-F, and marked F. All narrow edges

AN EASY WAY TO MAKE MONEY

Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business. One man says "I made $60.00 the first day." Others average $200 to $500 a month. Very little capital needed. Jobs plentiful. Every motorist a possible customer. No experience needed. We teach you.

SHALER Tire Repair Outfit

Improved Wrapped Tread Method Used by Tire Manufacturers



Does as good work as the big high priced vulcanizing outfits. A boy can use it. It's the only vulcanizer that has Automatic Heat Control, and can't undercure or overcure a tire. Requires no watching or regulating.

FREE Book

"How to Open a Tire Repair Shop." It tells how to make big money. Don't delay. Write quick.

C. A. SHALER CO.
2210 Fourth St. Waupun, Wisconsin

Start a Garage

Make $100 to $400 a Month

Right in your own neighborhood. Be a Rahe Trained Motor Mechanic and get into a good paying business at once 80 000 small towns and rural communities without a Garage of any kind.

Learn in 6 to 8 Weeks

Daily practice on Automobiles, Trucks, Tractors — Greatest Training Equipment in America. All you need is will to "Learn By Doing." (No colored applications)



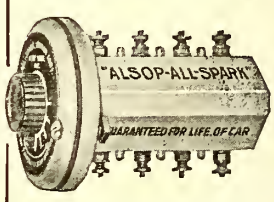
Write for 7-Day Trial Offer and Big Book **FREE**

RAHE AUTO AND TRACTOR SCHOOL
Dept. 2420
Kansas City, Missouri

No More Spark Plugs

need be bought if you use the

"ALSOP-ALL-SPARK"



the spark intensifier that puts new life into dead and worn out plugs. You'll never have to stop and clean your plugs again if you equip your car with the "All-Spark." Quickly attached to any 4-cylinder car, truck or tractor. Instantly regulated from the dash.

Price Complete, $7.50

Saves Fuel and Spark Plugs. Gives More Speed and Power. Sparks Carbon Choked Plugs. Causes Perfect Combustion. Gives More Powerful Spark. Eliminates Carbon and Vibration.

Order to-day or write for circular.
All-Spark Ignition Co., Inc., 13X Water St., N. Y. C.

Learn Autos and Tractors



Wonderful opportunities constantly offered trained men; we train you thoroughly to start your own business or make good money as motor expert, driver, shop foreman, etc.

5000 Graduates making good. Catalog Free.

Cleveland Automobile School, 1807 E. 24th St., Cleveland, O

MARKO

STORAGE BATTERIES
ARE GOOD—TRY ONE
Paul M. Marko & Co., Inc.
1402-1412 Atlantic Ave.
Brooklyn, N. Y.

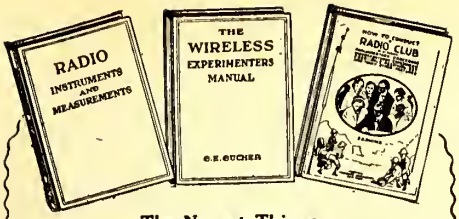


HERE'S YOUR CHANCE

This 5 Passenger, 4 cylinder, 37 H. P. BUSH Car—Timken Bearings—Willard Batteries—2 Unit Starting & Ltg.—116-inch whl. base. Write at once for the best Automobile Offer in existence—Don't wait—Cars guaranteed or money back.

BUSH Address J. H. Bush, President, Dept. [illegible] MOTOR CO., Bush Temple, Chicago, Illinois

www.americanradiohistory.com



The Newest Things
IN WIRELESS
Are in These Three Books
Just Off The Press

RADIO INSTRUMENTS AND MEASUREMENTS
Every amateur should have this book as it answers the questions you want to ask and covers all phases of the subject matter indicated by its title.
Cloth Bound, 320 Pages. Price $1.25

THE WIRELESS EXPERIMENTERS' MANUAL
By E. E. Bucher
Mr. Bucher's latest book. The only one that comprehensively covers all phases of wireless work, including the latest practices in both Radio Telegraphy and Telephony. Most complete text book on these subjects yet published.
Cloth Bound, Approximately 300 Pages. Price $1.75

HOW TO CONDUCT A RADIO CLUB
By E. E. Bucher
One of the most popular wireless books ever published. Covers parliamentary procedure, indoor and outdoor experiments, 5,000-mile receiving sets, use of vacuum tubes and many other subjects.
Paper Cover, 148 Pages. Price 50c

THE WIRELESS AGE
A monthly magazine that will keep you posted on the up-to-the-minute things in wireless communication. Official organ of the National Amateur Wireless Association.
Price Per Year $2.00

SPECIAL COMBINATION PRICE
All Four for Only $4.50

WIRELESS PRESS
1850 Woolworth Building, New York

"The Livest Catalog in America"
Our big, new electrical cyclopedia No. 20 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 180 Big Pages, 500 illustrations, 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy." 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 20 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.

WIRELESS

Send 6 cents in stamps or coin for which we will send our latest Cyclopedia Catalog No. 20 as described.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

$2
Get Details



Telephone Sufferers!
THERAPHONE
High Power Scientific Receiver Earpiece is tuned to the ear. It can't confuse nor fatigue. Absorbs shocks, improves the Hearing and conserves time. For Busy, Deaf, Nervous, Privacy and Noises. Guaranteed to suit. (Check or C. O. D.—Export $2.20). No Agents.
Evolution Phone Company
48 Greenwich Ave., New York City

WIRELESS Apparatus, Raw Materials, Magnet wires, motors, experimenters' needs, novelties listed in our Catalogue C-3. Assure yourself of prompt service and right prices by buying from this world famed, reliable, Experimenters' Supply House. 99 *of every hundred orders received shipped within 24 hours. Catalogue C-3 FREE on request.*
THE NEWMAN-STERN CO., Cleveland, O.

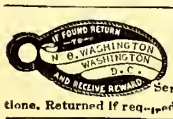


B-BATTERIES
Standard Signal Corps, U. S. Army for Vacuum Tubes Type BA-2, fully guaranteed, at 90c postpaid. Also Wireless Receiving and Sending Instruments at reasonable prices. State wants. Send for bulletin.
22.5 *Volts*
15 *Cells*
The H. S. Wireless Co., 164 Ross St., Brooklyn, N. Y.

STAMMERER



Send 10 cents for my remarkable book, "How To Stop Stammering." Kill the fear of stammering. Re education the key.
The Hatfield Institute, 109 N. Dearborn St., Chicago, Ill.



EARN MONEY
Stamping Names on Key Tags. $50
Either sex. Spare time. Some make
Send 25c for Tag with your name on and instructions. Returned if required. Exp. Key Tag Co., Cohoes, N.Y.

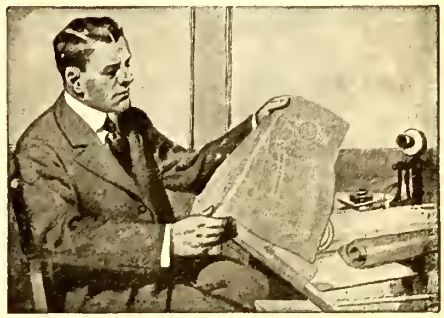
or surfaces are invariably machined off with the hand-feed of the tool rest and carriage. At Fig. 3-B, there is shown the proper position of the diamond point tool turning the commutator, and the point of the tool is best placed a *slight distance* above the center line of the shaft. A handy sand paper block, several sizes of which can be made where much commutator work is done, is shown at Fig 3-C. The curvature of the wooden block over which the sand paper is stretched, should approximate that of the perifery of the commutator. These blocks are extensively used in cleaning the commutator on motors and generators in actual operation in factories, etc. The sand paper is secured in two slots or by screw clamps on the rear of the block.

At Fig. 4 the operation of boring out a commutator to fit a shaft is shown, as well as the detail of the boring out tool. Tools for this purpose are available in the Armstrong or other style of patent clamping tool, in which a short nib of self-hardening steel properly sharpened may be placed, but it is common practice to forge a tool for this purpose of the pattern shown. The cutting edge of the tool may be ground to a diamond point on the emery wheel, as shown. In some cases it may expedite the work to use a drill somewhat smaller than the size of the shaft, for which the commutator is to be bored out to fit, placing the drill in a chuck held in the tail-stock sleeve. It is best to have the point of the boring-out tool slightly above center as before mentioned in the use of the turning tool. The automatic carriage feed, which traverses the tool either way along the lathe, may be used and time gained by increasing the *cut* a thousandth of an inch or two on the cross-feed handle. When the tool has progrest thru the commutator one way; thus a new cut will be taken by the boring-out tool when the carriage is being traversed back toward the tail-stock. It is presumed in this case that the commutator has been accurately centered as regards the outside perifery in the lathe chuck; also the commutator should not be gript by the chuck jaws directly, but a piece of $\frac{1}{16}$-inch brass or copper for small commutators, should be placed around the segments in the manner shown, and the jaws clamped down.

Inside and outside calipers are necessary to correctly carry out this machine operation, the outside calipers being first used to accurately determine the diameter of the shaft, and the inside calipers are then set from the other calipers. From time to time the inside calipers are then tried in the opening being bored out at the center of the commutator, and very light cuts taken toward the last, until the bore is of the right size to permit the commutator fitting on to the shaft. In some cases the commutator has to be bored out so that it will just fit on the shaft with a little urging, and it is then held in place by a key on the shaft. Very small commutators are usually made to have a driving fit. In other words, the hole bored out in the commutator in this case must be a few thousandths of an inch smaller than the diameter of the shaft. It is frequently necessary to apply ice to the shaft, and heat to the commutator, in order to *contract* the former and *expand* the latter, so as to allow the commutator to fit over the shaft. It may even then require a little urging with a mallet and a piece of pipe in order to drive it into place, depending upon how accurately the commutator has been bored out. In a short time the shaft will expand and the commutator will contract, thus providing a very firm juncture, and holding the commutator rigidly in position on the shaft.

(Next installment will appear in the December issue.)

Mechanical Engineering



Learn at Home!

Employers everywhere are looking for men with mechanical ability. Splendid salaries and rapid advancement are offered.

There is an easy, delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving men and women just the training they need for success in mechanical engineering and more than 200 other subjects. Hundreds of thousands have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6208, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

ELECTRICAL ENGINEER	CHEMICAL ENGINEER
Electrician	SALESMANSHIP
Electric Wiring	ADVERTISING MAN
Electric Lighting	Window Trimmer
Electric Car Running	Show Card Writer
Heavy Electric Traction	Outdoor Sign Painter
Electrical Draftsman	RAILROADER
Electric Machine Designer	ILLUSTRATOR
Telegraph Expert	DESIGNER
Practical Telephony	BOOKKEEPER
MECHANICAL ENGINEER	Stenographer and Typist
Mechanical Draftsman	Cert. Pub. Accountant
Ship Draftsman	Traffic Management
Machine Shop Practice	Commercial Law
Toolmaker	GOOD ENGLISH
Gas Engineer	STATIONARY ENGINEER
CIVIL ENGINEER	CIVIL SERVICE
Surveying and Mapping	Railway Mail Clerk
MINE FOREM'N OR ENG'R	Textile Overseer or Supt.
ARCHITECT	AGRICULTURE
Architectural Draftsman	Navigator / Spanish
PLUMBING AND HEATING	Poultry Raising / French
Sheet Metal Worker	Automobiles / Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____



WANTED—Railway Mail Clerks

Average $117 Month
Common education. Pull unnecessary. Men-Boys, 18 to 35

COUPON

Franklin Institute
Dept. L 101, Rochester, N. Y.
Sirs: Send me without charge, sample Railway Mail Clerk Examination questions; list of other government jobs now open, and free book describing them.
Name.....
Address.....



INSYDE TYRES Inner Armor
for Auto Tires. Double mileage, prevent blow-outs and punctures. Easily applied in any tire. Thousands sold. Details free. Agents wanted.
Amer. Accessories Co., Dept. 53, Cincinnati

www.americanradiohistory.com

Study Chemistry

with the aid of one of our chemical and apparatus sets. They contain all the chemicals and apparatus necessary to perform practically every experiment found in any text book.

All Chemicals are Contained in Class Bottles

Chemical Set No. 1	$13.50
Apparatus Set No. 1	11.75
Chemical Set No. 2	20.50
Apparatus Set No. 2	31.25
Chemical Set No. 3	54.25
Apparatus Set No. 3	55.00

Write for particulars which state quantities, etc., of chemicals and apparatus supplied.

Junior Set No. 00

For those who do not wish so elaborate a set at first, we have put out a Junior Set, consisting of 48 chemicals in glass bottles and 16 pieces of apparatus.

PRICE $5.00

Ziegler Experimental Laboratory
47 Judson St. ROCHESTER, N. Y.

USE HB BALL BEARING ELECTRIC MOTORS

Lower Power Cost – Better Power

HB Ball Bearing Electric Motors save greatly on operating cost. More economical, more dependable, better in every way than gas engine. Trouble proof, built for heavy duty. Ideal power for factory, garage and machine shop.

$20 brings you any HB Motor. Balance on easy terms.



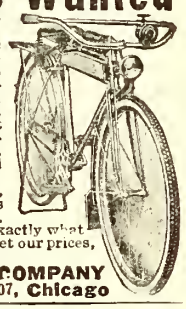
Sizes 1 to 15 h.p. A Size to meet Your Needs.

Service Department gladly advises on your requirements. Get their advice—FREE—simply state what machinery you wish to run and type of current available. Your power system planned for best results at least cost. Pin this ad to your letterhead and mail today for full information. Ask also about HB Battery Chargers, Generators, etc.

HOBART BROTHERS COMPANY
Box 215B Troy, Ohio
Successful Manufacturers Since 1868

Rider Agents Wanted

Everywhere to ride and exhibit the new **Ranger "Motorbike"** completely equipped with electric light and horn, carrier, stand, tool tank, coaster-brake, mud guards and anti-skid tires. **Choice of 44 other styles,** colors and sizes in the **"Ranger"** line of bicycles. **EASY PAYMENTS** if desired at a small advance over our Special Factory-to-Rider cash prices.

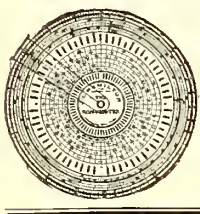


DELIVERED FREE on approval and 30 DAYS TRIAL.

TIRES Lamps, Wheels, Sundries, and parts for all bicycles—half usual prices.

SEND NO MONEY but tell us exactly what you need. Do not buy until you get our prices, terms and the big FREE catalog.

MEAD CYCLE COMPANY Dept. L-107, Chicago



SPECIAL KON-VER-TER SLIDE RULE

The Hamilton KON-VER-TER slide rule has over 8000 graduations and over 1800 characters on it, will handle anything in Arithmetic, Algebra, Geometry or Trig. This slide rule is in use in all parts of the world and is much simpler to operate than others of similar lines. Does not require a wizard to use it.

Eventually you will get this rule, get it now and save the extra bother and expense. Utility rulee $1.00. Special De Luxe, white ivory celluloid $2.50, instructione free. Leatherette case 50c extra.

J. C. HAMILTON & CO.,
Dept. R 7 Water St., Boston, U.S.A.

Handwriting Tells You Secrets

Be successful. Find out what holds you back. Send us an ink specimen of your handwriting and $1.00. Our expert Graphologists will tell you your faults, virtues, talents, etc. Your $1.00 back if you are not satisfied.

ROBERT R. ROSS, 110 West 40th St., N. Y.

Be FREE From STAMMERING

Home Exercise Course. Results GUARANTEED or NO PAY. Write for full particulars.
Sutherland Course, Educational Bldg., 70-5th Ave., N. Y.

Sir Charles Parsons on War Inventions.

(Continued from page 640)

Another device, used first by the Germans and afterward by the Allies, consisted of an insulated cable laid on the bottom of the sea, mark a passage thru a mine field or other intricate channel. One end of it was earthed and an alternating current was past along it. Delicate devices were then installed on the vessel, and these enabled it to follow the cable accurately. Sir Charles said that by this means ships were guided for a distance of fifty miles and followed the cable with as much precision as a railless electric street car follows a trolley wire.

BORING INTO THE EARTH FOR POWER.

Sir Charles also discust what England could do when its coal supplies began to give out, saying:

"One cannot but realize that, failing new and unexpected discoveries in science, such as harnessing molecular and atomic energy in matter, the great position of England cannot be maintained for an indefinite period. At some time more or less remote, long before the exhaustion of our coal, population will gradually migrate to those countries where natural sources of energy are most abundant."

He suggested that a new form of energy might be discovered by sinking a shaft twelve miles deep, * that is, about ten times as deep as any in existence. It would cost $25,000,000 and take about eighty-five years, but not only would much useful knowledge concerning the internal constitution of the earth in relation to minerals of high specific gravity be gained from it, but it might also solve the problem of obtaining power.

"In Italy, at Lardarello," Sir Charles said, "boreholes have been sunk which discharge large volumes of high pressure of steam which is being utilized to generate about 10,000 horse power by turbines. At Sol Fatara, near Naples, a similar project is on foot to supply power to the great works in the district. It seems, indeed, probable that in volcanic regions a very large amount of power may be in future obtained directly or indirectly by boring into the earth."

Sir Charles also spoke of the intense pressure produced by moderate forces closing up cavities in water. A committee appointed by the Admiralty investigated during the war the rapid corrosion of propeller blades of some ships performing arduous duties. It was "found that the corrosion was due to the intense blows struck upon the blades of the propellers by the nuclei of vacuous cavities closing up against them. Tho the pressure bringing the water together was only that of one atmosphere, yet it was proved that a nucleus of 20,000 atmosphere might be produced." Sir Charles said this great pressure might be generated under some conditions in rivers and waterfalls when the velocity in river current exceeded fifty feet per second, and was probably as great a source of corrosion as the washing down of boulders and pebbles.

*This scheme was fully described in Mr. Gernsback's editorial, "Tapping the Earth's Heat," in the March, 1919, issue of the "Electrical Experimenter."

Electricity furnished by a central station pumps half of the entire water supply of Baltimore, Md.

Send To-day for the "Electrical Worker's Friend"

An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting A.C. motors. Special at $3.50

Or write for full particulars of this valuable book.

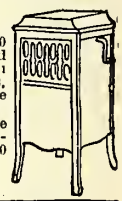
SMITH & SMITH PUBLISHING CO.
Dept. B. 1524 LOWRIE ST., N.S., PITTSBURGH, PA.



STUDENTS' ART MAGAZINE Publishes cash art assignments, lessons and articles on Cartooning, Designing, Illustrating, Lettering and Chalk-Talking. Criticises amateurs' work. Full of information for artists and art students.

Satisfactory or money refunded. 20c a copy, $1 for 6
Send $1 NOW. Thrift Stamps Taken
G. H. LOCKWOOD, Editor, Dept. 536, Kalamazoo, Mich.

CLEARTONE PHONOGRAPHS
$4.00 to $200.00 Retail



Needles 45c per thousand in lots of 500,000 Motors $1.35 to $14.75 each. Tone Arms and Reproducers $1.30 to $5.75 per set. Main Springs 20c to 90c each. Records, Needles, Sapphire Points and Parts at reasonable prices.

Write for our 84 page catalogue, the only one of its kind in America, illustrating 33 different styles of Talking Machines and over 500 different Phonographic Parts.

LUCKY 13 PHONOGRAPH COMPANY
Export Dept. 46B E. 12th St., N. Y., U.S.A.



Hang Your Own Lighting Fixtures

Semi-Bowl $5.85. Plate & Ball 85c. 4 light shower $5.35. Completely wired including glassware. Send for new catalogue, complete line.

ERIE FIXTURE SUPPLY CO.
Sta. C Erie, Pa.

EARN $1200 A YEAR IN SPARE TIME

WRITING ONE PHOTOPLAY a week right in your own home. We show you how to TURN YOUR IDEAS INTO DOLLARS. Demand increasingly Greater than Supply. Easy, fascinating, instructive work.

NO EXPERIENCE NECESSARY—just common sense and OUR HELP to make your "happy thoughts" and daily experiences into scenarios, *in the lives of all people—in YOUR life—are many incidents that will make heart appealing photoplays the producers are looking for.* Write NOW for our FREE book of valuable information and Special price and PRIZE OFFER.

Chicago Photoplaywright College, Box 279-E2 Chicago.

STAMMERING

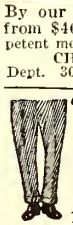
and other SPEECH DEFECTS quickly and permanently corrected at America's Pioneer School. Founded 1894. Thousands of graduates. Sessions continuous. Dormitories in connection. Scientific advice gladly given. Literature Free Consult Us.

THE LEWIS SCHOOL, 31 Adelaide Street, Detroit, Mich

LEARN WATCHMAKING

By our PROFIT SHARING plan watchmakers earn from $40 to $80 per week and the demand for competent men is greater than the supply. Write for free book.

CHICAGO SCHOOL OF WATCHMAKING,
Dept. 30, 190 N. State Street, Chicago.



"BOW LEGS and KNOCK-KNEES" UNSIGHTLY

Send for booklet showing photos of men with and without THE PERFECT LEG FORMS.

PERFECT SALES CO.
140 N. Mayfield Ave., Dept. 50 Chicago, Ill.





Men Wanted! To Become Draftsmen

Salary $175-$250 month when competent. Chief Draftsman will train you personally, also furnish free all tools and drawing table. Training given until placed in position at above salary. Address

CHIEF DRAFTSMAN DEPT.
Engineer's Equip. Co., Inc., Div 7448 Chicago

BE A BANKER

Prepare by mail in spare time for this attractive profession in which there are great opportunities for both men and women. Send at once for free book. "How to Become a Banker," by EDGAR G. ALCORN, President.

American School of Banking, 114 McLene Bldg., Columbus, O.

Be an Artist

Comics, Cartoons, Commercial, Newspaper and Magazine illustrating. Pastel, Crayon portraits. Poster and Fashions. Earn Big Money. *Taught by Mail* or Local Classes. Write for illustrated booklet, terms and list of successful pupils

ASSOCIATED ART STUDIOS, 13A Flatiron Bldg., N. Y.

www.americanradiohistory.com

Popular Astronomy Questions and Answers

By Isabel M. Lewis

(Continued from page 638)

of the sun and that cepheids of longest period have ten thousand times the luminosity of the sun and are rarely surpassed in size by other stars.

Knowing the light-giving power of these stars at a standard distance from the periods of their fluctuations, it is easily possible to find the distance of the clusters in which they appear by the simple relationship connecting apparent with absolute brightness for the apparent brightness of stars of a given magnitude varies inversely as the square of their distance from us.

This simple method founded on the peculiarities of the cepheid variables has yielded wonderful results and made it possible to find the distances of objects so far away that *their light takes two hundred thousand years to reach us*, as easily as the distance of a star ten or fifteen light years away can be found by direct trigonometric measurements of the parallax.

There are many theories to explain the puzzling cause of the fluctuations of light of the cepheids. It is doubtful if two stars are concerned as in the case of eclipsing variables, and it is generally believed that the light variations arise from some change within the masses of isolated stars, such as periodic pulsations or internal oscillations whose course is unknown.

FINDS ANOTHER NEW COMET.

Discovery of a second new comet in three days by the Rev. Joel H. Metcalf was announced August 20 by the Harvard College Observatory. After picking up in the eastern sky on August 20 the first of the year's new stray stars, Mr. Metcalf reported that on the night of the 22d at 11 o'clock he found in Bootes constellation in the western sky another uncharted body, more conspicuous than the first. The discoverer said it could be seen with a small telescope.

Verification of Mr. Metcalf's latest find came in an announcement from Paris of the independent discovery of the same body by M. Morielly of Marseilles the night after Mr. Metcalf found it. The Harvard Observatory also verified it by visual and photographic observation.

The two discoveries of Mr. Metcalf, which are the latest of many he has made, occurred at South Hero, Vermont.

AURORA BOREALIS TIES UP PHONE SERVICE.

Aurora Borealis or "Northern Lights" tied up the telephone and telegraph lines of Canada and the United States as far south as Kansas City and clear across the continent at intervals during the middle of August. The longest interruption was from noon until 12:30 the following day, when the peak load of both telephone and telegraph companies is always felt.

Measuring instruments showed that the "foreign" current had broken all known previous records when it touched 120 volts at times. Previously, when the effect has been felt, five volts was enough to cause trouble, but the record voltage this time exceeded all scientific records. The worst previous disturbance from this cause was in 1914.

According to officials of the Western Union Telegraph Company the disturbance paralyzed the New York City service at intervals.

ELECTRICITY AS A PROFESSION



is laden with success—possibilities for you! Now, while this promising profession is comparatively new and uncrowded, is the time to TRAIN.

The improved and advanced teaching methods of the School of Engineering of Milwaukee,—their original text books, lectures, laboratory experiments and workshop practice—will quickly train you to *develop yourself*, in addition giving you the thorough theoretical knowledge and Practical Ability that insure success.

Five Specialized Departments

have been organized, each complete in itself, covering all branches of electrical instruction. Among them is a place for you, no matter what your previous education or future aims.

College of Electrical Engineering

The B.S. Degree in 3 years, from the College of Electrical Engineering will fit you to immediately assume positions of importance in the electrical profession. Large expert faculty of instructors.

Institute of Electrotechnics

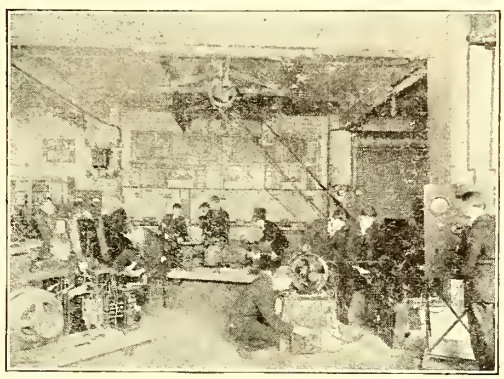
A Junior and a Senior Course organized to train young men having either an 8th grade or part high school education for a promising new profession. Prepares also for entering College of Electrical Engineering.

School of Practical Electricity

Will train you in one year to become a master electrician. The modern methods, fully equipped laboratories and latest electrical installations are the result of 15 years of continuous specialization in Electricity.

School of Electrical and Mechanical Drafting

A one year course, requiring no special educational preparation for entrance. Opens a vast field of opportunity to the man who will train.



Extension Department

Offers four special courses in Electricity, Mathematics, Drafting, and English. A practical method of mail instruction. "Earn While You Learn" is a most popular and practical plan at this school. A half day of school and a half day employment satisfactorily combines theory and practice.

Now Is The Time To Get The Facts

New Terms Open Jan. 2.

To be fully informed now may save you time and money later. For complete details and information concerning the course that interests you—Clip the Coupon **Now.**

Ask about the Students Fraternity House with Board and Room at cost. Athletics, Glee Club, R.O.T.C. (optional) and Lakeside advantages.

Scissors Here

I am interested in the below-marked course or courses. Kindly send me full information. Also booklet "Succeed through Electricity."

( ) College of Electrical Engineering.
( ) Institute of Electrotechnics.
( ) School of Practical Electricity.
( ) School of Mechanical and Electrical Drafting.
( ) Extension Department.
( ) Earn While You Learn.

Name .....

Address .....

Age..... Education.....

SCHOOL OF ENGINEERING OF MILWAUKEE

124-373 Broadway, Milwaukee, Wis.

What 15c Will Bring You from the Nation's Capital

Washington, the home of the Pathfinder, has become the World's Capital and reading the Pathfinder will be like sitting in the inner council with those who will mold the world's destiny for the next generation

The little matter of **15c** in stamps or coin will bring you the Pathfinder **13** weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth and only the truth; now in its **27th** year. This paper fills the bill without emptying the purse; it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you appreciate a paper which puts everything clearly, fairly, briefly—here it is. Send **15c** to show that you might like such a paper and we will send the Pathfinder **13** weeks. The 15c does not repay us; we are glad to invest in new friends. **Pathfinder, Box 76 ,Washington, D. C.**

INDEX to ELECTRICAL EXPERIMENTER SCIENCE & INVENTION

For Vol. 1, 2, 3, 4, 5 **15c**

EXPERIMENTER PUBL. CO.
Book Dept. 231 Fulton St., N. Y.

www.americanradiohistory.com

Health In A Glass Tube

The interesting story of a man "too busy to bother" who appreciated perfect health, energy and vitality only after he lost it—and how he won it back in a startling way

By FRANK HARTLE

YOU probably know dozens of people like my friend John Brainard. Strong, robust, a human dynamo for work, a real bull-dog for stamina, and a very likeable fellow in spite of his entire lack of sympathy for sickness and sick people. He regarded sickness as a mild sort of a crime and had such faith in his own excellent health that he had about as much sympathy for sick people as, according to Mark Twain, David had for Goliath. If you happened to mention that you didn't feel extra well, Brainard would say, as courteously as was absloutely necessary, "T'bad, very sorry"—and you could almost *see* the entire matter sail out of his other ear. Sickness and suffering were foreign to John Brainard and he couldn't understand it in other people, that was all.

But as Josh Billings once said, "Health is like munny. We never have a true idee uv its value until we lose it." And quite suddenly John Brainard realized what ill-health is. Too much overwork, inconsiderate hours, immoderate meals, and general inattention to his health finally "told on him." One day I went to his apartments and found him in bed with a severe attack of sciatica, but fuming with rage in spite of the intense pain. "Why should I have this?—I've been as healthy as a horse all my life. Why should *I* be sick?—hang, it, I won't be sick," and he jerked himself to a sitting posture only to fall back in pain upon the pillow.

For a week John Brainard lay in bed in intense agony. Those of you who have suffered from acute sciatica or rheumatism know what it is. The doctor came and went, but Tuesday and Friday when I called, John only said, with a weak attempt at his former cheerfulness, "Nothing doing, Frank. They haven't pushed the right health button yet. Who was that fellow, anyway, who said something about 'a man too busy to take care of his health is like a mechanic too busy to take care of his tools."

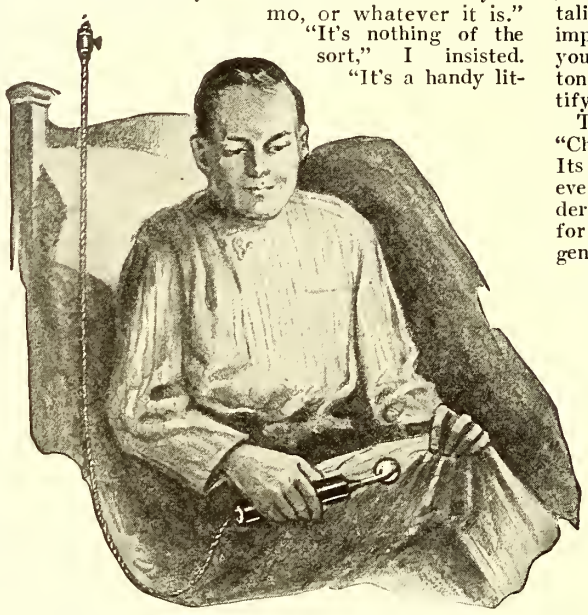
Next day while at lunch with George Conrad, our mutual friend, I mentioned about John's still being so very ill. "Listen, Frank, old boy," he said, "I don't want to be presumptuous or anything like that and I certainly believe that the Doc will fix John up fine, but there's a treatment which entirely cured my wife of chronic neuralgia, and now it's bringing total cure to my cousin, another sciatic sufferer. I think if John would give it a trial it might help him some." Ten minutes further conversation with Conrad convinced me and I went right over to John's home to "spring it."

"John," I said quietly, as I tip-toed into his bedroom, "I've got the very thing. Conrad has given me some real facts about what electric violet rays are doing for people and I think—"

"Oh," he interrupted, "I don't know, I don't imagine it can help me."

"Of course you don't know. And you never *will* until you try. Now don't talk foolish, Johnny, old scout. Won't you even believe your friends? This violet ray treatment has *proved* what it is."

And then I went on to tell him all I had learned about violet ray treatment—how it had been invented by the great Tesla in 1890, how it was being used with wonderful success by eminent physicians all over the world, how he could use it on himself and it wouldn't shock him like electricity in other forms, how it would surely at least *help* his own sciatica when it had *cured* other folks' sciatica, neuralgia, hay fever, asthma, neuritis and dozens of other diseases, and finally I told him how it would bring back to him his old "pep," vigor, and "knock-'em-dead" vitality. Then John rolled over and said, "Alright, if it brings me out of this blamed bed a well man I'll swear by it for life. Cart in the dynamo, or whatever it is."



"When I ran that glass tube over my hide'," said John, "it felt just like a local anasthetic on a wild tooth."

"It's nothing of the sort," I insisted. "It's a handy little tube-shaped thing that attaches to that electric socket right over your head. And you can apply it yourself right to your 'hide' without feeling a bit of a shock."

Three days late I had gotten a violet ray instrument from Chicago and John used it on his legs and thighs. "Say," he cried, after the first treatment, "I thought electricity always shocked a fellow. "Why, when I ran that glass tube over me and the violet rays flshed around, it just felt like a local anaesthetic on a wild tooth. If this keeps up—oh, boy!"

John Brainard got up for good three days ago for the first time in over two weeks. Five days' treatment with the violet rays put him on his feet.

"Where is your 'rheumatiz,' John," I remarked yesterday.

"Dunno, Frank, I can't find it anywhere. It just 'violet-rayed' itself away, I guess," he said, pointing to the instrument in the bathroom.

"I see you keep it attached."

"Yes, you see my wife discovered that the best beauty specialists in town used it, and she—well, my wife's a woman you know."

* * * *

Violet rays have brought *good results* in almost every disease and Violetta, being the most advanced instrument produced and selling many thousands ahead of all others, is certain to bring you the health-giving results you have always wished. But we do not want you to take our word for it. Judge for yourself—try it for ten days in your home before you decide one way or the other.

Now, through the Violetta, you can have in your own home, the wonderful violet-ray treatments exactly as given by eminent physicians and beauty specialists throughout the country. Now you can rid yourself of Chilblains, Colds, Corns, Constipation, Dandruff, Deafness, Eczema, Eye Diseases, Hay Fever, Headache, Goitre, Insomnia, Lumbago, Nervousness, Neuritis, Obesity, Paralysis, Piles, Pimples, Pyorrhea, Rheumatism, Skin Diseases, Sore Throat, and many other ailments.

Multiply your bodily health—vitalize your nerves—double or treble your energy and vitality. Sleep better, increase your strength, improve your appetite and digestion. Soothe your nerves, reduce or increase your flesh, tone and strengthen the entire system, beautify your complexion. All with the Violetta.

Trixie Friganza, the famous actress, says, "Cheerfully will I add my praise for Violetta. Its the best 'pain chaser and 'soother' I've ever had the good fortune to find. It's wonderful. It cured my brother of neuritis. As for myself, I use it for facial treatment and general massage. I cannot say too much for it." Frank Borzone, of Seattle, Washington, says: "I purchased the Violetta for my wife who was suffering from an acute attack of sciatica. From the very first treatment it induced peaceful rest and she is entirely well now." Scores of letters like these are received each day.

The Violetta is not a vibrator. It is not a machine that contracts the muscles—it does not shock—it does not pound the muscles—it is absolutely painless.

Eminent physicians from all over the country apply the Violetta with wonderful results. Dr. Bert H. Rice, of Vinton, Iowa, says: "I have good results with the Violetta. Almost instant relief in Facial Neuralgia." Dr. Daniels, Lisbon, North Dakota, says: "Have used the Violetta in such cases as Goitre, Bronchitis, Pleurisy, Neuritis, Neuralgia and Lumbago, and find it very beneficial. In fact, I would not be without it in my office." Dr. G. B. Duncan, Kewanee, Ill., says: "The Violetta is the finest thing I ever used to relieve congestion in any part of the body; and to relieve pain. Treatments are so pleasant that all of my patients like it."

Write today for a very interesting little booklet explaining fully about the Violetta and how you can try it for ten days before you decide. Read some of the amazing results produced in almost every disease. Read how the Violetta can be attached to any electric socket and also used where there is no electric light. Read how this little instrument, shaped somewhat like a thermos bottle with a glass tube and bulb at the end, pours electric energy and vigor into every muscle, fibre, cell, and pore of your body. Read how you do not have to obligate yourself in any way until the Violetta has proven its value in your particular case.

Write for this interesting booklet now. Fill out the coupon printed below for your further convenience, *and mail at once.* Address Bleadon-Dun Company, Dept. 2-J, 326 W. Madison St., Chicago, Ill.

BLEADON-DUN CO., Dept. 2-J, 326 W. Madison St., Chicago—Please send me your free booklet about the Violetta and ten days' trial offer.

Name.....

Address.....

.....

www.americanradiohistory.com

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section nine cents a word for each insertion. No advertisements for less than 75c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the January issue must reach us not later than December 12.

The Circulation of the Experimenter is over 123,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Auto Accessories.

Fords start easy in cold weather. Will run 34 miles per gallon on cheapest gasoline or half kerosene using our 1920 carburetors. Increased power; styles for all motors; can attach them yourself. Big profits to agents; money back guarantee. 30 days trial. Air Friction Carburetor Company, 270 Madison St., Dayton, Ohio.

Wanted—Good live selling agents to sell the Chainless, Clutchless and Gearless "Dayton" Electric Starting, Lighting and Ignition system for Ford Cars. Do not make application unless you can provide a Ford car and buy an outfit for demonstrating purposes, as "Ford owners are from Missouri and must be shown." The Dayton Electric Mfg. Co., Dayton, Ohio.

Battery Charging Pays Big Profits. City current or gas engine operates. Easy terms. Hobart Brothers, Troy, Ohio.

Auto Motors and supplies. Buick, Hupp, Franklin, Michigan, Everett, Hudson, Chalmers. Both water and air cooled motors, $40.00 each and up. Bosch Magnetos, $15.00 each and up. Presto Tanks, $5.00. Coils, Carburetors, Head Lamps, Horns, Air Compressors, Generators, Starters. Write for bargain bulletin second hand auto accessories. Johnston, West End Pittsburg, Pa.

Vulcanize Rubber without heat or tools. Whirlwind seller to every Auto owner. Further particulars free. Muscatine Agency, E. E. 402, Muscatine, Iowa.

Tires—Direct to you prices. Exclusive representatives wanted each locality to use and sell Mellinger Extra Ply Tires. Guarantee Bond 8,000 Miles. Sample sections furnished. Mellinger Tire Company, 980 Oak, Kansas City, Missouri.

Send one dollar for the Tuffley Puncture Detector. A new invention for quickly locating punctures in the inner tubes of automobiles, motorcycles, and bicycles, in a clean and scientific manner without the dirty and sloppy method of using water. Sent postpaid to any address for $1. Phil. W. Tuffley, 1456 E. St., San Diego, Cal.

Equip Your Car With Air Brakes. Upon receipt of $2.00 I will send you Blue prints and full description of my Patented Air Brake. R. E. Welch, 247 Auzerais Ave., San Jose, California.

Agents Wanted.

Next Saturday you can earn any of the following: a five cup detector, two slide tuning coil, telegraph outfit two stations, variable condenser, 1000 ohm wireless receiver, ground switch, 400 feet of copper clad aerial wire, high frequency buzzer, or 8 large aerial insulators for selling two dozen household necessities that go like wildfire because they sell so cheap. Send your order now but no money until you have sold them. Hurry, hustle, grab this chance. Leonard Beck, 1298 Carroll St., Bklyn, N. Y.

500 Agents Wanted at Once for Mitchell's Magic Marvel Washing Compound. 300% Profit. Enormous Repeater. "Washes clothes snotlessly clean in ten to fifteen minutes. One thousand other uses in every home. Astounds and delights every woman. Nothing else like it. Nature's mightiest cleanser. Contains no lye, lime, acid or wax. Free samples furnished to boost sales. We positively guarantee the sale of every package. Exclusive territory. Own your own business. You cannot fail to make big money. Barber, Ohio, made $600 last month. Send for free sample and proof. Hurry, hustle, grab this chance. L. Mitchell & Co., Desk 318, 1312-1314 E. 61st, Chicago.

Agents wanted to sell our high grade specialties. Ivol Supply Co., 703 Stanley St., Schenectady, N. Y. Send stamp for particulars.

Every Woman wants Silvoplate—Magic Cleaner that never fails. Sure easy sales plan; main or sideline; quick profits; prepaid deliveries. Sample, 10c; dogen, $1.60. L. B. Sutton, Manufacturer, D-5, New Canaan, Conn.

Agents—Free Sample Outfit. Greatest Washing Tablet proposition. Enormous profits as much as 18c on 25c sale. B. Thayer, 2140 T Clybourn Ave., Chicago, Ill.

Signs for store and office windows. $50 week easily made. Chicago Sign System, G-326 River St., Chicago.

Send for free catalog. "Golden Opportunities" Typewritten tested formulas. Chemical Analysis trade secrets in every line. No printed trash. Satisfaction guaranteed. Industrial Sales Service, 73 Washington, Memphis, Tenn.

Agents Wanted—Cont'd

$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Ave D, Decatur Ill.

Agents—Here is $50.00 to $200.00 weekly proposition. Permanent and repeat. Every office and home needs Argus Moistener for moistening stamps and envelopes. Argus paper clips and pencil and fountain pen holders sell to every man you show—they are different and better than any on the market. Write for particulars. Argus Mfg. Co., 406 No. Paulina St., Dept. 19, Chicago.

Agents—Something new—fastest sellers and quickest repeaters on earth. Permanent, easy, profitable business. Good for $18 to $36 a week. Address: American Products Co., 1500 American Bldg., Cincinnati, Ohio.

New Windshield Cloth solves baffling problem. One wipe cleans rain-blurred windshield. Stays clear 24 hours. Motorists amazed. Agents getting rich. 300% profit. Exclusive territory. Cabco Co., Toledo, Ohio.

Insyde Tyres, inner armor for Automobile tires. Double mileage and prevent punctures and blowouts. Quickly applied. Cost little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, Ohio.

"Klean-Rite"—Best laundry tablet made. Washes clothes without rubbing. Sells like wildfire. Pays agents biggest profit. Special offer and sample free. Besco. 3253. E. L. Belleplain, Chicago.

Sell me your Sparetime. Every house a sale. People all use it. For full particulars address, The Benninghof Chemical Co., Dept. 552, Hiram, Ohio.

Walk Agents: Men with spare time and speciality venders make $5.00 per day upward canvassing office buildings, banks, and business offices, selling the famous Calumet Piece-Pipe, (three pieces,) genuine French Briar. Put up in attractive individual package. Its sensible construction makes cleaning easy and appeals to everybody. Send for proposition. 10,000 bankers have bought and recommend it. The Calumet Co., Dept Q, Mail Sales Division, Cincinnati, Ohio.

Wonderful Chance. Men's shirts and furnishings at wholesale rates or make $10 daily as agent starting real business. Gooddell Co., 102 Duratex Bldg., New York.

Beginners—Complete "Mail Order System," C-Box, 1005 Atlantic City.

Mexican Diamonds flash like genuine, fool experts, stand tests, yet sell for 1/50 the price. Few live agents wanted to sell from handsome sample case. Big profits, pleasant work. Write today. Mexican Diamond Importing Co., Box F 1 Las Cruces, N. Mex.

Agents. Big returns, fast office sellers; particulars and samples free. One Dip Pen Co., 12 Daily Record Bldg., Baltimore, Md.

Auctioneers.

Auctioneers—Make big money. Free eatalog. Carpenter's Auction School, Kansas City.

Salesmen Wanted.

Side-Line Salesmen—We have an attraetive line of premium assortments for live salesmen. Commission from $5.00 to $20.00 per order. If you want an up-to-date line, write today. Canfield Mfg. Co., 4003 Broadway St., Chicago, Ill.

Sell the line that hasn't been worked to death. 25% to 31% more than usual for selling staples. $50 a week easy. $100 a week quite eommon for those selling our Sanitary Brushes, Dustless Mops and Dusters. Good territory available. Promotion for producers. Modern factory and convenient distributing houses assure good service. North Ridge Brush Co., 114 Clark Ave., Freeport, Ill.

Typewriter Supplies.

Ribnsaver makes dried, pale ribbons like new for one cent. 50c postpaid. Order yours today. Ribnsaver Co., 186 La Salle St., Dept. 2, Chicago. Illinois.

For the Photographer.

Do You Take Pictures? Write for free sample of our big magazine showing how to make better pictures and earn money. American Photography, 465 Pope Building, Boston, Mass.

Business Opportunities.

Abraham Bros., Shanghai, China, Importers and Exporters desire connections.

Breed Canaries—Profitable pastime—particulars free. Bird Farm, Lynnhaven, Virginia.

Chiropractic—The new profession. You can learn and earn your way. Practitioners earning $3,000 a year and upwards. Proficieney quickly acquired. Send card for information. Howard College, 515-25 S. Ashland Blvd., Chicago.

Dollars Yearly in Your Back Yard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. Metz, 313 East 89, New York.

Money-Talks Magazine. Published for progressive men. Send for sample copy. 70-B Park Place, Newark, New Jersey.

Copper Plating Powder. Free package and my original formula, 25c. Instantly and durably Copper Plates steel, iron, tin, etc., by adding water and applying with a rag. Easily and cheaply made. Material anywhere. No free samples. John T. Pierce, 222 East 42nd Street, Los Angeles, Cal.

Enter a New Business. Earn $3,000 to $5,000 yearly in professional fees making and fitting a foot specialty. Openings everywhere with all the trade you can attend to; easily learned by any one at home in a few weeks, at small expense; no further capital required; no goods to buy; job hunting, soliciting or agency. Address Stephenson Labratory, 18 Back Bay, Boston, Mass.

$30 a Week. Evenings I made it with a small Mail Order Business; continued my regular job daytime. Free Booklet Tells How, 2c postage. Al Exp. Scott, Cohoes, N. Y

Start a Business of Your Own. Invest $237. Make from $100 to $200 weekly giving moving picture shows in schools, churches, societies, etc. Pleasant evening work. Write for particulars. W. H. Wade, Dept. 120, 14 N. Michigan Ave., Chicago.

Money Making Farms—19 States. $10 to $100 acre. Stock, tools, crops often included to settle quickly. Write for big illustrated catalog. E. A. Strout Farm Agency, 150 EC Nassau St., New York.

Substantial manufacturing corporation wants capable men to establish branch and manage salesmen. $300 to $1,500 necessary. You handle own money. Will allow expenses to Baltimore if you will qualify. For particulars address Secretary, 416 N. Howard St., Baltimore, Md.

You Can Start your own business with $10.00 if you get my formulas. Send one dollar and will send you formulas and directions, you can make over $10,000 yearly. Write Gust Perganson, 224 S. Sixth St., Springfield, Ill.

Hurry. New device for indexing. Most wonderful results. Will sell directly to men of means. Rev. Emil Meyer, Route 1, Baker, Kan.

Have You A Proposition To Finance? Does your business need money? Let us solve your problem. Write K. J. O'Conner, Secretary, 1 West Thirty-Fourth Street, New York.

$1 Does It. Texas oil land making holders big money everyday. Bank references furnished. Investigate us thoroughly, that's all we ask. Results count. Our plan $1 down, balance monthly few months gives you Warranty Deed to land. May pay profits $200 or more monthly. Maps, reports, established facts free. Address, Sourlake Texas Old Co., 867 De Menil, St. Louis, Mo.

Amazing Profits Manufacturing "Puffed Crisp." Delicious confection. Begin at home. Machine, instructions complete $6.50. Samples 10 cents. "Besco," 3253-EY Belleplaine, Ave., Chicago.

Quick Action Advertising—How it is Building Business for the Progressive Advertiser of America. A little story of results, told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates—today. Douglas Wakefield Coutlee, 225 West 39th Street, New York.

(Continued on page 724)

www.americanradiohistory.com

(Continued from page 723)

Exchange.

Two analytical balances chemical apparatus and chemicals. In good shape and cheap. Write for list. George Burr, 71 Cartwright, London, Canada.

For Sale or Exchange—One set Hawkins-Electrical Guides, new. C. C. Cooke, Lewis Hotel, Portsmouth, Va.

Bargain Boehm, System Clarinet. Will take omnigraph as part payment. Herbert Erickson, South Haven, Michigan.

Sell—Electrical set with wooden box, $4.00. Structo auto-builder, $4.00; Chemical Labratory, $4.60; Knapp type S. S. dynamo motor, $4.50; 2 V. 20 A. H storage battery with hydrometer, $2.50; Crystaloi detector, $3.25. Send stamp for descriptions. Raymond Fiedler, 70 Sargent St., Lawrence, Mass.

For Sale—½ K. W. transmitting set, $25, Loose coupler, $5.00 Wm. H. Griffiths, 491 Locust Ave., Washington, Pa.

For Sale—First $4.00 takes new $7.50 Knapp dynamo-motor. John Jones, 257 So. 5 St., Columbia, Pa.

Wanted, bad—January, 1918 Experimenter. Pay 50c. Write Paul Lind, Lenore, Ida.

For Sale or Trade—Electrical and wiresless apparatus. Write for list. What have you? Sam McMaster, Bellefourche, South Dakota.

Wanted—Bicycle motor attachment. Complete description. Harry Nelson, Haverstraw, N. Y.

Sell—Flanders 4 with carburetor, magnets, clutch, tank; telephone; bell ringers; electric fans. Want typewriter. Ralph Oberlin, Ada, Ohio.

Sell—Electrical apparatus. List for stamp. Patterson, 11 Cottage Street, Stamford, Conn.

For Sale—Two nickel-plated unicycles. (One Wheel stage bicycles. Each $25. Pyrene extinguisher, $5. R. Richardson, 1341 Park Rd., Washington, D. C.

Will Trade valuable patent for lighting outfit or small dynamo up to ¼ horsepower. Good reason. State condition, type, strength. F. Schlachter, 95 Liberty Street, Oshkosh, Wis.

Will Exchange ½ H. P. Wagner electric motor cither 110 or 220 volts. Cost $65. Want high grade sending or receiving apparatus. Mack Simmons, Van Alstyne, Texas.

For Sale—All kinds of apparatus; Radio included. Send for list. Nathan K. Thon, Box 169, Austin, Minnesota.

Exchange, Buy, Sell. Wireless, electrical goods, etc. Large list 6c. State what you have and want. Zehrbach, Box 250, Hiram, O.

Telescope, $3.00; Hawkins Guides, 1 and 2, $1.75; Astronomy, $1.00; Lowells Mars, $1.75; Howard Garner, Lawrenceburg, Kentucky.

Sell—Cyclopedia Applied Electricity, $12.00; Steven's "Favorite" 22 Rifle, $4.00; Electro Chemical Laboratory, $2.00; Schreyer, 72 Ridgewood, Place Staten Island.

I have some small motors, tools and instruments. Will exchange for rifles or shotgun. J. F. K., P. O. Box 18, Akron, Ohio

For Sale: Switchboard with volt and amp meters auto-cutout, and cell switch, rheostat, volt meter switch, 4 D. P. S. T. 10 A. switches. Good condition. Make offer. Warren Lincoln, North Easton, Mass.

For Sale or Exchange. Shoemakers machine, new, wall telephone. Extra cabinet ringer. Water Motor ⅛ motor. Machinists dies and taps. Hawkins Guides Masonic Library, School & Reference Library. Small Ammeter. Harry Clemmer, 917 Fairfax Ave., N. W., Roanoke, Va.

For Sale. Amateurs complete sending and receiving set. Send for list of same. Cyril W. Hooper, Box 404, Republic, Mich.

For Sale. Hammond Portable Typewriter, new. Write, D. Blodgett, 615 W. Second St., Flint, Michigan.

Trade practically new violet ray for excellent ¼ A. C. Motor, or cash. E. Nihiser, Broadway, Hagerstown, Md.

What is offered collectively or separately? All instruments are guaranteed O. K.—4 sending condensers, $3.50 value each, 2 No. .00002 m. f. Receiving condensers, $10.00 each; 1 $35.00 receiving transformer; 1 K. W. sending transformer, value, $60.00. E. Duskis, 1758 Bergen St., Bklyn, N. Y.

Electrical Blueprints of various kinds. See my ad under "Electrical" this issue. Charles L. Chittendea.

Wanted. Small gasoline motor buy or exchange. B. W. Earl, Edgewater Park, New Jersey.

Murdock 10 Ampere Marble Base Key, $6; Hot-wire ammeter, 0-3 amperes, $3; Murdock three pole antenna switch, $3; Brandes Superior Phones, $4; Moorhead two filament tube, $4; R. C. Hitchcock, Box 550, Middletown, Conn.

Trade. 2½ H. P. Motorgo Marine Engine in perfect condition for 1 K. W. Thordarson flexible transformer in perfect condition. Complete set I. C. S. Civil Engineering books for sale, $30.00. Maurice H. Simmers, 409 So. Campbell St., Macomb, Ill.

Exchange—Cont'd

For Sale. Complete Electrical Labratory. Joseph Saltry, 319 Oak St., Scranton, Pa.

Bargain: Curtiss Biplane, 3 ft., model, $8.50. Guaranteed to fly. Send for photos. 24 Fors spark coils, 50c each, 4 for $1.75. 3000 meter loose coupler, $4.50. Complete arclight. $3.00. Edw. Webb, New London, Ohio.

Jewelry.

Distinctive Jewelry for Driscriminating buyers. Our prices surprisingly low. We guarantee to save you money. Send for our catalog and see why. David Stern Company, "Value, Service, Satisfaction since 1885," Chicago, Ill.

Instruction.

Questions Answered. All subjects. Send for circular 7. Answerall Information Bureau, 51 Cliff St., New York.

Cartooning Comics and Lettering in fourteen easy lessons. Only $3, postpaid. Over 300 illustrations. Order yours now. Ernie's School, Elyria, Ohio.

Learn Dancing; become popular. All dances taught by mail; easy; no music. Thousands taught successfully. Write for special offer. W. C. Peak (Graduate Castle House), Room 227, 821 Crescent Place, Chicago.

Become a leader at social gatherings. Mystify, Amuse, Entertain. Learn mind reading. Complete private instructions, 25 cents. Circular free. Mysto, 633 Prospect Ave., N. Y.

Cornetists—Trombonists: Send for "Free Pointers." Weak Lips-High Tones. Virtuoso Cornet School, Buffalo, N. Y.

Musical Instruments.

Violins. Deep, Mellow, Soulful—on credit. Easy terms for wonderful instrument. Get details today. Gustav Henning, 231 11th St., Miami, Florida.

Old Money Wanted.

We Buy and Sell Old Coins. $2 to $500 each paid. Keep All Old Money; you may have valuable coins. Send 10c for New Illustrated Coin Value Book, 4x6. Guaranteed prices. Get posted. Clarke Coin Co., Box 110, Le Roy, New York.

Never Sell Old Coins until you see our copyrighted 6 x 9 Illustrated Coin Value Book (New Edition) —showing high prices we pay $100 paid for 1894 dime, S Mint. $5.00 for 1856 Eagle Cent. Send 10c for your copy today. Hundreds of old coins wanted. International Coin Co., Box 151-P, Philadelphia, Pa.

Stamps and Coins.

Free—10 varieties unused stamps. (Fine.) Postage, 2c. Dayton, East Foxboro, Mass.

Premium to approval applicants. Harland Burgett, 419 Spring St., Lima, Ohio.

Stamps—Packet, catalog over $2 for only 25c. 100 from 100 countries, 30c. O. Chartico, Wallingford, Conn.

50 Different Stamps, 3c. 100 different, 10c Buckey, 412-B Bowen St., Dayton, Ohio.

Best one cent approvals in America. F. P. Hand, 1117 S. 60th St., Philadelphia, Pa.

South America. Buy direct. 1000 fine assorted Paraguay, Uruguay, etc., for a $2 bill. Exchange rare stamps with collectors and dealers; lots or on sheets. C. P. Mego, Necochea 193, Lomas Dezamora, Argentine Republic.

100 Different Stamps, 12c; 200 27c. Michaels, 5600 Prairie, Chicago.

300 different stamps, 50c. Fred Onken, 630 79th St., Brooklyn, New York.

Stamps—61 All Different Free. Postage, 3c. Mention paper. Quaker Stamp Co., Toledo, O.

California Gold, quarter size; 27c. Half dollar size; 53c. Columbia Nickel and Catalog, 10c Norman Shultz, King City, Mo.

Health.

Tobacco Habit Conquered. $1 prepaid. Entirely new. Guaranteed. Harrison, 105 Walker, Evansville, Ind.

Pyorrhea, (Bigg's Disease—Bleeding or Swollen Gums.) H. E. Kelty, D. D. S., M. D., pyorrhea specialist for 15 years, has developed a successful home treatment for pyorrhea, purifying, healing, preventative. Full month's treatment, $1 postpaid. Or, write for free booklet. Pyorem Mfg. Co., 439 Seventh Street, Brooklyn, New York.

Cigarette, pipe or chewing habit conquered. Nature's method. Guaranteed. Write for free brochure. Edw. J. Woods, TA-300, Station F, New York.

Goiter—Rid yourself of this terrible disease at home, cure guaranteed or money refunded; formula and full directions for using this wonderful new discovery, sent to all sufferers. Price, $2.00. P. O. or express money order. Address: Wellington Labratories, No. 40 15th St., Detroit, Mich.

Song Poems.

Write the Words for a Song. We write music and guarantee publisher's acceptance. Submit poems on war, love or any subject. Chester Music Co., 920 So. Michigan Ave., Room 265, Chicago, Ill.

Song-writers' Manual and Guide Sent Free! Contains valuable instructions and advice. Submit song-poems for examination. We will furnish music, copyright and facilitate publication or sale. Knickerbocker Studios, 319 Gaiety Bldg., New York.

Write the Words for a Song. We revise poems, write music and guarantee to secure publication. Submit poems on any subject. Broadway Studios, 197C Fitzgerald Bldg, New York.

You Write Words For A Song. We write the music, publish and secure a copyright. Submit Poems on any subject. The Metropolitan Studios, 914 So. Michigan Ave., Room 113, Chicago, Ill.

Song Writers.

Song Writers—You cannot afford to miss our proposition. Reference at any bank for first-class sheet music house. Warner C. Williams & Co., Dept. L, Indianapolis, Ind.

Short Stories, Manuscripts, Wanted

Short Stories, Poems, Plays Etc., are wanted for publication. Literary Bureau, 165 Hannibal, Mo.

Tricks, Puzzles and Games.

Illusions—Stage Tricks with 500 illustrations, catalogue, 15c. Small catalogue free. Hornmann Magic Company, 304 West 34th Street, New York.

Magic Card Tricks, Sensational Escapes, Jokes, Novelties, everything in the amusement line. Large illustrated catalogue of a thousand tricks, free. Write today. largest amusement manufacturers in the world. Heaney Magic Co., Desk 200, Berlin, Wisconsin.

Black Art Hindoo experiments. 1919 edition. 25c. Invisible ink. Free trick. Catalogue each order. Lindhorst Magic X Shop, St. Louis.

Magic Pictures complete outfit for making, 10c. Greatest fun producer on earth. R. E. McIntyre, General Post Office, New York City.

Magic. Entertain at home. Tricks, puzzles, novelties. Big Catalogue A, 25c. Martinka & Co., Inc., Harry Houdini, President, 493 Sixth Avenue, New York City.

Novelties.

Something New! Have you seen them? Curiously mysterious Wonder Shaving. Novelties imported from Japan. Little wooden pieces, when dropped into water, open up, turning into fish, flowers, orange trees, birds, babies, in all colors. Children laugh while old folks are mystified. Entertaining and amusing to invalids or in sick-room. One dozen assorted, all colors, in pretty package with directions, price 15 cents, 3 packages, 35 cents. Excellent for entertaining dinner parties, used as favors, they create talk. One dozen packages sent prepaid for $1.00. Send now. Be first to have these novelties. Address George P. Heinemann, 1424 Rosemont, Ave., Chicago, Ill.

Here, Boys. Make a toy aeroplane; see our Nifty, ad, page 678.

Pictures—Post Cards.

Rare Real Photos; Bathing beauties, models, the kind you want. Sample Dime. Write, (Artiste,) Auburn, Ind.

Wonders of New York, 25 views, illustrated, 25c, cash. John Notes, 90 Division St., New York.

Real Photos. Handsome girl models. Rare poses. Samples, 25c. Garvey, Dept. E., 20 Perkins Place, Brockton, Mass.

Phonographs.

"Build Your Own Phonographs and manufacture them for profit. Drawing, Instructions, Parts Price List. Blue Print, etc., complete sent free upon request. Write today. Associated Phonograph Co., Dept. EI, Cincinnati."

Build Your Phonograph. "Perfection" high-quality spring and electric motors, tone arms, reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Ind.

Music For Christmas. Our prices on standard talking machines so low you cannot afford to be without one in your home. Send for our catalog. You'll save money. David Stern Company, "Value, Service, Satisfaction since 1885," Chicago, Ill.

Make Your Own Phonograph. Particulars free. DeSelO-PhonE, P. O. Box 720, Attica, Indiana.

www.americanradiohistory.com

Electrical Supplies and Appliances.

Battery Charging pays big profits with HB equipment. Electric light generators and motors can also be furnished on easy payments. Full information free. Hobart Brothers, Troy, Ohio.

Lava Insulation is not molded but individually sawn, lathe turned, milled, drilled, threaded. No limitation on form, only on size. Kilned at two thousand degrees. Hard, strong, accurate, fire, acid proof. Ask for book. American Lava Insulator Company, Chattanooga, Tenn.

Electrical Blueprints—For connecting A. C. motors, 236, 54 single phase, 42 two phase, 50 three phase star, 40 delta, 12 star-delta. Appendix, 36, changes of voltage, speed, phases, cycles, etc. Prints for connecting D. C. motors, 123, Shows changes of voltage by reconnecting and rewinding. Also various ways of testing. For use on autos as well as large motors. Diagrams for connecting transformers. Ten samples of A. C. motor, or transformer samples 25c. Particulars and other information on request. Charles L. Chittenden, 811 West 18th St., Kansas City, Missouri.

Electrical Workers and All Others who are interested in electrical work in the reconstruction that is taking place to send us their name and receive descriptive literature of our modern blue print chart method of electrical wiring, Souvenir information card included. Electrical Wiring Diagram Co., Box C 173, Altoona, Pa.

Boys—Here is the simplest and cheapest electric telegraph ever devised. With the "K" Applicator you need no batteries. Get electricity free, instantly anywhere at any time. Send thirty cents, (postal money order) for full instructions how to make the "K" Applicator and how to operate an electric telegraph without batteries. Is easier to make and requires less material than you would use in making a kite. Gives constant smoothe even current day and night, never runs down, even upon closed circuit. Works on any metallic line, even barbed wire fence, as no insulators necessary. The "K" Applicator, Missouri Valley, Iowa.

Electro Magnets, powerful horseshoe magnets. Will lift 150-200 lbs. on 4 or 5 dry cells; guaranteed; $5.00 prepaid. J. Nauta, 141 Butler St., Paterson, N. J.

Storage Batteries—Make the plates yourself. We will tell you how. Sample plate 40c. Windsor Specialty Co., not incorporated, 5419 Windsor Ave., Chicago, Ill.

Boys—Let me know what you need in the electrical line. I can save you money. Bell wire, per lb., 60c; bells, 42c; metal pushbuttons, 12c; insulated staples, per hundred, 20c; buzzars, 42c; two cell nickel-plated flashlight, $1.20. Postage extra. Geo. M. Wiedeman, 1805 S Wichita St, Wichita, Kansas.

15c Heavy Brass Binding Posts. 15 for $1.00, postage 5c. 3 point slate base contact switches with binding posts 35c each, postage 5c. A. Haupt, 2442 Igden Ave., Chicago, Ill.

Motors, Engines and Dynamos.

Small Motors and Generators from bankruptcy and receivers' sales. Motors for all phases of current. Immediate delivery. Less than one-half regular prices. See display ad on page 688. Johnston, West End, Pittsburgh, Pa.

Blueprints.

Electrical Blueprints of various kinds. See my ad under "Electrical" this issue. Charles L. Chittenden.

Blueprints: Small Steam Engines & Boilers, Gasoline Engines, ⅛-¼-½ H. P. 3 sets, (13 sheets) Postpaid $1.00. Circular on Castings for stamp. Universal Gas Motor Co., 364 Monadnock Blk., Chicago.

Patents For Sale.

Recently Patented wonderful draftsman's protractor and Geometrical Instrument. For particulars. David Lopez, 98 Commonwealth, Detroit, Michigan.

Outright or Royalty. Self plowing alcohol torch. Exceeds all others now in use. No solicitors wanted. Folgmen, 31 Third St., Brooklyn, N. Y.

Sell—Royalty, or partner, Newly Patented Insect destroyer, investigated. 1542 Gates Ave., Brooklyn.

For Sale—A very good and practical invention or will exchange for a diamond ring. Here's a chance for somebody. Write Gust Pergansson, 224 S. 6th St., Springfield, Ill.

News Correspondents.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Stammering.

St-Stu-t-t-tering and Stammering cured at home. Instructive booklet free. Walter McDonnell, 105 Potomac Bank Bldg., Washington, D. C.

Patent Attorneys.

M. H. Loughridge, Patent Attorney, Consulting Engineer. The high class service of the large manufacturer of modest costs. Designs and manufacturing specifications prepared. 1457 Broadway, New York.

Patent Your Own Inventions. Save attorney's fees: we prepare applications; furnish full instructions and give satisfaction. Free information. Carl Larsen Co., Park Row Bldg, New York City.

Patents. Foremost word free. Write now. Metzger, Washington, D. C.

Patents. Prompt, personal, efficient service by an attorney-at-law, skilled in all branches of Patent practice. Over 12 years actual experience, full information upon request. B. P. Fishburne, 324. McGill Bldg., Wash., D. C.

Patents—Fees in installments. Frank T. Fuller, formerly Lieutenant Engineers, Washington, D. C.

"Inventors Adviser" sent free on request. William C. Linton, 918 F Street, N. W., Washington, D. C.; 363 University Street, Montreal, Canada.

"How to Establish Your Rights" to patent protection is a bulletin every inventor should read before disclosing his idea to others. This bulletin, form, "Evidence of Conception" and other interesting and valuable patent information free. Lancaster and Allwine, 242 Ouray Bldg., Washington, D. C., "Originators of the form, "Evidence of Conception."

Patents. Herbert Jenner, Patent Attorney and Mechanical Expert, 622 F St., Washington, D. C. I report if patent can be had and its exact cost. Send for circular.

Inventions, Patented—Trade-Marks Registered, Labels, Prints, Publications copyrighted, prompt service, reasonable fees, plain advice, request detailed information before placing your business. Jaynes & Jaynes, 802 Kellogg, Washington, D. C.

Millions spent annually for ideas! Hundreds now wanted! Patent yours and profit! Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc., 212 Patent Dept., American Industries, Inc., Washington, D. C.

Patents Procured—Trade Marks Registered. A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington., D. C., or 2278 T Woolworth Bldg., New York.

John M. McLachlen, Attorney-at-Law. Patents, Trade Marks, Copyrights. 410 McLachlen Bldg., Washington, D. C.

M. F. Miller, Ouray Building, Washington, D. C., Patent Attorney, Mechanical and Electrical Expert. Best quality of work and results. Moderate charges. Advice free.

Inventors, send sketch of model of your invention, for opinion concerning patentable nature, and exact cost of applying for patent. Book, "How to Obtain a Patent," sent free. Gives information on patent procedure and tells what every inventor should know. Established twenty-five years. Chandlee & Chandlee, 414 Seventh St., N. W., Washington, D. C.

For Inventors

Money-Talks Magazine. Published for progressive men. Send for sample copy. 70-B Park Place, Newark, New Jersey.

Inventions Wanted. Cash or royalty for ideas. Adam Fisher Mfg. Co., 205 St. Louis, Mo.

900 Mechanical Movements, also illustrations explaining 50 perpetual motions. My book, "Inventors Universal Educator," Fifth Edition, tells how to procure and sell patents. Government and other costs. Covers the matter from A to Z. 160 pages elegantly bound. Contains noted decisions of U. S. Supreme and State Courts on patent cases. Mechanical Movements greatly assist inventors—suggest new ideas that may prove of great aid in perfecting inventions. Tells how to select an Attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers. Price, $2. Postage free everywhere. Fred G. Dietrich & Co., 603 Ouray Bldg., Washington, D. C.

Inventors write me about patents. My fees payable monthly. Booklet free. Frank Fuller, Washington, D. C.

Inventors! Protect yourselves, record idea before exposing to anyone, including attorneys. Paul E. Klein, Cons. Eng. Reg. Pat. Att'y., 21 Park Row, New York.

Inventors join National Institute of Inventors. 118 Fulton St., New York City. Membership society 1900 strong. Will help protect, develop, finance and market your invention. Absolutely no charge. Write for booklet.

"Inventor's Guide" Free on request; gives valuable advice and information for all inventors. Write Frank Ledermann, Registered Patent Attorney. 17 Park Row, New York.

Scenery For Hire.

Collapsible Scenery for all plays. Decorations. Amelia Grain, Philadelphia.

Books.

Books—Practical Mechanical, Auto, Aviation, Home Study Books. Easy payments. Send dime "tonight" for catalogs. Ansco, Department G, Aurora, Ill.

Book—describing Hun atrocities and their attacks on women and girls in Belgium. 25c. Belgian Specialty House, 2806 Union Ave., Dept. 3, Chicago.

Concordia,—contains essays, formulas, plans. Year's subscription, 50 cents; trial, 20 cents. Concordia Magazine, 9 Water, York, Pa.

Laws of Nature—Every married and engaged person should know, 50c; (no stamps.) Central Company, 601 Ninth Ave., New York. Novels, mechanical, women's books. Write for lists.

Great Rabbit Book, 25c. Raise them. A. A. Leve, Syracuse, N. Y.

Dear Reader. If Occult, New-Thought and Scientific books appeal to you, send for my catalog, it's free. I have books on Personal Magnetism, Concentration, Spiritualism, Clairvoyance, Seership, Will, Mind, Hypotism, Messmerism, Character, Reading, Healing, Mysticism, Success, Salesmanship, Mechanics, Entertainment, etc. A. W. Martens, J-49, Burlington, Iowa.

Spititism—Is it a delusion? Get the truth on this subject. Why has it over spread England? 125 page book of facts. 10c. R. C. Polston, Bookman, Omaha, Ill.

What Every Girl Should Know—Clothbound, 50c. What Every Mother Should Know; clothbound, 50c By Margaret H. Sanger, 104 Fifth Avenue, New York City.

World-Romic System. Masterkey to all languages. Six textbooks, $1.44; French chart, 37c; Spanish, 37c; aviation dictionary, $1.50; French English aviation dictionary, 61c. Languages, 143 W. 47th St., New York.

To Get Better Pictures. Read the amateur photographer's weekly; illustrated weekly prize competitions; print criticisms; many unique features, $1.50 per year; three months trial subscription, 25c. Abel Publishing Company, 401 Caxton Bldg, Cleveland, O.

Buy Books For Christmas. Latest Popular Fiction at unheard of low price. Send for our complete list. You'll save money. David Stern Company, "Value, Service, Satisfaction Since 1885," Chicago, Ill.

Wireless.

Switch Points. Binding posts, switch levers, and small parts, send 2c for catalogue describing these and other goods. A. W. Bowman & Co., 23 Church St. (Harvard Square), Cambridge, Mass.

Complete receiving sets $7.00 and up. With 100 ohm receiver, tested mineral; guaranteed. Bulletin for stamp. Jenkins, Room 2, 923 Purchase St., New Bedford, Mass.

Radio Supplies for Amateurs. Complete Instruments; parts, raw materials. Ermco, 3247 Germantown Ave., Philadelphia, Penn.

2500 Meter Navy Coupler—Undamped wave couplar and pancake coils, B-Battery cabinet, etc. Send stamp for particulars. Carl H. Rauschenberg, Monongahela, Pa.

Wireless, standard 1¼-inch switch knob-lever complete, 35c. Switch points with screws, 25c dozen. State panel thickness. Magnet wire, 22 or 24, half pound, 60c. Electro-Novotoy Shop, 2100 Fifth, Charlotte, N. C.

Amplifier Units. Two step $15. Radio Sales Co., 1629 McAllister St., San Francisco, Cal.

Look—22½ Volt 15 cells, B Batteries: Standard Signal Corps. U. S. Army for Vacuum Tubes Type BA-2 at 90c postpaid. Also receiving and sending instruments at reasonable prices. State wants. The H. S. Wireless Co., 164 Ross St., Brooklyn, N. Y.

Telegraphy.

Telegraph and Railway Accounting taught thoroughly and quickly. Unprecendented demand for both sexes at big salaries. Oldest and largest school, established 45 years. Catalogue free. Dodges Institute, Seventh St., Valparaiso, Indiana.

Motion Picture Plays.

Earn $1200 a Year in Spare Time writing photoplays. Experience unnecessary. Send for free book valuable information, special prize offer. Photo Playwright College, Box 278, E7 Chicago.

Photoplays Wanted. Big prices paid. You can write them. We show you how. Free particular. Rex Publishers, Box 175, E7, Chicago.

Wanted To Buy.

Cash for Old False Teeth—We pay up to $35.00 per set (broken or not). Also buy discarded gold jewelry, gold crowns, bridges, platinum, diamonds, watches and silver. Send now. Cash by return mail. Package held 5 to 10 days for sender's approval of our offer. U. S. Smelting Works, Dept. 73, Chicago, Ill.

(Continued on page 726)

www.americanradiohistory.com

(Continued from page 725)

Help Wanted.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 5665 St. Louis, Mo.

Secret Service Operatives and Detectives are in demand. Earn big money. Travel everywhere. Fascinating work. Learn this profession by home study. Particulars free. American School of Criminology, Dept. E, Detroit, Mich.

Government positions highly desirable; thousands appointed annually through frequent examinations everywhere; prepare immediately for Post Office Clerk, City or Rural Letter Carrier, Railway Mail Clerk, Washington Departmental Clerk, Stenographer-Typist; unexcelled correspondence instruction, $5. Request particulars concerning position desired. Federal Civil Service School, 602 Kellogg, Washington, D. C.

Men Wanted—Become automobile experts. $45 week. Earn while learning. Franklin Institute, Dept. L, 806, Rochester, N. Y.

Government Positions are Desirable. Prepare for Railway Mail, Post Office, Rural Carrier, Customs, Internal Revenue, Departmental Immigration, and other branches through our expert (former Government Examiner.) Write for free booklet "EE" giving full information about these positions and our Money-Back Guarantee Contract. Patterson Civil Service School, Rochester, New York.

Business Worth While. I start you silvering mirrors. Plating tableware; Plans Free Clarance Sprinkle, Dept. 48, Marion, Indiana.

Hundreds Men—Boys, 18 or over, wanted by U. S. Government as Railway Mail Clerks. Permanent life positions through poor times and good. Average pay, $1400 year. Advance rapid. Pleasant work constantly traveling. Every second week off at full pay. Paid vacation. Common education sufficient. Write immediately for full list, positions open and Fall examination schedules. Franklin Institute, Dept. L, 26, Rochester, N. Y.

American Made Toys Wanted. An opportunity for homeworkers on small scale and manufacturers on large scale. Unlimited quantities needed of Toy Soldiers, Army, Navy, Marines, Cannons, Machine Guns, Warships and other Toys and Novelties. Greatest chance for industrious people for independent business. Enormous demand and future in American Made Toys, all over United States, Canada, Mexico and South America with over 50,000 10c stores and toy dealers. This new American industry stands out conspicuously. Factories are established, people trained, machineries made, Christmas Sets needed in millions this year. The great hit for 1919 without any competition. We are buyers of these goods all year, paying fixed prices. Attractive prices offered for painted goods. Experience or tools unnecessary. Hundreds and more made complete per hour. Casting form outfits from $3.00 up. If you mean business, send for booklet and information free. Toy Soldier Manufacturing Co., 32 Union Square, New York.

Better Pay, shorter hours, easier work and other advantages can be had in Government positions which are easy to secure now. You owe it to yourself to find out if you are qualified. No expense. Just send name for Form RM 2081, free. Earl Hopkins, Washington, D. C.

Artists in Great Demand. Big salaries paid for full or part time. Learn quickly at home in spare time. Commercial Art Cartooning illustrating, Designing. Outfit free to new students. Send for handsome Free Book. Write Now. Washington School of Art, Inc., 1449 H St., N. W., Washington, D. C.

We Will start you in the cleaning and dyeing business, little capital needed, big profits. Write for booklet. The Ben-Vonde System, Dept H., Charlotte, N. C.

Detectives make big money, Travel; be your own boss. Either sex. We instruct, small cost. Write Johnson's Detective School, 232 Shaldon Ave., Grand Rapids, Mich., Dept. A.

Detectives Earn Big Money. Excellent opportunity. Particulars free. American Detective System, 1968 Broadway, New York.

Printing.

3000 Two Color Labels, $1.00. Irving J. Wolf Station E, Philadelphia.

1000 Letterheads, Envelopes, Typewriter Letters, $2. Circulars, Labels, $1; samples. M. Lomond, 65 Broadway, Brooklyn, N. Y.

Good Printing Quick. 250 Bond Letterheads, Envelopes, Billheads or Cards, $1.00, postpaid. H. R. Bamberg Co., 2245 So. Kedzie, Chicago.

Gummed Labels!! Interesting Samples Free! Edward Harrison, "Artistic Printing," Baltimore.

For the Hair.

I Was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have good hair-growing results. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E. 32nd St., BA-300, New York.

Chemicals.

Price List of Chemicals and Labratory apparatus—for experimental work with 10 formulae, 6c. Frane, Eureka, Ill.

Selenium for phototelegraphy, 75c oz. Thorium Nitrate (radio active), 80c oz. Rare Mineral (radio active), containing radium thorium, praseodymium, neodymium and cerium, 50c oz. Rare Metal Salts, ten different, 3 to 5 grams of each. $1.75. Radio Chemical Supply Co., 915 Westcott St., Syracuse, N. Y.

Experimenters—Are you interested in novel, chemical experiments? Send 10c for a large collection. Meral Sager, 44 Apple St., Tiffin, Ohio.

Amateurs, Chemists and Experimenters—You need pure chemicals and best quality apparatus to be successful with your experiments. Send for our new catalog listing the same chemicals and apparatus as used by Colleges, Schools, etc. Jos. Simpson & Co., 3880 Windsor Pl., St. Louis, Mo

Dyes—25 different colors for dyeing cotton, wool, silk etc. Material sufficient for dyeing scores of skeins. Set includes five wool and cotton skeins, two dyeing chemicals and spoon measure. Neatly packed. Sent postpaid for $4.50.

Organic Chemicals—Set of forty (40) different compounds (acids, alcohol, ketones, hydrocarbons, phenols, etc)—in glass bottles—includes aniline, amyl alcohol, methyl, salicylate, beta-naphthol, three (3) dyes etc. Send $6.50.

Chemicals—50 different chemicals including Iodine, Mercury, Antimony, etc. Material sufficient for hundreds of experiments. Send $4.00.

Pigments—25 different pigments used in manfacturing Paints, Varnishes, Rubber, Paper, etc. Send $4.00. Technical Equipment Co., Dept. 2Ec. 22 East 17th St., New York.

Selenium in stick form; 75 cents per oz., postpaid. Ziegler Experimental Labratory, Rochester, N. Y.

Cosmos Labratory—Expert chemists. Trade secrets, formulae, processes given. Analysis promply reported. 10 De Bloise St., Dept. A., Newport, R. I.

Potassium Sulphocyanide, C. P., 50 cents per oz. postpaid. Ziegler Experimental Labratory, Rochester, N. Y.

Photo Developing.

Mail us 15c with any size film for development and six velvet prints. Or send six negatives any size and 15c for six prints. Or send 35c for one 8x10 mounted enlargement. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke, Va.

Clean, Neat, Perfect Kodak Finishing at the lowest prices. Work returned the same day received. Send film for sample print and copy of catalog on developing, printing, enlarging and hand coloring, also copy of Photo Craft Magazine, which will help you make better pictures. Photo Craft Co., Box 69, Ann Arbor, Mich.

For 15c we will develop and furnish prints from one, six or eight exposure film or enlargement 8x10, your favorite negative, 20c to show quality and service. Associated Photo Company, Sta. A 12, Cincinnati, Ohio.

Cameras.

Send For Our Catalog No. 121 Today. It's the biggest little thing in the photographic world. Look over its pages and see the wonderful values we give and the money you will save buying of us. Remember, too, we guarantee to save you money on anything you buy. Your money back if you are not satisfied for any reason what-so-ever. You must send for this money-saving catalog. It's free. Drop us a card today. David Stern Company, "Value, Service, Satisfaction Since 1885," Chicago, Ill.

For Men.

Dredge's Necktie Valet removes wrinkles (without ironing) from Neckties. Sample, 25c. Get one today. Dredge, 190 Pilgrim Avenue, Highland Park, Mich.

Shaving Powder—Enough for five razorless shaves, 25c. Durso, Dept. 41, 25 Mulberry, New York City.

Get Vital Strength. Retain youthful vigor. Wonderful results. Intensely interesting booklet free. Winslow H. Chase, Washington, D. C.

Send us your dull razor blades. We re-edge them Good as New, any kind, 2½c each. Prompt service and satisfaction guaranteed. Dealers wanted. Keenedge Company, Inc., 184 Washington St., Chicago, Ill.

Don't throw your shirt away when Cuffs are worn, send 35 cents for a pair of New Soft Cuffs. Suitable for any color shirt. Van Decar Co., Fifteenth St., Troy, New York.

Detectives Earn Big Money. Travel. Great demand. Experience unnecessary. We train you. Write for free particulars. American Detective System, 1968 Broadway, N. Y.

Formulas.

500 Successful money-making formulas and trade secrets. Postpaid, 25c. Charles Dynes, Winchester, Ind.

370 Formulas 10c. Fitzgerald, 15 West 65th St., New York.

Formulas—Luminous Paint, Tobacco Cure, Renewing Dry Batteries, Hektograph, Mechanics Soap, Resilvering Mirrors, Gas Tonic, Egg Substitute, Trappers Baits, 10c each; 700 others 25c. Collection complete, 50c. All formulas tested. Satisfaction guaranteed Bargain Book Shop, 200 Highland Ave, South Sudbury, Mass.

500 Formulas, including Resilvering Mirrors, Renewing Dry Batteries, Mechanics Soap, Luminous Paint, 25c. Ideal Book Shop, 5501 EE North Robey, Chicago.

10,000 Tested Formulas. Cost, 1c for 25. Before ordering send for catalog "P" today. Goodnow, Highland Ave., South Sudbury, Mass.

1,000,000 Formulas. Processes. Trade secrets for every business. 1016 pages, $2. Ideal Book Shop, 5501-EE, North Robey, Chicago.

We Own Selected scientific, chemical, pratcical reccipts and formulas. Some so-called Trade Secrets. Covers Hair Tonics, Hair Removers, Shampoos, Massage Creams, Pile Ointments, Stove Polishes, Shoe Polishes, Silver Polishes, Stains, Varnishes, etc. Special offer; fifty cents each, dollar for three. Waco, Formulary, Waco, Texas.

Why Go Dry. Whisky, Beer, Wines, etc., that have the kick. Made at home, no trouble, no alcohol or still used. Only everyday cooking utensils needed. Made with pure and inexpensive ingredients that can be purchased anywhere, but when used as directed, generate their own alcohol and produce excellent whisky. Good wholesome beer and delicious stimulating wines at trifling cost. Guaranteed book of 28 secret formulas which I have personally tried and tested. Sent postpaid promptly for $1.00. Frank Ward, Dept. D, Box 503, Baltimore, Md.

Personal.

Whiskey, Brandy, Beer etc., with a kick. No still or alcohol; 20 fine formulas, $1.00. Superior Supply Co., 1440-A Niagara, Denver, Colo.

The Salesman Win$. Thousands of positions open. We teach traveling salesmanship by mail and guarantee of position or refund tuition. For interesting particulars, address Kansas Vocational Bureau, Miltonvale, Kansas.

Miscellaneous.

Bench Lathe, Goodell Pratt No. 125 Foot Power Table and 44 other attachments Cheap. Also patent on Hammer Handle Fasteners. A bargain, write now for detailed description and price. Chas. Erickson, 241 West 6th South, Salt Lake City, Utah.

Wanted. Small Gasoline and Steam Engines. Small Lathes, Drill Presses and other light machinery. Will pay high cash prices for good material. Johnston, West End, Pittsburgh, Pa.

Tobacco or Snuff Habit Cured or no pay; $1 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

"How to Read Thoughts"—Mind Reading at any distance, 20c; "How to Hypnotize," Cure Diseases. Give Astounding Exhibitions, $1.00; "Silent Friend," Key to Rapid and Honest Wealth, $1.00; "How to Win," 362 pages, Success Assured, $2.00; "Health Culture," Insures Vital Strength, 25c; Five Dozen Money Makers, 30c; Catalogue gratis. Science Institute, E119 1336 Morse Ave., Chicago, Ill.

For Advertisers.

Advertisers! For results, place your 30 word ad in The West Virginia Advertisers one year for only $1 E. J. Evans, Pub., 729 6th Ave., Huntington, W. Va.

Money? Jacobus Art Ads make small space pay big in dividends. Price, 5.00. Write today. Jacobus Service, 1073 Sanford Ave., Irvington, N. J.

"Quick-Action Advertising—How it is is Building Business for the Progressive Advertisers of America." A little story of results, told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates—today. Douglas Wakefield Coutlee, 225 West 39th St., New York.

Office Devices.

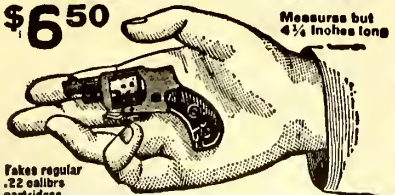
Addressographs, Multigraphs, Duplicators, Multicolors, Folders, Typewriters, Dictaphones, Check Writers, Sealers. Office Device Company, 222-Y North Wabash, Chicago.

www.americanradiohistory.com

"The Baby" Double Action Hammerless Revolver

A HANDSOME AND MOST EFFECTIVE WEAPON

$6.50



Measures but 4¼ inches long

Takes regular .22 calibre cartridges

The new Baby Double Action Hammerless Revolver has been produced to meet the ever increasing demand for a revolver that would combine small size and light weight with the essential features of Efficiency and Practicability. It is small in size, yet is just as effective and serviceable as the most expensive weapon you can buy. Every lady should have a revolver and should know how to use it, and there is no safer or better one made than this. A great feature is the safety action that guards against accidental discharge, making it quite safe for young men and ladies. The illustration gives an idea of its appearance, but it must be seen and used to be thoroughly appreciated. The ammunition used is the standard .22 calibre (short) cartridge obtainable anywhere, or you may obtain the cartridges from us (cartridges can be shipped only by express). The revolver fires six shots in one loading. The operation of the charging mechanism is extremely rapid and absolutely reliable, six well aimed shots can be fired in as many seconds. The revolver is very well constructed, with finest nickel plated fluted barrel of cylinder, and it weighs about 14 ounces. The Price of the Baby Revolver is only $6.50, sent by mail postpaid to any address.

SHARPEN-M-ALL SAFETY RAZOR STROPPER

SHARPENS EVERY KIND OF SAFETY RAZOR BLADE

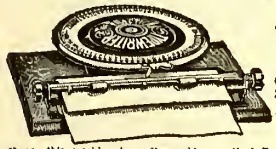
Sharpens the Gillette and Durham Duplex both edges at one time

ALSO SHARPENS THE GEM JUNIOR, EVER READY, KEEN-KUTTER, MARX CROSS, CLARK, AUTOSTROP, STAR CRUSTEEL, AND ALL OTHERS.



By using the SHARPEN-M-ALL STROPPER, you will not only get BETTER SHAVES, but you will SAVE MONEY on blades, as you will be able to get from 150 to 200 shaves from one blade, and the last shave will be as good as the first. The construction is simple and will last a lifetime. There are no parts that can possibly get out of order. Any novice can use it just as well as the most expert barber. It is operated by simply turning the crank or handle as shown in the illustration. It has two spiral rollers that travel from heel to point as they are revolved, giving the CORRECT DIAGONAL STROKE. There are no screws, adjustments or any kind of tinkering necessary to operate the machine. The rollers are made of a special material that STROP AND HONE the blade at the same time. The rollers turn only one way, so there is no fear of damaging the blade or the stropper. The SHARPEN-M-ALL is packed in a handsome case, 4x12x1¼ in., and has three holders and full instructions. The weight of the complete machine is but eight ounces. Price, only $1.20, postpaid.

Price, $1.50 postpaid. SIMPLEX TYPEWRITER ONLY $2.50



Cheap But Good. So Simple a Child Can Use It. We Guarantee the Writing.

Though so marvelously cheap, this machine is a thoroughly practical Typewriter. We positively guarantee it to produce writing equal in every respect to that of any $100 machine. It does not seem possible at the price, but if we could send you a specimen of its work and you will be convinced. With reasonable care it will last a lifetime. It is so simple that a child just able to read can write with it. You can learn all there is to know about it in five minutes, and an hour's practice will make you an expert operator. Every business man must have a typewriter. A legible pen writing is unbusinesslike and creates the impression that the firm is a slow-going and slow-going concern. We assure you that the Practical Typewriter fully deserves its name as it is fit to do the correspondence of any business or profession, and to do it well. You should not miss this chance of securing a bargain. The letters of the alphabet, the numerals 1 to 10, and punctuation marks are so grouped that the letters most used are before the operator most of the time, enabling him to write rapidly. The rollers hold the paper in position while writing and at the end of each line a slight turn of the roller moves the ratchet which makes a click and forces the paper forward, giving the proper line spacing, so that the lines are all an equal distance from each other, no desirable in letter writing. Each typewriter packed in a strong box, with full printed instructions for use. Price complete, $2.50 sent by mail postpaid.

Boys, you can have Movies at your own home with this latest model MOVING PICTURE MACHINE

Uses Standard Films same as the larger machines. Very easily managed. Simply turn the handle. Good Variety of Films always obtainable

PRICE Complete ONLY $3.00 Postage 15c, extra including Film.

Extra Films, 15c each postpaid



THIS IS A GENUINE MOVING PICTURE MACHINE and the motion pictures are clear, sharp and distinct. The Moving Picture Machine is finely constructed, and carefully put together by skilled workmen. It is made of Russian Metal, has a beautiful finish, and is operated by a finely constructed mechanism. The projecting lenses are carefully ground and adjusted, triple polished, standard double extra reflector, throwing a ray of light many feet, and enlarging the picture on the screen up to three or four feet in area. The light is produced by a safety carbide generator, such as is used on the largest automobiles. This throws a dazzling white light on the screen.



It is a solidly constructed and durable Moving Picture Machine. The mechanism is exceedingly simple and is readily operated by the most inexperienced. The pictures shown by this marvelous Moving Picture Machine are not the common, crude and lifeless Magic Lantern variety, but are life-like photographic reproductions of actual scenes, places, and people which never tire its audiences. This Moving Picture Machine has caused a rousing enthusiasm wherever it was used.

ANARCHIST BOMBS



Consists of a little glass vial, containing in liquid form a chemical which will produce a most horrible odor. One dropped in a room full of people will cause more consternation than a limburger cheese. The smell will entirely disappear in a short time. 3 Boxes for 25c, shipped by express only with a Dollar's worth of other merchandise.

ITCHING POWDER



This is another good practical joke; the intense discomfiture of your victims to everyone but themselves is thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more. 3 Boxes for 25c. Sent only by express. (Must order at least One Dollar's worth of other merchandise.)

INVISIBLE INK



The most confidential messages can be written with this ink, for the writing MAKES NO MARK. Cannot be seen unless you know the secret. Invisible for many reasons. Keep your pockets and other private memorandums away from prying eyes. Great fun for playing practical jokes. Only 15c Bottle.

LOVE LETTER INK



Writing written with this remarkable ink vanishes entirely in a few weeks (sooner if desired), leaving the paper QUITE BLANK. 15c p. pd.

LUMINOUS INK Writing can be READ ONLY IN A DARK ROOM; writing shines like fire. Quite invisible at daytime. Very remarkable. 15c bottle; 3 for 40c postpaid.

Oh Boy! Have You Seen LITTLE EGYPT

THE ORIGINAL ORIENTAL DANCER

AND THE WONDERFUL

SHADOW DANCER

If not, do not fail to send for these, it will be money well spent. In fact, we would go as far as to guarantee you more fun in showing these two novelties to your friends than you have had in a long time.

They Will Dance For A Life-Time

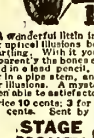
Price 30 cents each or both for 50c Postpaid

SQUIRT RING



You may have a lot of fun with this up-to-date Gem Squirt Ring. It consists of a handsome gold plated ring, attached to a rubber bill, as arranged that the latter is quite out of view when the ring is in the proper position. Such an attractive looking ring as this cannot fail to be the center of attraction. While the victim is absorbed in getting the paper forward, you just squeeze the rubber bell and the observer experiences a very great surprise. PRICE 25c each, 2 for 40c or 6 for 80c sent, postpaid. J. S. A. CO

Wonderful X-Ray Tube

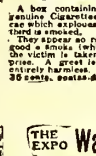


10c

A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your fingers, the lead in a lead pencil, the interior spaces in a pipe stem, and many other similar illusions. A mystery that no one has been able to satisfactorily explain.

Price 10 cents; 3 for 25 cents; 1 dozen 75 cents. Sent by mail, postpaid.

LOADED CIGARETTES

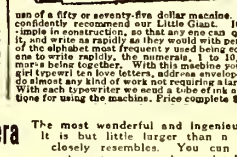


Just Like Ordinary Cigarettes, But Quite Real Ejectors.

A box containing ten apparently genuine Cigarettes. They contain a tube which explodes when about one-third is smoked. They appear so real, and afford as good a smoke, (while they last) that the victim is sure to be surprised. A great laugh producer and entirely harmless. Price, box of ten, 30 cents, postage 4c.

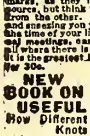
THE "LITTLE GIANT" TYPEWRITER

A First Class Writing Machine For $1.25



A perfect little typewriter for $1.25. There are thousands of persons who would like to own a typewriter but whose needs and business do not warrant the expense at sched to the purchase and use which explosive when about one-third is smoked. To such persons we confidently recommend our Little Giant. It is strongly made, but simple in construction, so that any one can quickly learn to operate it, and write as rapidly as they would with pen and ink. The letters of the alphabet most frequently used being so grouped as to enable one to write rapidly, the numerals, 1 to 10, and the punctuation marks being together. With this machine you can send your best girl (or wife) love letters, address envelopes, make out bills, and do almost any kind of work not requiring a large expensive machine. With each typewriter we send a tube of ink and full printed instructions for using the machine. Price complete $1.25 by mail postpaid.

Sneezing Powder



Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or even a mile away will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real source, but think they have caught it one from the other. Between laughing and sneezing you yourself will be having the time of your life. Excellent for parties, social meetings, car rides, or any place at all where there is a gathering of people. It is the greatest fake out. Price 10c, 2 for 30c.

By Express Only

STAGE MONEY



With a bunch of these bills, it is easy for each person of limited means to appear prosperous. By flashing a roll of these bills at the proper time and peeling off a genuine bill or two (which is outside of the roll), the effect created will be found to be all that can be desired. Prices, postpaid: 15 bills, 10c; 50 Bills 25c, 125 for 50c, or $3.50 thousand.

NEW BOOK ON ROPE SPLICING

USEFUL KNOTS, HITCHES, SPLICES, ETC.

How Different Knots Are Made and What They Are Used For. Knots to Use and Knots to Avoid.

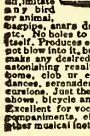
A most practical handbook giving complete and simple direction for making all the most useful knots, hitches, rigging, splices, etc. Over 100 illustrations. All about wire rope attachments, lashing, blocks, tackles, etc. 37 Heraldic Knots illustrated. Of great value to mechanics, riggers, campers, boatsmen. Price 20c p. pd.

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night

The very latest discovery in the scientific world. Hitherto, practically unobtainable except at an exorbitant price, we have at last succeeded in producing this remarkable LUMINOUS PAINT, which, when applied to the surface of any article, emits rays of white light, rendering it perfectly visible in the DARKEST PLACE. THE MORE BRILLIANT THE SURROUNDINGS, THE MORE BRILLIANT THE LIGHT. This wonderful paint is simple to use. Anyone—yes can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the push buttons or switch plates of your electric lights, match boxes, and innumerable other articles; make your own Luminous Crucifixes, Luminous Rosaries, etc. Enough in one bottle containing sufficient to coat several small articles. Price 25c. Larger sizes 50c and $1 postpaid.

MUSICAL KAZOO



With the Musical Kazoo you can, without previous practice whatsoever, play any tune right off, imitate any bird or animal, bagpipe, snare drum, Punch and Judy, etc. No holes to finger. It is simplicity itself. Produces excellent music. You do not blow into it, but sing, speak, laugh or make any desired imitation. Used with astonishing results at society meetings, clubs or church entertainments, dances, serenades, picnics, outings, excursions. Just the thing for choruses as above, bicycle and marching clubs, etc. Excellent for vocal or instrumental accompaniments, either with or without other musical instruments. Price 15c, postpaid.

MAGIC FLUTE

Wonderfully Sweet Toned and Musical

A marvelous musical instrument. No other instrument can produce sweeter music, whether it be the joyous notes of a quick-step or the solemn strains of a church hymn—in fact, any class of music can be played upon the Humanotone without practice, as it is almost a self-playing instrument. When played with a piano accompaniment, or any other musical instrument, the effect is charming. Full printed instructions for playing sent with each instrument.



Post Paid 15c

TAYLOR BARNARD & CO.

"THE HOUSE OF QUALITY"

24 E. Adams St., Dept. T-21

CHICAGO

Genu

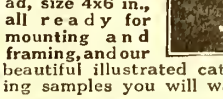
If you



in art, here is just what you have long wanted for your den or bedroom. For a short time we will make a special introductory offer as follows:

Send 25c and we will send you three Genuine Original Photographs as shown in this ad, size 4x6 in., all ready for mounting and framing, and our beautiful illustrated catalog. After seeing samples you will want more.





We guarantee all our photographs are original and are made in our own studio and can not be purchased elsewhere.

Paris Novelty Company

Dept. P-20 26 E. Adams St., Chicago, Ill.

BOOKS

THAT EVERYONE SHOULD READ. KNOWLEDGE AND FICTION

Cloth Bound

Dyke's Motor Manual	2.50
Automobile Troubles and How to Remedy Them.	1.50
Automobile Ignition, Timing and Valve Setting, Self-Starting and Lighting, including Ford System	1.50
Automobile Driving, Self-Taught	1.50
Motion Picture Making and Exhibiting	1.50
The Practical Handbook of Gas, Oil and Steam Engines	1.50
Electricity and Magnetism	1.25
Power Gas and the Gas Producer	1.25
A B C of the Motorcycle	1.50
Gas Engine Troubles and Installation	1.50
Motor Boats, Construction and Operation; Hydroplanes, Hydro-aeroplanes	1.50
A Practical Course in Mechanical Drawing	.65
Practical House Framing	.65
Hints for Carpenters	.65
Architectural Perspective	.65
Practical Concrete-Block Making	.65
Modern Cement Sidewalk Construction	.65
How to Measure Up Woodwork	.65
Easy Lessons in Architecture	.65
Hints for Painters and Paper-Hangers	.65
Hand-Forging and Wrought Iron Ornamental Work	1.25
Pattern-Making	1.25
Dustman's Book of Plans and Building Construction	2.50
How to Make a Wireless Set	$0.50
Metal Work and Etching	.50
Electroplating	.50
Wood-working for Amateur Craftsmen	.50
Gleason's Veterinary Hand Book	1.50
Famous Pictures—The Book You Should Buy	3.50
Complete Manual on Hypnotism	.90
Motor Truck and Automobile Motors and Mechanism	1.50
Johnson's New Handy Manual on Plumbing, Heating, Ventilating and Mechanical Refrigeration	1.50

Paper Bound

How to Become a Successful Newspaper Man	$0.25
Hunters' and Trappers' Guide	.25
The Star Amateur Electrician	.10
Electric Bells and All About Them	.35
Astrology Made Easy	.25
Hopson's Engineers Blue-Book	.25
English Self-Taught—For French	.25
Italian Self-Taught	.25
English Self-Taught—For Spaniards	.25
Norwegian Self-Taught	.25
German Self-Taught	.25
English Self-Taught—For Germans	.25
Spanish Self-Taught	.25
Polish Self-Taught	.25
Swedish Self-Taught	.25
How to Learn to Play the Banjo	.25
How to Learn to Play the Violin	.25
How to Learn to Play the Piano or Organ	.25
How to Learn to Play the Mandolin	.25
Stage Secrets	.50
How to Entertain at a Social Party	.25
How to Box	.25
Rare Coin Guide	.10
The Modern Dances (Tango Made Easy)	.25
How to Pitch Curves	.25
French, Self-Taught	.25
Up-to-Date Practical Letter Writer	.45
How to Make Poultry Pay	.40

All Books Sent Postpaid

THE EXPO Watch Camera



The most wonderful and ingenious Camera made. It is but little larger than a watch, which it closely resembles. You can carry the Expo about in your pocket and take pictures without any one being the wiser.

One Cent a Picture

The Expo loads in daylight with 25 Exposure Films, costing 25c, thus the picture taking part of a whole day's outing may be had for the nominal sum of 25c—one cent a picture. 10 Exposure Films also obtainable. It is simplicity itself to operate. Takes pictures through the stem, where the Rapid Fire Lens is located. The photos (⅝"x⅞") may be enlarged to any size.

Quick as a Flash

Time and instantaneous shutters; weighs but 3 ounces; nickel plated. Endorsed by amateurs and professionals the world over. Thoroughly practical—printing and developing of films just the same as ordinary cameras—in daily use by the police, newspaper reporters, detectives, and the general public. Important beats have been secured with the Watch Camera by enterprising reporters. Produces clear, sharp negatives indoors or outdoors, equal to any camera on the market, size or price notwithstanding.

Price $3.00

Expo Watch Company Postage 10c Anywhere

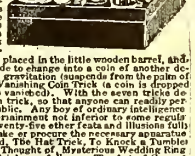
$3.00 FILMS, 10 Exposures 20c, 25 Exposures 30c Leather Pocket Carrying Case, 30c

The CONJURER'S CASKET

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment

ANYONE CAN DO THEM

50c



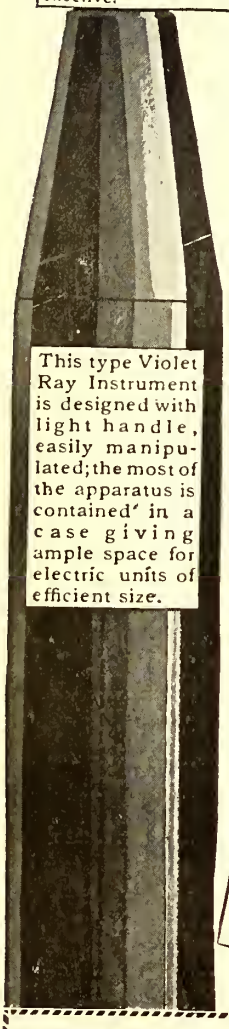
It is great fun mystifying your friends. Get this Conjurer'n Cabinet, and you will be the cleverest fellow in your district. It contains the apparatus for seven first-rate tricks, including The Disappearing Rose, that, when placed on the lapel of your coat, vanishes from sight as well; the Magic Vase and Ball Trick in Wooden Ball so placed inside, and upon replacing the lid has disappeared and is found in someone else's pocket!; The Magic Nail with which you can apparently eat your finger almost in two; the Wonderful Card Trick (a card is placed in an envelope, and when opened an entirely different card, together with cheese wall, clothing, etc.); The Glass Goblet and Vanishing Coin Trick (a coin is placed in a little wooden barrel, and when opened again, is found to have vanished entirely, or can be made to change into a coin of another denomination); The Famous Mesmerised Penny, that defies the law of gravitation (suspends from the palm of the hand, cheese wall, clothing, etc.); The Glass Goblet and Vanishing Coin Trick (a coin is placed in a little wooden barrel, and when opened again, is found to have vanished entirely, or can be made to change into a coin of another denomination); The Famous Mesmerised Penny

Regain Your Health Thru Renulife VIOLET RAY Treatments at Home



Unequaled for neuritis and rheumatism

More Than 25,000 Volts
No pain, shock or muscular contraction. Entirely harmless — powerfully effective.



This type Violet Ray Instrument is designed with light handle, easily manipulated; the most of the apparatus is contained in a case giving ample space for electric units of efficient size.

There is no "quackery" or uncertainty about *Renulife Violet Ray.* It is not claimed to be a "Cure All," but it has proved in thousands of cases a practical health-producing, revitalizing agent—powerful in restoring normal physical conditions—yet gentle, soothing and perfectly safe. *You* can treat yourself. Get full information regarding uses shown on coupon below.

Users Get Wonderful Results

(Voluntary Testimonials)

"The Renulife Violet Ray High Frequency Generator is superior in efficiency because of its perfect character and control of current, compactness and perfect insulation. The smallness and lightness of Electrode holder is also a great advantage." "The doctor told me that the trouble was hardening of the arteries. I wish I had got it a year ago. I would not be without it for all the money in the world." "I cannot recommend it too highly." "I have been using mine now for a week for Sciatica and I am highly pleased with results." "I think it is one of the best little machines that was ever invented." "I have used it with excellent results for the restoration of hair and stiff and sore rheumatic finger joints." "Am well pleased with the Generator, and the kind treatment received from your Company." "My Generator has stopped my neuritis." "Every house should have a Renulife Violet Ray High Frequency Generator, for the treatment of Neuralgia, Neuritis, Sore Throat, Kernels in Neck, Cramps, Headache, Stiff Neck, Muscular Soreness, Rheumatism, Paralysis—in short, pains of all kinds."—M. D. "I have been much relieved by the use of your Violet Ray Generator." "It is fine for Insomnia." "I find it such a help in nervousness." "I would not part with it for five times the price. It is sure a little wonder." "I am more than pleased with the Generator; the whole family are using it." "A neighbor lady was suffering from lumbago and could not move, and my wife brought over the Generator and in less than ten minutes the lady was greatly relieved." "Your Generator is just the thing for me. That tired feeling has left me, and I feel like myself again." "It has relieved me of the nervousness and also it has helped me a great deal in using it for the treatment of rheumatism."

How Renulife Benefits

Science has demonstrated a strange relation between electricity and life cells. This instrument harnesses a tremendous current of electricity and applies in the form of Violet Rays so that the body welcomes and responds to it in a marvelous manner—no pain—shock or the slightest harmful effects. A few seconds of Renulife Violet Ray gives more benefit than hours of the old time battery methods—because a thousand times as much voltage is made use of.

The irresistible, revitalizing powers of *Renulife Violet Ray* reach every nerve cell, fibre and part of body. Blood is enriched and purified by a flood of oxygen, giving added vitality and strength. Assimilation and digestion improved—functions retored to normal—extra supply of fresh blood quickly brought to area treated, removing congestion and supplying nourishment. While relieving pains and aches, the manifest results of disorders, it removes the deep seated cause, combines the benefits of electricity, vibration, exercise, stimulation and oxidation.

Get Book "Health via Violet Ray"

Learn the whole marvelous story of the Violet Ray—this method that works with nature to restore and build up. Learn how you, at home, can now use these great curative forces of Violet Ray—heretofore only available at big expense from physicians or beauty doctors. Send coupon or postal card now and receive free book describing uses, quoting low prices (within the reach of all) and explaining liberal *Trial Plan.*

Renulife Electric Co., Inc.
1211 Marquette Bldg., Detroit, Mich.
CANADIAN RENULIFE ELECTRIC CO., Ltd.,
1211 Netting Bldg., Windsor, Ont.
Toronto Office: 612 C. P. R. Building.

Live Sales Representatives write for proposition



Increases energy and vitality



Treatment for nervousness and general debility



Ozone most beneficial for catarrh, throat and lungs. Also anemia



Stops falling hair — promotes hair growth. Wonderful beauty aid

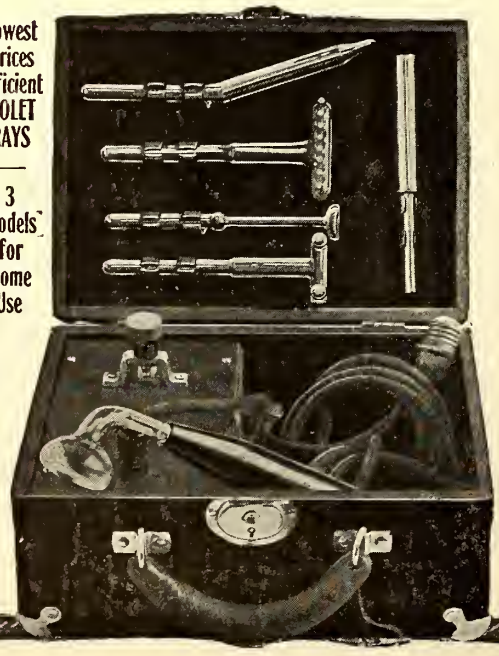
Chicago Office
Room 410
123 West Madison

BOOK **FREE**



Lowest Prices Efficient VIOLET RAYS

3 Models for Home Use



COUPON FOR BOOK and Special Information

RENULIFE ELECTRIC CO.,
12h Marquette Bldg., Detroit, Mich.

Please send without obligation, your book "Health," explaining Violet Ray treatments with Renulife Generators; also give full particulars as to its application for ailments checked below.

TREATS SUCCESSFULLY

..Abscesses	..Facial Neuralgia	..Piles
..Anemia	..Falling Hair	..Pimples
..Asthma	..Goitre	..Pyorrhea
..Arteriosclerosis	..Gout	..Rheumatism
..Baldness	..Hay Fever	..Scars
..Blackheads	..Infantile Paralysis	..Sciatica
..Brain Fag	..Insomnia	..Skin Diseases
..Catarrh	..Lameness	..Throat Diseases
..Colds	..Locomotor Ataxia	..Sprains
..Chilblains	..Lumbago	..Toothache
..Dandruff	..Nervous Affections	..Weak Eyes
..Deafness	..Neuralgia	..Wrinkles
..Eczema	..Neuritis	..Warts and Moles
..Enlarged Prostate	..Paralysis	

Write your name and address in margin below and cut out with coupon

Copyright, 1919, R. E. Co.

www.americanradiohistory.com

The price goes up

Your last chance to procure a complete electrical education at as low a price as $16, payable $2 per month.

Several hundred people have written us that we were not fair to them by not announcing the forthcoming increase in price. We have decided to extend the date.



The price of the CROFT LIBRARY OF PRACTICAL ELECTRICITY must go up. We have fought against this increase as long as we could. You have, however, one more chance to purchase at the old price.

In fairness and justness to the readers of this paper, we desire to give everyone notice of the change in price before it goes into effect.

Know electricity as experts know it

No other library or course on the practical side of electricity adheres so closely to actual electrical work as the Croft Library of Practical Electricity. No other set of books or course is more modern, complete, or more easily understood. This Library, with its mine of working details, enables you to master electricity quickly, and to know it as experts do.

The standard in America

Terrell Croft has had twenty years' experience in electrical practice. He started as wireman's helper. Later he became trouble shooter, then draftsman, then electrical engineer for the Westinghouse Co. His twenty years' experience is boiled down to eight flexibly-bound pocket books which are now accepted as the standard in America.

Nothing better at any price

No matter how much you may pay for electrical literature, nor how much you spend on educating yourself in the finer points of practice, you cannot get more reliable, more authoritative, more detailed information than is contained in the Croft Library. It is an innovation in the world of electricity, as a ten-minute examination will prove.

Ten days' free trial
NOT ONE CENT IN ADVANCE

In order to receive advantage of the old price on these books, just fill out the coupon and return to us. Keep the books ten days and examine them thoroughly, putting their usefulness to every imaginable test. Then if they are not satisfactory, return at our expense.

Should they come fully up to your expectations, send us $2 per month for eight months.

McGraw-Hill Book Co., Inc.
239 West 39th Street New York



Meet Terrell Croft

Be guided in your study of electricity by an experienced electrical engineer of high professional standing, a man who gained his knowledge with his sleeves rolled up, and has met your problems in advance. He tells in plain, understandable language how to proceed by the best and most practical methods to the higher position.

FREE EXAMINATION COUPON

After February 28, price of the set $20

McGraw-Hill Book Co., Inc.
239 W. 39th St., New York.

Gentlemen:—Please send me the Library of Practical Electricity (shipping charges prepaid), for 10 days' free examination. If satisfactory I will send $2 in ten days and $2 per month until $16 has been paid. If not wanted, I will write you for return shipping instructions.

Name .....

Home Address .....

City and State .....

Where Employed .....

Occupation .....(Ex. 12-19)

www.americanradiohistory.com

Electrical Experimenter

233 FULTON STREET, NEW YORK

Publisht by Experimenter Publishing Company, Inc. (H. Gernsback, President; S. Gernsback, Treasurer; R. W. DeMott, Sec'y;) 233 Fulton Street, New York.

Vol. VII. Whole No. 80 **Contents for December, 1919.** No. 8

THOMAS A. EDISON SPEAKS TO YOU.....Front Cover
From a painting by Harold Brown
SUBMARINES TO SALVAGE SUNKEN SHIPS..... 745
SHIPS GUIDED BY ELECTRIFIED CABLE..... 746
DID THE ROMANS HAVE "WIRELESS"?..... 747
THOMAS A. EDISON SPEAKS TO YOU—SPECIAL INTERVIEW. 748
By H. Gernsback.
SLOW MOVIES ANALYZE MOTION..... 751
MYSTERIES OF STAGE-CRAFT, by H. Winfield Secor..... 752
AN AERIAL PASSENGER ROCKET..... 754
AN "OSCILLATING" SCENIC RAILWAY..... 756
AIRPLANE SUPER-CHARGER FOR HIGH-FLYING..... 757
By Charles M. Ripley.
SOUND AND FLASH RANGING IN THE A.E.F..... 758
By Prof. Augustus Trowbridge, Princeton University.
ROHLFS FLIES 34,610 FEET—NEW WORLD'S RECORD..... 760
NEW YORK ELECTRICAL SHOW..... 761
PIEZO-ELECTRICITY OR "SPEAKING CRYSTALS"..... 762
By A. McL. Nicolson.
LATEST ELECTRIC NOVELTIES..... 765
BEAUTY BY THE KILOWATT..... 766
STUCCOING HOUSES BY ELECTRICITY..... 767
POPULAR ASTRONOMY—IS THE MOON A DEAD WORLD?.... 768
By Isabel M. Lewis, M.A.
TRAINING WOMEN SUB-STATION OPERATORS..... 770
THE AMATEUR MAGICIAN, by Joseph H. Kraus, Jr..... 771
THE CONSTRUCTOR DEPARTMENT—ELECTRIC CHRISTMAS VILLAGE, by Fred F. Phillips..... 772
PHOTOGRAPHIC EXPERIMENTS, by Marion B. Reynolds..... 773
THE "FINER WORKINGS" OF STATIC ELECTRICITY..... 774
By Frederick Von Lichtenow.
THE ELECTRICAL MACHINIST, by H. Winfield Secor..... 775
"HOW-TO-MAKE-IT" PRIZE CONTEST..... 776
WRINKLES, RECIPES AND FORMULAS, by S. Gernsback..... 777
CARNARVON RADIO STATION..... 778
MODERN AMERICAN RADIO APPARATA.—THE PLIOTRON FAMILY..... 779
CALCULATION OF TREE WAVE LENGTHS..... 780
By A. N. Tenna.
RADIO GUIDES SHIPS THRU FOG..... 781
LOCATING SUBMARINE BY AUDION SYPHONING..... 782
By Edward T. Jones, A.M.I.R.E.
LATEST PATENTS DIGEST..... 783
"WITH THE AMATEURS" LABORATORY PRIZE CONTEST.... 784
SCIENCE IN SLANG—"JUICING THE JAZZ WAGON"..... 785
By Emerson Easterling.
THE ORACLE..... 786

EDITORIAL

Ether and Space

FOR thousands of years it was an establisht fact that the earth stood still, with the sun, moon and stars revolving around it. All known evidence, visual and otherwise, supported the "fact." But humanity with its deceptive senses had been fooled for generations, until the "establisht fact" was disproved by one Galileo, who brought very convincing proofs that it was the sun that stood still.

Since Euclid, down to a very few years ago, scientists thought that light was always propagated along absolutely straight lines. Einstein, however, showed an astonished world that a ray of light may be curved considerably. Indeed, we appear to have proofs to support him.

Again, for over one hundred years we have accepted unhesitatingly Faraday's teachings that the whole universe is permeated with a very tenuous and exceedingly fine substance, the ether. Faraday and Maxwell, in order to explain the wave theory of light and other electromagnetic waves, invented the ether, as they reasoned that you cannot have waves without a suitable medium in which to vibrate these waves. The ether, accordingly, is a substance so fine, so minute, that it permeates and fills not only the entire universe but all other substances. It fills the space between atoms in metals and all other solids or fluids; in short, it is everywhere. It was reasoned that the ether must have elastic, jelly-like material properties in order to explain many mystifying phenomena, but nothing of the actual structure of the ether is known.

But now Einstein and his followers come along and flatly deny all existence of the ether. In their support it must be said that there are no experimental proofs of the existence of the ether. The ether, in short, is only a theory, which was never proved—but so far also never entirely disproved. If a light ray is material, the ether is no longer required to explain its propagation. Indeed, all recent researches along this line tend to show that light *is* material. We know for instance that the sunlight exerts a pressure of many thousand tons upon the surface of the earth upon which it falls. This is termed the pressure of light. But can you exert pressure upon a body unless the light which exerts it has "body"; in other words, is material? Then, too, if a light ray is deflected in a gravitational field, it certainly must be material.

Once arrived on these premises let us see how space looks to our mental eye, robbed of its hypothetical ether. We will now have a vast vacuum, nothing but a vacuum at a temperature of—273° Fahrenheit. But how can a light ray, or a radio ray (wave) cross this bottomless void? An analogy may perhaps help here. Imagine a man stationed out in space shooting a stream of a non-freezing liquid earthward from a fire-hose. Suppose he vibrates (shakes) the nozzle back and forwards slightly. This would impart to the liquid stream a wave motion the same as we know a light ray has. There being no friction, the wave motion of the liquid stream would persist till the stream reaches the earth's atmosphere, where it would break up into drops.

Now we have seen that given a material stream we need no medium such as the ether to hurl it earthward. If, then, light and other electromagnetic waves are material, we no longer require the ether to explain the wave motion. We can even explain how it comes that the intensity of light diminishes inversely as the square of its distance. If a light ray is material—let us say composed of electrons—we can conceive how, thru its terrific speed of 186,000 miles per second, a certain quantity of electrons are lost continuously in space during its course. These electrons would probably be flipped off from the crests of the wave.

The next decade will no doubt shed further "light" on the question.

H. GERNSBACK.

The **ELECTRICAL EXPERIMENTER** is publisht on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions. Canada and foreign countries, $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coins or stamps). Single copies, 20 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC. If you change your address notify us promptly, in order that copies are not miscarried or lost. **A green wrapper indicates expiration. No copies sent after expiration.**

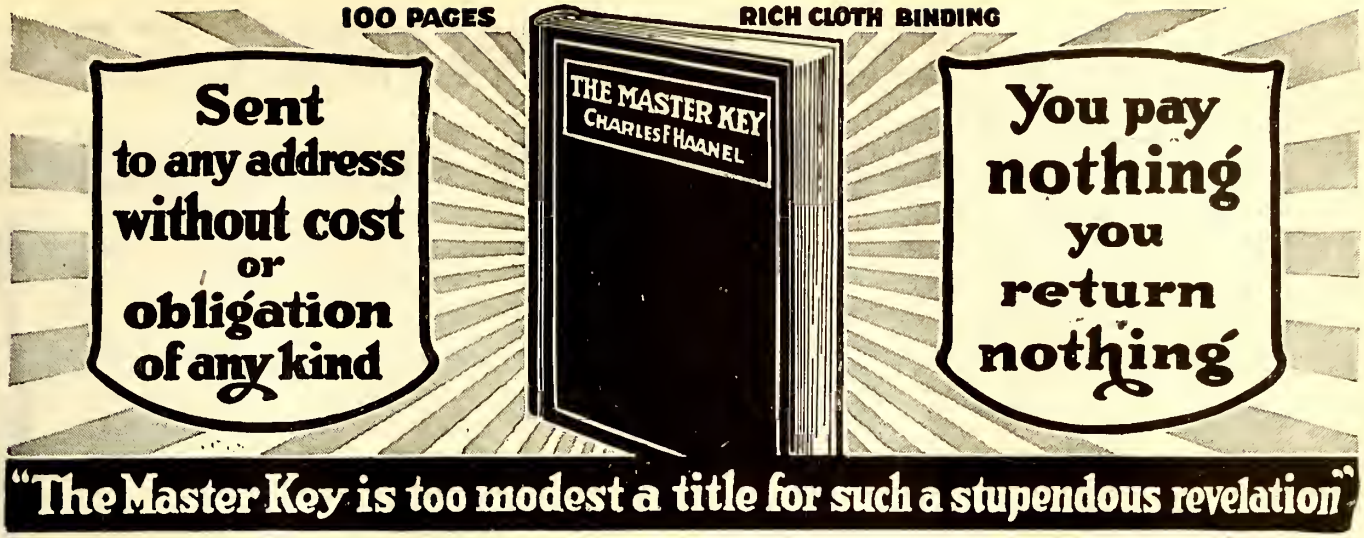
All communications and contributions to this journal should be addrest to: Editor, ELECTRICAL EXPERIMENTER, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. **ALL** accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

ELECTRICAL EXPERIMENTER. Monthly. Entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879. Title registered U. S. Patent Office. Copyright, 1919, by E. P. Co., Inc., New York. **The Contents of this magazine are copyrighted and must not be reproduced without giving full credit to the publication.**

The ELECTRICAL EXPERIMENTER is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris. Sole British agents—Geoffrey Parker & Gregg, 62 and 8A The Mall, Ealing, London.

Member of the Audit Bureau of Circulation.

www.americanradiohistory.com



SOME men seem to attract success, power, wealth, health and attainment with very little conscious effort, others conquer with great difficulty, still others fail altogether to realize their ambitions, desires and ideals. Why is this so?

The Master Key will tell you why! It will tell you that these things are controlled by Natural Laws, precisely the same as the falling of an apple.

The Master Key is a key with which many are converting loss into gain, fear into courage, despair into joy, hope into fruition. No one will emerge from its magic pages but with a firmer grasp of the future, a surer understanding of what he can do.

This may seem to be too good to be true, but remember that within a few years, by the touch of a button or the turn of a lever, science has placed almost infinite resources at the disposal of man, is it not possible that there are other laws containing still greater possibilities.

An understanding of this law will enable you to control every other power which exists. It is without doubt the greatest discovery of the Twentieth Century. In it may be found the remedy for every ill, the solution to every difficulty, the gratification for every desire; in fact, it would appear to be the Creator's magnificent provision for human emancipation.

A copy of this magnificent, richly bound hundred-page book will be sent to any address, without cost or obligation of any kind.

Charles F. Haanel, 203 Howard Bldg., St. Louis, Mo.

You should send for a Master Key.

www.americanradiohistory.com



LEARN WIRELESS By Mail—In Ten Weeks

Calls Coming in Steadily for National Radio Institute Graduates From All Parts of the Country. Four Concerns Guarantee to Take All Operators We Can Furnish.

Commercial Radio has arrived and many attractive positions are now open in the commercial land radio service, merchant marine, railroads, radio supply factories, lake and ocean steamship lines, telegraph companies and aerial mail service. We are now receiving requests for more National Radio Institute graduates than we can furnish.

Salaries Up to $250 a Month

with exceptional opportunity for promotion to Radio Mechanics, Electricians, Engineers, and Government Inspectors. No previous experience or training is necessary. You can learn wireless the National Radio Institute way in ten weeks by mail right in your own home. With our help you can quickly qualify for First Grade Government License and a good position at big pay. Many of our students secure positions before completing the course because it is based on actual practice and teaches what is needed to make a big success of wireless work.

Get Your Instructions From the Nation's Capital

(Our Course is Endorsed by the United States Government Officials)

The National Radio Institute, established in 1914, was the first in America to successfully teach wireless by mail. It is headed by authorities who have been closely allied with government training of students. The work is under the direction of J. E. Smith, E. E., formerly director of the Radio Department, Howard University, and E. R. Haas, formerly of the Radio Division of Yale University, assisted by a competent corps of trained instructors and lecturers.

We now have hundreds of students throughout the world. Our location in the Nation's Capital, together with the standing of our officers and their wide acquaintance among government officials connected with Wireless activities, places us in position to give our students the best instructions obtainable and to be of the utmost help in assisting them to secure good paying positions.

Travel If You Want To

If you want to travel and see the world, go to foreign countries and increase your knowledge of world affairs, wireless offers you the chance of a life time. However, you are not obliged to travel, but may secure a permanent position at one of the many land radio offices, railroads, telegraph or steamship companies, if preferred.

Pay As You Learn

Our plans of payment places a wireless education within the reach of anyone who desires to learn.

A small payment down on our convenient payment plan and small following payments enables you to earn the cost of your tuition while actually learning to be a wireless operator.

Free Instruments to Every Student

In addition to six text books—35 special lessons and 18 personal examinations—we send you, while taking our course, a standard Automatic Transmitting and Receiving Set for sending and receiving messages. These fine instruments are free only to National Radio Institute students.

Free Membership in N. R. I. Relay League

Upon enrollment every student in the National Radio Institute is presented with a handsome blue and gold pin, signifying his official membership in the N. R. I. Relay League, with a rapidly growing membership throughout the world.

FREE

In addition to our complete course in radio telegraphy, every student is given our complete course in modern radio telephony. This course comprises ten special lessons and ten personal examinations. These combined courses enable our students to fill positions requiring thorough knowledge of both radio telegraphy and modern radio telephony.

Send the following coupon today for our FREE book containing all particulars and special offer to students enrolling now.

Mail This Coupon Today

National Radio Institute,
Dept. 145, 14th and U Sts., N. W.
Washington, D. C.

Send me, free of charge, your booklet, "Wireless The Opportunity of Today", with full particulars regarding your famous ten weeks' Home Study Course and your Special FREE INSTRUMENT OFFER.

Name .....

Address .....

City..... State.....

www.americanradiohistory.com



Five Days to Prove I Can Raise Your Pay

I've done it for thousands of others. I can doubtless do it for you. If I can't, then it won't cost you a cent.

I MEAN just what I say. There's no trick or catch about it. Give me five days and I'll prove that I can get your pay raised for you. I'll do it on a "show you" basis. You get the proof before you pay me a cent.

You've probably heard of me. My name is Pelton. Lots of people call me "The Man Who Makes Men Rich." I don't deny it. I've done it for thousands of people—lifted them up from poverty to riches. There's no sound reason why I cannot do it for you. So let's try.

Now, follow me carefully. I'm going to tell you exactly how to do it. I'm the possessor of a "secret" for which men have been searching since Time began.

A FEW EXAMPLES

Personal Experiences

Among over 350,000 users of "Power of Will" are such men as Judge Ben B. Lindsay; Supreme Court Justice Parker; Wu Ting Fang, Ex-U. S. Chinese Ambassador; Assistant Postmaster General Britt; Lieut. Gov. McKelvie of Nebraska; General Manager Christeson of Wells-Fargo Express Co.; E. St. Elmo Lewis, of Detroit; Gov. Ferris of Michigan, and many others of equal prominence.

$300 Profit from One Day's Reading

"The result from one day's study netted me $300 cash. I think it a great book and would not be without it for ten times the cost."—A. W. Wilkie, Faulkton, So. Dakota.

Worth $15,000 and More

"The book has been worth more than $15,000 to me."—Oscar B. Sheppard, 1117 E. Locust St., Decatur, Ill.

Would be Worth $100,000

"If I had only had it when I was 20 years old, I would be worth $100,000 to-day. It is worth a hundred times the price."—S. W. Taylor, The Santa Fe Ry., Milano, Tex.

From $100 to $3,000 a Month

"One of our boys who read Power of Will before he came over here jumped from $100 a month to $3,000 the first month, and won a $250 prize for the best salesmanship in the State."—Private Leslie A. Still, A. E. F., France.

There's no need to discuss the whys and the wherefores of this "secret." Suffice it to say that *It Works*. That's all we care about—*It Works*. Over 350,000 men and women the world over have proved it for themselves.

Among them are such men as Judge Ben B. Lindsay; Supreme Court Justice Parker; Lieut. Governor McKelvie, of Nebraska; Wu Ting Fang, ex-U. S. Chinese Ambassador; Governor Ferris, of Michigan; and thousands of others of equal prominence.

Some of the things this "secret" has done for people are astounding. I would hardly believe them if I hadn't seen them with my own eyes. Adding ten, twenty, thirty or forty dollars a week to a man's income is a mere nothing. That's merely playing at it. Listen to this:

A young man in the East had an article for which there was a nation-wide demand. For twelve years he "puttered around" with it—barely eking out a living. To-day this young man is worth $200,000. He is building a $25,000 home—and paying cash for it. He has three automobiles. His children go to private schools. He goes hunting, fishing, traveling, whenever the mood strikes him. His income is over a thousand dollars a week.

In a little town in New York lives a man who two years ago was pitied by all who knew him. From the time he was 14 he had worked and slaved—and at sixty he was looked upon as a failure. Without work, in debt to his charitable friends, with an invalid son to support, the outlook was pitchy black. Then he learned the "secret." In two weeks he was in business for himself. In three months his plant was working night and day to fill orders. During 1916 the profits were $20,000. During 1917 the profits ran close to $40,000. And this genial 64-year-young man is enjoying pleasures and comforts he little dreamed would ever be his.

I could tell you thousands of similar instances. But there's no need to do this as I'm willing to tell you the "secret" itself. Then you can put it to work and see what it will do for you. I don't claim I can make you rich over night. Maybe I can—maybe I can't. Sometimes I have failures—everyone has. But I do claim that I can help 90 out of every 100 people if they will let me.

The point of it all, my friend, is that you are using only about one-tenth of that wonderful brain of yours. That's why you haven't won greater success. Throw the unused nine-tenths of your brain into action and you'll be amazed at the almost instantaneous results.

The Will is the motive power of the brain. Without a highly trained, inflexible will, a man has about as much chance of attaining success in life as a railway engine has of crossing the continent without steam. The biggest ideas have no value without will-power to "put them over." Yet the will, altho heretofore entirely neglected, can be trained into wonderful power like the brain or memory and by the very same method—intelligent exercise and use.

If you held your arm in a sling for two years, it would become powerless to lift a feather, from lack of use. The same is true of the Will—it becomes useless from lack of practice. Because we don't use our Wills—because we continually bow to circumstance—we become unable to assert ourselves. What our wills need is practice.

Develop your will-power and money will flow in on you. Rich opportunities will open up for you. Driving energy you never dreamed you had will manifest itself. You will thrill with a new power—a power that nothing can resist. You'll have an influence over people that you never thought possible. Success—in whatever form you want it—will come as easy as failure came before. And those are only a few of the things the "secret" will do for you. The "secret" is fully explained in the wonderful book "Power of Will."

How You Can Prove This at My Expense

I know you'll think that I've claimed a lot. Perhaps you think there must be a catch somewhere. But here is my offer. You can easily make thousands—you can't lose a penny. Send no money—no, not a cent. Merely clip the coupon and mail it to me. By return mail you'll receive, not a pamphlet, but the whole "secret" told in this wonderful book, "POWER OF WILL."

Keep it five days. Look it over in your home. Apply some of its simple teachings. If it doesn't show you how you can increase your income many times over—just as it has for thousands of others—mail the book back. You will be out nothing.

But if you do feel that "POWER OF WILL" will do for you what it has done for over a quarter of a million others—if you feel as they do that it's the next greatest book to the Bible—send me only $3.50 and you and I'll be square.

If you pass this offer by, I'll be out only the small profit on a three and a half-dollar sale. But you—you may easily be out the difference between what you're making now and an income several times as great. So you see you've a lot—a whole lot—more to lose than I.

Mail the coupon or write a letter now—you may never read this offer again.

PELTON PUBLISHING COMPANY
30-W Wilcox Block Meriden, Conn.

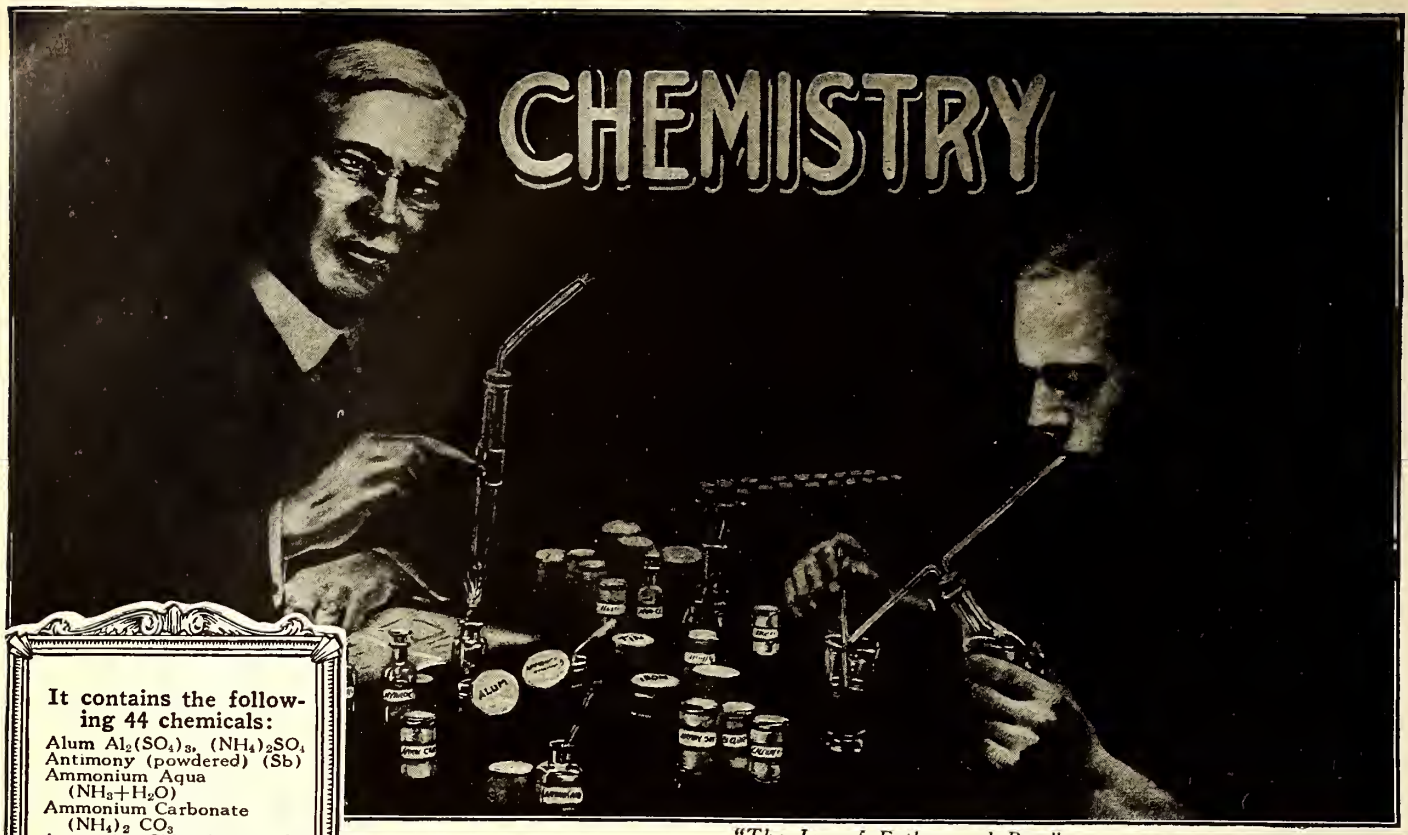
PELTON PUBLISHING COMPANY,
30-W Wilcox Block, Meriden, Conn.

You may send me "Power of Will" at your risk. I agree to remit $3.50 or remail the book to you in five days.

Name .....

Address .....

www.americanradiohistory.com



"The Joy of Father and Boy."

Chemical Laboratory

We present herewith to our friends our new **E. I. Co. Chemical Laboratory** which contains **real** chemicals and apparata to perform **real** chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparata and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a **Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.**

DESCRIPTION OF THE OUTFIT:

The outfit consists of forty-four (44) Chemicals all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) enough to make dozens of experiments with each. See list of Chemicals herewith.

The apparata furnished are all of the best obtainable make and of standard laboratory size and shape. A list of the 17 pieces of apparata furnished with this outfit is printed also herewith.

The Instruction book is a real **Chemistry Course for the Beginner.** Some of the Contents are: **Division of Matter:** This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. **Chemical Nomenclature:** This explains in simple language the derivation of the chemical names of the Elements and their compounds. There is a chapter on **Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms,** etc.

A good part of the book is devoted to Weights and Measures. The Metric System, the English system and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights, Volume, Capacity and Length; Per Cent solutions; Conversion of Measure expressed in parts; Poisons and their antidotes; Technical and common name of chemical substances; Formulas for Cleaning various substances, etc., etc.

Among the **100 Experiments** are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to Make Chlorine Gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

It contains the following 44 chemicals:

Alum $Al_2(SO_4)_3$, $(NH_4)_2SO_4$
Antimony (powdered) (Sb)
Ammonium Aqua (NH_3+H_2O)
Ammonium Carbonate $(NH_4)_2CO_3$
Ammonium Chloride (NH_4Cl)
Ammonium Sulphate $(NH_4)_2SO_4$
Barium Chloride ($BaCl_2$)
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride ($CaCl_2$)
Calcium Oxide (CaO)
Calcium Sulphate ($CaSO_42H_2O$)
Charcoal (Carbon) (C)
Chloride of Zinc ($ZnCl_2$)
Copper Sulphate ($CuSO_4$)
Ferrous Sulphate ($FeSO_4$)
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5(OH)_3$
Hydrochloric Acid (HCl)
Iodine (I)
Iron Chloride ($FeCl_2$)
Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
Magnesium Carbonate ($MgCO_3$)
Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
Nickel Chloride ($NiCl_2$)
Oxalic Acid ($H_2C_2O_4$)
Sodium Bicarbonate ($NaHCO_3$)
Sodium Borate ($NaBO_2$)
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate ($NaNO_3$)
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride ($SnCl_2$)
Sulphate of Nickel ($NiSO_4$)
Sulphate of Zinc ($ZnSO_4$)
Sulphuric Acid (H_2SO_4)
Tin (Granulated) (Sn)
Zinc (Metal) (Zn)
Zinc Carbonate ($ZnCO_3$)

The following apparata are furnished:

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube
Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure
Glass Tubing
One book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

The price is still $5.00. **Shipping Weight 10 lbs.** **(Can be shipped by Express only.)**

TRADE MARK **THE ELECTRO IMPORTING CO., Mfrs.** TRADE MARK
231 FULTON STREET NEW YORK CITY

"THE LIVIEST CATALOG IN AMERICA"

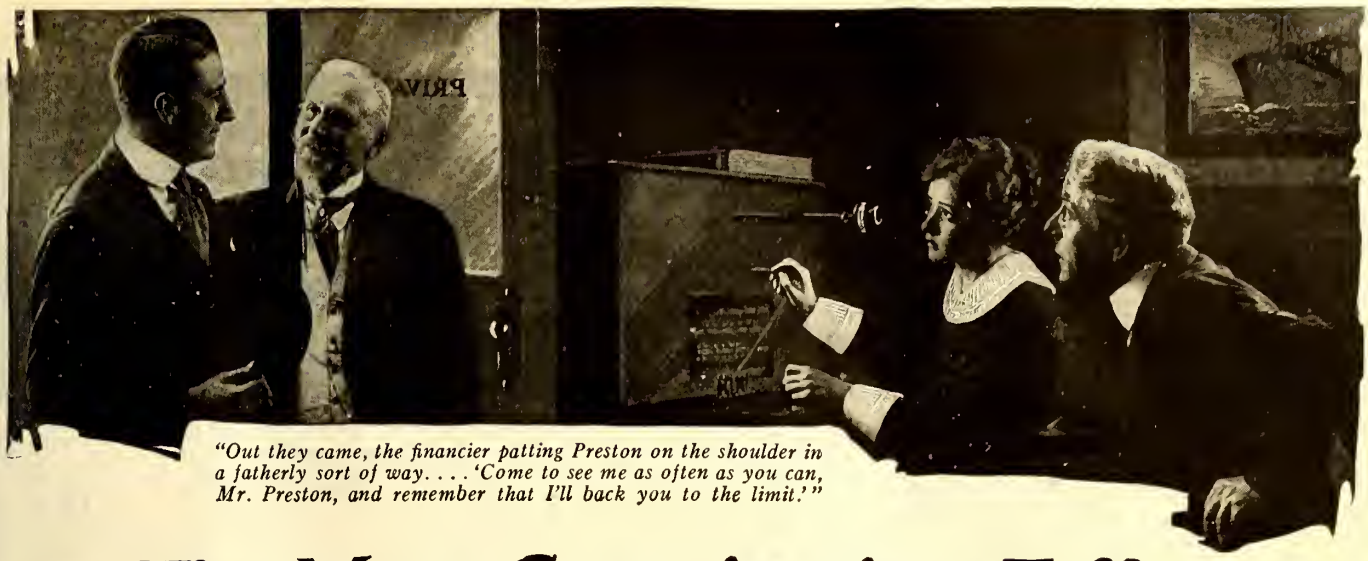
Our big, new electrical cyclopedia No. 21 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 176 Big Pages, 400 illustrations. 300 instruments and apparatus, etc. Big **"Treatise on Wireless Telegraphy."** 21 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 21 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

I enclose herewith 6 cents in stamps or coin, to cover postage, for which please send me your latest Cyclopedia Catalog No. 21 as described.

NAME .....
ADDRESS .....
STATE..... E. E. 12-19

www.americanradiohistory.com



"Out they came, the financier patting Preston on the shoulder in a fatherly sort of way. . . . 'Come to see me as often as you can, Mr. Preston, and remember that I'll back you to the limit.'"

The Most Convincing Talker I Ever Met

Everywhere this man goes, people shower him with favors and seek his friendship. Things which other people ask for and are refused, he gets instantly. How he does it is told in this amazing story.

LET me ask you this: There is a big business deal to be put through. It involves millions of dollars. Putting it through depends wholly on one thing—getting the backing of a great financier.

But this man is bitterly opposed to your idea and to your associates. Seven of the most able men and women in all America have tried to win over this financier. They failed dismally and completely.

Now, could you, a total stranger to this man, walk in on him unannounced, talk for less than an hour, and then have him take your arm as a token of friendship, and give you a signed letter agreeing to back you to the limit?

Could you?

ASTOUNDING? Yes! But it *W A S* done. And I'll tell you how. Here is the way it all came about. For a long time the directors of our company had felt the handicap of limited capital. We had business in sight running into a million dollars a month. But we couldn't finance this volume of sales. We simply had to get big backing, and that was all there was to it.

Because of trade affiliations, one man—a great financier in New York—controlled the situation. Win him over and the rest was easy. But how to win him?—that was the question. No less than five men and two women—all people of influence and reputation—had tried. They were all repulsed—turned down cold and flat.

You know how a thing of this sort grows on you and how bitter utter defeat is. Well, we were talking it over at a board meeting, when one of our directors announced that he knew of only one man who could possibly put through the deal—a man by the name of Preston.

So it was agreed that Preston was to be sounded out at luncheon the following day. He proved to be a fine type of American. At 34 years of age he had become president and majority stockholder of a thriving manufacturing business rated at three-quarters of a million dollars.

Preston was deeply interested, as anyone would be over the prospect of closing such a big deal. The director in question said casually, "Why don't you run down to New York and take a shot at it, Preston?" Preston looked out of the window for a moment, and then quietly answered, "You're on."

I WENT along with Preston simply as a matter of form to represent our interests. Aboard the 10:25 train out of Chicago we headed for the smoker and got to talking with the crowd there.

Then I noticed something. Preston had dominated them all. Everyone was eagerly hanging on his words, and looking at him with open admiration. No sooner would he stop talking than one of the men would start him up again. And as the men dropped off at stations along the way they gave Preston their cards, with pressing invitations to look them up. No doubt about it, Preston was *T H E* man aboard that car.

The colored porter, too, came under his sway. For that night, when the berths were being made up, the porter came unasked to Preston, told him that his berth was right over the car trucks, and insisted upon changing it to a more comfortable one.

And so it went all the way to New York. Everyone who met Preston took a great liking to him the instant he spoke. They seemed to be eager for his companionship — wanted to be with him every minute, openly admired him, and loaded him with favors.

Even the usual haughty room clerk at the hotel showed a great interest in Preston's welfare. He showered us with attention while a long line of people waited to register.

The next morning we called on the great financier—the man who was so bitterly against us and had flatly turned down seven of our shrewd influential representatives.

I waited in the reception room—nervous, restless, with pins and needles running up and down my spine. Surely Preston would meet the same humiliating fate?

But no! In less than an hour out they came, arm in arm, the financier patting Preston on the shoulder in a fatherly sort of way. And then I heard the surprising words, "Come to see me as often as you can, Mr. Preston, *and remember that I'll back you to the limit!*"

AT the hotel that night sleep wouldn't come. I couldn't get the amazing Preston out of my thoughts. What an irresistible power over men's minds he had. Didn't even have to ask for what he wanted! People actually competed for his attention, anticipated his wishes and eagerly met them. What a man! What power! . . . Then the tremendous possibilities of it all—think what could be done with such power.

What was the secret? For secret there must be. So the first thing next morning I hurried to Preston's room, told him my thoughts, and asked him the secret of his power.

Preston laughed good-naturedly. "Nothing to it—I—well—that—is—" he stalled. "I don't like to talk about myself, but I've simply mastered the knack of talking convincingly, that's all."

"But how did you get the knack?" I persisted.

Preston smiled, and said, "Well, there's an organization in New York that tells you exactly how to do it. *It's amazing!* There's really nothing to study. It's mostly a knack which they tell you. You can learn this knack in a few hours. And in less than a week it will produce definite results in your daily work.

"Write to this organization—the Independent Corporation—and get their method. They send it on free trial. I'll wager that in a few weeks from now you'll have a power over men which you never thought possible . . . . but write and see for yourself." And that was all I could get out of the amazing Preston.

WHEN I returned home I sent for the method Preston told me about. It opened my eyes and astounded me. Just how he had won over the financier was now as clear as day to me. I began to apply the method to my daily work, and soon I was able to wield the same remarkable power over men and women that Preston had. I don't like to talk about my personal achievements any more than Preston does, but I'll say this:

When you have acquired the knack of talking convincingly, it's easy to get people to do anything you want them to do. That's how Preston impressed those people on the train—how he won over the financier—simply by talking convincingly.

This knack of talking convincingly will do wonders for any man or woman. Most people are afraid to express their thoughts; they know the humiliation of talking to people and of being ignored with a casual nod or a "yes" or "no." But when you can talk convincingly, it's different. *When you talk people listen and listen eagerly.* You can get people to do almost anything you want them to do. And the beauty of it all is that they think they are doing it of their own free will.

In committee meetings, or in a crowd of any sort you can rivet the attention of all when you talk. You can force them to accept your ideas. It helps wonderfully in writing business letters—enables you to write sales letters that amaze everyone by the big orders they pull in.

Then again it helps in social life. Interesting and convincing talk is the basis of social success. At social affairs you'll always find that the convincing talker is the centre of attraction, and that people go out of their way to "make up" to him.

Talk convincingly and no man—no matter who he is—will ever treat you with cold, unresponsive indifference. Instead, you'll instantly get under his skin, make his heart glow and set fire to his enthusiasms. Talk convincingly and any man—even a stranger—will treat you like an old pal and will literally take the shirt off his back to please you.

You can get anything you want if you know how to talk convincingly. You've noticed that in business, ability alone won't get you much. Many a man of real ability, who cannot express himself well, is often outdistanced hy a man of mediocre ability who knows how to talk convincingly. There's no getting away from it, to get ahead—merely to hold your own—to get what your ability entitles you to, *you've got to know how to talk convincingly!*

THE method Preston told me about is Dr. Law's "Mastery of Speech," published by the Independent Corporation. Such confidence have the publishers in the ability of Dr. Law's method to make you a convincing talker that they will gladly send it to you wholly on approval.

You needn't send any money—not a cent. Merely mail the coupon, or write a letter, and the complete Course "Mastery of Speech," will be sent you by return mail, all charges prepaid. If you are not entirely satisfied with it, send it back any time within five days after you receive it and you will owe nothing.

But if it pleases you, as it has pleased thousands of others, then send only five dollars in full payment. You take no risk. You have everything to gain and nothing to lose. So mail the coupon now before this remarkable offer is withdrawn.

Independent Corporation

Publishers of the Independent Weekly

Dept. L11012. 119 W. 40th St. New York

Please send me Dr. Frederick Houk Law's "Mastery of Speech," a Course in Business Talking and Public Speaking in eight lessons. I will either remail the Course to you within five days after its receipt, or send you $5 in full payment of the Course.

Name .....

Address .....Elect. Exper. 12-19

www.americanradiohistory.com

MAGAZINE Prices Slashed



Millions of magazine subscriptions expire this month! With the tremendous advance of paper prices and labor it is certain that nearly all magazines will advance their subscription prices at least from 25% to 50%.

BY ORDERING NOW YOU WILL SAVE BIG MONEY.

In announcing these wonderful prices it is with the absolute knowledge that our readers are offered the lowest prices for standard Magazines that it is possible to obtain anywhere. Only by special arrangement with the publishers are these prices possible, but to take advantage of them, you must act quickly. **Don't delay, do it now.** This offer is so good that of necessity it must be limited in time. Just think of buying standard Magazines at reduced prices in time for Xmas Presents, and they certainly make ideal gifts being a constant reminder for a whole year of a considerate friend. Just glance over our wonderful prices, and see how we enable one dollar to bring you two dollars' worth, and then make up your list. When sending your order, don't forget to state where magazines are to be sent. But be sure you do it now. To-morrow means you may forget and lose this wonderful opportunity. All prices quoted are for subscribers in U. S. A. only, Canadian and Foreign subscriptions require additional postage.

The Publishers Will Mail the Magazine Direct From Their Own Office to You.

Electrical Experimenter $2.00 Popular Science 2.00 Regular Price $4.00	Our Price	**$3.50**
Electrical Experimenter $2.00 Scientific American 5.00 Illustrated World 2.00 Regular Price $9.00	Our Price	**$8.25**
Electrical Experimenter $2.00 American Magazine 2.00 Woman's Home Companion 2.00 Regular Price $6.00	Our Price	**$4.75**
Electrical Experimenter $2.00 Etude (for Music Lovers) 2.00 Regular Price $4.00	Our Price	**$3.35**
Electrical Experimenter $2.00 Boy's Magazine 1.50 Regular Price $3.50	Our Price	**$3.00**
Electrical Experimenter $2.00 World's Work 4.00 Regular Price $6.00	Our Price	**$4.75**
Electrical Experimenter $2.00 Everybody's Magazine 2.00 Delineator 2.00 Regular Price $6.00	Our Price	**$4.75**
Electrical Experimenter $2.00 Designer 1.50 Woman's Magazine 1.50 Regular Price $5.00	Our Price	**$4.00**
Electrical Experimenter $2.00 McCall's Magazine 1.00 Regular Price $3.00	Our Price	**$2.50**
Electrical Experimenter $2.00 Today's Housewife 1.00 Regular Price $3.00	Our Price	**$2.50**
Electrical Experimenter $2.00 McCall's Magazine 1.00 Review of Reviews 3.00 Regular Price $6.00	Our Price	**$5.25**
Electrical Experimenter $2.00 St. Nicholas 3.00 Boy's Magazine 1.50 Regular Price $6.50	Our Price	**$5.50**
Electrical Experimenter $2.00 Century 4.00 Scribner's 4.00 Regular Price $10.00	Our Price	**$8.75**
Electrical Experimenter $2.00 Wireless Age 2.00 Radio Amateur News 1.50 Regular Price $5.50	Our Price	**$4.75**
Electrical Experimenter $2.00 Boy's Life 2.00 Regular Price $4.00	Our Price	**$3.50**
Electrical Experimenter $2.00 Illustrated World 2.00 Radio Amateur News 1.50 Regular Price $5.50	Our Price	**$4.50**
Electrical Experimenter $2.00 Field and Stream 2.00 Regular Price $4.00	Our Price	**$3.50**



Special Clubbing Prices of Electrical Experimenter WITH:

Club No.	Magazine	Regular Price	Our Price
60	**Adventure**	$3.00	$4.75
40	American	2.00	3.75
35	**Boy's Life**	2.00	3.75
25	**Boy's Magazine**	1.50	3.00
70	**Century**	4.00	5.25
40	**Christian Herald**	2.25	4.00
40	**Cosmopolitan**	2.00	3.75
20	Country Gentleman	1.00	2.75
100	Country Life	5.00	6.75
60	Current History	3.00	4.75
60	**Current Opinion**		
35	**Delineator**	2.00	3.50
28	**Designer**	1.50	3.15
35	**Everybody's**	2.00	3.50
35	**Etude (For Music Lover's)**	2.00	3.25
60	Factory	3.00	4.75
35	Field & Stream	2.00	3.50
35	**Garden Magazine**		
40	**Good Housekeeping**	2.00	3.75
80	**Harper's Bazar**	4.00	5.75
40	**Hearst's Magazine**	2.00	3.75
35	**Illustrated World**	2.00	3.50
35	Ladies Home Journal	1.75	3.50
80	Literary Digest	4.00	5.75
60	Metropolitan	3.00	4.75
100	Mid-Week Pictorial	5.00	6.75
27	Modern Priscilla	1.50	3.15
60	**Motor**	3.00	4.75
40	**Motor Boating**	2.00	3.75
40	Munsey's Magazine	2.00	3.75
20	**McCall's Magazine**	1.00	2.75
35	**McClure's Magazine**	2.00	3.50
70	Outing	4.00	5.25
40	**Pictorial Review**	2.00	3.75
40	**Popular Science**	2.00	3.50
25	**Radio Amateur News**	1.50	3.00
50	**St. Nicholas**	3.00	4.25
40	Saturday Evening Post	2.00	3.75
95	Scientific American	5.00	6.50
70	**Scribner's**	4.00	5.25
70	Smart Set	4.00	5.25
60	System	3.00	4.75
15	**Today's Housewife**	1.00	2.50
35	**Wireless Age**	2.00	3.50
40	Woman's Home Companion	2.00	3.75
17	**Woman's Magazine**	1.00	2.65
60	**World's Work**	4.00	4.75
50	**Youth's Companion**	2.50	4.25

For computing together Magazines listed separately, add Class Numbers before title and multiply by 5, giving our price to you in dollars and cents.

Write for Special Prices on ANY Publication not listed here

We will save you money

SEND ALL ORDERS TO "CIRCULATION DEPARTMENT"

EXPERIMENTER PUBLISHING CO., Inc.

233 Fulton Street, New York City, N. Y.

www.americanradiohistory.com

The Couple That Spent Every Cent

WHERE did it all go? Forbes earned a good salary. Neither he nor Mrs. Forbes could be accused of extravagance. But somehow they could never keep more than a few dollars ahead of expenses. Then something happened that gave them a scare—and out of it they found an easy way to get on EASY STREET.

ABOUT six months ago I got the scare of my life. Edith was worried, too. But in the end it was one of the best things that ever happened to us.

I guess I had a pretty close call. The doctor said afterwards that he never expected me to pull through.

But it wasn't my own sickness that gave me my fright—at least, I wasn't alarmed about myself. It was the sick condition of the family finances, and thinking of Edith and the boy that put me in a panic.

There I was, flat on my back in bed; a big doctor's bill running up; a trained nurse to pay every week; and no reserve to fall back on—not a dollar laid by for emergency.

Luckily the firm was good enough to continue my salary without a break, or I don't know what we would have done.

The things that went through my mind during that slow process of getting well made me feel like a criminal. Suppose the worst had happened? No provision for Edith and the boy except a little insurance—the total amount not enough to last more than a year at the rate we had been living.

It hurt like a stab. It seems incredible that two people in their right minds could drift along the way we had been doing, constantly living up to the last cent, constantly on the edge of a slippery precipice. Yet according to statistics, something like 50% of all the men in America over sixty years of age are dependent on relatives or charity for support—including men who had earned princely incomes when in their prime. Think of it! And all because they had failed to look ahead—had never learned how to save. It hit me right between the eyes. For I was nearly thirty-two years old—certainly old enough to know better; yet I wasn't a dollar nearer independence than when I was twenty.

One day, while still in bed, I ran across something in one of the magazines that opened my eyes to our whole trouble.

It said that most people make hard work of saving simply because they don't go at it in the right way. Their money doesn't last long because they have no check on it—no definite system for adjusting their outgo to their income. It said the only practical way is the budget system—split your salary up into proportionate parts; allow so much each week for this, so much for that, and then stick to it.

Then the article told of an almost automatic way for doing this—a new system for managing personal affairs; it was called the Ferrin Money Making Account System.

It struck me that this was just what Edith and I needed if we ever expected to get our feet on solid ground. When I showed my discovery to Edith, she agreed with me, and immediately sent for the complete system.

That little step has proved to be our salvation. It has helped us put nearly $500 in the bank in less than six months—out of the same salary that was formerly never enough. At the same time it helped us to pay a big doctor's bill without ever missing the money.

The Ferrin Money Making Account System has shown us how to cut out all that old haphazard, hit-or-miss kind of spending, how to save money that we formerly frittered away—how to stop the little leaks that were keeping us poor.

The Magic Budget Plan

The Ferrin Money Making Account System is simplifying money matters for thousands upon thousands of people all over the country — helping square up bills and debts—putting money in the bank for people who never before saved a cent. It will help you in the same way. This system, which is simplicity itself, comprises:

The Ferrin Money Making Account Book.
The Ferrin Kitchen Calendar (for the household).
The Ferrin Pocket Account Book.
The Ferrin Investment and Insurance Register.
The Ferrin Household Inventory and Fire Insurance Record.

Compact information is given on Making a Budget, Keeping Expense Accounts, Making Safe Investments, Making an Inventory of Household Goods.

The Pocket Account Book (price when sold separately, 50 cents) contains printed slips so that you have only to jot down the amounts of your daily expenditures. The Kitchen Calendar (price 50 cents) keeps track of household expenses. At the end of each week or month these amounts are transferred to the Money Making Account Book, which contains 112 pages, size 8¼ x 10½ inches, and is bound in half blue Silk Cloth Back—Cadet Blue Cover, Paper Sides—Turned Edges, semi-flexible, stamped in gold on Front Cover. This book has been prepared by an expert to fit any salary from the smallest to the largest. Incorporated in it is a recapitulation for every month of the year, which shows at a glance the Budget and the amounts paid out during the month for the various classified items of expense. It is the only book to our knowledge which has a Budget column for every month. Special columns are provided for items on which an income tax does not have to be paid, so that these amounts may be deducted at the end of the year.



"The things that went through my mind during that slow process of getting well made me feel like a criminal."

One Money Saving Feature

A war tax is now levied on almost every kind of article you buy. Few people know that the amounts so paid on daily purchases may properly be deducted from their income tax report. The following items, for example, are deductable: Interest on personal indebtedness; taxes on land, buildings and household property, war taxes on club dues, theatre tickets, transportation, telephone messages, telegrams, tobacco, etc.; contributions to churches, charitable, scientific or educational institutions which are not conducted for profit. By keeping track of these war taxes on the pages for daily expenditures, and transferring the weekly or monthly totals to the Money Making Account Book, you will effect a saving on your income tax that will surprise you and that will pay the small price of the System many times over.

The Ferrin Investment Insurance Register is designed to keep an accurate record of your investments, insurance policies, etc. Contains 32 pages, size 5 x 8 inches, price separately, 50 cents. The Ferrin Inventory and Fire Insurance Record will enable you to make and keep a complete inventory of every room in the house; also provides for record of your fire insurance policy. It is an absolute necessity in case of fire. It may save you many thousand times the cost, which is 50 cents when sold separately.

Two Minutes a Day

The Ferrin Money Making Account System takes only two minutes a day. Any grammar school boy or girl can keep the accounts. This method is not a hard task.

Now you need not worry about the money you spend for clothes, food, rent, or the theatre. You will spend it freely because you know how much you can afford to spend.

The Ferrin Money Making Account System is a most practical gift to any newly married couple. Many people use them for Christmas gifts.

Send No Money

See how the Ferrin Money Making Account System works magically, no matter how much or how little your income. We know what you will think of it when you see it. So we are willing to send you the complete System without your sending us any money in advance. Just mail the coupon, and back will come the System by return mail. If you feel that you can afford not to have it, simply send it back, and you will owe nothing.

But when you have seen what big returns the Ferrin System will pay you, you will surely want to keep this wonderful aid to money-making, especially as we are now making a special short-time offer of only $3 for the complete System.

You will appreciate what a remarkable offer this is when you consider that other expense account books are sold for $3 and cover a period of only two years. The Ferrin Money Making Book covers four years, and therefore has twice the value, $6. And in addition you get the Ferrin Kitchen Calendar, the Ferrin Pocket Account Book, the Ferrin Investment and Insurance Register, the Ferrin Household Inventory and Fire Insurance Record, each worth 50 cents, or $2. You have the opportunity, therefore, of securing $8 value for only $3.

But we can make this special combination offer only for a limited time. You are, therefore, urged to mail the coupon now—to do so costs nothing, and does not obligate you in any way, and it may be a revelation to you of how much more you can get out of your income.

READ:

Letter from Head of Financial Department of Largest Corporation of its kind in the United States:

"I consider your account book a remarkable contribution to the people of this country at this time.

In our company we have 5,000 employes and it was a revelation to me, in giving them advice in regard to the making out of their income tax returns to find how few had any intelligent idea of their income and their living expenses.

The simplicity of your plan, which, by comparison with previous methods of account keeping, would seem to be well-nigh automatic, appeals to me strongly.

They say you can't teach an old dog new tricks, but I will say to you that I am going to use the Ferrin Book for my own family expenses, and consider it will make money for me right from the start."

(Signed) D. S. BURTON.

Letter from A. B. Dick, Jr., of the A. B. Dick Company, of Chicago, Manufacturers of the Edison-Dick Mimeograph Machine:

"I can candidly say that all the record books which you have issued are practically invaluable to the man who wishes to handle his personal and household accounts in the proper manner. I have seen several systems to take care of these matters, but yours covers the ground in a more thorough manner than any of them.

"To further show my appreciation, I would like to have three copies of your Investment and Insurance Register, and also one copy of the 'Money Making Account Book,' if these are off the press and available. It would be particularly gratifying to have them in sufficient time for the opening of the new year. If you will forward your bill, I will be very glad to remit."

(Signed) A. B. DICK, JR.

FREE EXAMINATION COUPON

INDEPENDENT CORPORATION

Publishers of the Independent Weekly,

Dept. F-11012, 119 West 40th St., N. Y.

Please send me the Ferrin Money Making Account System (the entire five books) for Free Examination. I will send you $3 in full payment within 5 days after receipt, or return the books.

Name .....

Address .....

El Exp 12-19

www.americanradiohistory.com

Electricity
taught by a practical man

You Can Learn

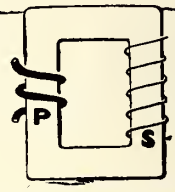
By This Practical Method of

Home Study



Every Burgess student receives perfect satisfaction. My course is clear and simple. No limit is placed upon my efforts to help each student during the time he is studying and afterwards because of the uniform success of my method of instruction, I agree to refund the tuition to any graduate who believes that he has not obtained full value when he has completed the course.

HUNDREDS of Burgess-trained men and boys have advanced to better positions by means of the practical electrical knowledge learned at home by this method. *If you are willing to utilize a little of your spare time you can do the same.*



Advancement

is made possible to any ambitious man or boy—whether a beginner or experienced in electrical work — who will faithfully devote part of his spare time to this course of home study.

For Beginners and Experienced Men

This home study course is based upon the years of practical electrical experience of Yorke Burgess who gives personal attention to each student. There is no limit to what you can accomplish with its aid. *It is up to you.*

READ What these Burgess-trained men say.

"You remember perhaps, when I started your course, I was working on a farm and that I had never had any electrical experience whatever. * * * The practical advice offered convinced me that a master, and a man who knew men, was my instructor. As you continued to more than make good on your statements, my confidence in you grew, and I knew then as I know now that I made a wise selection in taking your course in preference to any of the others I looked into. * * * I have been earning nearly as much weekly as I used to earn monthly.

If you have any fellows who write you about your course and who are not sure it will fit them, send them my name and address, and I shall certainly give you a boost, as I am always glad to do."

Yours very sincerely,
C. D. BAKER.
(Address given on request)

"I took some of my lessons down to the plant and studied them. The superintendent saw them and asked me what they were. The next day he informed me that I would draw $150.00 instead of $110.00.

Your pupil,
G. D. WATERS.
Fairview, W. Va.

RESULTS OF THIS SERVICE

Practical electrical men recommend this course to others.
Students are invariably promoted and get better salaries.
Over 80 per cent of the students are engaged in the electrical business.
Over 15 per cent of present enrollment came through satisfied students.
Beginners get employment in electrical work after taking the course a short while.

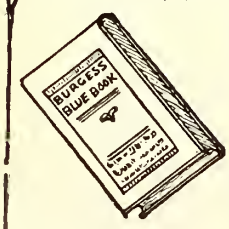
FIFTY-FIFTY

This method of learning PRACTICAL ELECTRICITY is supplied on EASY PAYMENTS, including apparatus, instruments, material, etc. Start any time—stop any time—your payments cease if you are not satisfied. Send for the BURGESS BOOK today. It gives full information without cost or obligation.

YORKE BURGESS, Superintendent

BURGESS ELECTRICAL SCHOOL

745 East 42nd Street **Chicago, Illinois**



BURGESS BLUE BOOK

ELECTRICAL MEN AND STUDENTS

PRICE $1.00

A pocket hand-book for ELECTRICAL MEN and STUDENTS. Contains over 200 CALCULATION FORMULAS and worked-out problems showing their use. Also DRAWINGS of ELECTRICAL APPARATUS and DEVICES of which the **inside connections are clearly shown.** ALTERNATING CURRENT CALCULATIONS and hundreds of everyday problems are covered. Recommended by electrical men all over the country. Used in technical schools. Purchased by electrical concerns for employees and customers. There is no other book like it. A $1.00 bill, money order or check brings the book. We refund your money if you are not fully satisfied.

BURGESS ENGINEERING CO.

Yorke Burgess, President
Consulting, Electrical Engineering
750 East Forty-second Street **Chicago, Illinois**

We give information on electrical subjects, design and perfect electrical devices and apparatus. Power plants, electric railway and operation and railway signals a specialty. Write us your needs and let us furnish data and advise you. Our service is prompt, reliable and satisfactory.

Read What These Purchasers Say of Burgess Blue Book

"I have bought a good many books in my days, but the Blue Book is the best one on electrical matters."
J. F. Downer, Medford Hillside, Mass.

"It is surprising how much information, drawings, etc., can be concentrated into such a small pocket size book."
Joseph C. Hanhauser, Philadelphia, Pa.

"Your Burgess Blue Book, which I have received recently, has caused quite a stir among my fellow electricians, for many of them asked me to get one for them as soon as they read mine. They think it is a great help to them in their work."
Frank Stalzer, Toledo, Ohio.

"This Blue Book is the best book for the practical electrician that I have ever seen."
John F. Downes, Medford Hillside, Mass.

www.americanradiohistory.com

A Startling Memory Feat That You Can Do

How I learned the secret in one evening. It has helped me every day



WHEN my old friend Faulkner invited me to a dinner party at his house, I little thought it would be the direct means of getting me a one-hundred-and-fifty per cent. increase in salary. Yet it was, and and here is the way it all came about.

Toward the close of the evening things began to drag a bit, as they often do at parties. Finally some one suggested the old idea of having everyone do a "stunt." Some sang, others forced weird sounds out of the piano, recited, told stories, and so on.

Then it came to Macdonald's turn. He was a quiet sort of chap, with an air about him that reminded one of the old saying that "still waters run deep." He said he had a simple "stunt" which he hoped we would like. He selected me to assist him. First he asked to be blindfolded securely to prove there was no trickery in it. Those present were to call out twenty-five numbers of three figures each, such as 161, 249, and so on. He asked me to write down the numbers as they were called.

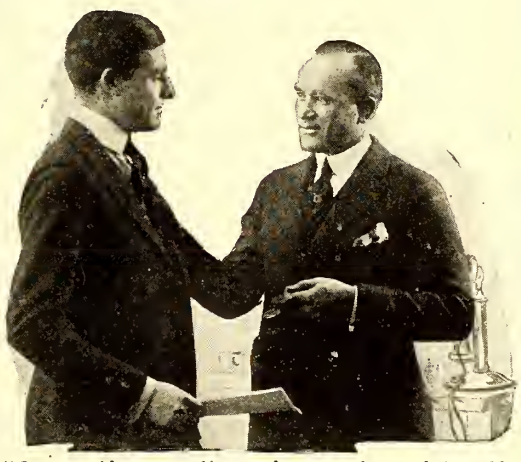
This was done. Macdonald then astounded everyone hy repeating the entire list of twenty-five numbers backwards and forwards. Then he asked people to request numbers by positions, such as the eighth number called, the fourth number, and so on. Instantly he repeated back the exact number in the position called. He did this with the entire list—over and over again, without making a single mistake.

Then Macdonald asked that a deck of cards be shuffled and called out to him in their order. This was done. Still blindfolded, he instantly named the cards in their order backwards and forwards. And then to further amaze us, he gave us the number of any card counting from the top, or the card for any number.

You may well imagine our amazement at Macdonald's remarkable feat. You naturally expect to see a thing of this sort on the stage, even then you look upon it as a trick. But to see it done by an everyday business man, in plain view of everyone, blindfolded and under conditions which make trickery impossible, is astonishing, to say the least.

* * * * * *

ON the way home that night I asked Macdonald how it was done. He said there was really nothing to it—simply a memory feat, the key to which anyone could easily learn in one evening. Then he told me that the reason most people have bad memories is because they leave memory development to chance. Anyone could do what he had done, and develop a good memory, he said, by following a few simple rules. And then he told me exactly how to do it. At the time I little thought that evening would prove to be one of the most eventful in my life, but such it proved to be.



"Our president complimented me on always being able to tell him instantly facts he wanted to know."

What Macdonald told me I took to heart. In one evening I made remarkable strides toward improving my memory and it was but a question of days before I learned to do exactly what he had done. At first I amused myself with my new-found ability by amazing people at parties. My "memory feat," as my friends called it, surely made a hit. Every one was talking about it, and I was showered with invitations for all sorts of affairs. If anyone were to ask me how quickly to develop social popularity, I would tell him to learn my memory "feat"—but that is apart from what I want to tell you.

The most gratifying thing about the improvement of my memory was the remarkable way it helped me in business. Much to my surprise I discovered that my memory training had literally put a razor edge on my brain. My brain had become clearer, quicker, keener. I felt that I was fast acquiring that mental grasp and alertness I had so often admired in men who were spoken of as "wonders" and "geniuses."

The next thing I noticed was a marked improvement in my conversational powers. Formerly my talk was halting and disconnected. I never could think of things to say until the conversation was over. And then, when it was too late, I would always think of apt and striking things I "might have said." But now I can think like a flash. When I am talking I never have to hesitate for the right word, the right expression or the right thing to say. It seems that all I have to do is to start to talk, instantly I find myself saying the very thing I want to say to make the greatest impression on people.

It wasn't long before my new-found ability to remember things and to say the right thing at the right time attracted the attention of our president. He got in the habit of calling me in whenever he wanted facts about the business. As he expressed himself to me, "You can always tell me instantly what I want to know, while the other fellows annoy me by dodging out of the office and saying 'I'll look it up.'"

* * * * *

I FOUND that my ability to remember helped me wonderfully in dealing with other people, particularly in committee meetings. When a discussion opens up the man who can back up his statements quickly with a string of definite facts and figures usually dominates the others. Time and time again I have won people to my way of thinking simply because I could instantly recall facts and figures. While I'm proud of my triumphs in this respect, I often feel sorry for the ill-at-ease look of the other men who cannot hold up their end in the argument because they cannot recall facts instantly. It seems as though I never forget anything. Every fact I now put in my mind is as clear and as easy to recall instantly as though it were written before me in plain black and white.

We all hear a lot about the importance of sound judgment. People who ought to know say that a man cannot begin to exercise sound judgment until he is forty to fifty years of age. But I have disproved all that. I have found that sound judgment is nothing more than the ability to weigh and judge facts in their relation to each other. Memory is the hasis of sound judgment. I am only thirty-two, but many times I have been complimented on having the judgment of a man of forty-five. I take no personal credit for this—it is all due to the way I trained my memory.

THESE are only a few of the hundreds of ways I have profited by my trained memory. No longer do I suffer the humiliation of meeting men I know and not being able to recall their names. The moment I see a man his name flashes to my mind, together with a string of facts about him. I always liked to read but usually forgot most of it. Now I find it easy to recall what I have read. Another surprising thing is that I can now master a subject in considerably less time than before. Price lists, market quotations, data of all kinds, I can recall in detail almost at will. I rarely make a mistake.

My vocabulary, too, has increased wonderfully. Whenever I see a striking word or expression, I memorize it and use it in my dictation or conversation. This has put a remarkable sparkle and pulling power into my conversation and business letters. And the remarkable part of it all is that I can now do my day's work quicker and with much less effort, simply because my mind works like a flash and I do not have to keep stopping to look things up.

All this is extremely satisfying to me, of course. But the best part of it all is that since my memory power first attracted the attention of our president, my salary has steadily been increased. Today it is many times greater than it was the day Macdonald got me interested in improving my memory.

* * * * * * *

WHAT Macdonald told me that eventful evening was this: "Get the Roth Memory Course." I did. That is how I learned to do all the remarkable things I have told you about. The publishers of the Roth Memory Course—the Independent Corporation—are so confident that it will also show you how to develop a remarkable memory that they will gladly send the Course to you on approval.

You need not pay a single penny until you have examined the Course and found that it fully lives up to all the claims made for it. Send no money. Merely mail the coupon or write a letter, and the complete Course will be sent to you instantly, all charges prepaid. If after examination you decide that you do not want to keep the Course, then return it and you will owe nothing. On the other hand, if you find, as thousands of others have found, that the Roth Memory Course will do wonders for you, then merely send five dollars in full payment.

You have always wanted a good memory. Now you can have it. Remember, you pay no money until you have proved that the Course will benefit you. You have everything to gain and nothing to lose by taking immediate action. So mail the coupon NOW before this liberal offer is withdrawn.

FREE EXAMINATION COUPON

INDEPENDENT CORPORATION
Publishers of The Independent Weekly
Dept. R-11012, 119 West 40th Street, New York

Please send me the Roth Memory Course of seven lessons. I will either remail the Course to you within five days after its receipt or send you $5 in full payment of the Course.

Name .....

Address .....

..... Elect. Exp. 12-19

www.americanradiohistory.com



"THE 100% WIRELESS MAGAZINE"

Partial CONTENTS OF DECEMBER ISSUE:

"Audio Frequency Wireless Telephone." By E. T. Jones

"The Eaton Oscillator and Eaton Circuit Driver." By William H. Priess

"Why I Am Opposed to Government Radio Control." By Dr. Greenleaf W. Pickard

"Underwater Submarine Telegraphy."

"Developing an Audion for the Amateur." By E. T. Jones

"A 170-25000 Meter Receptor." By Francis R. Pray

"Amateur Radio Broadcast de Navy Department."

"Notes on R-34 Return Trip." By R. F. Durrant, Lieut. R. A. F.

"San Diego, Cal., from London." By Alexis J. Hall

"How Manufacturers Work 'Formica' and 'Bakelite.'" By J. Stanley Brown

"Ideas—2nd Spasm." By Thos. W. Benson

"Increasing the Secondary Voltage of Your Transformer." By F. E. Terman

"Notes on Crystal Detectors." By C. H. Byron

What "Radio Amateur News" Is:

With its sixth issue RADIO AMATEUR NEWS holds the field undisputedly as the greatest radio magazine in print to-day. In point of circulation, number of articles, illustrations, RADIO AMATEUR NEWS now leads all other wireless magazines. Take for instance the December issue with its sixty-four pages; there were fifty-one separate purely radio articles and 112 illustrations. *Over thirty-three thousand copies were printed and circulated.*

Each issue of the RADIO AMATEUR NEWS now contains 64 pages (or more) and an artistic cover in two colors. The illustrations average 125 every month and there are from 40 to 50 up-to-date articles, some by our biggest radio scientists, in every issue.

RADIO AMATEUR NEWS is the greatest and biggest radio magazine in print today.

RADIO AMATEUR NEWS is the only INDEPENDENT monthly wireless magazine in existence. It caters to no commercial interests—it has no boss save its readers. It is "different"—it has the latest radio news. It is a scientific magazine but it caters largely to the RADIO AMATEUR—it is by and for the Amateur. It is published by the publishers of the ELECTRICAL EXPERIMENTER, but there is no duplication of articles in the two magazines. Both are entirely different—but both together will give you ALL the radio news of all the world. Whether you are a professor or an Amateur, get a sample copy or order it from your Newsdealer today.

JUNIOR RADIO COURSE

A distinctly new feature began with the September issue in our new Junior Radio Course. In the December issue Lesson No. 4 appears complete. This course is intended for the beginner and everything presented will be in plain English—even the merest tyro in radio will find no trouble in understanding and assimilating the knowledge. The series is a very important one and nothing like it has ever appeared in print before. Everyone owes it to himself in this new age to know something about wireless and this course will enlighten all laymen. Profusely illustrated with pictures that anyone can understand.

15c The Copy

$1.50 A Year

Canada and Foreign $2.00 A Year

SEND 15c FOR SAMPLE COPY TODAY

56 PAGES
125 ILLUSTRATIONS

SPECIAL OFFER

Gentlemen:

Please enter my subscription for RADIO AMATEUR NEWS for the term of one year for which I enclose herewith $1.50. For this you will send to me immediately your great Wireless Course, containing 160 pages, 350 illustrations, size 6¾ x 10" with fine flexible cloth cover. I have added 5c extra for postage. (I have written my name and address in margin below.)

EXPERIMENTER PUB. CO., 231 Fulton St., New York City

www.americanradiohistory.com

Shake Hands With Yourself!

Do You Really Know Yourself? Are You in the Line of Work for Which You Are Naturally Best Fitted? Read This Interesting Story of a Man Who First Shook Hands With Himself—and Then With Success.

A CLERK since 1911! Eight long years I had been at the same desk, the same work, and almost the same pay. And, from all signs ahead, 1930 would still find me in the same old grind.

Perhaps you may know just how I felt. At 9:00 every morning I would hang up my hat, settle in my chair and get set to "put in another day." Never a single rush of joy for my work. For some men I knew, each week meant a succession of big deals crowned with big rewards. For me, Monday dragged into Tuesday, which crawled wearily into Wednesday, which finally overlapped into Thursday, and so on—until the welcome oasis of Saturday afternoon and Sunday at home. And then came another week, etc., etc., ad infinitum.



One day, in February of this year, came an incident which was later to mean a great deal to me. While getting together some data for our salesmanager (who had only been there a short time) I overheard part of his conversation with one of his salesmen.

"Willis," I heard him say to the salesman, "I'm *mighty* sorry that you have fallen down on your job. But I really knew when I came here that you would never make a good salesman. I knew it by your face, your carriage, and your manner of speech. Salesmanship isn't written on any part of you. I have given you your chance and you admit that you are misfit in your present position. But I feel sure that you could make an A-1 success in other work. Because a man fails in one line is no reason that he will not make good in another. I believe that you have the capabilities of an excellent office manager and if you wish I will see——"

The door slammed shut but my mind seemed to have been torn loose from its rut. Was *I* a misfit? Was *I* really in the position I was naturally fitted for? I had just drifted into this "clerk's job" eight years ago without studying myself for my biggest capacities. I merely wanted a job—and I got it. I *knew* I had the capacity for big things *in the right line*. But what *was* my right line?

For more than a week I tried to think it out and decide what was best to do. Finally I determined to ask the advice of the salesmanager himself. He had helped Willis and perhaps he would help me. It would do no harm to talk with him and he might be able to help me make a decision.

So I put the whole matter up to him, and asked him to give me the benefit of his opinion.

I felt his keen gaze bore through me as I spoke. Instinctively I knew that his ears were listening to my story but that his eyes were making a sharp estimate of their own.

Finally he spoke. And to my amazement, he solved the whole problem for me. "Henning," he said, "you have been swimming against the current, I do not believe that your *real* work is at a clerk's desk. It might seem that I am hasty but my judgment is usually right. You could, I firmly believe, make a real success as a salesman. I'm willing to give you the chance. If you *don't* succeed, then it will be one of the very few mistakes I have ever made in sizing a man up by his face."

Well, I *did* succeed. I knew it—because money talks and my salary tells me so. I am known as one of the best salesmen in the firm. And now, instead of looking on my work as drudgery, I enjoy it as a great game. Thru my salesmanager's courtesy, I have learned to read character at a glance from the little course he studied and which the publishers sent me for free examination. I find it of immense help to me. Most of us know a few things about character readings. We know that a high forehead indicates the intellectual type—that a receding chin denotes weakness while a pronounced chin means determination. But often these signs are counterbalanced by others which are just as apparent but which the average person doesn't recognize. Consequently we often jump to conclusions about people which later prove incorrect. It's like trying to read a sentence by looking at the first one or two words.

It's all as clear as a book when you know the simple alphabet of signs that spell out a man's character and mental "slants"—an alphabet that is surprisingly easy to learn and of remarkable value to apply. People with whom I had never been able to get along I now number among my best friends. I am popular with my co-workers and receive their hearty co-operation and good-will. In my business dealings, when I approach a prospect I know immediately whether to use tact or sweep him away by enthusiasm—whether to get right down to business or open up in a roundabout way—what angle of talk will make the best appeal to each man and what arguments will clinch him.

I know immediately just how to deal with everyone I meet. I know how to interest them, how to appeal to them most effectively, how to touch their "responsive chord." I can gauge at once their tastes, mental traits, temperament, and personality. Immediately upon meeting a man I know how to make him my friend. At least 40 per cent. of the credit for my success I attribute to my easily-acquired ability to read at sight the character of everyone I meet.

Just as Nature intended that the normal condition of our bodies is perfect health, so the normal condition of everyone is perfect success. We are all meant to be a success at *something*. We all have the capacity within us to achieve big things *in the right line*. If we are not a big success, it is merely because we are in the wrong occupation. Napoleon was a failure at authorship. Florence Nightingale failed as a social favorite. Grant was a failure at everything until he became a soldier. These were their *wrong* occupations. We all have the germ of success within us—the capacity to do big work in some one line. The thing to do is find out what *your* line of work is.

Dr. K. M. H. Blackford has helped thousands of men find out the work for which they were best fitted to achieve big success. This famous character analyst has been retained at record fees by such corporations as the Westinghouse Electric and Manufacturing Company, Scott Paper Company, The Laurentide Co., Ltd., and many other big concerns, to pick and place rightly the men they employ. And 98 per cent. of Dr. Blackford's selections—regardless of their previous experience—made good at the jobs in which they were placed.

Dr. Blackford has helped thousands of others and is now ready to help you. A good many of us are just plugging day in and day out at work we are not naturally fitted to do, work we do not like, work we can never fully succeed at. We swim against the tide, trying to fit our given set of talents to the wrong job. But thru Dr. Blackford, we can now all judge in just what line our biggest success lies. And we can learn the worthwhile secret of knowing, in one quick survey of their features, physique, gestures, and habit of conversation, unerringly the character of every person we meet—of looking *into* people and *through* them, instead of *at* them.

Thru the little course of lessons in "Reading Character at Sight" now being distributed by Dr. Blackford, we can know, the minute we lay eyes on people, how to make them our friends, in either a business or social way—how to talk to them, how to influence them to the best advantage. Thru the secrets given by Dr. Blackford, we can get a better line on the folks we meet than the friends who have known them for years.

Thousands have already benefited thru the course. Some have decided thru it just what their life-work really is. Others have saved themselves from business disaster and unscrupulous partners. Many others have avoided hiring men whom they knew at a glance to be dishonest and unreliable. Many salesmen use the knowledge they have gained to judge and approach their prospects. Executives use it to deal with and judge their employes. Doctors use it in dealing with their patients. Lawyers find it of great help in their court work and in their actions towards clients. Public speakers employ it in judging their audience, and in debate.

And besides its great practical value this course in "Reading Character at Sight" is as fascinating as a game to use in your social life. Written on every man, woman, and child are signs, as clear and distinct as tho they were written in letters a foot high, telling their character. Mouth, nose, chin, eyes, voice, gestures, carriage—each tell a story, which averaged up, give a complete outline of a person's character. And a fascinating pastime it is to be able to tell a person's innermost nature by glancing at him.

Entire Course on Free Examination

This ability to analyze character immediately and without error can easily be yours. It is not a gift. There is no trick or second sight about it. It is not a supernatural mysterious power. It is merely the immutable rules of science, practically applied. You can do it as infallibly as Dr. Blackford. This new course in "Reading Character at Sight" in seven simple and fascinating lessons will be sent to you without cost, for examination. You can judge for yourself just what the course will mean to you before you decide whether or not you want it, return it and forget the matter. Otherwise mail its reasonable cost of $5. The coupon printed below will bring you the entire course for free examination without obligation. Use it.

Free Examination Coupon

INDEPENDENT CORPORATION
Dept. B11012, 119 West 40th Street,
New York City
Publishers of The Independent Weekly

Please send me Dr. Blackford's Course of seven lessons called "Reading Character at Sight." I will either remail the course to you within five days after its receipt or send you $5 in full payment of the course.

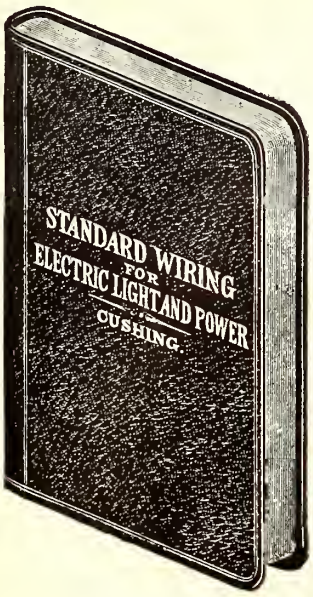
Name .....

Address ..... El. Exp. 12-19

www.americanradiohistory.com

LEARN WIRING

Earn $30.00 to $60.00 a Week



POCKET SIZE
LEATHER COVER

This Latest Edition of "STANDARD WIRING"

Will Make You An Expert Wireman

GENERATORS—How to install them, care for them and operate them; all their troubles and how to prevent and cure them; all diagrams showing connections for compound, series and shunt wound machines. How to operate them in parallel or in series. How to protect them and wire them in accordance with the underwriters' requirements.

MOTORS—How to install them, how to protect and operate them. The required amperes, volts or horse power when any two factors are known. How to take care of hot boxes, sparking commutators and other troubles. How to change the direction of rotation when desired. How to start and stop any kind of motor in any class of service. All diagrams of motor wiring. How to find the proper size of wire for any motor for direct current or for A. C. single, two or three-phase.

OUTSIDE WIRING—Pole line construction, line wires, service wires, roof structures, poles and their dimensions and weights, and how to erect and protect them and wires they carry. Insulators, guard arms, guy anchors. Tree wiring, splicing, service and entrance wiring. How to install Lightning arresters. Transformers with diagrams and instructions.

INSIDE WIRING—when and where to use rubber covered, slow burning and weatherproof wire. How to find the proper size of wire to use for lamps, motors or heating devices for any current, voltage and drop, either by formula or by the many tables that are given in this section of the book. How to wire for two-wire or three-wire systems. Direct current, two-phase and three-phase with formulae and tables, with examples worked out for each system and in a simple manner that anyone can understand and use. How to run wires on walls, ceilings, floors, through partitions and walls and in concealed places, damp places and where dangerous surroundings exist. When and where to install Switches, Cut-outs and Circuit Breakers and just how to do it. How to wire for high and low voltage systems and the precautions to be taken. The proper way to install Knife and Snap Switches, Cabinets and Cut-out Boxes, Outlet, Junction and Switch Boxes, Panel Boards, Wooden and Metal Raceways. How to install complete interior conduit jobs either for rigid metal, flexible metal or flexible non-metallic conduit. Concealed knob and tube work or armored cable. How and where to install and wire electric and combination lighting fixtures. How and where to use flexible cord and where not to use it. How to install arc lamps and gas filled lamps and the fixtures and rules required.

LIGHT AND ILLUMINATION—What is meant by proper and efficient illumination, the latest data on Mazda and gas filled lamps of every candle power and wattage. Direct, indirect and semi-indirect illumination and where each should be used. Illumination required for various classes of service from show window lighting to public halls and from factories to small residences.

TABLES—Fifty-two tables giving every dimension, carrying capacity, resistance, weight and strength of every size of wire and cable of copper, steel and iron.

All the necessary dimensions, capacities, weights, and other data on conduits, fuses, insulators, lamps, sockets, motor efficiencies, current per horse power of motors.

Electrical units and their equivalents. Proper size of wire for all classes of power, light and heating installations. The proper symbols to use to indicate on plans just what is wanted from a motor to a small snap switch with all necessary diagrams.

APPARATUS AND SUPPLIES—A classified list of the leading manufacturers of officially approved wires and wiring devices. Engines, generators, motors, appliances, fixtures, and all supplies necessary for any complete installation from a Central Station to a small cottage.

The most complete and accurate Book on Wiring and Construction published

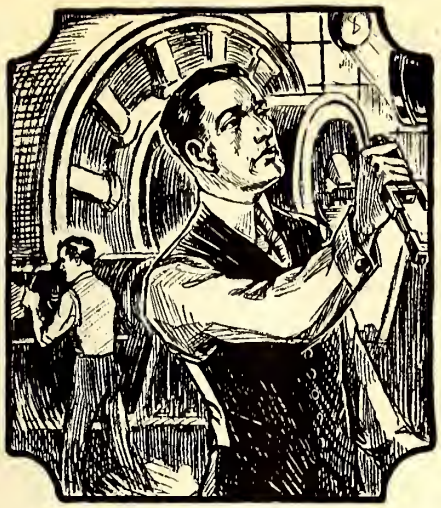
350 PAGES - LEATHER COVER - POCKET SIZE, $1.50

Sent Postpaid to Any Address on Receipt of Price by

H. C. CUSHING, Jr., 8 West 40th St., New York

Every Electrical Inspector in the United States will approve your work if done in accordance with the simple rules given in "Standard Wiring"

www.americanradiohistory.com



Dr. Charles P. Steinmetz,
Chief Consulting Engineer of the General Electric Company, has said that, "The world needs men who know something of electricity, of the operations and control of electrical power. It needs men more every year, its very existence depends on the electrician."—*Electrical Experimenter, June, 1919.*



What a Knowledge of Electricity Would Mean to YOU

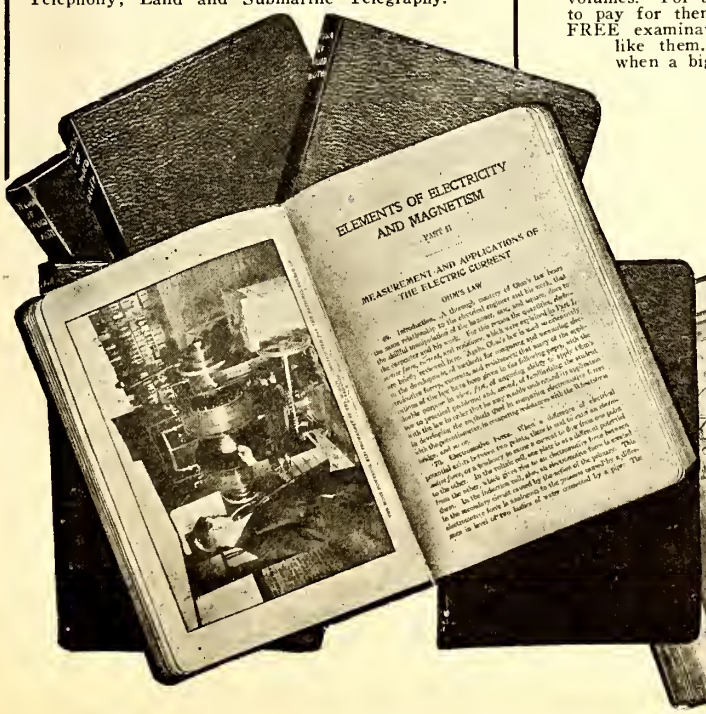
A real job with a man's size salary—that's what it would mean. It's easy to get it if you know electricity. Electricity is the biggest force in the world today. It's one of the best paying fields a man can get into. Just see what the great Steinmetz says about electricity—"the very existence of the world depends on the electrician." That's the kind of business to be in for real money making. Get into it as quick as you can—train yourself at home—in your spare time.

8 Great, Big VOLUMES

3800 Pages—2600 Pictures

Clearly Covering

Elements of Electricity; Electrical Measurements; Electric Wiring and Lighting; Underwriter's Electrical Requirements; Theory, Calculation, Designs and Construction of Direct Current Generators and Motors; Types of Generators and Motors; Management of Electrical Machinery; Electric Lighting; Alternating Current Machinery; Power Transmission; Electric Railways; Power Stations; Switchboards and Switching; Storage Batteries; Applied Electro-Chemistry; Electric Elevators; Electric Welding and Heating; Wireless Telegraphy and Telephony; Land and Submarine Telegraphy.



The Cyclopedia of Applied Electricity

The world's greatest electrical books will fit you to hold the biggest kind of a job. They were written by the engineers and experts that helped to make electricity what it is today. These men know what you need. They give you 50 year's of electrical experience at your finger tips. Plain, everyday language and thousands of pictures make everything as simple as A B C. Glance over the partial list of what the books contain and see our offer that gives them to you a whole week free. Mail the coupon today.

Reduced Price—Year to Pay

The regular price of this great library is $5.00 a volume—$40.00 for the set of 8 volumes. For a limited time though you can have the whole set for $24.80 and take a year to pay for them. This is less than one cent a day for each volume. Entire set sent for FREE examination—no money in advance—return the books at our expense if you don't like them. **Mail the Coupon Now.** Don't be satisfied with an ordinary job when a big one is open to you.

AMERICAN TECHNICAL SOCIETY
Dept. E-259 **CHICAGO, ILL., U. S. A.**

Mail this Coupon

American Technical Society
Dept. E-259
Chicago, Ill., U. S. A.

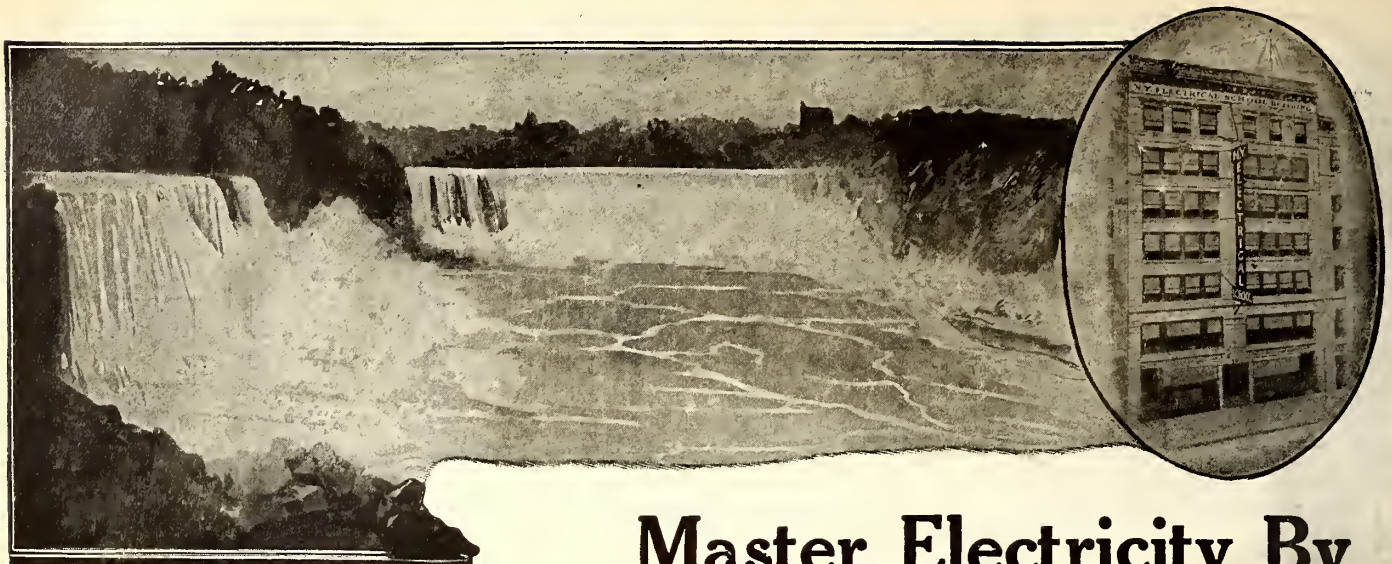
Please send me the Cyclopedia of Applied Electricity for 7 days' examination, shipping charges collect. If I decide to buy I will send $2.00 within 7 days and balance at the rate of $2.00 a month until $24.80 has been paid. Then you will send me a receipt showing that the set of books and a Consulting Membership in your Society are mine and fully paid for. If I want to get along without the books, I will return them, after 7 days, at your expense.

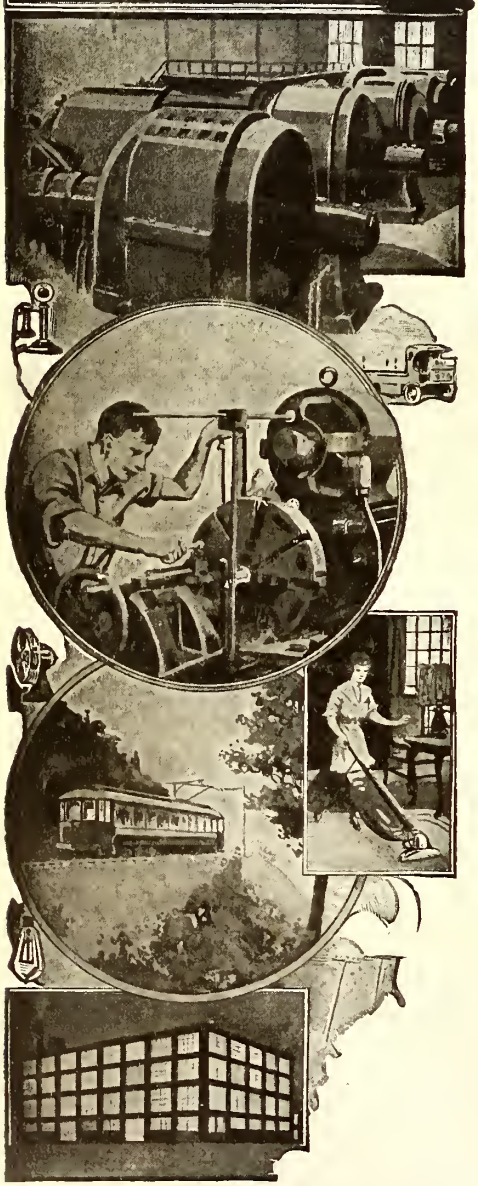
Name.....

Address.....

Reference.....

www.americanradiohistory.com





Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business method and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 5,500 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

Special Automobile Ignition Course

We have just installed a special automobile ignition course for auto mechanics, garage men and owners. The course covers completely ignition, starting, lighting and other electrical equipment in connection with automobiles, motor boats, etc.

Let us explain our complete courses to you in person. If you can't call, send now for 64-page book—it's FREE to you.

New York Electrical School
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

_____(NAME)

_____(ADDRESS)

New York Electrical School

29 West 17th Street, New York

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

ELECTRICAL EXPERIMENTER

H. GERNSBACK – EDITOR
H. W. SECOR – ASSOCIATE EDITOR

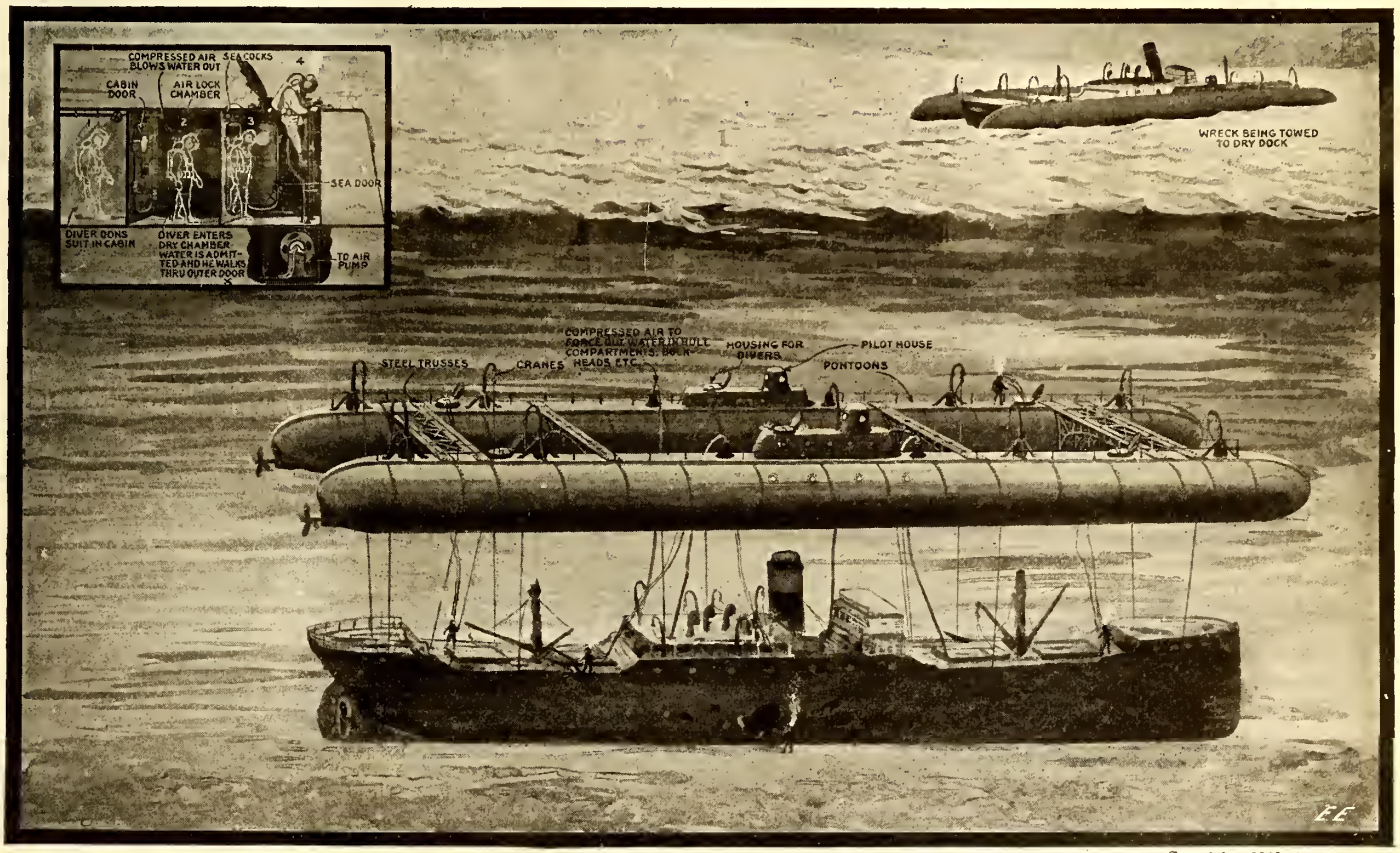
Vol. VII. Whole No. 80 December, 1919 No. 8

DEC 27 1919
U.S. PATENT OFFICE

Submarines to Salvage Sunken Ships

THE submarine proved to be one of the most effective and formidable sea devices ever conceived during the course of the World War, and now a Yankee genius, Mr. George Wall, comes forward with a peace-time suggestion for utilizing the principle of the submarine to raise some of the thousands of ships sunk during the war.

The accompanying illustration shows Mr. Wall's suggestion in practise. One of the basic principles underlying this new *submerging-pontoon* salvaging craft, is that of the great buoyancy produced when such a large air-tight chamber as a submarine is filled with air while submerged. The lifting power or buoyancy of such a pontoon of the size of a submarine, is tremendous, especially when it may have a length, let us say, of from 500 to 600 feet. These pontoons could be submerged to any depth while seeking the wreck, in the same manner as submarines submerge, i. e., by admitting water into the submerging tanks. When it is desired to rise to the surface, this water is blown out of the ballast tanks by comprest air.



Copyright, 1919, by E. P. Co.

A New Scheme for Salvaging Sunken Vessels Proposed by a Yankee Genius, and Comprising Salvaging Craft Constructed in the Form of Gigantic Submarines, Which Can be Sunk When Desired and Their Immense Buoyancy Utilized in Lifting the Wreck.

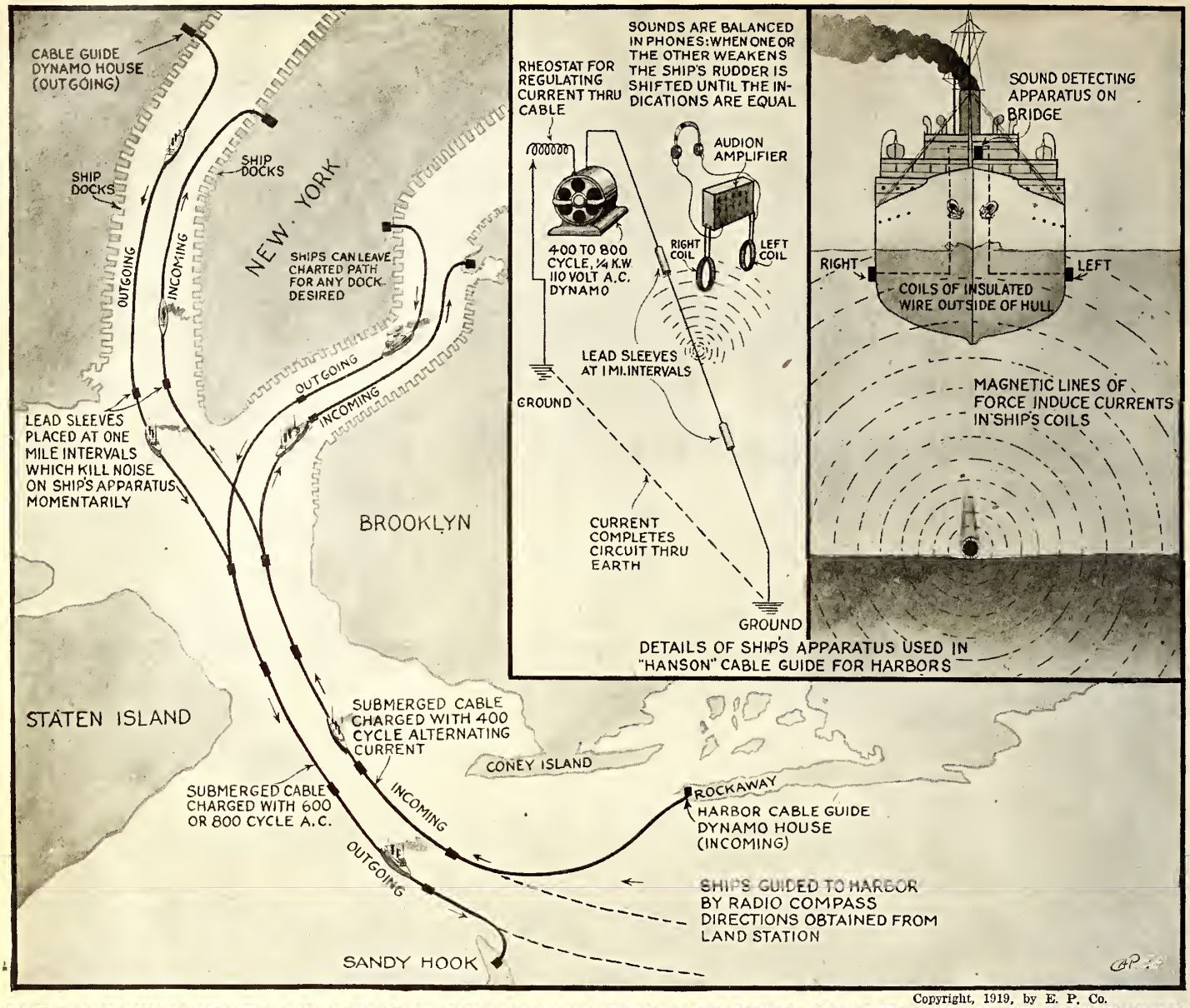
TWO SUBMERSIBLE PONTOONS USED

The submarine-pontoon of which two or more may be used in raising an ordinary size vessel, are not tied together mechanically, but may be anchored to each other when desired, by means of steel girders. A number of powerful, motor-operated derricks are placed along the decks of the salvaging pontoons, and from these a series of steel cables depend downward. At the start of the salvaging operation on the wreck, divers are employed to pass cables around under the hull of the boat. The free ends of these cables are caught and brought up to the surface where they are fastened to the lifting derricks of the second pontoon.

Such a salvaging outfit possesses many advantages over the surface type of craft, which cannot submerge, and under many salvaging conditions it is often impracticable to lower a diver down to the scene of the wreck, owing to the long lengths of air-hose, hoisting cables, etc., which have to be used. With the present invention, it is possible whenever necessary, to submerge the pontoons and keep them submerged the same as any ordinary submarine, for several hours. These pontoons may be fitted with powerful electric

(*Continued on page* 809)

www.americanradiohistory.com



Copyright, 1919, by E. P. Co.

All During the World War There Were Hundreds of New Inventions Developed and Applied. One of These Was the "Hanson" Electrified A.C. Cable, Buried in the Mined Regions Where Our Ships Had to Travel. By a Suitable Listening Device Aboard the Ship the Navigator is Enabled Instantly to Ascertain Whether or Not He is Out of the Proper Course. A Great Stunt for Foggy Weather.

Ships Guided by Electrified Cable

THE marvelous "fog tamer" invented by Earl S. Hanson, a young Los Angeles scientist, is to be thoroly tested by the Navy Department, it is said. The Hanson invention marks an important step to make practical what has been called the greatest development in marine travel since the discovery of the steam turbine.

Mr. Hanson's device makes it possible for steamships to navigate any channel with perfect safety, no matter how winding or treacherous, thru the heaviest ocean fogs or under the most adverse weather conditions. It will prevent the tying up of shipping outside of harbors while vessels wait for the weather to clear so that they can navigate the channel. Steamship service between New York, Liverpool, Brest, Southampton, Cherbourg and other channel ports will be as regular as railroad passenger trains arriving in the giant terminals of New York.

Tests will be made at once at the naval base at New London and later a greater test with some of the biggest liners of the world, such as the *Leviathan*, will be made in Ambrose Channel, New York harbor. Material has been shipt to New London for the first test and men have already been detailed for this work. As soon as the official tests prove satisfactory all the great ports of the United States will be equipt by the navy with the device to defy fog, hail, rain, snow and sleet.

By the use of the new invention in connection with the radio compass which the navy has now perfected, all danger or delay in ocean travel due to weather is absolutely eliminated.

The radio compass brings all shipping in sight of land and the new device, like a friendly hand, reaches out and takes the biggest of ships thru the most tortuous channels safely and quickly to its pier.

The new device is simplicity itself. A cable is laid in the center of the ship channel. Thru it is sent an electric current of low frequency which thru the listening devices on board ship gives off a sound of certain pitch that cannot be mistaken for any other sound. The ship hugs the cable from harbor line to the dock. On the bridge and in the captain's cabin listening devices like telephone receivers are placed and attached by wires to the hull of the ship. The ship follows the course of the cable. Any variation away from the cable is indicated by visible indicators (sensitive galvanometers connected in the receiving coil circuits), which show in feet the distance away from the cable, and the ship is then put back over the cable by the steering rudder in the usual way. By the ear receivers the indicator may be confirmed at all times.

Vessels going into port will use one cable; those coming out another. *The sound on each is different* and there can be no confusion and therefore no collision.

Along the cable, at mile intervals, a section is sheathed with lead. Thru this no sound can come and therefore the man on listening duty can tell instantly how far the ship has progrest, and by the cable chart in front of him, can tell where the cable turns and where the ship must be steered to follow the curve of the cable and the center of the channel. The new device, according

(*Continued on page* 831)

www.americanradiohistory.com

Did the Romans Have "Wireless"?

"WIRELESS telegraphy is new; wireless communication is as old as Biblical times." With this trite statement the National Geographic Society quotes from a communication by John A. Kingman, who sets forth the interesting theory that the island of Capri was an imperial wireless station of ancient Rome.

"We know that the ancients signaled in various ways and over long distances," he says. "They signaled by beacon fires, by beacon smoke, by pigeons, by flags, and by shouting from one sentinel to another.

"Lighthouses are as old as the earliest chapters of the Bible. Beacon fires and beacon smoke were commonly used by the early Greeks, and there was no reason why the more practical Roman should not have employed inproved methods, such as *heliographing*.

HOW ROMANS USED GREAT MIRRORS.

"We do know that at the siege of Syracuse by Marcellus mirrors were employed by Archimedes; and tho we may doubt the burning of vessels from shore by mirrors, as stated on that occasion, we can appreciate the blinding effect of many mirrors on the eyes of the navigators of the attacking vessels. That is what probably happened during that conflict. At any rate, it shows that the great Archimedes, at least, had found some use for mirrors other than the usual one.

"In Imperial times the Romans had mirrors large enough to reflect the entire person; they even had mirrors of glass backed with tin instead of quicksilver.

"Signaling was certainly a common military practise among the ancients, and ancient writers, such as Virgil, Aeschylus, and Herodotus, frequently alluded to it.

"An interesting case of long-distance signaling by relaying is mentioned by Herodotus, in which it appears that certain tidings were sent to Xerxes in Asia by means of a line of beacon fires arranged thru the Greek islands.

"The ancients went further than simply announcing some prearranged message; they had codes and sent long messages. The Greeks signaled on one occasion 100 miles at one jump. This was from Mt. Chigri, 1,698 feet, to Mt. Athos, 6,500 feet.

"Gallup's Hand Book of Military Signaling states that 'under favorable conditions the distance to which messages may be sent and received is only limited by the curvature of the earth'; also, that 'square mirrors are better than round ones only because they contain about one-quarter more reflecting surface for the same packing space.' Round mirrors are used now. Mirror signals have been seen with the unassisted eye at distances of 160 miles. While this is, perhaps, a record, and tho there is no statement as to the size of the mirror, it probably did not exceed twelve inches square.

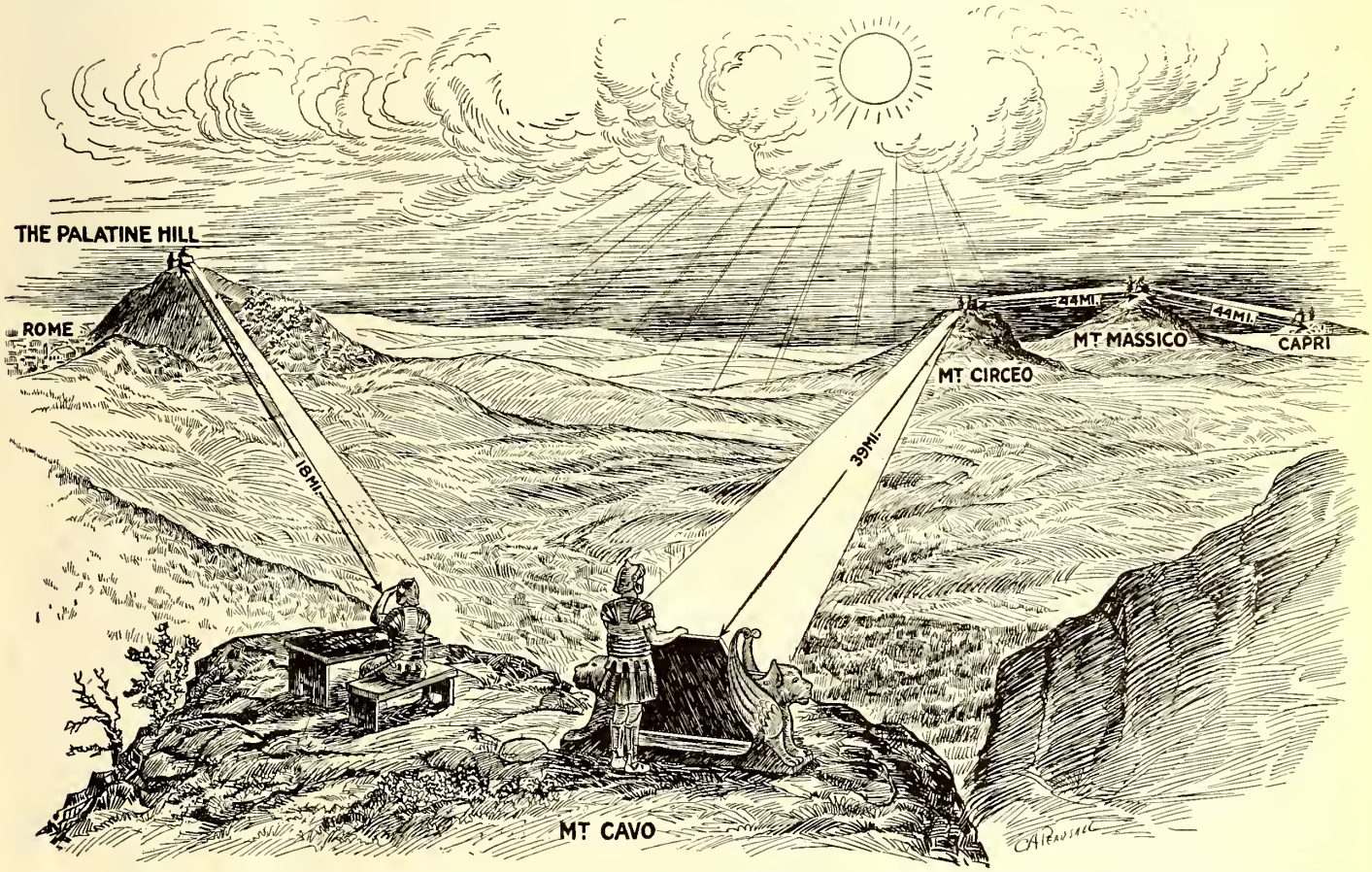
"The reasonableness of the Capri 'wireless' station theory tempts one to speculate as to how much signaling was done and how it was done. It will be remembered that Tiberius, the unpopular successor of Augustus, spent eleven years of his reign on Capri, and without coming to Rome directed most successfully the affairs of the vast empire. He even foiled the conspiracy of his trusted minister, Sejanus who was supposed to have general charge of affairs after Tiberius retired to the island.

"Tho Tiberius went to Capri, an old man, he was the actual ruler—emperor, in fact—and his heavy hand was felt all over the empire until the very end. With regular news bulletins and reports, received daily if need be, containing confidential information, he would be able to issue instructions and manage affairs as thoroly as if he were in Rome.

"Possibly the *Publica acta* (Senate Journal) and the *Diurna acta* (authorized news) were sent to Capri by signal instead of by messenger. We can conceive that such a system, organized most likely under Augustus, must have operated very smoothly after some years of experience and practise. I hazard the theory of mirrors because of its simplicity and convincing character. Signaling by beacon seems too primitive for the wonderful civilization of the empire. Of course, at night-time beacon fires would have to be employed; mirror signaling was a fair-weather method.

"The distance in an air line between Rome and Capri is 130 miles—too long for direct signaling; but if we look along the coast of the Tyrrhenian Sea we find numerous mountains affording points where the signals could be relayed. The frequency of the relaying would depend on the conditions. The highest point on Capri is Monte

(*Continued on page* 832)



There Is Nothing New Under the Sun, Not Even "Wireless." It Now Appears That the Ancient Romans Already Had a System of Sending Messages Over Several Hundred Miles Merely By the Use of Mirrors,—a Sort of Heliograph. This Illustration Shows How It Was Possible to Telegraph from Rome (The Palatine Hill) to Capri, a Total Distance of 145 Miles. Our Illustration Shows How the Flashing of Signals Was Accomplisht During the Day Time. At Night, Fires in Front of the Mirrors No Doubt Were Used.

www.americanradiohistory.com

Thomas A. Edison Speaks to You

By H. Gernsback

MR. EDISON having kindly consented to speak to the readers of the ELECTRICAL EXPERIMENTER, an interview with the illustrious inventor had been arranged for during the latter part of October of this year.

This interview, by the way, has some history attached to it. During the early part of 1917 a similar appointment had been made to interview Mr. Edison on the same subject. But just then the great war broke out and Mr. Edison, who, as is well known, was immediately appointed the head of the Naval Consulting Board, broke off all engagements, devoting himself day and night to the welfare of his country. For this reason the interview only took place a few weeks ago.

THIS is the first interview which Mr. Edison has given out for some years past.

Mr. Edison, who, as is well known, was elected Chairman of the Navy Consulting Board at the outbreak of the world war, was taken up with important duties, refusing to see all visitors. Even several years before this, no general interviews were given out. In this story are covered many points of interest not only to all experimenters and the man interested in science, but to the world at large. Much that is new has been presented here, and it will be noted with satisfaction by all that at the age of seventy-three, Mr. Edison's mind is as keen and clear as ever. We are certain our readers will appreciate this important article. Nearly all of the photographs and illustrations appearing in this story have never been publisht.

I ARRIVE AT MR. EDISON'S LABORATORY.

I arrived at West Orange on a crisp October morning and was soon in the little gate house which protects Mr. Edison from a curious public. Plain and modest as it is, the little red house has past thru its gates hundreds and thousands of the world's most famous men and dignitaries. Few such modest little houses, if any, have held under their roofs such an array of famous people who have come to pay homage to one of the greatest inventors the world has ever known.

In this little gate house is located the famous time clock on which Mr. Edison rings in his time and rings out every day of the year, many holidays included. An inspection of his week's time card revealed that Mr. Edison had invariably been at the laboratory before 8 o'clock in the morning and had worked as many as eighteen hours for three days at a stretch. Only once did he have a twelve-hour day. Right then and there I wondered how Mr. Edison felt about the now so popular eight or six-hour day, and I meant to ask him about it, but we became so engrossed in other more important questions which are moving the world, that altho we touched upon this subject, the eight-hour day question was never broached by me.

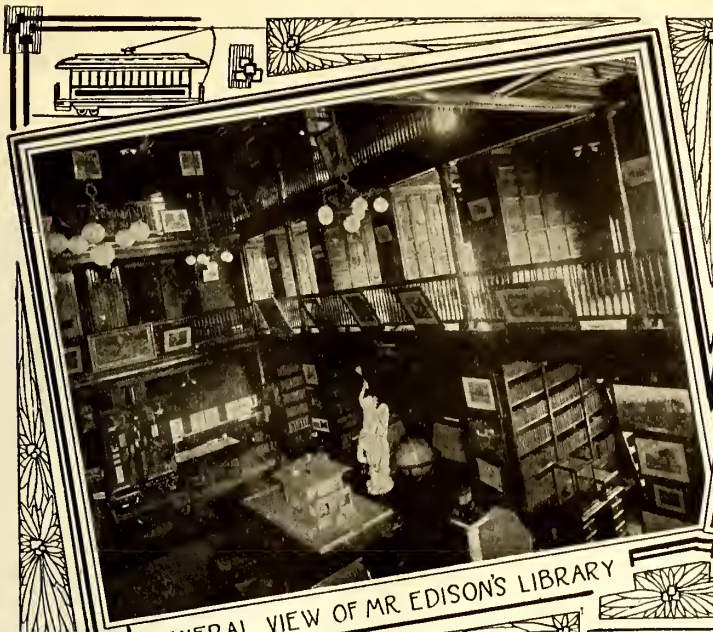
After passing thru the gate house, I made my way to Mr. Edison's library, where I was welcomed by Mr. W. H. Meadowcroft, his trusted and capable friend and secretary. While waiting for Mr. Edison, who was just then engaged with some chemical experiments, Mr. Meadowcroft pointed out all the interesting objects of Mr. Edison's library. This library is a huge affair and, besides containing electrical, chemical and physical reference works printed in almost any imaginable language with English, French and German predominating, many other curiosities are to be found here. There are many dozens of autographed photographs of famous men hanging about the walls, as are famous historic photographs portraying this or that view of an important phase of Mr. Edison's great discoveries, such as the electrical traction, the electric light, the phonograph,



The Only Authentic Photograph of Mr. Edison's Hands Ever Taken Publisht Here for the First Time. The Spots on the Hands Are Chemical Stains Which Could Not Be Washt off at the Time the Picture Was Taken. IF THE WORLD WERE CALLED UPON TO MAKE AN INVENTORY OF WHAT MR. EDISON'S HANDS ACTUALLY WROUGHT IN ENRICHING THIS PLANET, THERE WOULD NOT BE GOLD ENOUGH TO PAY HIM.

Copyright by E. P. Co., 1919. All rights reserved.

www.americanradiohistory.com



GENERAL VIEW OF MR EDISON'S LIBRARY



MR. EDISON AT HIS DESK. HE DID NOT KNOW THIS PICTURE WAS BEING TAKEN



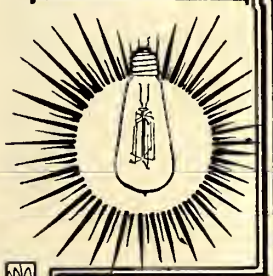
MR EDISON AND "BLUE DEVILS" SUMMER OF 1918



MR EDISON'S FAVORITE PICTURE TAKEN A SHORT TIME AGO



CUBIC FOOT OF COPPER IN MR. EDISON'S LIBRARY BY TIFFANY



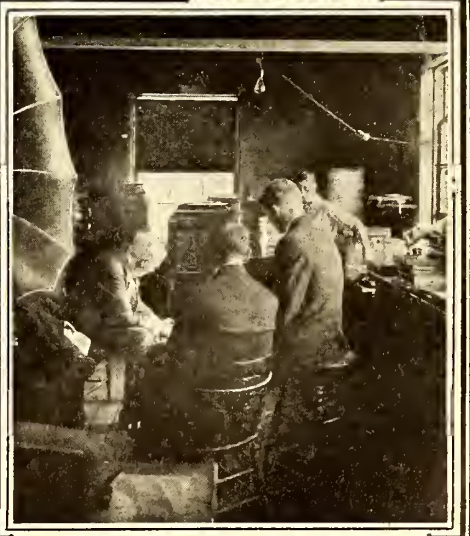


STATUE ON MR. EDISON'S LIBRARY "TRIUMPH OF ELECTRIC LIGHT OVER GAS



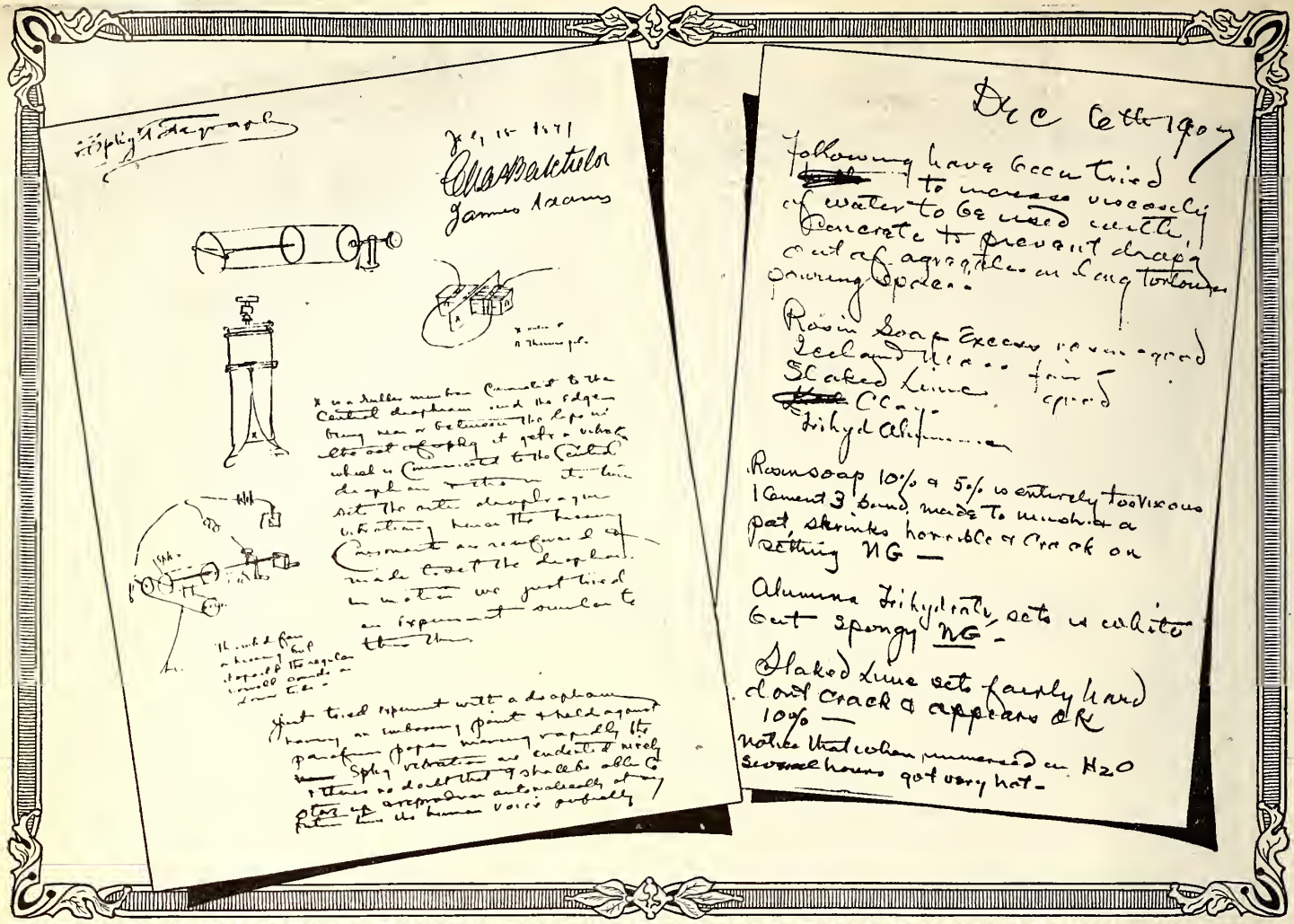
MR. EDISON THROWING FIRST BALL AT BASE BALL GAME ON EDISON FIELD DAY





MR. EDISON WITH ASSISTANTS LISTENING TO PHONOGRAPH RECORD

www.americanradiohistory.com



The Illustration at the Left Shows a Photographic Reproduction From One of Mr. Edison's Note Books. It Is Nothing Less Than the Now Historic Proof of the Invention of the Phonograph. It Shows the Conception of the Idea Plainly. On July 18, 1871, Mr. Edison Was Making Some Experiments Which Had Nothing To Do with the Phonograph. As a Matter of Fact It Seemed To Be More or Less Nebulous In His Own Mind, for at the Top of the Page He Wrote "Speaking Telegraph." The Part of Interest to History Is Found in the Foot Note of the Page, Which Reads as Follows:

"Just Tried Experiment with a Diaphragm Having an Embossing Point and Held Against Paraffine Paper Moving Rapidly. The Speaking Vibrations Are Indented Nicely and There Is No Doubt I Shall Be Able to Start Up and Reproduce Automatically at Any Future Time the Human Voice Perfectly."

Note Also the Two Witnesses' Names Under the Date, at Top of Page. The Other Page Shows a More Recent Sample of Mr. Edison's Handwriting. It Is From One of His Memorandum Books and Is Dated December 6, 1907. Note How Much Attention Mr. Edison Pays to Record Even Trivial Experiments, Also His Characteristic "N. G." In Two Places. The Changed Handwriting After an Elapsed Time of Thirty-Six Years Is of Great Interest.

the moving picture and many others. A huge white marble statue immediately catches the eye. Mr. Edison brought this from Paris at the time of the World's Exhibition in 1889, it having caught his fancy. The marble figure represents a boy seated upon a broken gas lantern, holding aloft triumphantly an electric light. Another object of recent dating is a solid cubic foot of copper weighing several hundred pounds mounted upon a mahogany pedestal. This solid piece of copper, made by Tiffany and suitably engraved, was presented to Mr. Edison by the copper interests of this country as a tribute to the great inventor. This symbolic gift can be better understood when it is realized that fully 50 percent of most of this copper is used for lighting purposes, which art was founded by Mr. Edison.

In this library I also inspected the famous "bed" upon which Mr. Edison catches a little sleep when he is engaged in day and night work at the laboratory. This cot is a very prosaic affair, and is located in the corner of the library amidst books and other curios. It is a bed in name only, for it is comprised of nothing but a mattress, pillow and a blanket.

On one of the walls, we also find a complete history of Mr. Edison's Alkaline Storage Battery, exhibited on a large wall board. This is graphically shown by displaying every part, chemicals included, that go into the making of this famous non-lead battery. The thing that most interested me in Mr. Edison's library, however, were his notes, and right here we find one of the pregnant reasons for Mr. Edison's great success.

MR. EDISON'S LABORATORY NOTES.

As is well known, few inventors have made their inventions pay. They are usually "inventors"—and that is all. Mr. Edison, on the other hand, aside from being an inventor, is also an excellent business man. Mr. Edison is systematic and knows the value of notes. He won many a patent suit on account of his notes written dozens of years ago. Early in his career it was brought home to him that when you have an idea, a record should be made *at once!* This was so engrained into his system that it is almost an impossibility for him to make even the most trivial experiment without making a careful record of it. Mr. Edison writes his notes in pencil, and at the end of the day the notes are carefully put away. Each month these notes are bound into a book, where they are kept for further reference. The office staff card-indexes his experiments and cross-indexes them, so at any time Mr. Edison can readily find any one experiment he made during the month, or, for that matter, any experiment that he made 25 years ago, if necessary. The notes are invariably made on yellow paper on ordinary scratch pads, the pages measuring about four by six inches. Being systematic, Mr. Edison always uses the same size pad year after year, and it is therefore refreshing to see the same sized sheets, and the same kind of paper made into bound volumes. While I was still inspecting some of these note books, many of which contain priceless data, Mr. Meadowcroft was informed by telephone that Mr. Edison was ready to receive me.

We walked across an open space separating the library from the chemical laboratory, and Mr. Meadowcroft explained that the building in which Mr. Edison was working that day was known as the chemical laboratory. Mr. Edison, however, does not work in the same laboratory all of the time, but for the past

(*Continued on page* 802)

www.americanradiohistory.com

"Slow Movies" Analyze Motion



THIS camera is known as *Novagraph*, and is an ultra-speed camera According to its inventor, Mr. Charles Watson, it is the result of years of hard study and costly research work, together with intense concentration and experiment. The camera is "cranked" the same as any ordinary motion picture camera, i.e., by hand, and exposes the film to the subject at the rate of 160 *exposures per second*, as compared with the usual *sixteen exposures* of the ordinary motion picture camera taken in the same interval of time. In projecting the film at the normal speed, sixteen pictures per second, the audience views the screened picture *slowed down to one-tenth the usual rate*, thus affording a perfect eye analysis of every motion of the subject. One hundred and sixty exposures per second does not mean that this is the maximum speed at which this camera can be operated. At any time the exposures, if need be, may be speeded up to 200 per second, or even 300, if necessary. In this case, however, the projection would be unduly slow, and quite unnecessary for making the essential analysis of ordinary motion. Needless to say, this camera is of enormous value, and its value lies particularly, perhaps, in its efficiency in scientific work. By means of the Novagraph, wonderful photographs of surgical operations have been taken, and the dexterous manipulation of instruments is made so clear that even an amateur is prompted to attempt the skilled operator's work. The Novagraph recently played an important part in taking photographs of heart actions and medical subjects, at which time Dr Samuel W Lambert, late Dean of the College of Physicians and Surgeons, Columbia University, exprest his highest approval of the wonderful work of this machine and immediately recognized the opportunity of the "slow" motion picture camera in medicine and surgery. At the Convention of Physicians and Surgeons in June at Atlantic City, members from all over the world were tremendously impressed with the above-mentioned motion picture. So much so, that Dr. M. C. McBride stated that never before had the members of the audience broken out into such spontaneous and tremendous applause.

Photographs were taken of the heart and lungs, in which case the movement of the oricles and ventricles of the heart were brought out so clearly that it seemed as tho the heart were being moulded into its various forms. Every little spasmodic contraction was instantly noticeable, and the analysis of its motion rendered complete to the finest detail. Twenty-pound bulldogs were used in conducting these experiments, and as daylight was not powerful enough to enable the camera to attain its best results, 7,200,000 candle-power Sunlight arcs of the new Sperry design were used.

The Advent of the "Slow Movie", as It is Called, Has Clarified for Us Many Hitherto Foggy Scientific Facts. Did You Know That It Is Possible for a Running Horse to Get All Four Feet Off the Ground Simultaneously? How Does the Heart Look While Beating? Is a Man or a Woman the Most Graceful Swimmer? All the Views at Right Were Taken by the "Novagraph" Camera Between Two Successive Exposures of the Ordinary Movie Film Shown at Left. The Slow Movie Camera Catches Details Which the Regular Movie Never Shows.

Five hundred feet of film are run thru this camera in forty-nine seconds! Ordinary film traveling thru the camera at this rate would instantly burn up. Hence specially treated film must be used.

In the taking of slow motion pictures it is the general rule of the director to have two cameras placed side by side, the Novagraph and ordinary commercial camera, both cameras trained upon the same subject; the film is then "shot" at the same time. The positives of these films are then cemented end on end. Immediately on projection of the film taken by the ordinary camera, a small sub-title telling of the appearance of the same picture, but taken at the ultra-rapid speed, introduces the Novagraph *detailed analysis* picture on the screen.

In one case a famous billiard artist had photos taken of some very fancy and difficult shots—one in particular being a billiard ball leaping from the table into a wicker basket. When this photograph was taken with the ordinary camera the ball appeared in one frame only. With the Novagraph, however, which was taking pictures of the play at the same time, there were twelve such exposures, depicting the actual flight of the billiard ball into the wicker basket, proving that the Novagraph recorded twelve extremely rapid exposures to one of the ordinary camera. Very interesting pictures were made of the extent of deterioration of steel, and on photographing pictures when a test was being made of its tensile strength one could clearly see the breaking and rending of these steel rods Photographs of high explosives being used to blast rock were so distinct, and the analysis of the cringing movement and the shredding apart of these rocks were so clear as to make the ordinary layman express the greatest surprise that a blasted rock would cause such an intensely interesting scene.

A very peculiar phenomena happened recently in New Jersey. The high-speed camera experts were to take some interior photographs. When it came to the developing of these films it was found that the ordinary camera, which we said before always accompanies the Novagraph camera in the taking of such pictures, produced a most perfect film. In the high-speed camera, however, such was not the case. Every third film was absolute blank. *On inquiring into the cause, it was found that alternating current had been used for the illumination, and this camera had actually photographed the alternations of the current.*

We do not ordinarily perceive any alternations or pulsation in such a current which would be at once indicated by a distinct flicker

(*Continued on page* 796)



www.americanradiohistory.com

Mysteries of Stage-craft

How Electricity Makes Possible Modern Stage Wonders

By H. Winfield Secor

IT is a far cry from the present-day theater, with its thousands of electric lamps which can be flashed on and off in the twinkling of an eye, back to the gas-lighted theater of our grandfather's time. The stage electrician of the present generation is king of all he surveys, and a king he truly is, for he can mar or make any theater production. Some of the interesting things which are actually being done on the stage today are described in the following article—electrical and mechanical and stagecraft tricks which the audience never sees.

REVOLVING AND ELEVATING STAGE FLOORS.

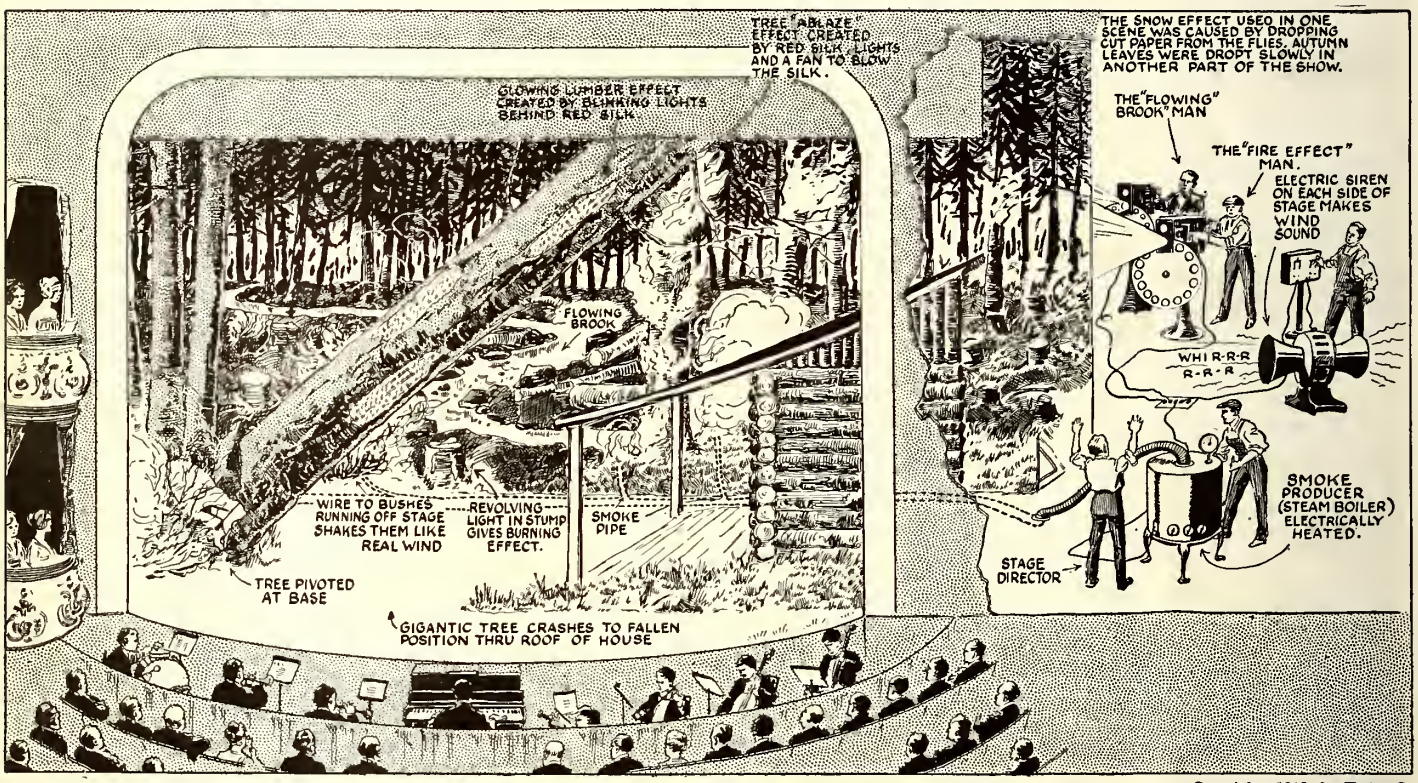
In order to expedite the change of scenes in the more elaborate theatrical productions, especially those having several different scenes to each act, many novel ideas have been developed and installed in several New York theaters, including revolving, as well as rising and falling stage floors. Three different forms of these movable stage floors, which enable several different scenes to be set up at one time, are illustrated at figures one, two, and three. Each of these three ideas, for providing multiple stage floors, have been actually tried out and proven successful.

Figure 1 illustrates a rising and falling stage in use at one theater. Two platforms, each large enough to carry the stage setting as shown, are built in the form of a gigantic elevator; the top platform being separated about 20 feet above the lower platform, with steel girders at the ends and at the rear, where they will not show in the setting. Under the lower platform, which normally is level with the basement floor, there is placed a battery of *hydraulic elevators*, which operate by water under pressure. For the second scene shift, scene No. 1 may be set on either the upper or lower platform, and the second scene brought to the stage level in a few seconds by the hydraulic elevators. That is, considering that a two-act show is being put on. With a three-act show or a production having several acts with many changes of scenes, then at the start, scene No. 1 would be set on the lower platform, while scene No. 2 would be set on the upper platform. When the curtain goes up, scene one appears before the audience, the setting of scene two being 20 feet above the stage. The lights are then winked off for a few seconds, or the front curtain is dropt for a moment and raised again, when, Lo! and behold! the scene has changed! How is it done? Simply by operating the hydraulic elevator cylinders and plungers to lower the platform structure, so that scene No. 2 which was above the stage is now level with it, and the lower platform containing scene No. 1 is level with the basement floor, where the scene shifters immediately get busy and remove the scenery of set No. 1, and dress it with the scenery for scene No. 3.

The revolving stage which is in use in one of the largest New York play-houses, which is necessary as this circular floor is of quite a large diameter, is illustrated in use at figure 2. Two, three, or even four scenes can be set up at one time on this revolving stage. Where an elaborate musical comedy or extravaganza is to be produced with anywhere from 10 to 15 changes of scenery, the convenience and speed with which the different scenes may be changed and the show run off, will be appreciated. The revolving stage is rotated when desired by a throw of a switch, controlling an electric motor which rotates the platform thru a powerful worm gear underneath the floor. The platform rotates on roller bearings.

At figure 3, there is shown the checker-board scheme of quickly changing the scenes in a show. In one scheme now in actual use, the scenes for the three acts are set up on the right, left and rear scene platforms, as shown. These platforms are mounted on substantial rubber-tired wheels, so as to make a minimum amount of noise when the scenes are changed. When act No. 1 has been placed, the curtain is dropt and the platform carrying scenery for this act is rolled to the right, and the platform carrying the scenery for act No. 2, is pulled into place. One of these sets, including the platform, is quite heavy, and while it can be shifted by a number of men, recourse is had to a series of ropes fastened to the platforms and also to a powerful electric motor winch in the basement, whereby any

(Continued on page 810)

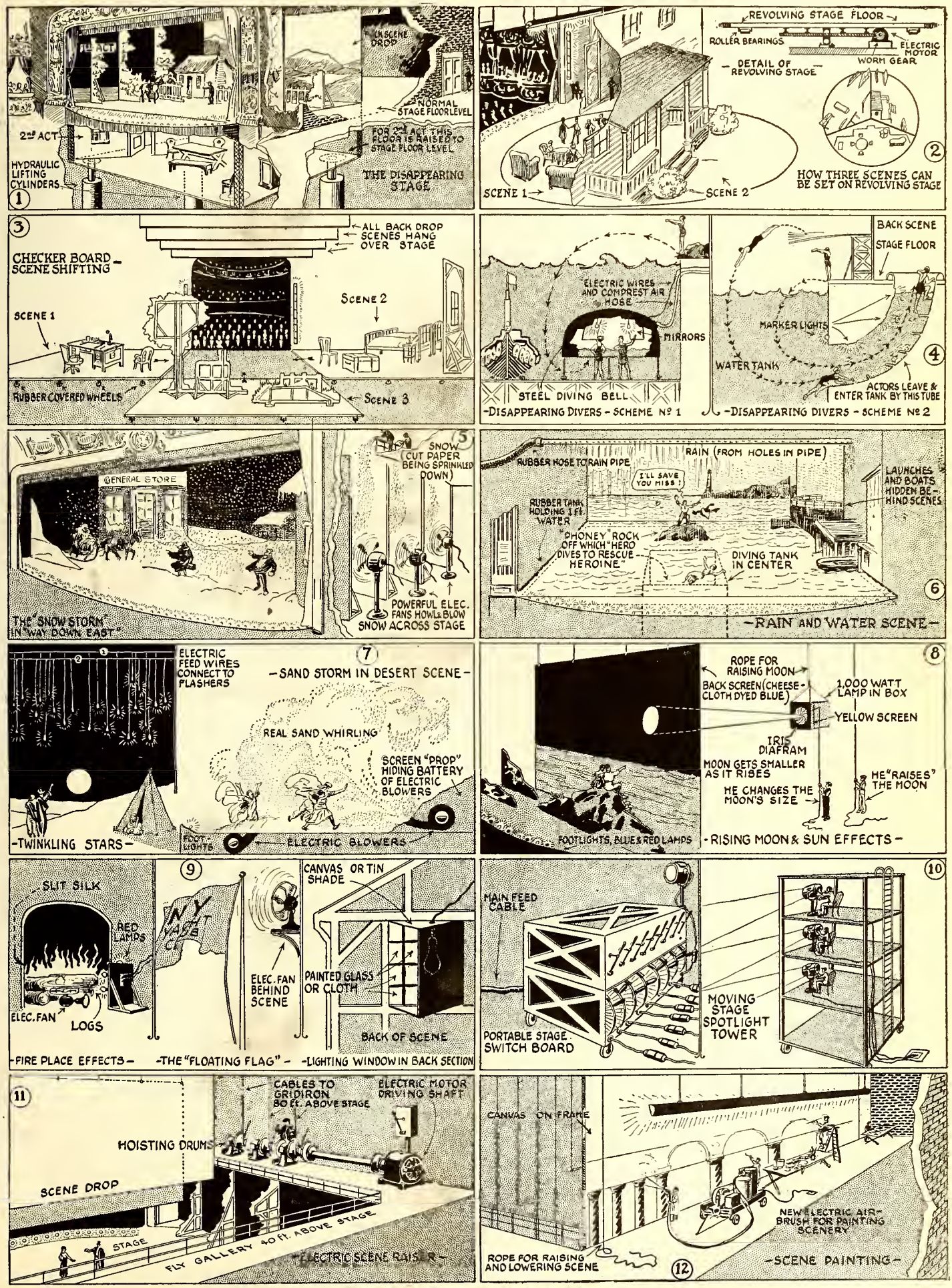


Copyright, 1919, by E. P. Co.

Scene from "The Storm" by Langdon McCormick, a Most Realistic New York Theatrical Production. In the First Act, There Is a Very Good Snow Storm Effect; the Bushes and Trees Swaying in the Wind as it Moans. At the End of the Third Act, the Audience Is Treated to One of the Greatest Masterpieces Ever Produced in Stage Settings,—a Sure-enough "Forest Fire" with Crashing Trees and Howling Wind,—and Not One Speck of Real Fire on the Whole Stage. In This Sensational Scene, the Fire May Be Seen to Creep Slowly Thru the Trees in the Distance. As It Gains Headway the Flames Leap Higher and Higher Until the Whole Stage Is Enveloped in Flames. Trees Fall, the Bushes and Underbrush Sway In the High Wind, and the Largest on the Stage, as Shown Above, Crashes Thru the Cabin Occupied by Burr Winton and David Stewart. The Incandescent or Burning Wood Effect on the Trunk of the Trees, Is Created by Electric Lights, Suitably Camouflaged Behind Colored Silk, Etc. Those Lights, Blinking on and Off, Enhance the Effect. Powerful Electric Sirens Produce the Wind Noise and the Creeping Fire Thru the Trees in the Distance Is Projected From Back Stage on to the Back Drop by Special Lanterns Provided With Moving Colored Discs.

www.americanradiohistory.com

Mysteries of Stage-craft



Complete Story on Opposite Page

www.americanradiohistory.com

An Aerial Passenger Rocket

OUR pleasure resorts and summer amusement parks have for many years tried to satisfy the whims of the proverbial "tired business man" and his family, not to mention the millions of others who flock to the great amusement parks at Coney Island and other national play-grounds scattered thruout the country. There are many hair-raising surprises to be found at all of the large amusement parks—such as scenic railways with dizzying inclines down which the passenger-laden cars rush at speeds greatly surpassing those of our fastest express trains, while the passengers proceed to yell and scream their delight as they dash at two-mile-a-minute speed into a pitch dark subterranean cavern made out of papier-maché with the aid of a glue pot, and then decorated by some clever artist to resemble a smaller member of the Rocky Mountain family. But aside from the steel-nerved lady and gent who have in the past few years delighted thousands at the big three-ring circus by looping-the-loop in mid-air in a real automobile or on a bicycle, there haven't been any real hair-raising and startingly new novelties produced in the Amusement World. The illustration here presented, shows a newly proposed amusement-park feature, which smacks decidedly of the essence of war, and while old man Mars and his spiked club, so familiar to our war-time cartoonists, has disappeared from favor in our national family life today, we hope, in fact we know, there is still a small fraction of the war-time spirit burning in the heart of everyone. So those who still think now and then of the war and some of the great deeds performed and the gigantic death-dealing machines developed during that period, will be interested in this new "Aerial Passenger Rocket" amusement device proposed by H. W. Secor and H. Gernsback of New York City.

You board this aerial passenger shell or rocket, on the ground, after which you are "loaded" by a powerful hydraulic plunger into the base of a gigantic comprest-air or electro-magnetic gun, which hurls you skyward with bewildering speed. The next moment you find yourself flying thru space with all the sensations of being imprisoned in one of the ex-Kaiser's dainty ltitle 42 C.M. shells, hurtling thru the upper air strata on its 70-mile journey toward Paris. The greatest pleasure of a trip in the new aerial passenger rocket is yet to come however. The next phase of the journey, all of which occupies the space of but a few seconds, so far, is when the passenger-carrying missile strikes the great mound of water at the top of the race-way or track, shown in the illustration. The water acts as a cushion, and prevents the shell from striking with a disagreeable jolt. All the while you, as a passenger, have been enjoying one of the most novel sensations of your life, thanks to the double-pivoted chair mounted on gimbal rings, and provided with a weight which stabilizes the chair constantly in a vertical position, and now you find yourself dashing earthward with express-train speed down a hollow steel raceway, along which the water discharged from the fountain at the top travels in its journey to the lagoon below. Directly you strike the water in your downward rush, there is a mighty splash as you strike the water and dash thru it, guided by the curved steel rails, until you return around the loop on your journey toward the starting point. As the shore of the lagoon is reached, the pasesnger-laden missile, acting under its own momentum, or else aided by a belt or link conveyor, such as used on scenic railways, is loaded onto electric cars of the type shown, which carry it along the track to the debarking station. Here the aerial rocket is unloaded and new passengers get aboard. The doors are closed and the human skyrocket starts on its journey toward the mouth of the "gun" once more. By proper design of the whole affair, it is possible for several rockets to be employed, the gun firing them at carefully timed intervals, a fraction of a minute apart. Of course, if one of the shells happens to get stuck on the water chute, and shell No. 2 comes sailing thru space directly behind it, then of course there will be a collision,—but that is nothing, for did you not start out to have a real sensation?—and you will have one sure enough, just the same as those you read of during the war, when one of the Hun's mighty shells and a French shell met in mid-air. Yes, this looks a little bit like a real accident, something on the order of the physicist's classic—"When an irresistable force meets an immovable body . . . . . etc."!!!??

Putting aside the smaller details, such as what kind of grease to lubricate the gun and what color to paint the projectiles, altho the inventors would like to see red, white and blue stripes painted along the tips of the shells, pointing rearward, we now come to some more serious problems. One of these is: What kind of a gun or projecting device can be used to hurl the shell skyward with possibly eight to twelve passengers with not too great a velocity, such as 12 K.M. per second, which would hurl the projectile away from Mother Earth so fast that little Johnnie and his sister would never come back to earth again to see Ma and Pa? Further, it should have enough speed to make the shell follow a carefully calculated trajectory, taking into consideration the ballistics of the air, and of course, the wind pressure, etc., all of which our able artillery officers are wont to tell us they have boiled down to such an exact science, that they can hit the head of a pin with a twelve-inch shell ten miles away.

As we were saying, this is one of the big problems, and four methods are proposed, at least one of which should certainly prove practicable, providing a rich Croesus from New York or some other well-known monetary mart, gets up enough nerve to back this invention, and if he cannot be found, it may be suggested that at least one of the inventors has signified his willingness to make the first trip, when the aerial passenger rocket shall have been built. Four ways in which the rocket can be projected heavenward with sufficient speed, are as follows:

First: An electromagnetic gun or steel tube around which are wound a number of magnet coils, each of which is successfully and progressively connected with a source of electric current, so that the steel body of the projectile will be sucked forward at ever-increasing speed in a well known manner, which has been described a number of times in the ELECTRICAL EXPERIMENTER.

Comprest air forms the basis of a second method for forcing the projectile thru the tube at high velocity, and a comprest air plant and tank are shown in the present illustration, which in any event would prove a worth-while auxiliary source of power for operating the device.

Gun powder used as a source of power to project the rocket upward thru the tube, would provide a fine spectacular effect at night, and in the day-time, the noise of the successive explosions, as the shells popt skyward one after another, would prove an excellent drawing card, but perhaps no passengers.

A fourth scheme may utilize the well-known belt with spurs on it, similar to that used in scenic railways at the present time, or some other form of modified rapidly moving belt can be devised which would rapidly carry the projectile skyward. This scheme may seem impractical and something that cannot be realized in a commercial way, but if it is possible for a person in an automobile to loop-the-loop in mid-air as has been done, then with the proper design of the apparatus here proposed and with the necessary precautions taken to arrange proper protective nets and other paraphernalia so that the "Aerial Passenger Rocket" cannot land so as to injure the passengers, it would seem quite possible with modern engineering technique, that the device would be practicable. It would not be surprising to us, if such a scheme as this should greet our eyes even within the course of another year or two at one of our great national playgrounds.

Articles to Appear in the January Issue

How Henri Becquerel Invented Radio-Activity—Special Feature Article. Written by Prof. Becquerel.

The Helicopter, An Accomplished Fact. By Robert G. Skerrett. The newest thing in vertically rising flying machines.

Electric Locomotives Cross Western Mountains. With special illustrations. By H. Winfield Secor.

Popular Explanation of the Einstein Theory. By Isabel M. Lewis, M.A., of the U. S. Naval Observatory.

Is There a Sub-Electron? By Rogers D. Rusk, M.A. An interesting and timely discussion.

The Giant 100-Inch Mount Wilson Reflecting Telescope. A brilliant discourse on large astronomical telescopes and their lenses. By Prof. Floyd L. Darrow.

The Capitol Theater of New York City and Its Electrical Stage Features. By Joseph H. Kraus.

What Atomic Forces Could Do. A popular description of the tremendous energy locked up in the atom.

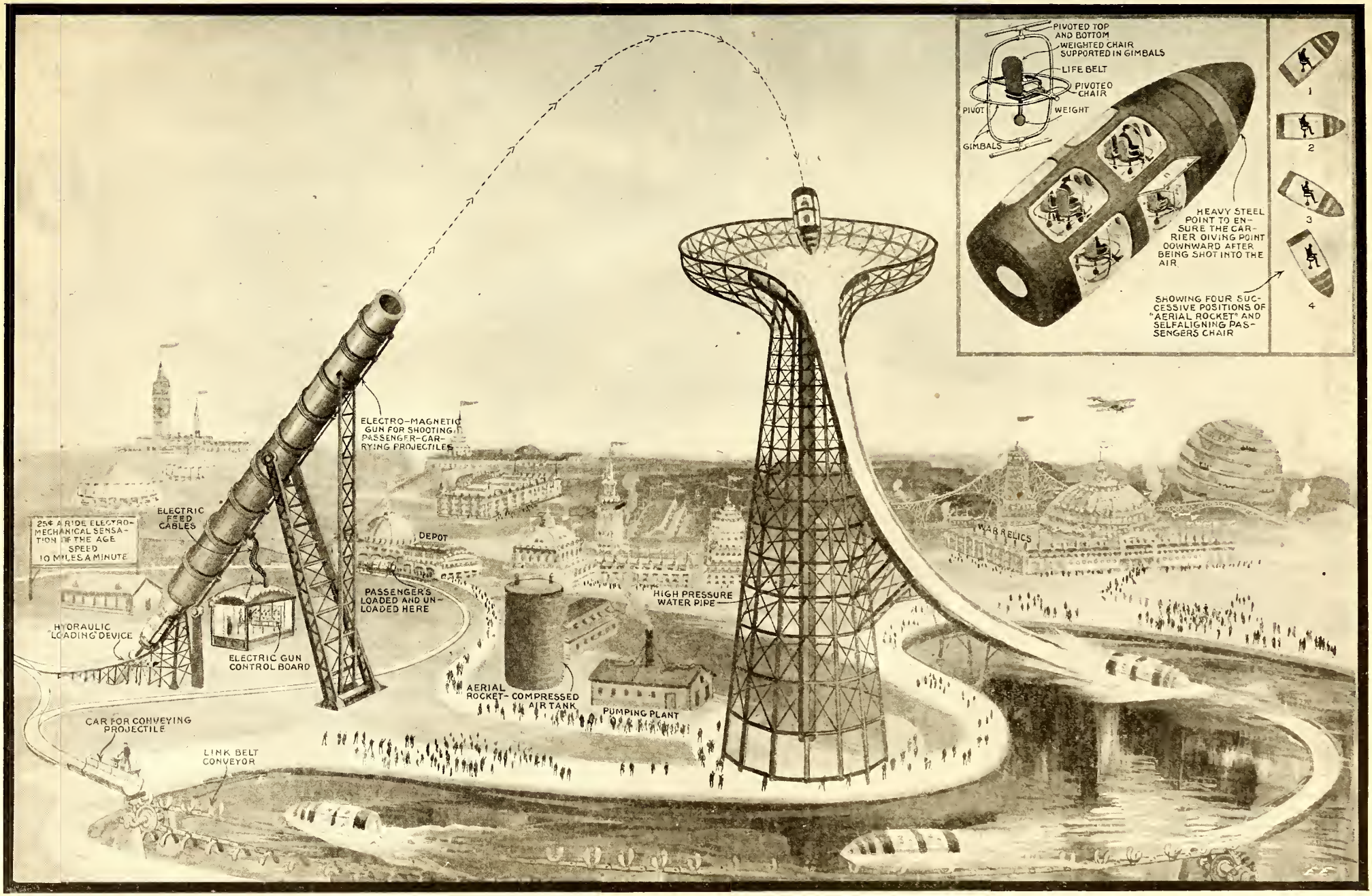
Exact Radio Direction Finding. With photos and diagrams. By A. E. Harper.

How the Electrical Engineer Works. Popular illustrated story of the daily work of the engineer.

Magnetic Storms. By Prof. Lindley Pyle.

Reversible Airplane Propellers and How They Work.

www.americanradiohistory.com



Copyright 1919, by E. P. Co.

The Illustration Herewith Shows a Novel Pleasure Resort Attraction Devised by Two New York Inventors. Altho, at a First Glance, It May Seem Impracticable to Construct Such a Daring Amusement Contrivance as This, a Little Reflection Will Show That It Is Not so Impossible at All. In the Circus We Are Used to Seeing a Person "Loop-the-Loop" or Turn a Somersault in Mid-Air While in an Automobile, the Vehicle and Its Passengers Landing Right Side Up on a Properly Inclined Platform, Down Which It Glides to Earth. Our Artillery Experts Can Compute with Extreme Accuracy the Trajectory of Various Projectiles, Both Large and Small, and Thus It Should Be Quite Possible, with the Aid of Modern Mechanical Engineering Technique, to Build One of These Aerial Passenger Rocket Amusements Successfully. The Gun Out of Which the Shell or Rocket, with Its Human Cargo Is Shot, May Be Operated by Compressed Air, by Powder, or It May Be an Electro-Magnetic Gun. After the Shell Has Sped Thru the Air, Over the Course Indicated by the Dotted Lines, It Lands on a Large Cushion of Water Emerging from the Stand Pipe Shown. It Proceeds to Glide Down to the Lagoon on a Cushion of Water Also, and Upon Striking the Lagoon, It Is Guided Back to the Starting Point by a Link-Belt as Here Illustrated. Electric Cars of Special Type, Seen at the Left of the Picture, Carry the "Rockets" Back to the Station, Thence Around to the Gun Breech, Where a Hydraulic Plunger Loads the Carrier Into the Gun.

www.americanradiohistory.com

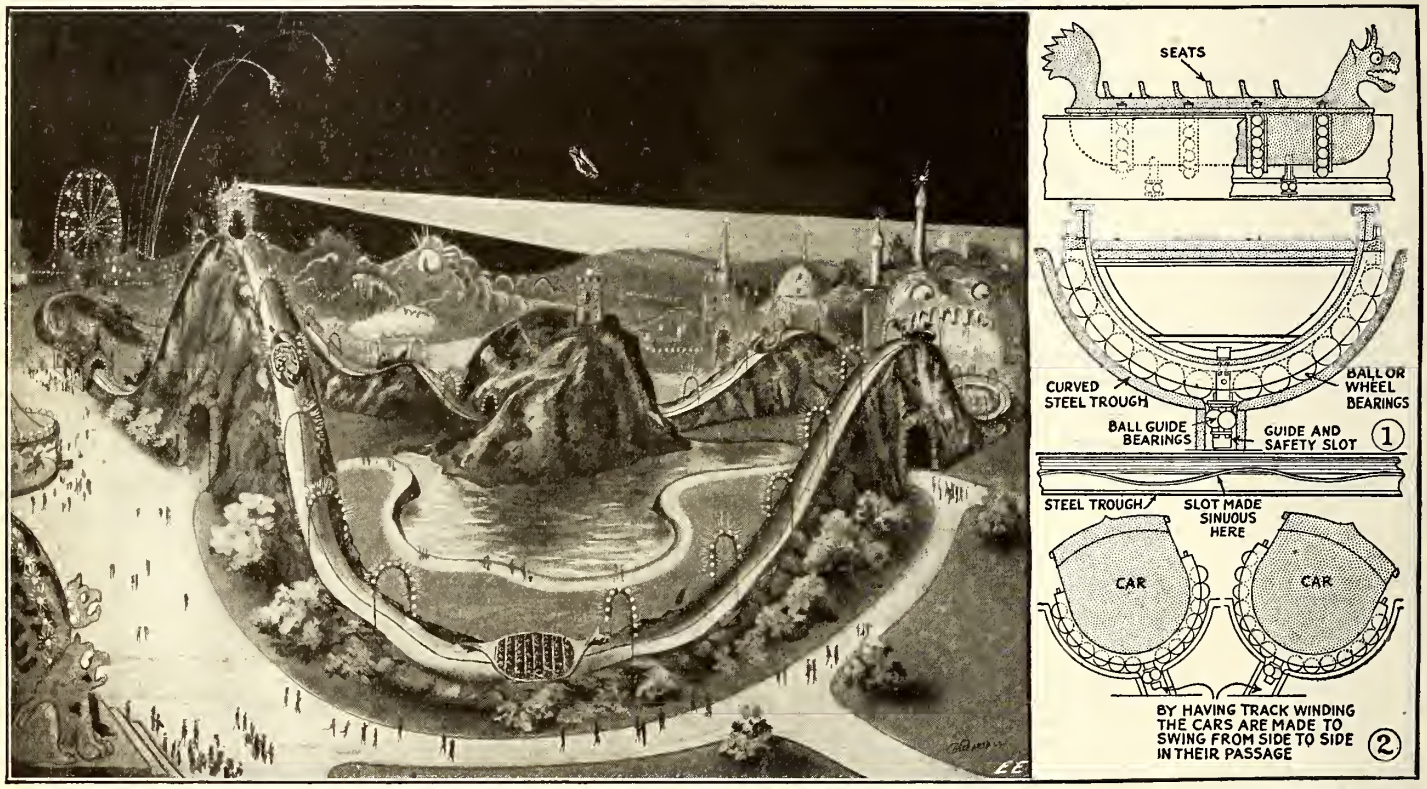
An Oscillating Scenic Railway

BY means of a sinuous undulating track on this new scenic raliway, the cars are caused to oscillate. Scenic railways are not new, by any means, but a radical departure in the design for an improved *Pleasure Railway,* as its inventor, Peter F. Meyer of Brooklyn, N. Y., calls it, is incorporated in the one here illustrated. Several novel and important features, both with regard to the amount of pleasure to be derived by the passengers on Mr. Meyer's pleasure railway, as well as with respect to their safety, have been worked out by the ingenious inventor.

One of the principal objects of Mr. Meyer's new design of scenic railway is the safety feature, and it is applied in a very simple manner. At the bottom of each passenger-carrying car there are two rigid vertical shafts, securely fastened to the base of the car, and suitable wheels are placed on these shafts in such a manner that they minimize any friction as the car rolls along, while at the same time preventing the car from jumping out of the rail slot, as becomes evident, as in order to do this the lower wheels on the vertical shafts would have to be wrenched off.

The inventor has provided an ingenious anti-friction scheme for supporting the cars in the hollow steel or wooden trough, along which the cars ride, and to this end he provides a series of round iron balls. These balls are held in grooves in such a manner that they cannot drop out, but they are held sufficiently loose so as to be easily rotated. The cars thus roll along on this series of balls in the same manner as a roller skate moves along with a minimum of friction on its ball bearings. Of course, where desired, and if the builders do not care to go to the expense of utilizing the ball bearings on the cars, wheels can be substituted, but these would have to be pivoted in two directions, preferably so as to obviate any undue noise or friction as the car sped along and suddenly changed to a tilting position, due to the grooves encountered in the guide rail or slot.

To begin with, the passenger-laden cars may be hauled to the top of the first highest incline by means of a link belt hoist or conveyor in the well-known manner. As the inventor mentions, the track over which the cars speed is best made continuous or endless; the cars to eventually finish a run in front of the station at which they started from. The track is made preferably of thin steel in a trough-like or semicircular form, and, as will be evident to the reader, the inventor has certainly shown original design, and also a very practical and feasible idea in bringing forward this new proposal for building scenic railways. If the people want something exciting and novel in this line, why not give them something that is really novel. For probably a generation now people have become accustomed to the old-fashioned, undulating, humpback scenic railway, but Mr. Meyer has, we think, given us something just as pleasing as its prototypes, and one which will bring in a new era for scenic railways. As you dash down one of the great inclines at mile-a-minute speed, you think you are safe and sound when you reach the bottom and have nothing to do until to-morrow, as the proverb goes, when suddenly—zowie!! the car careens sidewise, or slowly but surely takes an angular tilting position, the same as a small boat on the ocean. Of course you should not have a headache when you start on your journey over Mr. Meyer's oscillating scenic railways, but if you like good sport and feel right for the trip, you will wonder how it ever happened that the older type pleasure railways have existed so many years without a single change in their design or construction, excepting for the innovations now and then, with which we are more or less familiar perhaps, such as long dark tunnels (the longer the better some of us wish, what!!?? . . .), with a few "A Street in New York" hurdy-gurdy scenes, as well as Uncle Tom's "Little Eva" ascending to heaven, etc., ad lib. Possibly by next year they will degenerate to showing us scenes of the Bolsheviki regimé in darkest Russia, where you go down to the public "Spouse Market" and pick out your wife for the next six months.



Copyright, 1919, by E. P. Co.

The Cars on This New Scenic Railway Sway Back and Forth Sidewise, Like a Boat on the Ocean, as They Shoot Along the Troughlike Tracks. The Cars Roll on Ball Bearings, as the Detail Drawings Show. This Pleasure Railway Provides a "Real Thriller" for the Amusement-Seeking Public.

Turf Fuel for Power

Electrification of Moscow factories on a basis of turf fuel is in progress under the direction of the engineering staff of the Soviet Government, according to Arthur Ransome to whom the scheme was explained by the President of the Supreme Council of Public Economy. ("Russia in 1919," Huebsch.)

"He said that there was no water power near Moscow but big turf deposits which would be used as fuel. In order not to interfere with the actual lighting of the town from the power-station already in existence, they are taking the electric plant from the Provodnik works, which will supply enough electricity for the lighting of the town. As soon as that is set up and working, they will use it for the immediate needs of Moscow, and set about transferring the existing power-station to the new situation near the turf beds. In this way they hope to carry out the change from coal to turf without interfering with the ordinary life of the town. Eventually when things settle down they will get a larger plant. . . .

"I asked how they were going to get the machines. He said that of course they would prefer to buy them abroad, but that, though this was impossible, the work would not be delayed on that account, since they could make a start with the machines they had."

www.americanradiohistory.com

Airplane Supercharger for High Flying

By CHARLES M. RIPLEY

IN 1783 Benjamin Franklin witncst a balloon ascension and after seeing it he wrote as follows: "A few months since, the idea of witches riding thru the air upon a broom-stick, and that of philosophers upon a bag of smoke, would have appeared equally impossible and ridiculous—these machines must always be subject to be driven by the wind. Perhaps mechanic art may find easy means to give them progressive motion in a calm, and to slant them a little in the wind."

Today our aviators laugh at a 60-mile gale—it is negligible compared with their own speed of 150 miles per hour. And 200 miles per hour and even more, is seen upon the horizon for regular commercial airplane service; for the new *Supercharger* or oxygen booster assures us that the long distance air transportation of the future will be conducted at from three to five miles up in the sky, where the air resistance is less than half that at sea level.

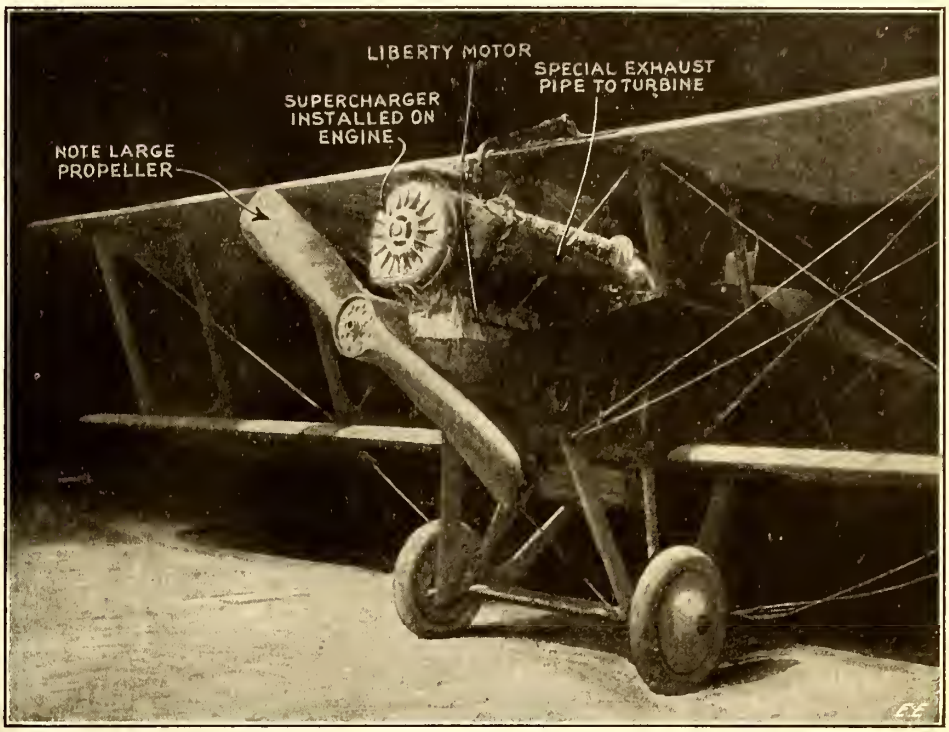
At Wilbur Wright Field, August 2nd, a U. S. Army aviator broke the world's speed record at high altitudes. Major R. W. Schroeder of the U. S. Air Service, while at an altitude of 18,400 feet, attained an official speed of 137 miles per hour.

The official report states that "he used a two-seated La Père biplane, built by the Packard Motor Car Co., and designed by Capt. La Père of the French Army, while in the employ of the U. S. Government. It had a 12-cylinder Liberty motor, equipt with a *supercharger* developed by Dr. S. A. Moss, a turbine research engineer of Lynn, Mass., working in cooperation with the engineers of the U. S. Air Service. So far as is known this is the highest speed ever attained at this altitude with a two-seated plane; and the best speed known for a single-seater at this altitude was only 128 miles per hour."

It is not generally known among "landlubbers" that heretofore every airplane engine lost 50% of its power when up 20,000 feet; and that at 25,000 feet its loss of power is between two-thirds and three-quarters—that is, instead of having 400 horsepower, as at sea level, it only has 100 to 150 horsepower.

So far as is known now, the *scarcity of oxygen* at the high elevations is the only factor which has made 30,000 feet "the Ceiling of the World." So the engine suffers from lack of oxygen, just as do the birdmen.

The thin "skin" of air which surrounds the earth is no thicker than the skin of an apple—relatively speaking. Thus it is that the daring birdmen who approach the ceiling of the world must prepare to take oxygen from a tank as they near 15,000 to 18,000 feet elevation. Otherwise they would suffocate.



La Pere Airplane That Broke World's Speed Record at 18,000 Feet Altitude. Liberty Motor Equipt With "Super-Charger" or Oxygen Booster, Which Is Shown at Front of Engine and Just Above the Propeller Shaft. This Small Attachment Practically Doubled the Horse-Power of the Engine at an Altitude of 18,400 Feet, Where the Air Is Extremely Rarefied and Deficient in Oxygen. In Future Flights It Is Expected That Previous Speed and Altitude Records Will All be Eclipsed.

The *supercharger* used recently by Major Schroeder and his observer, Lieut. G. W. Elsey, is one of the most remarkable inventions which have been developed as a result of America's participation in the World War. The observations (officially checked) show that altho the plane was 18,400 feet above the ground, the air supplied to the carburetor had the same density as that at 2,900 feet elevation. Thus the supercharger gave the engine an amount of power equivalent to what it would have had, if it had been 16,500 feet nearer to the ground. So this attachment is as useful and necessary to the engine as is the tank which supplies oxygen to the sky-pilot.

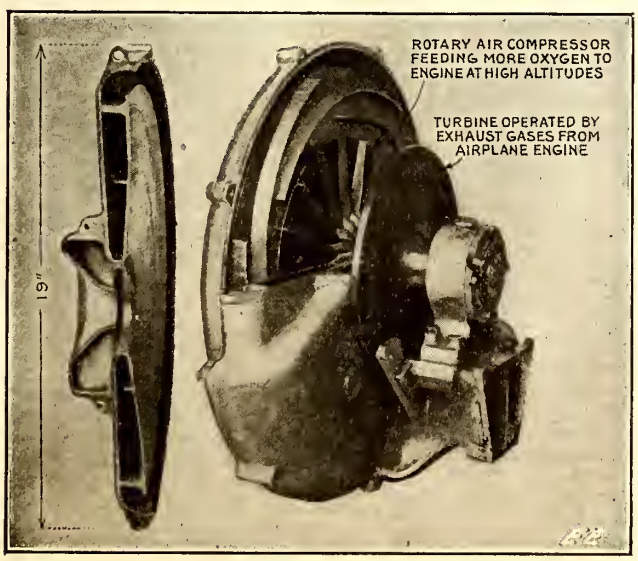
The supercharger or oxygen booster is a little device only 19" in diameter, and complete with piping, adds only 100 pounds additional net weight to the plane; yet it practically doubled the power of the Liberty motor! Such vast quantities of oxygen are needed by the motor that it is impossible to carry a supply in tanks as is done for aviators, so the supercharger TAKES IT FROM THE AIR! Literally the wonderful little device compresses the rarefied air until it equals that near sea-level, and then this "good, thick sea-level air" is fed to the carburetor. It takes a considerable amount of energy to suck in air which is already at 50 per cent vacuum or more and compress it—or "buck the vacuum." But there is where the engineer has played a brilliant trick—for he has found some energy there, miles up in the sky, which he can use.

Where do you suppose the power comes from which doubles the power of the Liberty motor as it approaches the "ceiling of the world"? Why, from the red-hot exhaust gases of the Liberty motor! It is so simple: heat is energy; heat is thrown away in the exhaust gases; therefore the Yankee engineers set about to collect this power.

Now the gases exhaust into manifold or flat-shaped pipes (one on each side) which convey it to a gas turbine. The turbine is thus driven at 20,000 to 25,000 revolutions per minute—40 revolutions per second! Thus the wasted energy is now reclaimed into a useful by-product power; and this power drives the air compressor. The combination of the turbine and the centrifugal compressor is called a *supercharger*, and the weight is only 100 pounds!

Engineers—whether airmen or not—have shown intense interest in and admiration for this outfit. A "gas turbine" itself is a

(*Continued on page* 820)



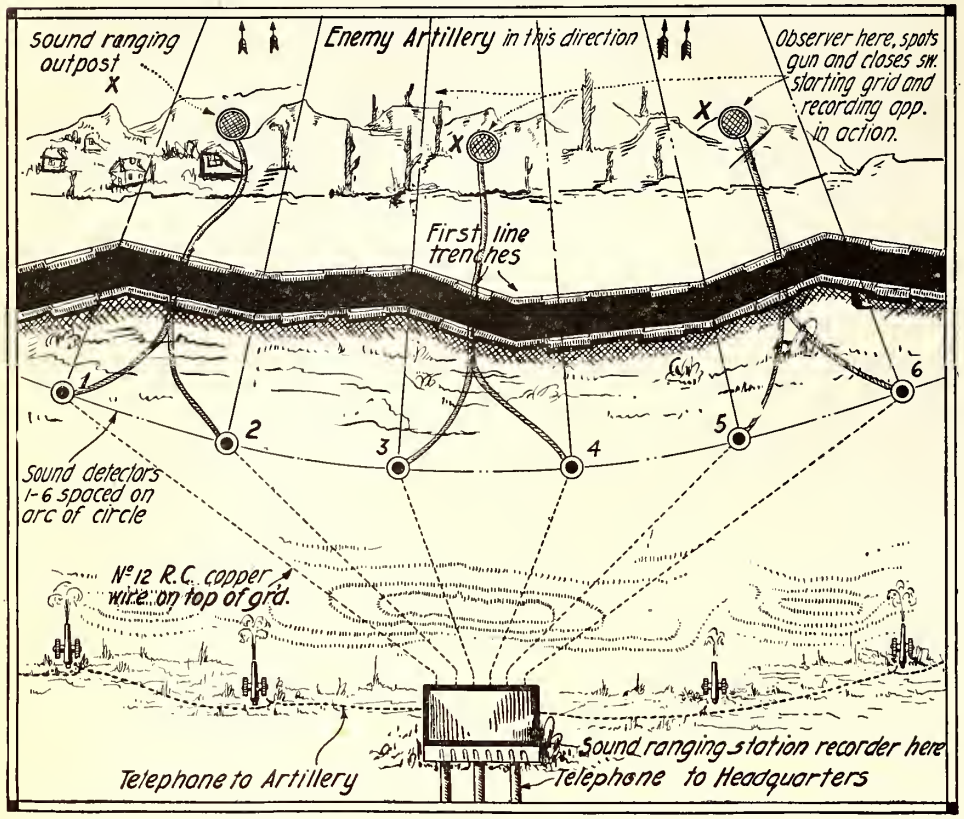
View to the Left Shows the Wonderful New Airplane "Super-charger" Which Pumps Increased Amounts of Oxygen Into the Gasoline Engine Carburetor System, When the Airplane Is Flying at High Altitudes. As Is Well-known, the Airplane Engine Loses About 50 Per Cent of Its Power at an Altitude of 20,000 Feet and to Overcome this Reduction in Speed and Climbing Power of the Plane, This Device Has Been Produced. A Turbine Drives the Rotary Air Compressor, the Turbine Being Operated by Exhaust Gases From the Airplane Engine.

www.americanradiohistory.com

Sound and Flash Ranging in the A.E.F.

By Prof. Augustus Trowbridge

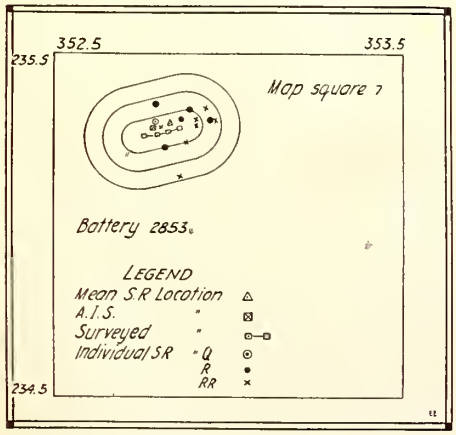
DEPARTMENT OF PHYSICS, PRINCETON UNIVERSITY. LATE LIEUTENANT-COLONEL, CORPS OF ENGINEERS, U. S. ARMY, IN TECHNICAL CHARGE OF THE SOUND AND FLASH RANGING SERVICE OF THE AMERICAN EXPEDITIONARY FORCE.



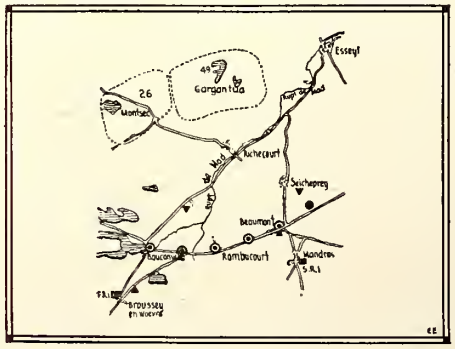
The Above Chart or Map Shows a Typical Layout of "Sound Ranging" Stations at the American battlefront in France, as Actually Used for Locating German Artillery. The Photographic Record of Enemy Gun Bursts Was Recorded at the Sound Ranging Headquarters Station, From Which Wires Radiated to the Various Listening Stations, Placed Along the Arc of a Circle at 1, 2, 3, 4, and So Forth. Every Enemy Gun Was Accurately Located, Numbered and Charted in This Way.

AFTER the first battle of the Marne in the early autumn of 1914 the war on the western front soon took on the character of a gigantic siege operation in which each belligerent played the parts both of besieged and besieger on different portions of the battle front. The long period of trench warfare set in during which each side increased the number, the caliber and the range of its artillery—the heavier calibers were most carefully concealed both through the choice of naturally favorable positions and through the use of the new practice of camouflage, so that the location of the enemy batteries by existing methods became increasingly difficult and often impossible.

The new problem, which the French were first to solve, was first, the location by some other means than sight of invisible enemy batteries and the directing of the fire of their own batteries on these and other enemy targets, and, second, the location of, and the *ranging* on, the enemy batteries which tho not completely hidden, were so distant that the ordinary triangulation methods from a short base-line hitherto practiced by the artillery were not sufficiently accurate to accomplish. To attain these two objects the French inaugurated two new services of artillery information which have been called respectively Sound Ranging and Flash Ranging.



This Map of Which Thousands Were Made Daily by the "A. E. F." Engineers on the Battlefront in France, Shows the Accuracy With Which Enemy Guns Were Located by Sound Ranging, S.R. by Artillery Information Service, A. I. S., Etc. Dots in Squares Show Actual Location of Guns.



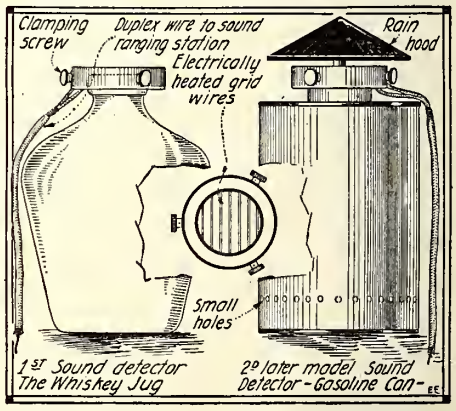
An Actual Map of Sound Ranging Stations in the Vicinity of Seicheprey, France. Sound Ranging Central Station at S.R. 1. Observing Instruments Indicated by Black Dots in Circles. Flash Ranging Stations F.R. 1. Enemy Artillery Located in Areas Enclosed by Dotted Lines.

These services were copied by the British with but slight modification as regards organization and later by the United States, which organized both services under one head.

The flash ranging services in all of the allied armies were very similar both as regards instruments and methods of observation and report; such differences as there were were due chiefly to the methods of training and to the character of the personnel. The Germans also had an extremely efficient flash ranging service, many of the good features of which were copied by the Allies as they became known through prisoners and captured documents.

A flash ranging section consisted of about 100 men under the command of a lieutenant, who was assisted by three other officers. The installation consisted of a central calculating station—marked F. R. 1.—and from four to six advance observation posts—marked as erect triangles on the accompanying map, which gives approximately the positions occupied by one flash and one sound ranging section on a ten kilometer front in the spring of 1918.

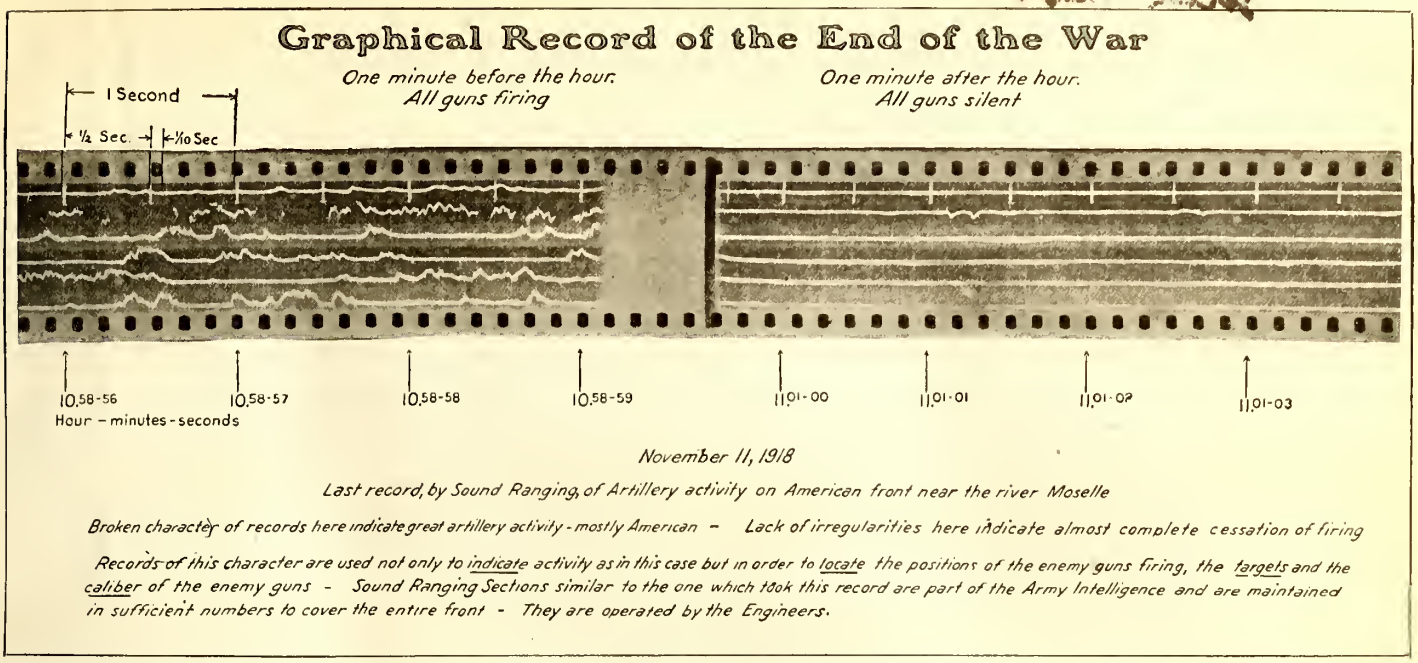
At each observation post two men were on duty at all times, day and night, and each post was in telephonic communication with the calculating station and with each of the other posts of the section. Each post was provided with suitable day and night telescopes mounted on graduated circles for measuring the bearing of a sight away from the north-south line. The method of operation was as follows: If an observer at one of the posts noted the flash of an enemy gun, or even only the smoke puff he called back to "central" the approximate bearing and distance; the



No Microphones of the Usual Carbon Grain Type or Anything Like Them Were Used In Picking Up the Sound of the Enemy Guns in the "A. E. F." Sound Ranging Work. What Was Used, However, Was a Fine Grid of Electrically Heated Wires Placed Over the Mouth of a Whiskey Jug, at First and Later Over the Mouth of a Discarded Gasoline Can, Which Latter Acted as Sound Resonating Chambers. When a Sound Wave From an Enemy Gun Several Miles Distant, Perhaps, Which of Course Was an Air-Wave, Impinged Against the Heated Wire Grid, It Caused a Variation in Temperature of the Grid, and in Turn a Variation of Its Electrical Resistance.

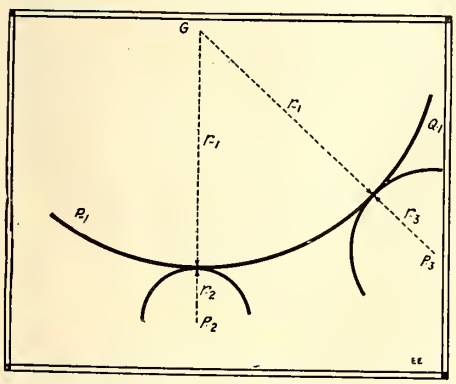
calculating officer at central was provided with a large plotting board, on which the surveyed positions of all of the observation posts were accurately marked and which was provided with weighted strings and angular scales for each of the posts. When a report came from an observation post the calculator at the plotting board set the corresponding string in the direction reported and brought all the other strings to cross the first at about the estimated distance and called to all the other

www.americanradiohistory.com



One of the Most Remarkable Graphical Records Extant Delineating the End of the Great "World War." This Is a Reproduction of a Sound Ranging Record Taken at the American Front at 11 O'Clock on the Morning of November 11, 1918. Note That the Gun-fire Was Very Active up Until the Last Minute Before 11 O'Clock; While at One Minute Past 11, the Firing Practically Ceased. Two Gun-bursts Appear on the right of the Chart at 11.01-01 and 11.01-025, Which Show Where a Boche Had Let Go a Few Seconds After the 11 O'clock Period When the Armistice Called for Firing to Cease.

posts to set their instruments in the proper direction as given on the board. After one or two more rounds by the enemy gun, several or all of the posts might be in a position to give an accurate report of the direction as seen from these posts, and the calculating officer be enabled to obtain an ccurate intersection of the strings on the board and thus be able to report to the artillery the location of the gun which had been firing. In case of great enemy artillery activity when there was danger that all the posts might not be sighting on the same enemy gun, an electrical synchronizing device was employed which enabled the calculating officer to assure himself



The Chart Above Shows How the Sound of a Gun Fired at "G", Requires Different Lengths of Time to Travel to Various Locations and How the exact Position of the Gun may Be Surveyed by Sound When Several Listening Stations Located at Say P1, P2, P3, etc., are Employed in Determining the Exact Arrival Time of the Sound From the Gun at Each of These Points.

that all the observations were made at the same instant. This rendered it unlikely that different observers should report on different guns firing at about the same time.

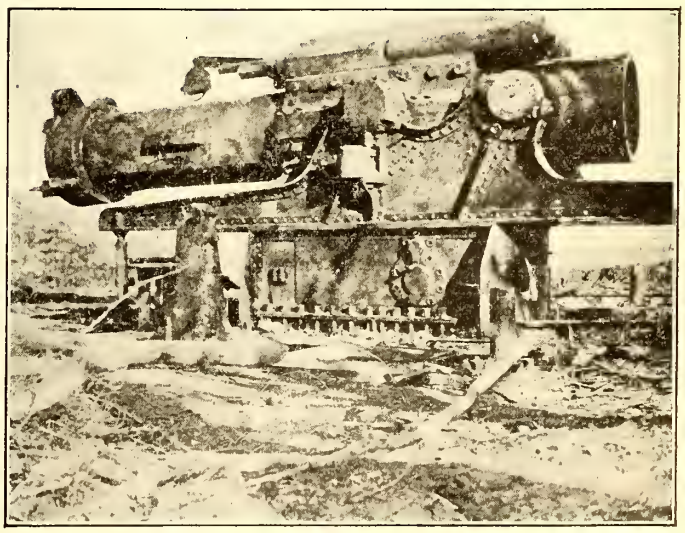
In directing the fire of the friendly artillery the procedure was similar with this difference that it was the *burst* of our own shells on the ground in the case of ranging on a visible target that was observed and plotted or the burst in the air in the case of an invisible target. In this latter case known corrections could be worked out to permit of a burst at or near the invisible target.

A sound ranging section was similar in organization to the flash section except that there were fewer men (60-70), due to the fact that instruments took the place of living observers to a great extent. The "central" instrument recorded photographically the time of arrival of the sound of the enemy guns at a series of instruments at surveyed positions near the front line and covering a length of about five miles; this instrument delivered automatically, developed and fixed photographic records in less than a minute after the sound of the enemy gun reached the front line and this record could be interpreted by the use of quick graphical methods so that the position of the gun could be telephoned to the friendly artillery in about a minute more. The probable accuracy of the location could be estimated and also the caliber and target of the gun which had just fired; this and the fact that neither rain, fog or darkness interfered with sound ranging were unique and valuable features of the service. Calculations were rendered difficult by great artillery activity tho they were not impossible except under actual barrage conditions.

On the accompanying map the sound ranging central is marked S. R. 1, and the observing instruments are shown as circles lying equi-spaced along a circular arc, whose center lies near the groups of enemy artillery shown enclosed in the two irregular areas, one of which was supposed to contain 26 and the other 49 active enemy batteries. The front line trenches ran about midway between these areas and the sound ranging instruments. In or near the trenches were two forward observation posts marked on the map as inverted triangles; at these posts observers were stationed, whose duty it was to start and stop by means of electrical relays the photographic mechanism at the central station whenever they heard the report of enemy guns whose positions it was desired to locate.

(*Continued on page 832*)

Stranger Than Any Fiction, Would Be the Tale That the "Sound Ranging" Experts of the "A.E.F." Could Tell You If They Wanted to, Regarding the Wonderful Hits They Made By Artillery. The Accompanying View Shows a Typical Hit on a Large German Howitzer Several Miles Behind the Lines, From an American Gun. This Shot Having Been Fired From Information Gained by the Sound Ranging Corps. The Enemy Gun Was Put Out of Commission, the Recoil Cylinders Having Been Blown Off and Totally Disabling It. In One Case, a Railroad Train Was Fired at Several Miles Behind the Lines the Train Being Completely Wrecked on the Bridge It Was Crossing at the Time. Due to Shell-fire. Not Only This, But the Location of Friendly Shell-bursts Could be Checked Up and Measured by the Sound Ranging Experts and the Gunners Told in a Fraction of a Minute, to Alter Their Range to the Right or to the Left, Until the Shell Landed Squarely on the Target.



www.americanradiohistory.com

Rohlfs Flies 34,610 Ft.—New World's Record

FLYING his Curtiss "Wasp" type triplane, with a 12-cylinder, 400-horsepower Curtiss motor, Roland Rohlfs, test pilot for the Curtiss Company, broke the world's altitude record, when, at Roosevelt Field September 18th, he reached the height of 34,610 feet, or more than six and one-half miles above sea level. On Saturday the 13th he had come within nearly 400 feet of this mark, but the flight was not official.

The previous unofficial record was 33,137 feet, made last May at Villa Coublay, France, by Adjutant Casale of the French Army.

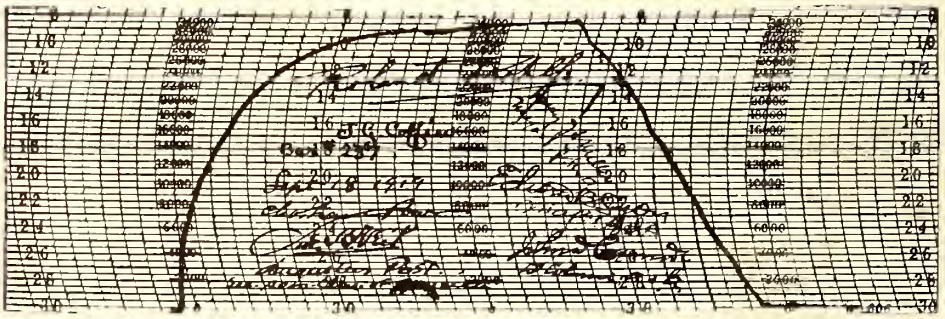
Every precaution was taken therefore to make sure that all official requirements for a record were observed. A committee representing the Aero Club of America, composed of Augustus Post, Secretary of the club; Sydney B. Veit, and Professor C. L. Poore, Professor of Celestial Mechanics at Columbia University, were present. The army was unofficially represented by Colonel John D. Carmody, in command at Roosevelt Field; Major E. B. Lyons, in charge of flying at Mitchel Field, and Major Henry F. Miller.

Rohlfs left the ground at 12:06 o'clock and landed within twenty feet of his takeoff at 1:59.



© International Film Service

Roland Rohlfs, Who Broke the World's Altitude Record. He Is the Test Pilot for the Curtiss Engineering Corporation, and Is Shown Seated in His Curtiss "Wasp" Machine Before the Start of the Flight Over Roosevelt Field, Mineola. He Ascended to a Height of 34,610 Feet, Establishing a New World's Record. The Inset Photograph Shows Rohlfs Rising From the Ground for His Record-Breaking Flight. The Chart Below Is a Copy of the Official Barograph Record of Rohlfs's Altitude-Breaking Flight.



As he landed he stept out and handed the sealed barograph to Mr. Post. When the latter called out that the instrument showed a new world's record the onlookers cheered. The barograph was then resealed by the Aero Club committee. It was shipt to Washington where it will be calibrated by the Bureau of Standards and subjected to the most detailed and exhaustive analysis and testing. Until the result of this examination is given out, the reading will not be recorded by the Aero Club as absolutely official.

Rohlfs wore a suit of fur-lined clothing, and heavy felt mittens made by himself from material half an inch thick. Of the flight, he said:

"At 20,000 feet, trouble began. I had to call on my oxygen bottle. This feeds air to my lungs thru a device something like a football nose guard. At first I tried drawing it in thru the nose and mouth, but this dried my throat and I had to shut my mouth and breathe thru the nose alone. If anything had happened to this oxygen apparatus I would have been a 'goner.'

"At 31,000 feet the plane began to wobble in a way that, frankly, frightened me. It careened this way and that, and while doing so dropt 600 feet. I threw on more power and up it went again." (The barograph markings showed the fall plainly.)

"When I reached the 'peak' the thermometer showed forty-three degrees *below* zero. It took seventy-eight minutes to get this high and I spent another twenty minutes trying to make the plane rise still higher. I used every trick I knew, but could not coax another foot of altitude out of it. I believe I attained the absolute top possible in this machine.

"I noticed several peculiar things up there. Near the top I felt nervous twitchings in parts of my body. These were at several scars left by an automobile accident several years ago. After my two other high flights my teeth ached severely and also my stomach. I guess I can count on the aches lasting about ten days more. They lasted that long when I went above 30,000 feet before."

Rohlfs reached 10,000 feet in eight minutes after leaving the ground. He flew as far as Riverhead, L. I., where a head wind made him turn about. When at the highest altitude he was above Lake Ronkonkoma, which is twenty-five miles from Roosevelt Field.

Rohlfs made his flight after most careful study of his problem, paying particular attention to how much weight he could spare from his machine with safety. Rohlfs contemplated removing the tires but changed his mind and left them on. By a judicious casting off of nuts, bolts, wires, and fire-fighting apparatus and lessening his gasoline supply to eleven gallons he reduced the weight of the machine by 100 pounds.

New World's Record for Pilot and Passenger.

A new official world's altitude record for pilot and one passenger was made at Dayton, Ohio, on September 6, when Major Rudolph W. Schroeder climbed to 28,500 feet in a Lepere biplane equipt with a 400 horse power Liberty motor, according to announcement made recently by the Contest Committee of the American Flying Club, which had charge of the recent New York-Toronto contest. The announcement followed the homologation of data and barograph charts sent by Colonel Thurman H. Bane, Chief of the Army Airplane Engineering Division at McCook Field, Dayton.

This new mark of 28,500 feet greatly surpasses the former two-man altitude record held by Captain Lang of the Royal Air Force, who ascended to 27,300 feet on January 2, 1919, in a 375 horse power English biplane. No official figures have been received in this country yet in regard to the reported altitude climb of Adjutant Casale, who, with one passenger, according to unofficial reports, broke previous records last June. Until official proof of this flight is received by the Contest Committee of the American Flying Club, Major Schroeder's record will stand as the world's record for pilot and passenger.

Major Schroeder's new record is of international interest because it was made possible by the new airplane engine *supercharger* originated during the war but

(Continued on page 826)

www.americanradiohistory.com

New York Electrical Show

THE annual Electrical Exposition held in New York was more resplendent than ever before, this year. It was discontinued during the war and, judging by the size of the crowds that visited the exposition this year, the public was pleased indeed to see once more on exhibit the latest advances in electrical wizardry. The exposition at New York was staged in the Grand Central Palace, a very handsome building and one that provided a commodious space for the beautiful display of the various apparata, instruments and devices, which included everything imaginable from a specially sensitive micro-ampere meter, the needle of which indicated in millionths of an ampere, the current produced by applying your dampened finger to an iron nail and a one-cent piece—up to a ponderous electrical storage battery truck, or a complete electrical dairy, where the electrically operated vacuum milker was demonstrated several times each day.



At the New York Electrical Show, Which the Editors Visited, There Were Several Ingenious and More or Less Practical Electric Apparata Exhibited and Demonstrated. A Few of the More Interesting and Useful Things That We Noted There, Are Illustrated and Described Herewith, for the Benefit of Readers Who May Not Have Had the Opportunity of Witnessing This Wonderful and Educational Electrical Display.

The accompanying illustration shows just a few samples of the hundreds of electrical devices exhibited and which appealed to every member of the family, from little Tommy Edison, Jr., up to old Grandad puffing contentedly on his old and tried "Meerschaum." What, between electrical washing machines that wabbled around, or back and forth, including some that oscillated up and down, with electric lights shining thru their soapy depths, electrical sirens and powerful X-ray machines, together with wireless sparks and a few dozen other choice crashes and flashes thrown in for good measure, the electrically interested populace was thoroly entertained. Excellent band music was furnished afternoons and evenings during the week of the exposition.

WHAT WE SAW AT THE SHOW

A very clever vase light was demonstrated and what "got our goat" was why—out of 100,000,000 people in America—some one had not thought of it before. It instantly converts any vase, no matter how big or small, into a beautiful electric lamp with a silk shade costing as much as you have money to buy yards of silk for. See Figure 1. As we walked down the aisle, our attention was arrested by one of the most efficient looking electric dish washers that we have seen for some time. The hot soapy water was forced up thru and around the dishes in great fashion, and if any microbes or bacteria could lift one of their hind legs after passing thru this scalding ordeal, well, they have got to show us, that's all! We told mother and the girls about it as soon as we arrived home, and as soon as the mail order houses start selling these electric dish washers on the installment plan, I and Mike McStinchy, the chief clerk at the office, have promised ourselves one apiece. Take a shot at Figure 2.

As we hove to, around the corner on one of the floors, we were almost "flabbergasted" trying to count the total number of electric vacuum cleaners exhibited. There must 'a been a million of 'em! One particularly large and interesting machine was being pushed slowly over a large Persian rug by a dusky demonstrator. "Some vacuum cleaner," quoth we. Egad, we had the wrong family this time! This machine (see Fig. 3) was an *electric rug and carpet washer*. When we got close up to it we saw that it had a rapidly oscillating scrub-

(*Continued on page* 815)

www.americanradiohistory.com

"Speaking Crystals"

By A. McL. NICOLSON*

MANY new and surprising things have come to light during the war. While the guns thundered in Europe, American scientists quietly went about their work, hatching out many new marvels.

One of the most unique inventions—at least from the Experimenter's standpoint—is the wonderful Piezo-electric effect of Rochelle crystals. In these, a veritable new gold mine has been opened to all experimenters. What these crystals will all do fairly staggers one's imagination. Think of a simple salt crystal that will actually talk, that can be a telephone receiver, and a transmitter combined, that will give as much as 100 volts when squeezed with two fingers, that will "sing" when current is supplied to it! And the best part is every one of us can make his own crystals and perform these experiments without having to buy this 20th century electrical wonder—for as yet it can't be bought, anyway!

We consider ourselves fortunate to present our readers with a very comprehensive article on the new invention by its inventor, Mr. A. McL. Nicolson. Many new uses will be found for the invention and we invite our readers to send us their experience for the benefit of all.—The Editors.

ELECTRICITY is liberated in many apparently different ways. There are at least a dozen so-called "sources" of electricity which are mentioned in text books. It probably could be shown that in every case in which electricity is produced, the fundamental cause of the manifestation is the same. We have merely different ways of operating on matter with the dissipation of some form of energy; and the electric charge or current is generated. This signifies the transformation of one form of energy into another, and, generally, the mechanism is reversible. For example, in the case of static electricity the influence machine may be used reversibly as a "converter" of electricity or of mechanical energy,—that is to say as a generator or as a motor. When we hear of a "new" source of electricity we are curious to find out all about the mechanism of the source—as to its reversibility, efficiency of energy conversion, applicability to the mechanical arts, etc.

"Piezo-Electricity", discovered by J. and P. Curie, is the name given, in 1881, to a crystal source of electricity. In this case electric charges of different signs are liberated on different surfaces of a crystal when mechanical stresses or vibrations are impressed on certain of its parts. The word *piezo*, pronounced p ī é z o, is derived from the Greek *piezein*, signifying "to press"; hence "pressure" electricity.

Crystals Which Evolve Electricity.

Not every crystal is *piezo-electrically* active. Nature grows crystals, whether mineral or organic, in thirty-two differing classes of structure—of these, just twenty classes offer the necessary condition for piezo-electric activity. And this condition is *asymmetry* of structure or of molecular arrangement. While a very large number of crystals have the electric property, only comparatively few exhibit the phenomenon to a sufficiently interesting degree to warrant mention of it at this time.

Amongst mineral crystals quartz and tourmaline are the best known having the asymmetric structure — the molecules consisting of regular "bricks", are staggered into a *skew symmetry* or *spiral structure*. In the case of the organic crystals, the molecules themselves are asymmetric, that is to say, they do not comprise "regular bricks". They have, in fact, little skew symmetries of their own. Both the mineral and the organic crystal exhibit their respective asymmetries as right- or left-handed skew structures. This is revealed in their power to rotate the plane of polarization of polarized light in corresponding right or left directions.

We are, just now, more interested in the *organic* crystal since this type, comprising, as it does, the asymmetric carbon molecule, has proved to be more susceptible of large piezo-electric effect. Examples of active organic crystals are sugar, camphor, tartaric acid, etc.

Rochelle Salt Crystal Very Active Electrically.

A crystal which is very active piezo-electrically is *"dextro rotary" sodium potassium tartarate or Rochelle salt.*

Recently, the Research Laboratory of the American Telephone and Telegraph and the Western Electric Companies investigated the possibility of developing piezo-electric crystals. It was soon found that crystals of *Rochelle salt* would give good results *if prepared in a special manner.*

Briefly, increased efficiency is brought about by the following conditions:

1. Selection of particular habit of growth.
2. Desiccation. (Preserving by exhausting the moisture.)
3. Development of the crystal into a composite polar structure.
4. Application of static compression.
5. Use of electric poles normal to each other.
6. Application of torque.

How the Crystals are "Grown".

Rochelle salt crystals are grown from nuclei or "seeds" of definite form. These are obtained by selection from crystal croppings spontaneously grown in a *supersaturated solution* of the salt (the formula is $Na\ K\ C_4\ H_4\ O_6 . 4H_2\ O$). The solution should be made up of 8 parts Rochelle salts to 5.33 parts of water. The density of the solution at 50°C. is 1.33 and the nuclei from which large crystals are grown, are "planted" in the mother liquor when the temperature has dropped to 38°C. *The crystal grows rapidly as the temperature of the liquor falls to that of its surroundings.* The seeds are selected so that they are practically square shaped—the seed, for this purpose, must lie with its principal or optic axis in a horizontal plane.

When a crystal is grown very rapidly—as by the temperature gradient method described—it develops a *composite* structure termed by mineralogists the "hour-glass". Fig. 1 illustrates the entire process graphically.

How the Crystals are Mounted

Important use is made of this structure and its development is fully encouraged. It is found that if the crystal, when grown to the desired size, from 30 to 200 grams, and when thoroly desiccated, or dried, develops new and stronger electric poles on its surface. The vertical walls, surrounding the principal axis, *form one pole* while the *two horizontal*, or basal planes

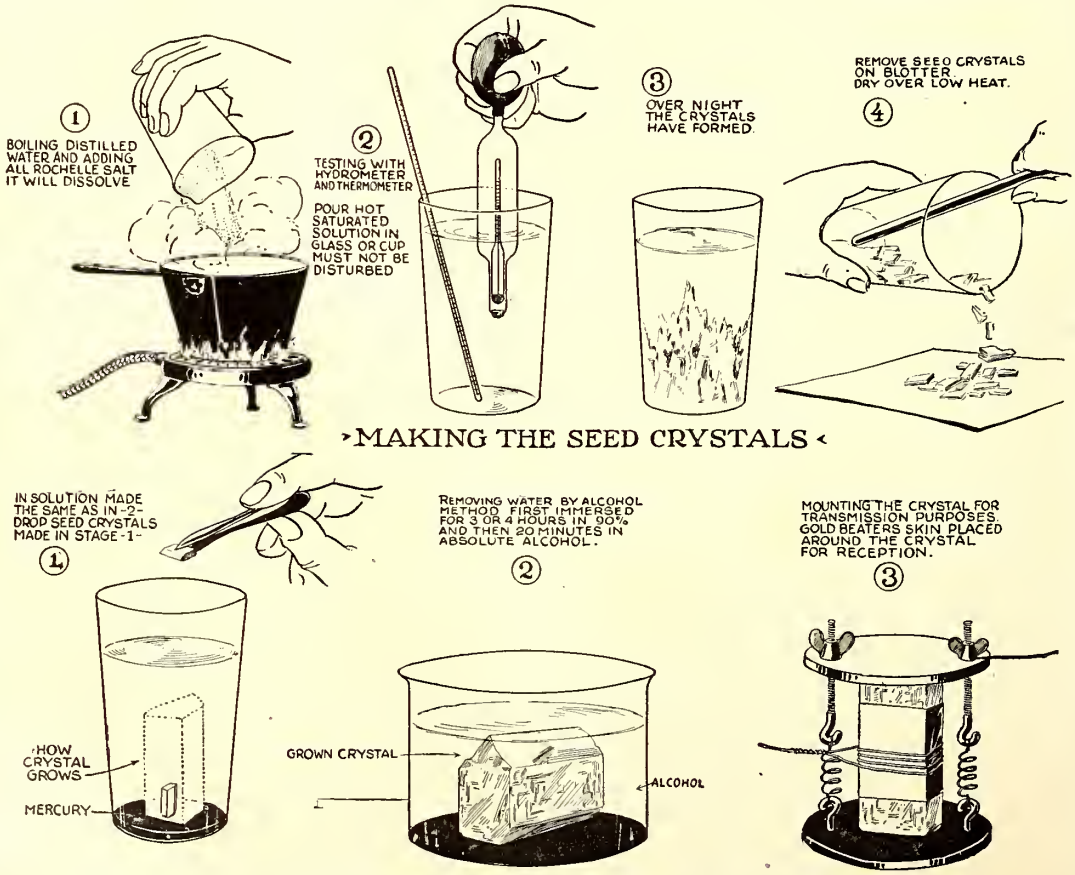
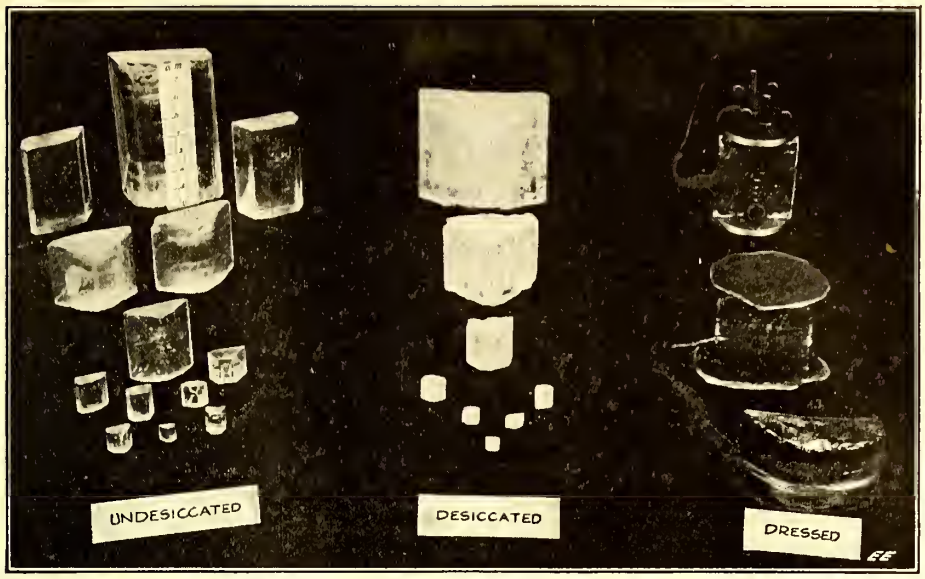


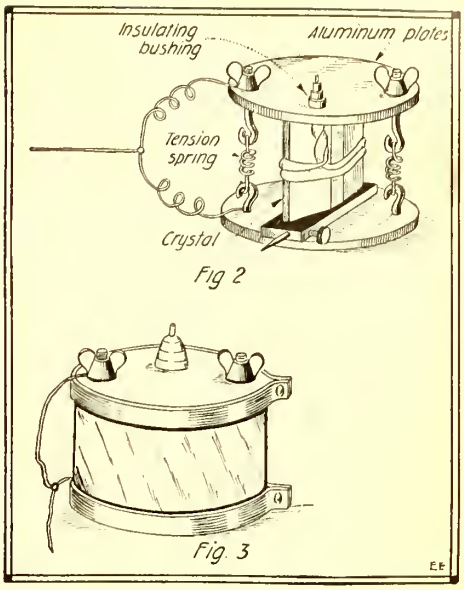
Fig. 1.

*Research Laboratories of the American Telephone and Telegraph Company and the Western Electric Company, Inc.

www.americanradiohistory.com



Appearance of Rochelle Salt Crystals Made By the Author,—Undesiccated; Desiccated and Finally Dressed, Ready for Mounting in Clamp.



Above:—Crystal as a Phonograph Transmitter. Below:—As a Transmitter or Receiver.

together *form the other pole.* Beeswaxed tinfoils serve as electrodes when applied to the crystal. Since compression greatly improves the piezo-electric effect in these crystals an appliance shown in Fig. 3 called the "spring compressor" may be used. The appliance comprises a pair of aluminium plates connected together with powerful springs. Thumb-screws are provided so as to apply 20 to 40 pounds pressure to the crystal. The compressor forms one pole, preferably the "grounded" pole of the crystal. The other is called the "girdle" pole, because fine wires may be stranded and wrapped around the crystal at its equator, making proper connection with the tinfoil coating there.

The mechanically sensitive regions of the crystal are at the four corners of the "square"—on the ends of the two basal planes. Care should therefore be taken to have the crystal *bear on these corners* in the spring compressors. This is readily accomplished by filing the crystal on its basal planes so as to render it slightly concave on both crystallographic poles.

An ordinary half round file is used, and the top and bottom faces filed in such a manner that the corners are elevated slightly; making them higher than the rest of the face.

When *compression* is applied to the crystal an electric charge is imparted to its poles—so that the *girdle* electrode becomes plus and the basal planes, together (or the spring compressors) become minus. This electrification will leak away and when the compression is relaxed, the *crystal poles will reverse* the signs of the liberated charges. Great sensitiveness is also obtained if the crystal is subjected to torsion. *A charge of several micro-coulombs and potentials exceeding* 100 *volts may be obtained by twisting the crystal with the fingers.*

The Crystals "Talk".

If, now, we reverse the process and apply electric potentials to the crystal poles, *sounds will be emitted by the crystal due to its relative displacement.* It will be found, if a small mirror be applied with wax to different parts of a crystal and its motions examined by projecting a beam of light reflected by the mirror to a screen, that the principal component of motion is one of *twisting.* The crystal thus "wriggles" under electric stress and *will emit tones in consonance with the potentials applied.*

Several interesting experiments have been performed utilizing one or other or both of the electrical and mechanical effects produced by the piezo-electric crystal. We may first use the crystal as a transmitter or detector of mechanical vibrations or sound. A very convenient application is to the phonograph. A needle may be inserted in a plate attached to one end of the crystal, fig. 2, so that, if held properly over a moving record the needle will transfer torsional movements to the crystal, and corresponding electrical currents will be generated. The alternating potential generated by the crystal under these circumstances may be as large as 10 volts and the resulting current will be several microamperes. In the simplest form of this experiment, electromagnetic receivers of high impedance may be used to detect speech and music from the phonograph. Since the impedance of the crystal at acoustic frequency is about 300,000 ohms, the impedance of the receivers used should be very high—*at least a few thousand ohms.* The crystal itself can operate *several hundred receivers* in series and parallel. See Fig. 4.

Instead of using the phonograph to agitate the crystal transmitter, we can, by adding a diaphragm to the crystal, talk or sing against the diaphragm and thus excite the crystal to about the same degree that obtains with the phonograph record. Thus by singing against the diaphragm near a resonant frequency of the crystal housing, say at a frequency corresponding to "middle C" in music, or 256 cycles per second, *we can generate an alternating current* in the crystal of 20 microamperes and an open-circuit potential of 15 volts. The former may be

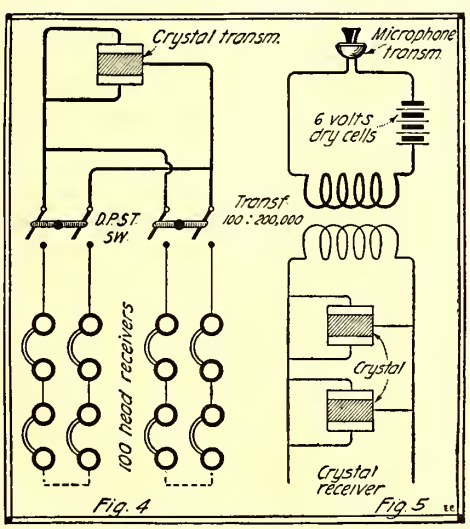
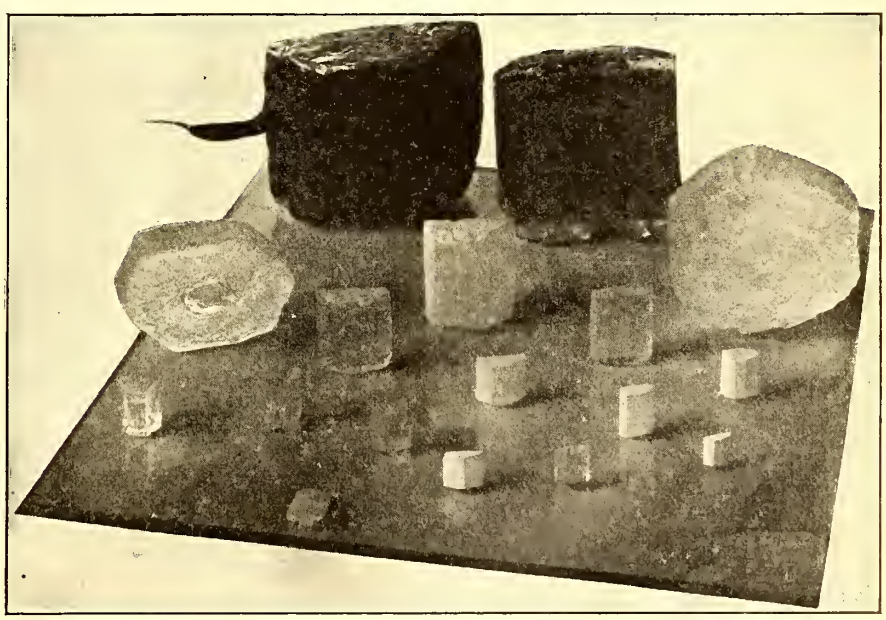


Fig. 4.—Circuit for Connecting Up 100 Telephone Receivers to Rochelle Salt Crystal Transmitter. Fig. 5.—Circuit for Crystal Telephonic Loud-Speaker. Photo at Right Shows Several Varieties of Rochelle Crystals.



www.americanradiohistory.com

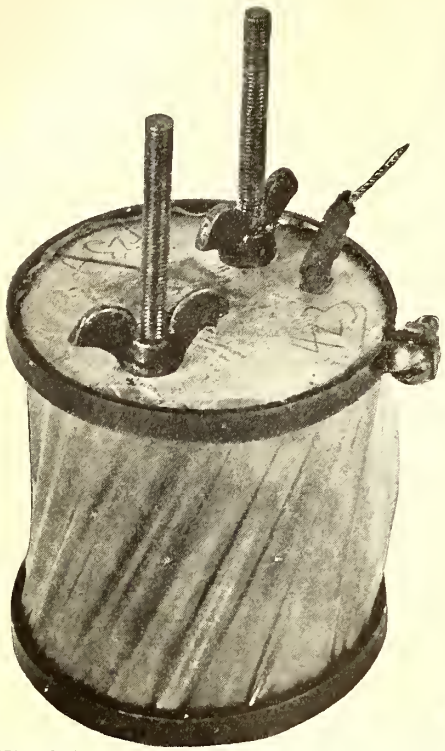
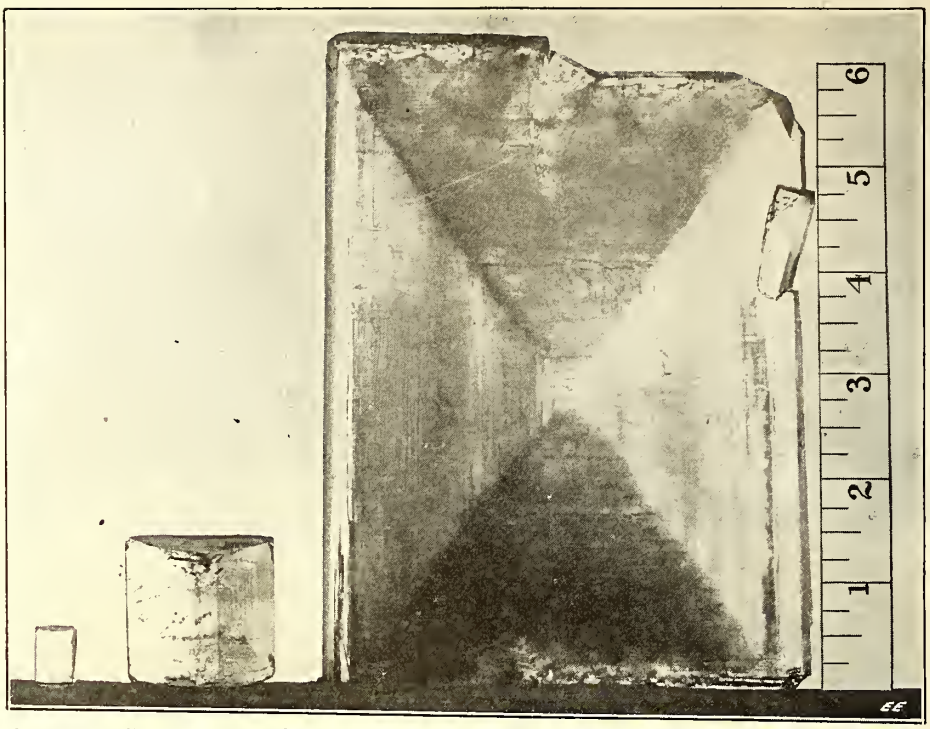


Fig. 3-A. How the Dressed and Mounted Rochelle Crystal Appears. The Diaphragm Is of Paper or Goldbeater's Skin Stretched Around the Outside as Shown.



Some Excellent Rochelle Salt Crystals "Grown" by the Author from "Seed Crystals." Some of These Crystals Have Been "Grown" as Large as Two feet and More. The Editors Have "Grown" Some Crystals Several Inches in Length Very Successfully, Following the Author's Instructions.

measured with a transformer, thermocouple and D. C. microampere meter, the latter with an electrostatic voltmeter.

The diaphragm used is rather novel. A strip of gold-beater's skin or even of paper (stiff bond) is wrapped around the spring compressors, holding the crystal, as in the first experiment, and metal bands tighten the strip on each of the two spring compressors. We now have a cylindrical diaphragm surrounding but not touching the crystal—yet conveying stresses to the crystal thru the spring compressors. The diaphragm, in order to be effective, must be corrugated as shown in Figs. 3 and 3A. This is done very readily by twisting the bands holding the diaphragm in opposing senses prior to its stretching and tightening. Usually a separate and removable appliance is used to perform these operations on the diaphragm.

Vibrations, due to sound waves, proceed from the cylindrical diaphragm thru the spring compressors, to the enclosed crystal. The crystal, when it is disturbed by the vibrations, converts these mechanical effects into corresponding electrical charges or currents, which may readily be detected in the receivers placed in the circuit.

Crystal Transforms Electricity into Speech.

But, as shown above, another interesting function of the crystal is that of a *receiver of electrical oscillations.* If we impress an alternating potential on the crystal poles and use the transmitter construction just described, then the crystal, itself vibrating under the electric stresses applied, will impart axial and torsional vibrations to the cylindrical diaphragm. Thus, corresponding acoustic effects will be produced which *may be heard considerable distances away from the crystal receiver.*

This experiment, using the crystal as a receiver, may be performed in different ways. Most simply, a carbon microphone may be applied as transmitter. This is shown in Fig. 5 with a local battery and high ratio transformer, which matches fairly well the low impedance of the local microphone circuit with that of the high impedance crystal. In this arrangement *the crystal operates as a "loud speaking" telephone* and may be heard several hundred feet away.

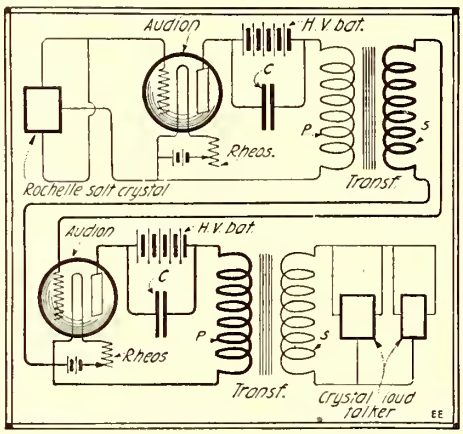


Fig. 6. Circuits for Connecting Speaking Crystal, Vacuum Tube Amplifier and a Second Crystal as a "Loud-Talker."

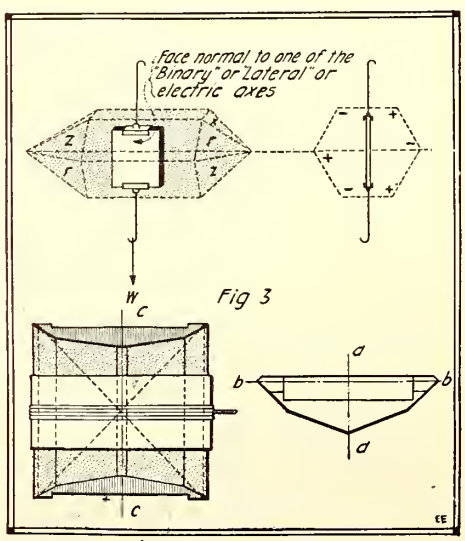


Fig. 7. Above:—Stress Applied to Quartz Crystal at "W" Produces Electric Current of Polarity Indicated. Rochelle Salt Crystals Act Similarly. Below:—Dressing of Crystals for the Girdle Orientation.

Another experiment is the use of crystals at both ends of a line. In order to increase the detecting and emitting effects of the piezo-electric crystal, the vacuum tube amplifier may be used. Fig. 6 shows a crystal transmitter, a crystal receiver, and an intervening two-stage vacuum tube repeater or relay. Speech and phonograph effects applied to the transmitter may be heard proceeding from the crystal receiver, with sufficient volume to fill a large auditorium. Under these conditions, if the crystal receiver is placed nearer than a few yards from the crystal transmitter, the receiver will *sing* to the transmitter. This well-known phenomenon in ordinary telephony is known as "howling" and is due, of course, to the presence of local free energy, of battery or amplifier, which will maintain circulatory oscillations of the acoustic and electrical effects.

At present the efficiency of these crystals, as defined by the ratio of the *output* to the *input*, is not high. This is principally because of the difficulty of associating a perfect *housing* with the crystal. The housing, is, of course, necessary in order to translate vibrations to or from the crystal. The efficiency becomes greater only when the frequency of the applied vibrations is close to that of the natural frequency of the combined crystal and its housing. Hence the comparatively large values of the alternating currents and potentials generated by the crystal when it is operated near any of its resonant frequencies—for, it may have several modes of vibration.

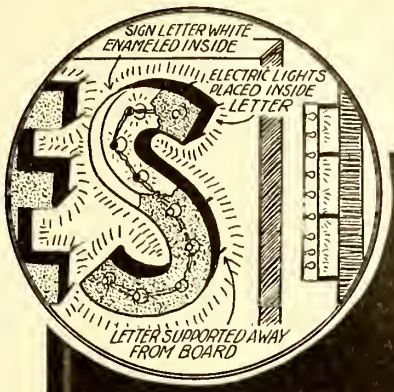
Some day it may be possible to pick up a pebble from the beach, place it to the ear and listen to voices spoken to another pebble found on some other shore.

[*As transmitters and loud-talkers, these crystals produce remarkable results and the amateur will be well repaid by his results, provided he follows the instructions given in this paper. As detectors for wireless telegraphy, however, they are practically valueless, if used in the regular way. Perhaps some amateur may some day hit upon a scheme which will produce the much-looked-for perfect crystal.*—EDITOR.]

www.americanradiohistory.com

Electric Sign With Indirect Lighting

The accompanying illustration of an electric sign, and which is mounted on the north side of 73rd Street and Broadway, New York City, involves a new departure of electrical advertising displays of this type. Instead of outlining the forms of the letters on the sign with electric light bulbs or illuminating the entire sign by indirect or flood lighting, reflected on to it from long reflectors placed at the sides and at the top, as is quite common practice, the letters themselves in this new sign form



One of the Newest Wrinkles in Electric Sign Design Is That Here Shown. The Letters Stand Out in Black Relief Owing to the Arrangement of the Lamps, Which Are Placed in Back of the Hollow Letters, as Illustrated in the Sectional View.

the reflecting troughs, in which the lamp bulbs are mounted. The inside surfaces of the hollow letters are painted white so as to serve as reflectors. The lights are supported at a short distance from the sign itself by means of iron rods as shown in the detail illustration herewith. In this way the letters seem to stand out in relief on the face of the signboard, and give a very pleasing and mysterious appearance indeed. The effect is much the same as that obtained when looking at an ordinary photograph, and then viewing a stereoscopic photograph of the same view or object with the aid of a stereoscope, when, of course, the images on the photograph appear to stand out in bold relief.

Aviators Instructed on Electric Chart

Many ingenious devices as well as mov- g pictures and electrical chart boards, and pecially illuminated maps, were devised id employed in training American aviators



ring the World War. Some of these ndered such excellent service and gave so ich promise that they have been retained d improved upon for utilization in the regular aviation training schools of the Army and Navy Departments. One of the most difficult things which the military or naval aviator has to learn is to shoot accurately while flying in the air. To the layman this may sound quite simple, but it is far from being such, and the experts who train aviators for this duty know it.

One of the methods used for instructing the soldier aviators in which electricity played its part is here presented. The bright spots indicate the positions of small incandescent lamps behind the screen on which the airplanes appear in various flying attitudes. These were all flashed on for the picture, but ordinarily are not visible. Aiming and firing practice is accomplished

Clever Electric Chart Board for Instructing Aviators in Firing at Enemy Planes. After the Dummy Machine Gun Has Been Sighted, the Lights Are Flashed On and the Gun Is Checked With Them.

by sighting a dummy machine gun at the position ahead of the plane, so that the time of travel of the bullet will be the same as that of the plane, and therefore it will reach a vital spot. After the sighting is completed, the lights are flashed on and the gun setting is checked by them. The three spots indicate the correct setting of the gun for various plane speeds of 75, 100 and 125 miles per hour.

"Casting" Motor Windings

A new type of rotor with cast winding, ich has been recently designed by one the leading electrical concerns, presents w features and improvements worthy of tice.

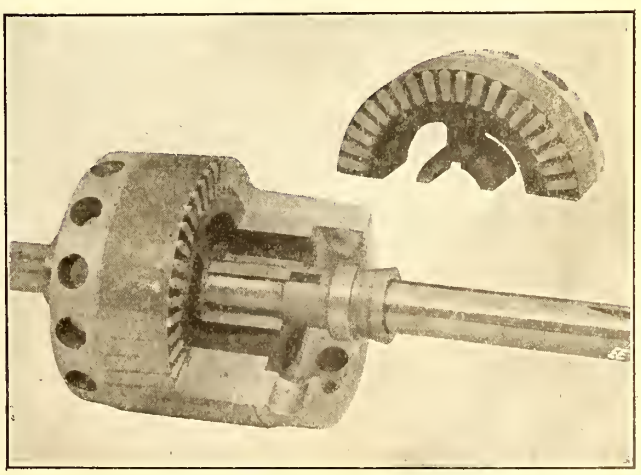
The bars and short-circuiting rings com- sing the windings employ the same mate- l and are cast in a single operation. With windings thus made a solid unit, rigidity, rability and better balance is produced. e cast winding from an electrical point view also insures uniform cross section d union between the bars and the end igs. This has become a factor in elimi- ting operating difficulties due to open- cuiting of joints between bars and end ngs.

Holes bored radially thru the cast end ings give effective ventilation for rotation n either direction.

The new cast winding rotor is said to e especially effective on induction motors of the *Squirrel Cage type*. The illustration shows a sectional view of the cast rotor.

The American Electrical Manufacturer Is Always Intent Upon Producing Machinery in Large Quantities and One of the Latest Departures in This Direction Is in the Form of a "Cast" Motor Winding. This Particular Cast Motor Winding Is a Squirrel-Cage Rotor for an Alternating Current Induction Motor. Not Only Is This Idea Mechanically Advantageous, but It Is Also Said to be Very Superior in the Electric Efficiency Achieved.

Each year sees more and more the mechanical manufacture of such parts of machinery as this.



www.americanradiohistory.com

Beauty by the Kilowatt



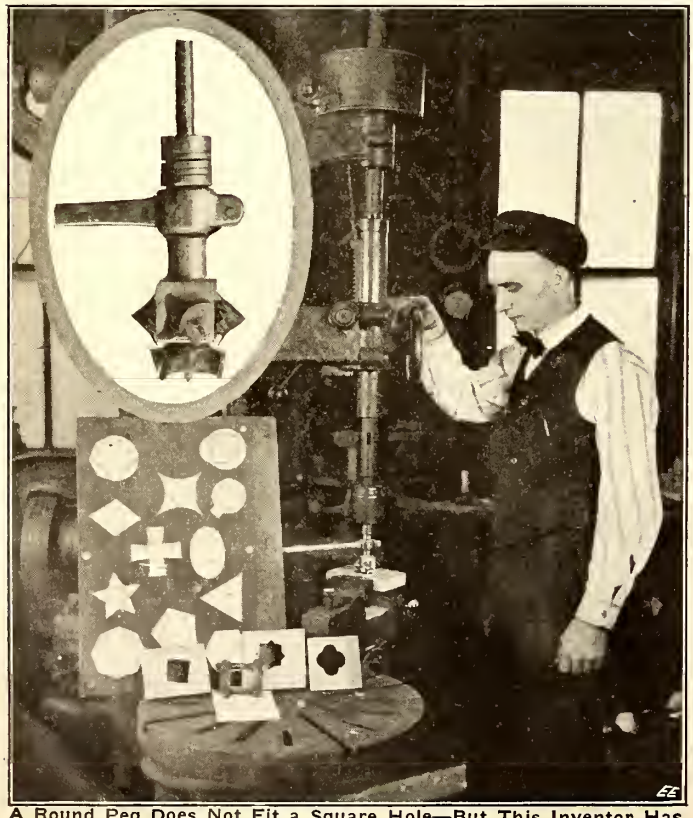
London, England, Has Started on a New Road to Fame—Making Women Beautiful by Electric Tattooing! A Permanent "Peaches and Cream" Complexion Is Yours, Gwendolyn, for Six Bits.

We have always been under the impression that the English women were blest with one of the finest complexions in the world, but here comes a cable from London telling of the popularity accorded to a new fad in the English city—that of electrically tattooing a permanent complexion or blush on the face. The report goes on to say that the pallid and sallow faces of London women are being permanently brightened and given a rosy tint by expert tattooists, whose electric needle applications can be graduated to suit any physiognomy, and further, that the tattooists report they have never done such a thriving and profitable business among women as now.

Howsomever, and be that as it may, our artist has depicted in the accompanying illustration one of London's fair damsels receiving the electric tattooing treatment for a permanent rosy complexion. Such an outfit comprises an electric tattooing needle operated from a battery and supplied with current thru a flexible wire, while a small rubber tube leads thru the needle proper to whichever complexion is selected by the customer. In some of these tattooing needles the coloring pigment is contained in a small hollow chamber on the base of the needle itself. We presume this fad will cross the ocean and become a new art on Broadway—the lane of many brilliant accomplishments, the least of which is Beauty.

Drill Bores Square Hole

Did you ever have a dream of a drill that would bore a square hole? All of us have at one time or another, perhaps. An auger *to bore square holes* has at last been invented by Carl H. Schmidgall of Peoria, Ill. The simple tool works its way by rotary motion thru wood, iron or stone. It is really five augers in one—four little conical rotary cutters milling out the corners of the square after the main shaft has bored a round hole. Drilling a square hole thru a one-inch piece of marble by present methods takes four hours or more of careful work by a skilled man. The new invention does it in five minutes. There are only a dozen parts in the machine, and, according to experts, it can be manufactured at a comparatively low price. A simple variation in the shape of the cutters makes possible the boring of holes of many different shapes.



A Round Peg Does Not Fit a Square Hole—But This Inventor Has a Circular Drill That Bores a Square Hole.

Mr. Schmidgall has been working on his invention since he was twelve years old. He is now twenty-nine, and operates the biggest hand-made tool shop in Illinois, outside of Chicago. Master mechanics from all parts of the United States have recently visited his shop to look at the square hole auger.

HANDLESS, HE USES TELEPHONE.

In the latest bulletin as issued by the American Red Cross we come upon the remarkable story of a man whose arms were amputated midway between the elbows and wrists. The best way to tell his story perhaps would be to quote directly what this man has done and is doing:

"At the time of the accident the oscalcis was removed from my left heel with tendon of Achilles. A brace made of steel, leather, and felt is a substitute for the tendon of Achilles, and with it I can walk several miles every day with ease. I frequently walk five miles just for the joy of walking.

"I have the following implements, each of which has a fitting that is an exact duplicate of the butt ends of the hooks. These hooks and the implements fasten into the wrist plates of the artificial arms with a spring catch, so that I can release either or both hooks and insert the other implements at will:—Knife, fork, and spoon for eating; hair brushes; tooth brush; whisk broom and hat brush; blacking brush for shoes; Gillette razor and lather brush; tooth-pick; fountain pen; match-holder; telephone-holder.



Without Hands—He Uses Telephone. A Striking Example of the "Reconstruction" Work on Crippled Soldiers Being Performed by the Red Cross Hospital Experts. Soldiers Without Arms or Minus Perhaps One or Both Legs, Are Being Trained to Do Most Everything Any Normal Man Can Do. They Are Taught Clerical Work, Drafting, Painting, and Many Other Arts and Trades.

"On the dressing table in my bedroom, I keep a pair of extra long hooks with which I put on and take off collar and necktie. The remainder of dressing and undressing is not with the standard hooks which are not long enough to reach collar button at throat. I button the collar at back of neck before I put the shirt on. I dress in about twenty minutes and undress in about half that time. Shaving takes from twenty-five to thirty minutes, depending on condition of razor. I do this entirely alone, washing and drying face afterward, taking the razor apart and drying it and changing razor blades when they are dull. Brushing hair and clothes, attending to teeth, and shining shoes are simple matters.

"I meet with little difficulty in telephoning, or the ordinary routine of desk work. Have been receiving good living wages for more than twelve years.

"About four years after my accident, I married one of the several nurses that helped care for me in the hospital. We have four children."

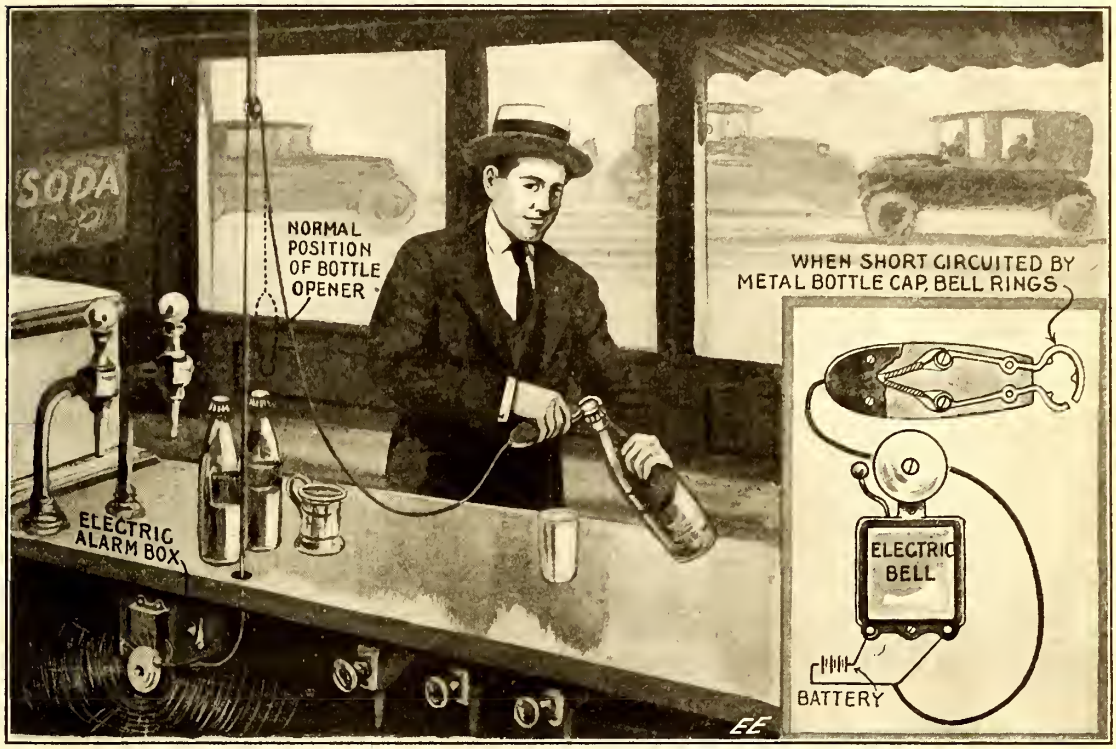
Thus the great work goes on—every day sees new and more remarkable developments in helping the lame to walk and the sick to get well.

www.americanradiohistory.com

Soda Water Bottle Alarm

The thousands of owners of small soda water stands all over the country annually lose hundreds of dollars due to people helping themselves to the various drinks when the proprietor is conveniently absent. To mitigate this loss to the owners of soda water stands the inventor, Mr. Charles F. Scarborough, has brought out a clever, electric alarm which is combined with a bottle-cap opener in the manner here shown.

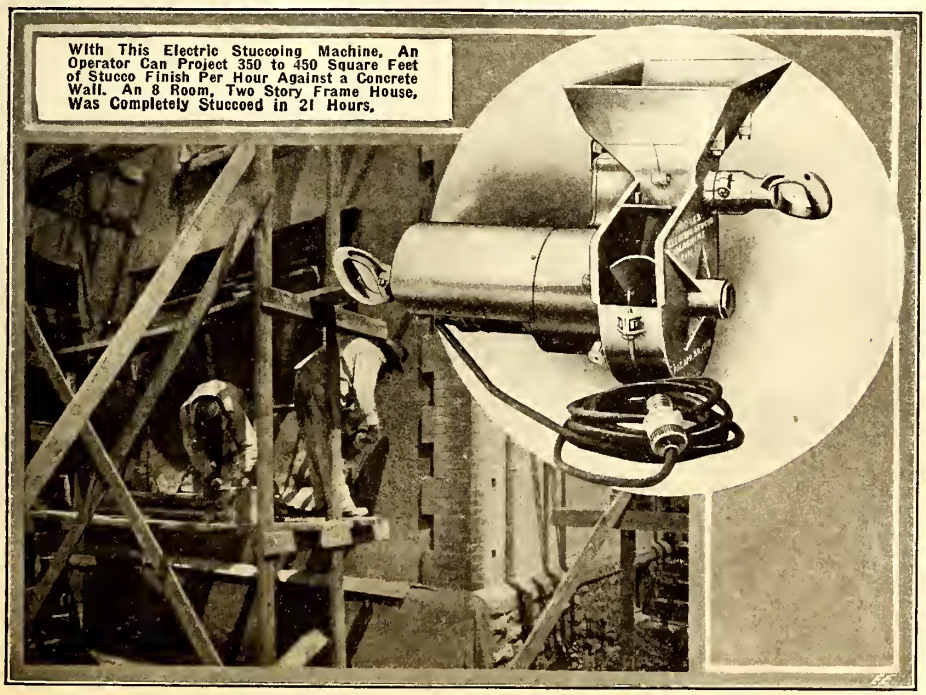
The alarm apparatus comprises a dry cell battery and bell mounted in small box, which can be placed out of sight so far as the customers are concerned. A flexible duplex wire or cable leads from the alarm box to the bottle-cap removing device. This cap remover comprises two distinct and thoroly insulated metallic rings which are connected to the bell circuit. If the circuit is closed as would be caused by a piece of metal coming in contact with the two metal fingers of the cap remover, then it will sound the alarm. Such soda bottles are usually opened up by a regular cap-remover and to make sure that the person desirous of stealing a drink, will use the electrified bottle opener, this is placed in as conspicuous a position as possible as the illustration shows. He grabs the cap remover, and the minute that it is placed in contact with the metal cap of the bottle, the circuit is closed—the bell rings, thus notifying the proprietor that he has "customers".



An Electric Soda Water Bottle Alarm, Which Has Recently Been Patented. It Comprises Two Electric Contacts Fitted in an Insulating Handle, Which, When Short-Circuited by the Metal Cap on the Soda Bottle, Will Cause the Bell to Ring.

Stuccoing Houses by Electricity

A recent house-finishing development is a motor-driven stucco machine by which the material is applied by projecting it from the machine by centrifugal force set up by revolving spider blades. The manufacturers of this device state that by applying the stucco in this manner, a skin, or enamel, is formed, making an outside coating which is impervious to moisture. As an instance of the speed at which the machine works it is said that an operator with a helper to supply the material can project 350 square feet an hour against hollow tile, brickwork or concrete blocks, and a trifle less against such material as metal or wood lath. The equipment is light in weight, aluminum castings being used for the frame and tool steel for the revolving spider blades and automatic feed. The weight of the motor, therefore, represents the greater part of the total weight of the machine. An auxiliary hopper is provided by which pebbles, crushed granite and similar materials can be effectively thrown into the stucco base.



With This Electric Stuccoing Machine, An Operator Can Project 350 to 450 Square Feet of Stucco Finish Per Hour Against a Concrete Wall. An 8 Room, Two Story Frame House, Was Completely Stuccoed in 21 Hours.

All of the work on an eight-room, two-story frame residence, including piazza posts, was accomplished with one machine, and the actual running time of the machine in completing the entire contract was just 21 hours. The lapsiding was not removed, but is covered with a saturated felt paper, against which was nailed the metal lath and the stucco then applied. The metal lath was completely imbedded within a projected depth of 5/8", and after being roughly floated, the white stucco finish effect was projected with the machine.

The following will be found a conservative average estimate of stucco projected by this clever machine.

Against a poured concrete base, a coat of stucco from 1/4" to 3/8", an operator should project 350 to 400 square feet per hour; against unpainted brick, hollow tile, concrete blocks, and like materials or construction from 300 to 350 square feet per hour; against Bishopric Board and like wood, lath backing, in filling up the keys and projecting as above, 300 to 350 square feet per hour; against Gypsum Plaster Board and other like materials from 400 to 450 square feet per hour.

Against Metal Lath furred out 1/4" with a backing of building or tar paper applied to a sheeted surface or studding, 350 to 450 square feet per hour.

www.americanradiohistory.com

Popular Astronomy

By ISABEL M. LEWIS, M.A.
Of the United States Naval Observatory

IS THE MOON A DEAD WORLD?



Photograph of the Moon Taken with the 60-Inch Reflecting Telescope of the Mt. Wilson Observatory Showing Regions of Albategnius and Hipparchus. This Photograph of the Moon Shows All the Varieties of Walled-Plains, Ring-Plains and Craters as Well as a Number of Conspicuous Clefts and Rills. Almost Exactly at the Center Is the Walled-Plain Albategnius, 65 Miles Wide, and Adjoining It on the North Is the Walled-Plain Hipparchus Nearly 100 Miles Wide. This Is One of Many Walled-Plains That Clearly Show Signs of Wreck and Ruin. Note the Superimposed Craters of a Later Origin. Just to the Northeast of Albategnius Is the Great Walled-Plain Ptolemaeus, 115 Miles Wide. In Its Interior to the Northwest Is a Very Conspicuous Little Crater 4 Miles in Diameter. Almost Due North of Ptolemaeus Is the Typical Ring-Plain Herschel, with a Rampart Rising Nearly 10,000 Feet Above a Dusky Floor From Which Rises a Central Mountain Peak. The Rampart Is Symmetrically Terraced Both Within and Without. To the Northwest of This Ring-Plain Is a Deep Lunar Valley About 80 Miles Long and in Places 10 Miles Wide. South From Ptolemaeus Extends a Long Chain of Great Walled-Plains Reaching to the Southern Border of the Photograph. Near the Western Border Which Marks the Terminator Appear Ring-Plains and Craters in the Greatest Profusion and the Harsh, Black Lunar Shadows Are Very Conspicuous. The Distinction Between Walled-Plains, Ring-Plains and Craters Becomes Clear From a Careful Study of This Photograph.

SUSPICIONS that changes are continually taking place in certain surface markings of the moon have been held for many years and as the face of our nearest neighbor and satellite is scanned more carefully from year to year with telescopes of high power these suspicions are being confirmed, rather than disproved, by many diligent and careful observers.

It has been estimated that at an elevation of about one mile above the surface of the moon the density of its atmosphere is only one ten-thousandth that of our own atmosphere at an equal elevation. It is, therefore, impossible for water to exist in the liquid form on the moon at moderate elevations, tho it may exist in the form of water vapor, hoarfrost or snow.

Comparatively recent researches of Very indicate that the highest temperature to which the surface of the moon is heated in the middle of the long lunar day, equal to fourteen of our own days in length, is probably about 200° F. During the long lunar night the heat rapidly escapes owing to the extreme rarity of the lunar atmosphere and within a few hours the temperature probably drops far below zero and at the lunar midnight may approach closely to the absolute zero of interplanetary space or —473° F.

If there were no other causes to produce changes in the lunar surface markings, it might be expected that these great extremes of heat and cold alternating periodically would register their effect upon the face of our satellite.

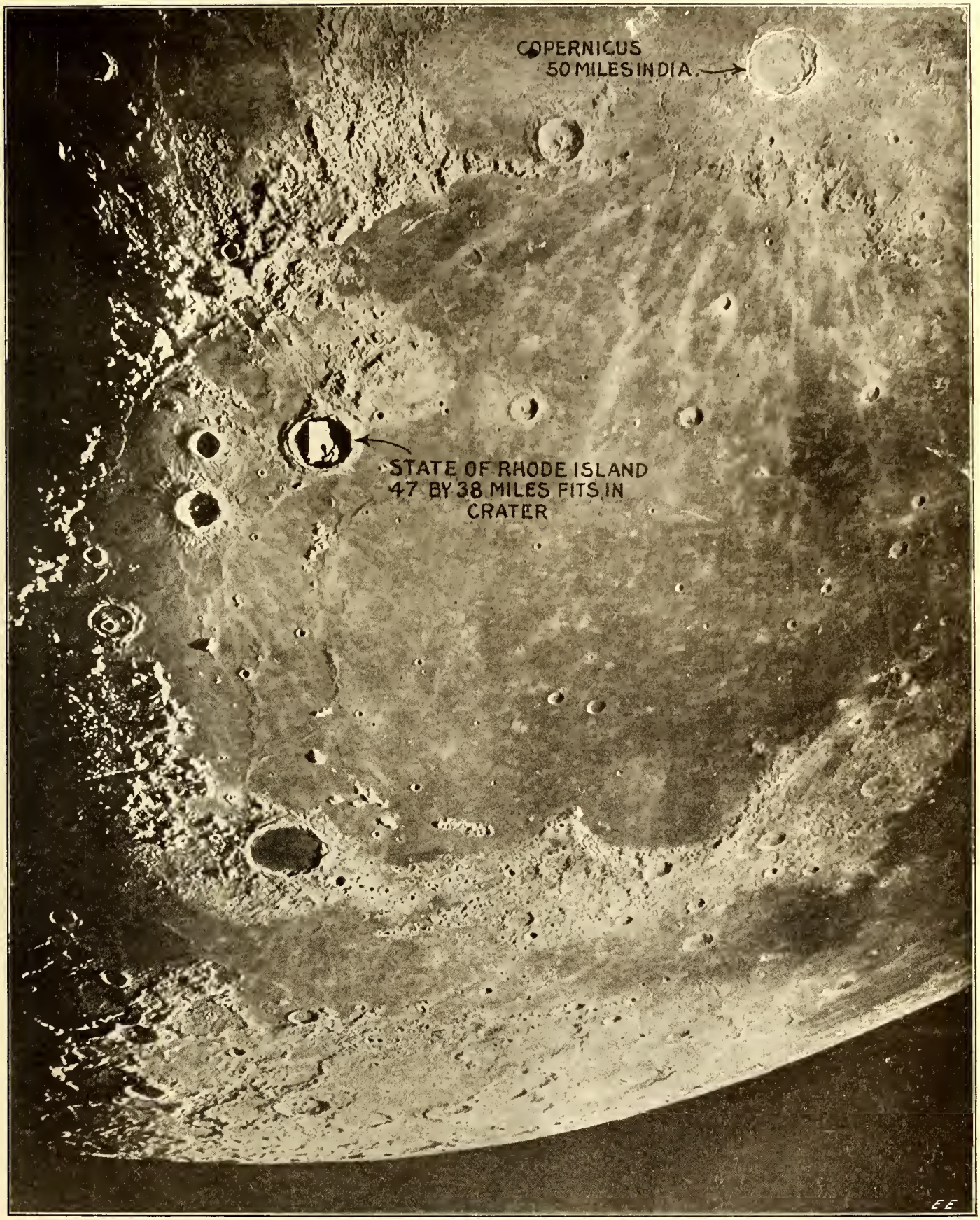
The evidence of change in the appearance of lunar features, aside from the expected and periodic changes due to variations in the lunar phase and altitude of the sun, which are of course not changes in the markings themselves, is to be found chiefly in connection with the more minute markings such as the crater-cones and

(*Continued on page* 820)

An Enlarged View of the Moon Taken by Ritchey With the 40-Inch Yerkes Refractor Showing Ray System of the Ring Plan Tycho (to the South), and of Copernicus, One of the Most Conspicuous and Magnificent of all Lunar Features (to the Northeast, Near the Lower Rim of the Photo). The Dazzling Whiteness of the Southwest Quadrant of the Moon Contrasts Sharply With the Dark and Comparatively Smooth Maria or Seas to the North and East. The Nearly Enclosed Sea, Mare Humorum, is Shown Near the Center of the Eastern Rim of the Photo. Its Area Is Approximately 50,000 Square Miles. The Walled Plain Gassendi, on its Borders, 55 Miles in Diameter, is One of the Most Beautiful Telescopic Objects on the Lunar Surface. A Lunar Mountain Range, the Riphaean Mountains, Is Shown a Little to the Northwest of the Mare Humorum. The Highest Peak is About 3,000 Feet Above the Surrounding Region, Which is a Very Moderate Lunar Elevation. This Is One of the Least Important Lunar Mountain Ranges. Close to This Mountain Range Is the Little Crater Euclides, 7 Miles in Diameter, One of the Most Brilliant Objects on the Lunar Surface; the Region Surrounding the Crater Is Equally Brilliant. The Ray Systems of Tycho and Copernicus are the Most Consnicuous of These Peculiar Markings Which are Found Associated With a Number of Other Lunar Craters. According to Prof. W. H. Pickering, Who Has Very Carefully Observed Them Under Excellent Observing Conditions, the Rays of Tycho do not Come From the Center of the Crater, But Orioinate in a Number of Minute Craters That Lie on the Outer Rim; While the Rays of Copernicus Originate in Craterlets Lying on the Inner Slopes of the Ramparts, Ascend to the Summit and then Spread Out Over the Surrounding Mare in Feathery Streaks.



www.americanradiohistory.com

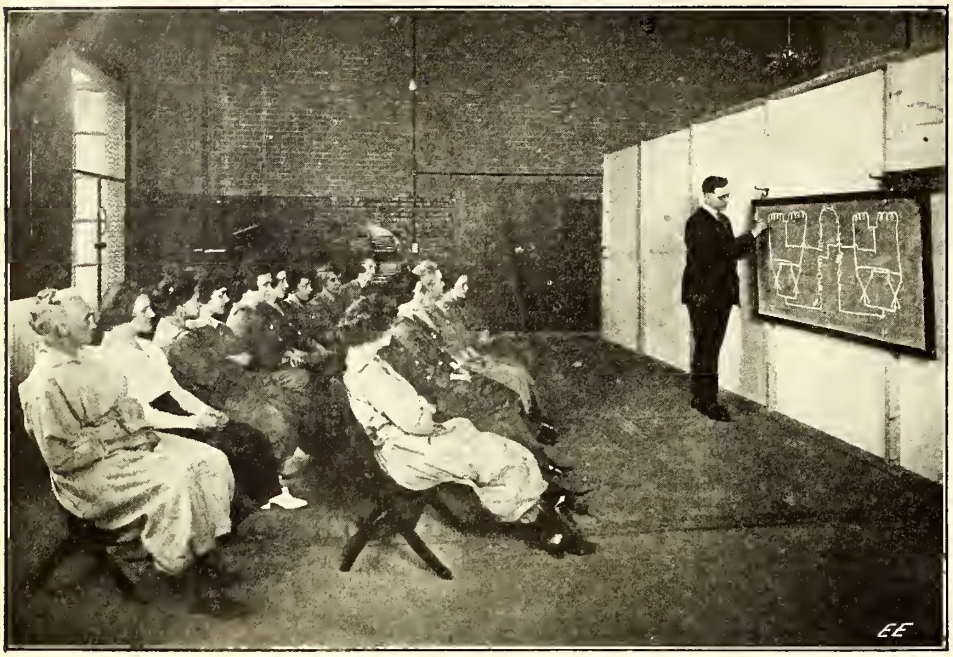


Wide World Photos

The World's Great Satellite at Closer Range Than Ever Before Seen by the Eyes of Man Was Made by the New Hooker Telescope of Mount Wilson Observatory of the Carnegie Institution of Washington, Just Installed, and Was the First Taken After the Telescope Went Into Commission. The Picture in Detail and Definition Is Superior to Any Hitherto Made. The Mirror of the Telescope, the Largest Yet Constructed, Is 100 Inches in Diameter. The Scale of the Illustration Is About One Hundred Miles to the Inch, or a Little Less Than Eight Feet to the Moon's Diameter. The Mountains Above and to the Left Are the Lunar Apennines; Those on the Left Below the Centre Are the Alps. Both Ranges Include Many Peaks From 15,000 to 20,000 Feet in Height. The Ring-like Formations Are the So-Called Craters, Most of Them Far Larger Than Anything Similar on the Earth. In the Upper Right Corner Is Copernicus, About Fifty Miles in Diameter. The Largest of the Conspicuous Group of Three Just Below the Apennines Is Archimedes, and at the Lower End of the Alps Is Plato. Attention Is Called to the Long Sunset Shadows Cast by the Isolated Peaks on the Left, and the Shadows Cast Within the Craters by the Crater Shells Can be Plainly Seen. The Central Portion of the Picture Is a Vast Plain, the Mare Imbrium.

www.americanradiohistory.com

Training Women Sub-Station Operators



Sister and Auntie Go to the Electric School—It Happened in Boston—and Learn All About Dynamos and Motors, and How to "Parallel" Alternators; What a Synchronous Motor Is; What to Do When a Circuit-Breaker "Opens"; Yes, They Learned Easily, Says Their Instructor.

The accompanying illustration shows women substation operators being trained at one of the power stations of the Edison Electric Illuminating Company of Boston. We do not usually associate electrical diagrams, circuit breakers, dynamos and storage batteries with women operators, possibly because we are not used to them, and being used to anything is mostly nothing more nor less than a habit. As we become used to these newer adventures of the fair sex in the electrical and mechanical branches of applied science, we shall, after a while, think nothing of it. Women substation operators have served faithfully and well in many power stations in England during the war, and undoubtedly will continue to serve in these capacities. It is a common practice both in this country and abroad for all women operators running power houses and substations to wear modified overall suits, so as to eliminate the danger of loose clothing being caught in any moving machinery. We know that women's minds are very subtle and quick to respond, and moreover they are eager and quick to learn, in any trade or art which they may set their minds on. We therefore presume that the serious-faced students of electric power house matters shown in the accompanying photo have graduated into full-fledged switchboard and dynamo operating experts.

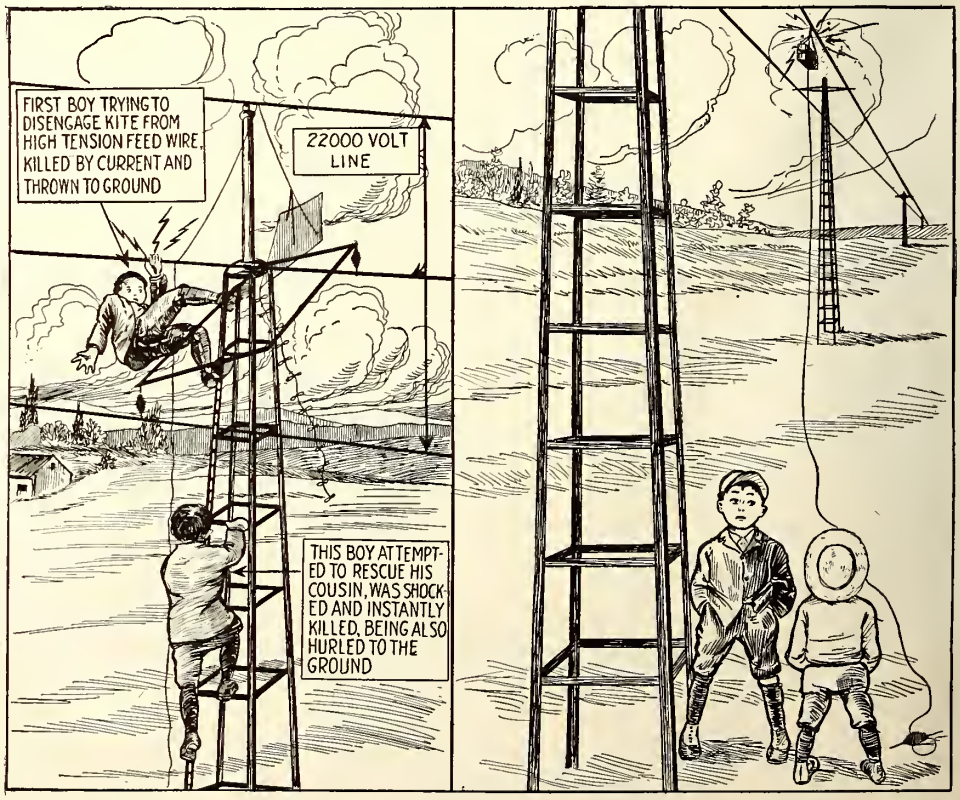
Ye scribe, having spent several long and patient years in power houses, pauses to philosophize on the mental equilibrium of the lady switchboard operators and dynamo tenders at the psychological moment when about steen thousand amperes charge over the line on a "dead short," and "blows" the breakers and perhaps the dynamos, too, with a roar like a young Niagara and flashes of fire like Pain's fireworks on the Fourth of July at Brighton Beach. And that is not all, for when a large steam main goes blooey and starts spitting out several hundred cubic feet of super-heated steam per second into the power room, they will think the end of the world has surely come; as the station fills up with steam accompanied by a deafening, seething roar as the steam escapes. But probably they will get used to these things the same as the male operators, and after one good initiation or so, never mind such little things as a 500 per cent overload short-circuit on the main generator bus-bars. We said "probably." But who can tell?

Two Kite Fliers Killed by Live Wire

Two boys came to their death recently at Winsted, Conn., as a result of contact with a high tension electric wire carrying 22,000 volts. Edward Isaacson, Jr., 13 years old, and his cousin, Walter Lindblad, also 13, were flying a kite on the elder Isaacson's farm when the kite caught in the electric wires atop a 50-foot steel tower.

The boys tried to disengage the kite and failing climbed the tower. Young Isaacson touched one of the wires carrying the heavy voltage and was thrown across the feed wire, dying instantly. Lindblad tried to assist his cousin but the current coursed thro his body and hurled him to the ground, where he was picked up dead.

The accompanying illustration shows how the current past thru the victim's body to earth. On such high tension lines all you have to do to get electrocuted is to touch one "live" wire; there is always a cross current or leak current somewhere which will complete the circuit as soon as this act has taken place. It is not safe to touch one rubber covered wire of a 2,500-volt feed circuit, let alone a 22,000-volt line. The electric chair requires only 1,800 to 2,200 volts to electrocute a man, and if you bear in mind that people have been electrocuted by touching a circuit carrying as low as 110 volts, then you will be extremely careful about touching any wires. If you are not the electrician who is *familiar* (understand that word) with the wire or pole in question, **leave it alone!** It may spell death. Electricians included.



How Many Volts Kill? Sometimes 110 Volts Will Kill; 500 Volts (Trolley Lines) Liable to "Jar" You to a Fall; 1,000 Volts—DANGEROUS! 1,500-2,000 Volts—FATAL. (1,800-2,200 Volts Used in the "Electric Chair".

Don't Fly Kites Over High Tension or Other Electric Wires. If the String Drops on the Wires, Even if Dry, You May Be Severely Shocked or Killed. Don't Touch the String—Leave It Alone.

www.americanradiohistory.com

The Amateur Magician

By JOSEPH H. KRAUS, Jr.

THE MAGIC BELL.

PROFESSOR HARGRAVE was known to all magicians as the originator of many ingenious tricks and sleight-of-hand passes and consequently aroused a feeling of considerable jealousy among others in the same field of work which he himself was engaged in. When, however, he made arrangements to publish broadcast those of his more spectacular tricks, the Magicians' Council, an order of the "Black Art," as that science is known, attempted to stop him, but their efforts were fruitless.

By special courtesy this publication has secured his consent for placing some of his works before the public in such a way that the lay readers who are the least handy with tools can construct apparatus to duplicate his marvelous feats. With this end in view not only the "gift of gab," or magicians' "patter," as it is sometimes called, is given, but also the constructional data are given. Let us attend one of Prof. Hargrave's performances.

"Good-morning, ladies and gentlemen," ventured Professor Hargrave, as he stept onto the stage in a recent performance at one of our largest theatres, "Evening, did you say?" he continued, "Oh, yes, to be sure it is, how absentminded I am. Well, what shall be your pleasure? This?" as he pointed to a beautiful bell hanging on a highly polished stand. "Very well."

Suiting his action to the words he reached for a pack of cards on one of the small tables and proceeded off the stage. Having had the audience select three cards,



View of the Glass Bell, Which Can be Made From an Ordinary Chandelier Shade.

he stept back to the stage again. Carrying the bell forward in full view of the audience and placing the stand right down front, he exclaimed:



The "Mystery Bell"—The Magician Shows That the Bell as Well as the Hook Upon Which It Normally Hangs, Including the Stand Separating the Bell, Are All Separate and Independent Pieces, Having No Strings or Electric Wires Attached to Them; Yet When the Bell Is Replaced on the Stand and Combined With the Stand Support, It Taps Out the Answers to Various Questions Asked by the Audience. It's Easy When You Know How!!

"Now, friends, I don't want to deceive you." He removed the hook from the rest of the stand; passing the hook to the public on one side of the stage and the bell down the other.

"Now examine those two articles carefully and note that there are no strings to deceive you; that hook is genuine silver. I bought it myself at Woolworth's jewelry counter, an emblem of the first thing I got when I appeared upon the stage some years ago from the enthusiastic manager." (To wit—the hook!)

By this time the bell had come back and Professor Hargrave continued: "The bell answers by ringing twice for *yes* and once for *no*." Then placing the hook into its position in the remainder of the stand, and resting the bell on its hook, he added: "Don't you, bell?" to the beautiful object of glass and metal.

The bell pealed forth two melodious sounds.

"Well, bell, suppose you tell me the number of spots which were on the first card I gave out? Seven? Very well. Did the lady choose hearts?"

The hammer rose and descended twice in succession.

"Seven of hearts. Was that correct, speak out please?"

The victim answered in the affirmative.

"Thank you."

"Now, bell, will you please tell me the name of the next card? (You know I have to talk kindly to the Little Miss). How many spots were on that card?"

One ring was the answer.

"Only one? Well, was it a spade?" The response was *yes* again.

"Ace of spades, was that right, sir? Don't shake your head, because I'm too far away to hear it rattle."

"Now for the next card. Tell me the number of spots on that." Hargrave awaited an answer but no response from the bell. "What— don't you know?" The bell answered in the affirmative by ringing twice. "Well, tell me then." Again no response, whereupon the performer became excited, exclaiming: "I hope you will all excuse the bell, but I don't think she knows, so we will have to go on with the rest of the performance.

Ding-Ding, Ding-Ding, Ding-Ding.

Oh, you *do* know. Well? How many spots on it, please?"

(*Continued on page* 792)



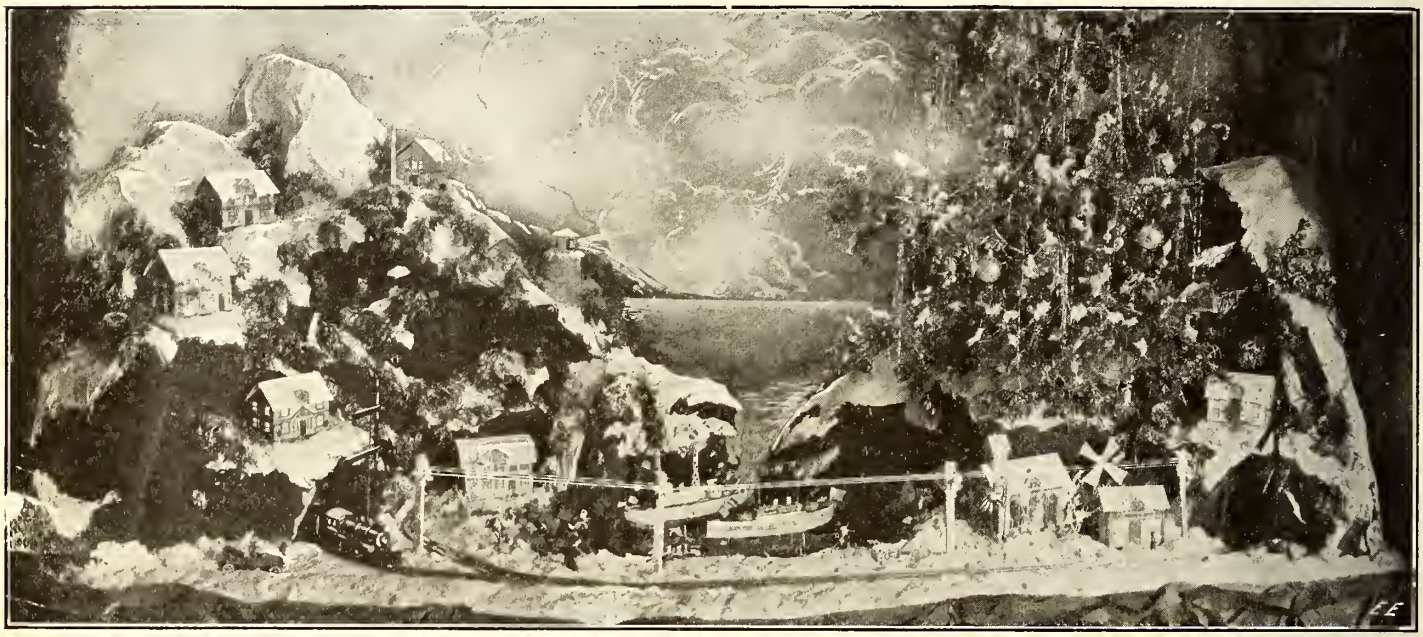
A Clever and Interesting "Card Trick" Which Anyone Can Perform at Parties and Evening Gatherings Without Lengthy Practise. The Performer Telling the Name of the Card Without Being Present. All That Is Necessary Is to Know the Number of Cards in the Tail of the "Q" Formation.

www.americanradiohistory.com

THE CONSTRUCTOR

A Model Electric Village

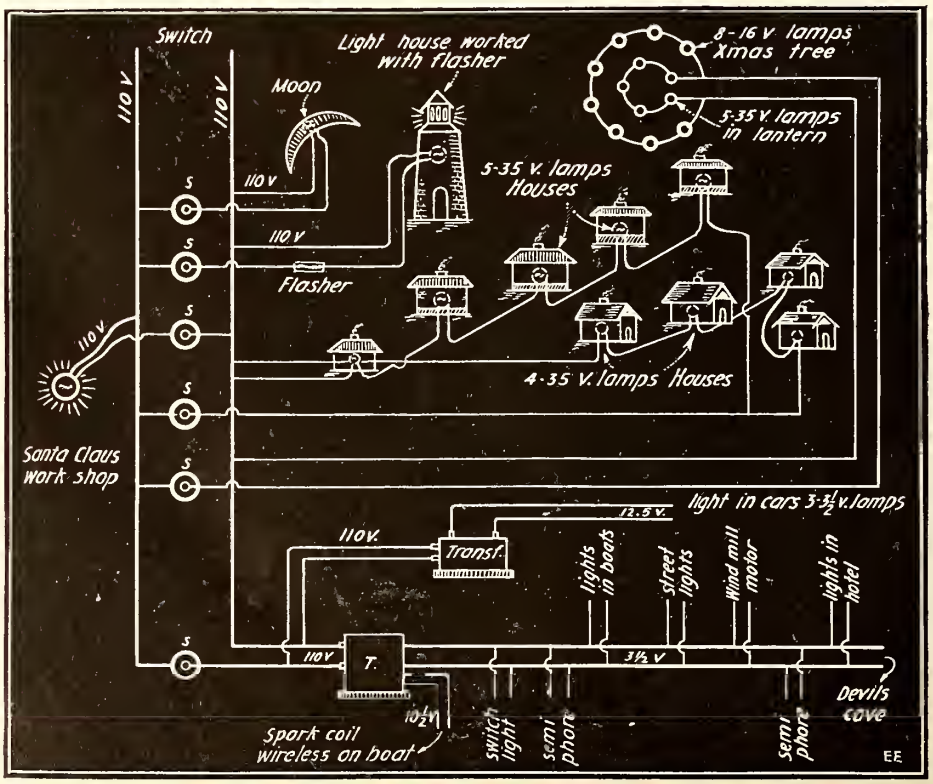
By FRED F. PHILLIPS



THE accompanying photos illustrate an electrical Christmas display that I got up for my boys, and as most of the ideas were taken from your magazine, I thought perhaps they might be of interest to your readers.

Three years ago I built a few simple electrical devices in connection with the boys' Christmas Tree, from ideas that I took from the EXPERIMENTER and the display made a "hit," not only with my own sons, but with a great many others and also the grown-ups in the vicinity. This has been followed by adding something new each year and the display here illustrated is the result of last year's work and I trust that thru new ideas gained in 1919, to build something more elaborate this Christmas.

Herewith is a diagram of wiring plan; this plan does not show telephone wires from rear of house to display in front room. I had a phonograph in the rear of the residence and transmitted music of bells and other Christmas pieces to the little church in the display. The mountains were built of wire netting over boxes and newspaper was used to cover them, the same being wet with flour paste and shaped over the wire, about 8 or 10 thicknesses were used. After it was dry, the same was painted with water color paints; white paint was used for snow and fireproof snow, such as is sold in the stores for the holidays, was used to make it sparkle. The boats are in a tank 4 feet square and 2½ inches deep; connections for lights in them and wireless on them, were run thru rubber tubing. The tank is made of tin. The light-house is made of tin and connected up with a flasher, made according to a diagram given in the EXPERIMENTER.



Wiring Diagram for Electric Christmas Tree and Village.

The back-ground is a piece of cheap canvas painted with water colors; inside the left-hand mountains, viewed thru a peek hole, was Santa Claus' work-shop, built on the idea of the old style candy Easter eggs. In the right-hand mountains was the "Devil's cave," where the bad boys go. This does not show up in the photo very well, as the red photographs black; it was built of red paper with lights under the same, to appear as hot coals.

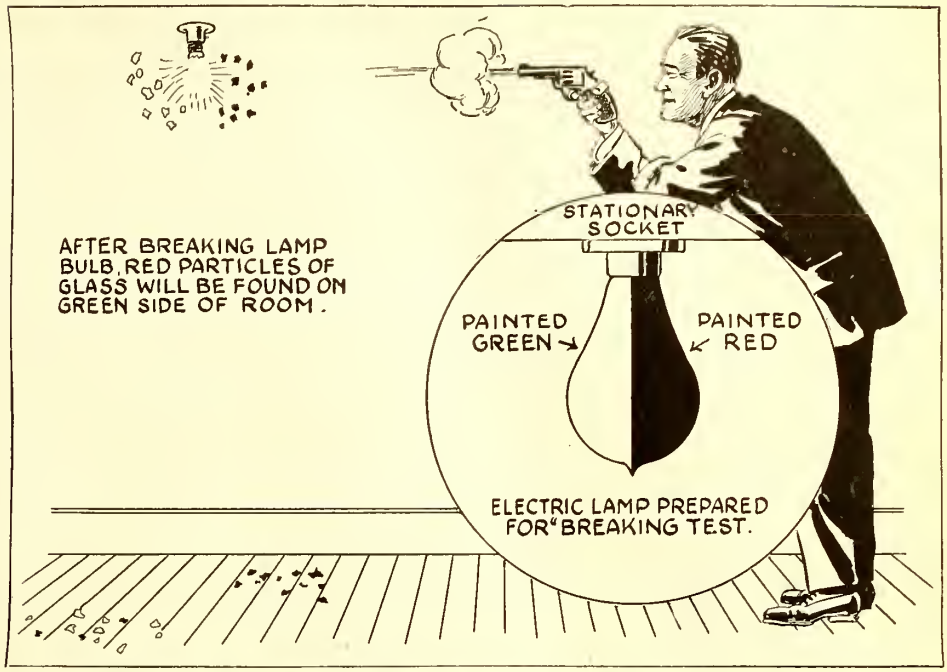
The miniature houses were built of cardboard and painted to represent different buildings. The display base was 3 feet from the floor, the display itself was 9 feet long, 4 feet wide and 6 feet high from the base.

www.americanradiohistory.com

Do Lamps Burst Inward or Outward?

When an electric lamp is broken by force the glass walls are driven inward and do not fly outward as generally supposed. To prove this take a burnt-out lamp bulb and paint one half of it red and the other green. Then screw it in a socket suspended in the center of a room so that it cannot revolve. Note the direction each color is facing. Then break the bulb with a shot from a revolver or air rifle. Upon examination of the bits of glass that are scattered on the floor red particles will predominate on the opposite side of room which this color faced before the lamp was shattered, and green particles will predominate on the opposite side from which it faced also. This proves that the pressure of the air crushed the glass walls inward instead of exploding outward.

Contributed by J. A. WEAVER.



Which Way Do You Think Incandescent Lamps Break—Inward or Outward? Paint One-Half the Bulb Red, the Other Half Green and Break It with a Pistol or Air Rifle Shot. it Bursts Inward As This Experiment Shows, the Colored Fragments Falling on Opposite Sides of the Room.

Photographic Experiments

By MARION B. REYNOLDS

"DODGING" photographs to bring out the artistic values in an apparently unartistic negative is one of the tricks of the trade which offers a great many possibilities, even for the amateur photographer. If one has either acquired or was fortunate enough to be endowed with a little patience and perseverance, plus a little ingenuity and imagination, there is no end to the variety of "stunts" one can perform with ordinary negatives.



An Ordinary Photograph by the Author—Note the Table Lamp. It Has No Glow About It.

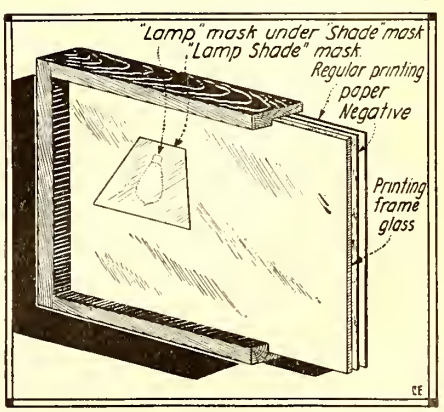


It Is Almost Impossible to Photograph a Scene Like This. By the Clever Use of a Simple Printing Mask, Such an Effect Is Readily Obtained from Any Negative.

One of these "stunts" is the introduction of artificial light in photographs snapped during the daytime, giving the effect of a picture taken in the evening. The accompanying photographs illustrate this point vividly. Obviously it is practically an impossibility to take a direct photograph giving the effect as shown in the photograph. With the average amateur's hand camera, the exposure would necessarily have to be rather long, as the only lighting used would come from a shaded lamp. A lengthy exposure would impose a trying job on the part of the sitter, as holding a position for any length of time is a difficult task and I will admit that he would have to possess a much quieter nature than I am blessed with. Then, too, halation would destroy to a great extent, the effect originally intended. This photograph was made on a bright day with a 3-A Folding Pocket Kodak, Rapid Rectilinear Lens, using Stop 16 and an exposure of four seconds. Incidentally I might say that it was taken by myself, using a black thread to release the shutter.

Printing the picture, producing the effect of a lighted lamp, was not a difficult procedure. The materials and equipment used were as few in variety as it is possible to work with and consisted entirely of amateur equipment. My printing frame glass happened to be thicker than is ordinarily used and very conveniently softened the lines of the masks used to obtain the result. The masks used need not be accurately cut as they are not used in contact with the negative but are placed on the *outside* of the printing frame glass. In making the masks, a piece of manila paper was cut to a shape resembling an electric light bulb, and another was cut to the exact size and shape of the lamp shade. In order that these masks might be placed in the correct position on the printing frame glass, the negative was placed in the printing frame and temporarily secured by means of gummed strips of paper. A piece of white unsensitized paper was then inserted in the frame so that the objects in the negative might be clearly defined. The first mask, cut to the shape of the bulb, was then placed in position with a little mucilage and the second placed immediately over it in the same manner, directly over the lamp shade in the negative, taking care to place mucilage only on the edges, making it possible to remove it without disturbing the first mask. After removing the white paper and replacing it with a sheet of sensitized paper, an exposure was made of about three seconds, using a very strong but soft light and dodging the lower portion of the negative with a triangular piece of cardboard. A second exposure was made of the same duration, but with the second mask removed, and a final exposure was made with both masks removed and without the use of the triangular cardboard. Upon developing the result, the effect was found to be just what was wanted.

Numerous other effects may be produced in this manner, such as a family circle around an open fireplace, or the rays of a light-house may be introduced in a daytime picture, turning it into a night scene. If one is willing to put a little thought and study into his experiments many other subjects and effects will suggest themselves, which if carried out will produce very pleasing results.



Showing How the Two Paper Shades or Masks Are Arranged in Front of the Printing Frame to Give the Effect of an Illuminated Table Lamp, As Shown at the Left.

www.americanradiohistory.com

The "Finer Workings" of Static Electricity

By FREDERICK VON LICHTENOW

THERE is hardly a branch of experimental electricity which requires a closer observation of its functional details than *Electrostatics*. The field itself, seemingly unlimited, not only offers a great variety of experiments, finished and complete in

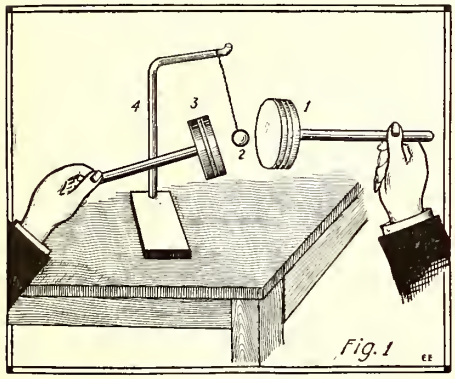


Fig. 1. Repulsive Action of Induced Charges. 1—Electrophorus Cover No. 1 (Charged). 2—Light Body (Pith). 3—Electrophorus Cover No. 2. 4—Insulating Stand

themselves and clearly demonstrating the basic principles of this element, but an additional multitude of variations from these—due to more or less marked changes in their conduction—which *in some instances* exemplify the "Finer Workings" of this earth-endowed mysterious power to a remarkable degree.

Many things about Static Electricity have doubtless remained unknown, just as well as even the action of the Wimshurst Static Machine, so long and widely used, is as yet not understood to the fullest extent.

Electrical experiments in general teach much; static experiments, however, are *in principle* and *in part* true replica of the great atmospherical movements and disturbances which occur above and around us, in consequence of which a favorable amount of conclusions regarding the latter may be drawn from these experiments. So much for static experiments in general.

Additional "clues" however, leading to the fuller understanding of this particular branch of the electrical science, may be gathered from experiments, which in a more or less pronounced way, expose the "Finer Workings" of static electricity.

Only the simplest apparatus is needed for their reproduction, in fact, weak charges-sources are a necessity to that end, since the

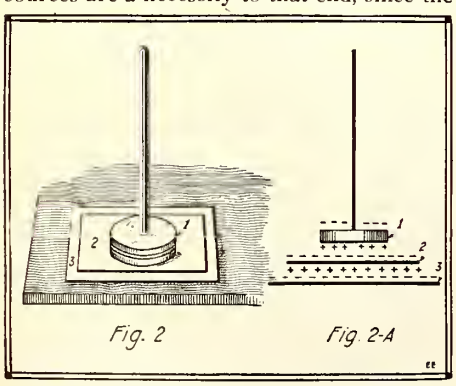


Fig. 2. Electrophorus Cover Charged Thru Glass. 1—Electrophorus Cover. 2—Sheet of Glass (1/16") 3—Hard Rubber Plate (Charged)

more powerful generators (static machines) liberate entirely too much unwanted energy (influence) into the surrounding air, as well as deliver too strong a charge into the instruments in operation, as to ever allow these very tender static actions to evidence themselves.

EXPERIMENT NO. 1.

Some light object (such as a pith ball), after suspending it by a silk thread from an insulating stand, is gradually approached by a charged electrophorus cover (a tin box fastened to a stick of sealing wax or hard rubber rod will do) until it moves toward the latter and is held under the influence of the charge in a position near the cover. "Near" means in this case the distance between the cover and the ball, when the latter, altho attracted, still hangs under *medium tension* and *will not move further on its own accord.* This has to be carefully worked out!

If now the cover of another electrophorus, *not* charged but in a so-called neutral condition, is brought near the light object from the opposite side and moved slowly toward it, the (supposedly neutral) cover will during this motion "force" the suspended pith ball ahead of itself and "push" it thru the intervening space up to the charged cover. (Fig. No. 1.)

The phenomenon finds its explanation in that the positively charged cover in attracting the light object induces a negative charge upon it as well as upon the so far neutral electrophorus-cover, repelling at the same time all positive electricity.

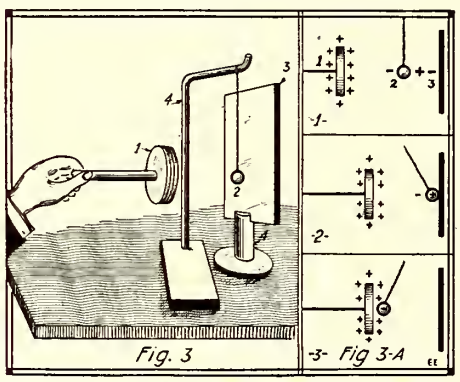


Fig. 3. Inductive Action Upon Neutral Body. 1—Electrophorus Cover (Charged). 2—Light Body (Pith). 3—Sheet of Glass. 4—Insulating Stands

(The small amount of positive electricity repelled on the light body (pith ball) is neutralized thru the air (at a distance) by the induced (—) charge on the face of the second El-cover). Both cover No. 3, and pith ball, carrying a like charge, repel one another and since this cover, which has besides the larger amount of induced charge (reflex-energy, so to speak) of the two residing upon it, is moved steadily in the direction of cover No. 1, the light object can not help but make contact with the latter.

It goes without saying, that, if the experiment is interrupted before the ball reaches the charged cover and the latter is removed altogether, the field of influence vanishes automatically, and both ball and the other cover are once more restored to a neutral condition.

The insulating stand to be used *in this experiment* should contain no metal parts and the pith ball should hang well off the table surface, as in all static experiments of a similar character.

Another way of gaining similar results—the effect, however, will be not quite so pronounced—is by employing a charged hard rubber plate instead of the charged electrophorus cover, using otherwise the same instruments and tactics. In this case, as is quite natural, the polarity of the respective parts will be found *reversed.*

If in either of the above cases the neutral El-cover is replaced by a *grounded conductor,* such as the operator's hand, for instance,

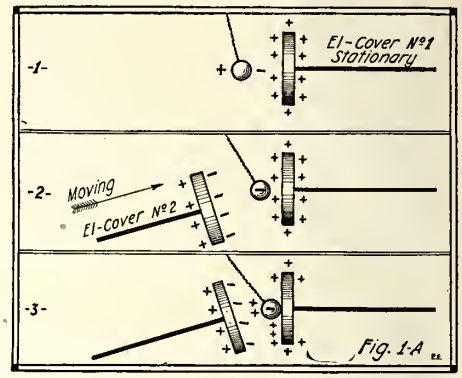


Fig. 1-A—Diagram Showing the Three Principal Stages of the Static Experiment Illustrated at Fig. 1.

which changes the fundamental principle of the experiment, then the pith ball will be first attracted to the hand (providing the latter is brought close enough to it) where the ball "unloads" its complement of positive electrons and an instant after, fully negatively charged, fly over to the + charged El-cover and make contact with it, which it, again, would not accomplish "under its own power."

Concerning the first two instances, I may further add, that, whenever the induced charge is too weak to neutralize the positive element repelled on the pith ball at a distance, the ball will (quite naturally) be momentarily attracted to the second El-cover, which in turn is a sign only, that cover No. 1 is not properly charged.

EXPERIMENT NO. 2.

(Electrophorus Cover Charged Thru Glass)

That an electrophorus cover will receive a charge, altho separated from its "cake" (charged hard rubber plate) by an insulating body, is proven by the following simple experiment:

The cover of an electrophorus (metal box used in experiment No. 1) is charged in the usual way, discharged and charged again until the sparks are raised to their

(*Continued on page* 837)

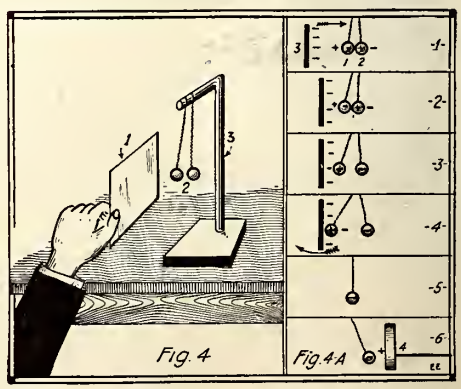


Fig. 4. Imprisoning Charge Upon Neutral Body by Induction. 1—Hard Rubber Plate (Charged). 2—Pith Balls. 3—Insulating Stand. Ball Hanging Nearest to the Plate Should Be Suspended by a Thread with a Wide Loop. Explanation for This Is Given in the Text

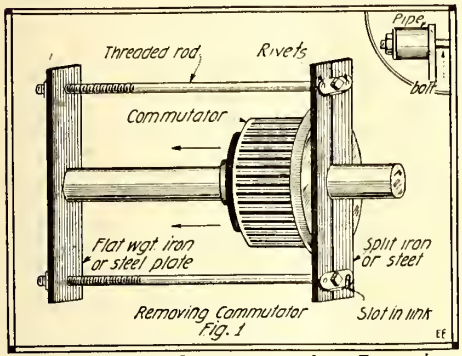
Fig. 4A. 1 and 2—Light Bodies (Pith). 3—Hard Rubber Plate (Charged). 4—Electrophorus Cover.

www.americanradiohistory.com

The Electrical Machinist

By H. WINFIELD SECOR

No. 2—Commutator Work (Continued)



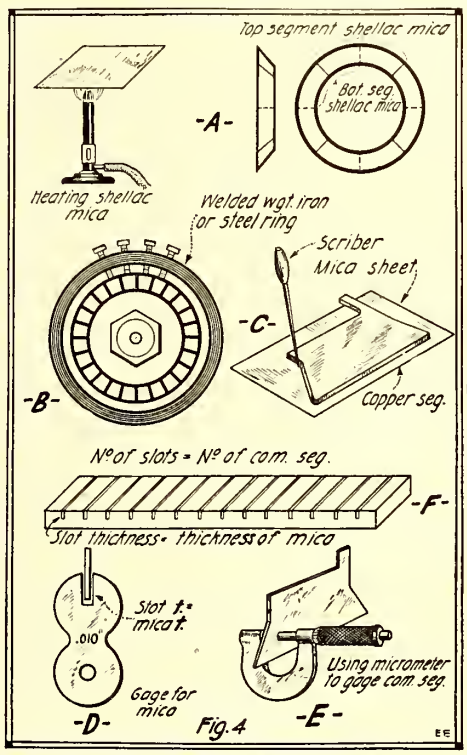
Simple Clamp Compressor for Removing a Commutator From an Armature Shaft.

IN the opening installment of this new series of articles describing the work of the Electrical Machinist, the subject of *commutators* was discust. Commutator work is of such great importance to all electrical workers, that it has been thought advisable to have this second paper continue with some interesting and practical wrinkles concerning this class of work. For the benefit of those who happened to miss the first paper, it may be said that this treated on the best methods of turning commutators in the lathe, how to repair burnt mica between commutator bars, and so forth.

Figure 1, shown herewith, illustrates a simple form of clamp for pulling commutators off the armature shaft. Of course the size of the clamp and the parts composing it, will depend upon the size of the commutator to be removed. A very satisfactory and efficient form of commutator clamp is that illustrated, wherein the plate which is placed behind the commutator is made in two parts, these parts being held together by small iron links which can be held in place by machine screws or rivets. The lower link has a slot in one side, so that when the clamp member is to be removed from the shaft, this link can be moved out of register with the pin on the one side of the clamp, thus enabling the user to swing the two clamp plates apart and thus remove it from the shaft. At the center of this spliced plate, the hole is made large enough to fit around the average size armature shaft. Two long bolts, threaded at least for half of their length if possible, are used to create the compression force to pull the commutator from the shaft. The iron plate over the end of the shaft must of course be stout enough to withstand any bending stresses.

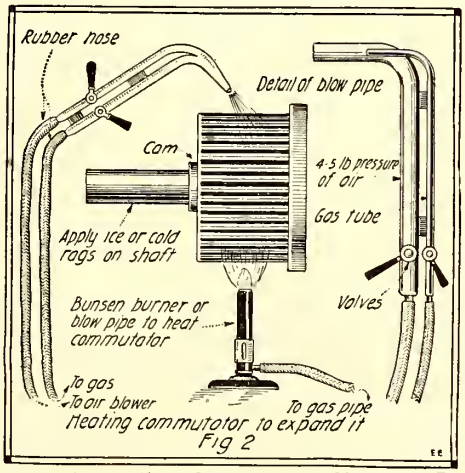
In emergency, all that is required to perform this work is two substantial blocks of wood instead of the iron bars. By means of suitable iron washers and nuts, similar results to those obtained with the iron clamp can be obtained. Where ordinary bolts are available in an emergency, it may have threads extending only for a few inches at the ends; they can be used very effectually by using washers or pipe nipples behind the nuts. When the commutator is removed as far as this action will permit, then the nuts can be backed up towards the ends of the bolts and by means of washers or short lengths of iron piping (nipples) placed under the nuts and washers, a new compression force can be utilized. Many a stubborn commutator has been removed in this fashion in actual practice.

Sometimes, a commutator will set fast on the shaft, aided by corrosion, so that it will not yield even when a powerful clamp such as that described and illustrated at figure one, is applied. Then it becomes necessary to make use of a well-known principle of physics, viz., to *expand* the outer ring or commutator and to *contract* the inner metal member within the ring, or in this case the shaft. If we expand both ordinarily, we will not gain very much toward loosening the commutator gript on the shaft, but owing to the different coefficients of expansion of the steel shaft and the commonly used brass commutator shell, we would gain something in most cases, even tho the shaft is not cooled by special means. There are two usual methods of heating the commutator,—the first being to use a Bunsen gas burner, and the

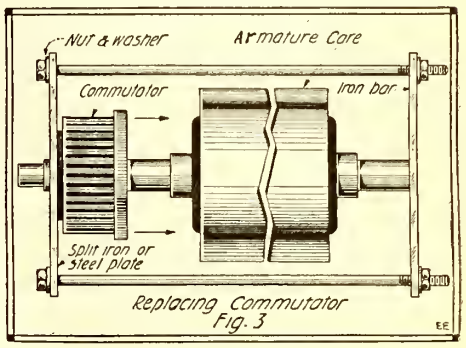


Practical Shop Wrinkles for the Young Electrical Machinist.

other a comprest air gas blow-pipe, which every electrical repair shop is fitted with. The mica and copper composing the Commutator will stand a lot of heat and the Electrical Machinist warms up the commutator by applying heat directly to it, in order to expand it, where he deems it necessary. Of course, it should not be heated red hot or anything like that, but simply heated up only until it is hot enough to make water sizzle when a drop or two is applied to the commutator. The expansion of the commutator and a relatively large contraction of the shaft can be greatly enhanced or augmented by applying rags soaked in ice water to the shaft during the heating of the commutator and at the time the clamp is applied in an effort to remove it from the shaft. On large commutators the heat is maintained from a blow-pipe, etc., while the clamp presses are being applied in order to remove the commutator. At figure 2, there is shown an outline sketch of the comprest air and gas blow-pipe. These blow-pipes are often home-made, or can be obtained at any machinist's supply house. The blow-pipe comprises two distinct and separate tubes usually made of brass as shown, there being a valve placed at the lower end of each tube, by which the amount of gas and air can be regulated. Flexible rubber hose connects the two blow-pipe tubes respectively with the gas main and air pipe line or blower. The gas used is ordinary illuminating gas, and a small, simple form of air blower such as the cam type is satisfactory for the purpose. The blower is invariably driven by a small electric motor or else it may be belted to the line shaft. A 1/6 to 1/8 horse power motor is sufficient for driving a small single-stage blower feeding a 1½ inch pipe line to which four of these blow-pipes are attached. The air pressure required is only a few pounds, four to five pounds being about right.



Sometimes the Commutator Has to Be Heated as Shown, and the Shaft Cooled, in Order to Force the Commutator Into Place.



Utilizing a Compression Clamp Rig for Forcing Commutator Into Position on Armature Shaft.

REPLACING COMMUTATORS.

Some form of clamp is necessary and usually employed in replacing commutators on the armature shaft. One method of applying pressure with a clamp is shown at Figure 3. Here the two-part spliced clamp or else a solid plate with a hole thru the center, big enough to fit over the shaft, is placed against the commutator while a second plate member is applied over the front end of the shaft. Now, when the wrench is applied to the nuts on the two bolts, pressure is applied in such a way as to force the commutator on to the shaft. Right here it should be pointed out that great care should be exercised before re-

(*Continued on page 788*)

www.americanradiohistory.com

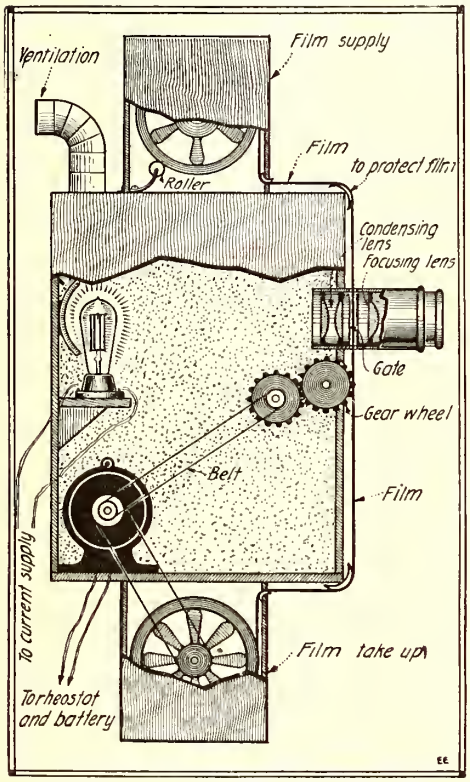
HOW-TO-MAKE-IT

This department will award the following monthly prizes: First Prize, $3.00; Second Prize, $2.00; Third Prize, $1.00.
The purpose of this department is to stimulate experimenters towards accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best idea submitted a prize of $3.00 is awarded; for the second best idea a $2.00 prize, and for the third best prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

FIRST PRIZE, $3.00

HOW TO MAKE AN ELECTRIC "MOVIE" MACHINE.

The condensing lens as shown in sketch comprises two plano convex lenses which can be bought at any optician's or second-hand shop cheaply. The focusing lenses are



Every Experimenter Will Enjoy Making a "Movie" Machine. This One Uses Standard Films.

two anastigmat types of a speed about f:4.5. They are each enclosed in a tube made of tin, one tube sliding in and out of the other to obtain proper focusing on the screen. These lenses can be bought all ready in the tubes or at an optician's store.

Standard film is proposed for use with this machine and since it is 1¾" wide, the film gate will have to be a little wider. The take up boxes for the film will have to be large enough to hold a coil of film 18" x 3". A strong box should be used since the film is quite heavy. The camera part will have to be necessarily larger to accommodate a small motor, lighting system and cogs and gears. A roller should be put in the lower left hand corner of the upper box to prevent the film from unwinding too rapidly. Tin should be put on the edges of the machine where the film is pulled over, or else a worn film is sure to be the result. By looking in theatrical papers you can obtain the name of a concern who sells films. The gate should be fitted with an intermittent stop motion permitting each picture to stop for a fraction of a second.

Contributed by FRANCIS E. ZIESSE.

SECOND PRIZE, $2.00

TABLE LAMP FROM TELEPHONE STAND.

A certain SPERRY had a "Sis" that always wanted something new for her Xmas. SPERRY, being an intelligent and polite gentleman, would never refuse. So this Xmas he's going to give her a cute table lamp. Here's how he went to it:

SPERRY gets into his shop, or rather, laboratory, and conducts a search. He finds a good-looking desk telephone (that is devoid of every bit but the stand)—a nickel-plated (⅜") pull-chain socket, a nickel-plated socket cap, a length of (⅜") pipe, a crowfoot for it, and some strong metal wire.

He then follows this routine: The pipe (D) (threaded) is slipt thru the stand (A) and screwed into a crowfoot (E), the crowfoot being fastened with screws to the base of the stand. The socket cap (B) is screwed to the top end of the threaded pipe, until the stand is made tight. There should be a little projection of the pipe—about ¼" above the cap (B), so that the socket (C) can be screwed to this. The shade holder is made of metal wire, or, of anything SPERRY happens to find at hand to suit him. The only trouble for SPERRY is to get the shade—it must be bought. The rinktum is then shined up and polished to a luster, and (the price tag attached) presented to "Sis."

Contributed by B. DOPPKE.

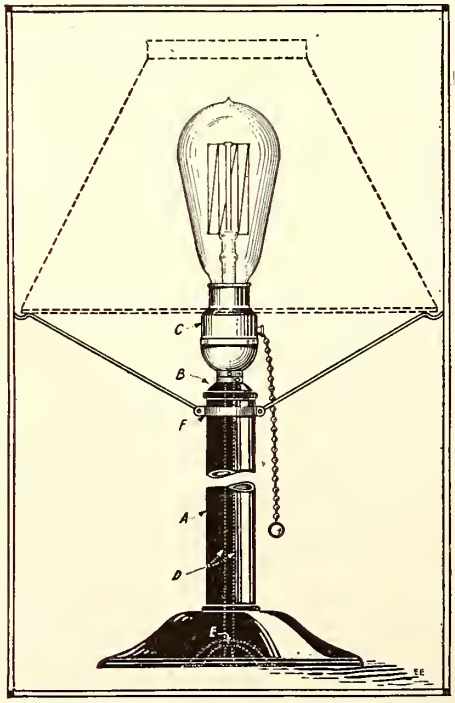
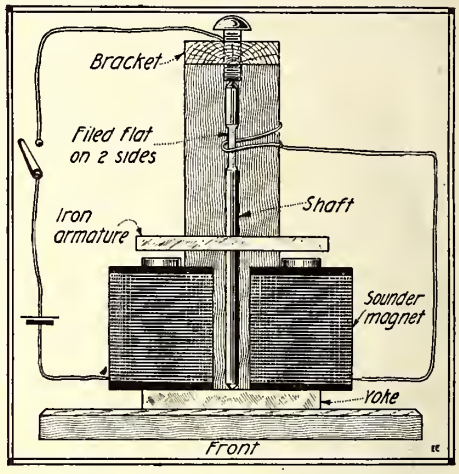


Table or Boudoir Lamp Which Anyone Can Make from an Old Telephone Desk Stand or Similar Pedestal, Together With a Few Pieces of Wire and Some Colored Silk. Old Rose Silk Outside and Blue Inside Gives a Wonderful Color Effect.

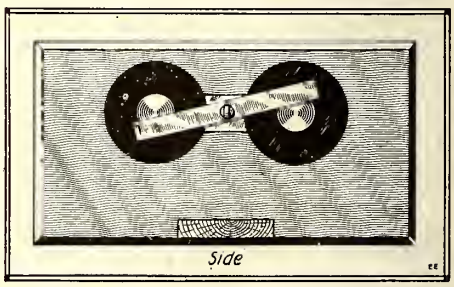
THIRD PRIZE, $1.00

A TELEGRAPH-SOUNDER ENGINE.

The following article explains how to make a simple electric engine from a telegraph sounder, a steel rod and a few pieces of wood:



Side View of Small Battery Motor Constructed From Discarded Telegraph Sounder



Top View of Telegraph Sounder Engine Without Upright or Top Bearing.

The wooden part consists of a base of 3 x 4 inches and upright 5 x 1 inches mounted at one end of the base, with a bracket 3 x 1 inches to hold the upper bearing screw. Mount the magnets and yoke on the base and make a slight indentation with a drill or center punch in the exact center of the yoke to form a bearing for the shaft.

The shaft consists of a mechanical toy rod about 4 inches long. File each end to a point and also file two flat surfaces on opposite sides of the rod, about 1 inch from the upper end. The iron armature should just clear the top of the magnets, and is fastened to the rod with solder or friction only. The brush is formed from a piece of copper wire fastened to the upright and bent around to touch the flat surfaces on the rod. It should make contact twice in every revolution. It should be adjusted so that contact is made when the armature is farthest away from the magnets and broken when the armature is over the magnets. This engine will run at a very high speed with one dry cell.

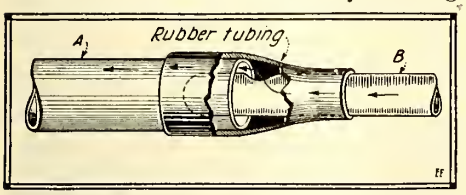
Contributed by HOWARD ROLLO.

www.americanradiohistory.com



SIMPLE STOP-COCK.

The following sketch shows clearly the construction of a simple stop-cock: A and B are glass tubes, the latter having such a diameter that it will pass into tube A. It also has one end rounded, i.e., closed, and a hole in its side about ⅝-inch from the closed end. This hole is made by directing



A New Idea of a Stop-Cock. Using Just Two Glass Tubes and a Piece of Rubber.

a pointed flame (from blowpipe) at the desired spot, till red hot, and then blowing into the open end. Fuse the edges of the hole. In operation, the small tube B is moved backward or forward, i.e., into or out of the rubber tubing. It is best to have the liquid enter B, and leave A.

Contributed by RAYMOND B. WAILES.

FREEZING "WATER" BY MAGIC.

In a small Erlenmeyer flask or beaker place 50 grams of ordinary photographers' hypo and 10 c.c. of water. Heat to boiling and allow to cool. Be very careful to see that the flask is clean and that no dirt enters during the operation.

When the solution has become cold pick up the flask, add a tiny crystal of hypo and give a quick shake. Practically instantaneously the liquid congeals into a solid mass with the liberation of a considerable quantity of heat.

To the uninitiated this is a very striking demonstration. What happens is this: Photographers' hypo is a salt containing a large quantity of chemically combined water, called water of crystallization. The heat releases this water and the salt dissolves in it together with the 10 c.c. of water added. The solution, however, is what we call supersaturated and is in an unstable state of equilibrium, such that a tiny crystal of the same salt and a quick shake will drive the salt with its water of crystallization out of solution.

The heat liberated too, illustrates the scientific fact that water or any other liquid in freezing actually gives off heat.

Contributed by FLOYD L. DARROW.

IMITATION SILVER AND PLATINUM AND OTHER WRINKLES.

Herewith are a few suggestions that may be worth something to the Wrinkles, Recipes and Formulas Department:

Imitation silver: Copper, 4 pounds; zinc 4 ounces.

Imitation platinum: Copper, 4 parts; zinc, 18 parts.

Impression metal: Bismuth, 3 pounds; lead, 1 pound; tin, 8 ounces.

To separate silver from copper: Sulfuric acid (H_2SO_4), 1 part; nitric acid (HNO3), 1 part; water, 1 part. Boil in mixture and a little salt (sodium chlorid) it will subside.

Contributed by JOHN V. CRAIG.

IGNITING ALCOHOL OR ETHER WITH A GLASS ROD

In the bottom of a tumbler place a half teaspoonful of potassium permanganate and moisten with an equal quantity of water. On a glass plate pour a little alcohol or ether.

Now cover the potassium permanganate with *strong* sulphuric acid. A vigorous action is immediately set up. Upon thrusting the end of glass rod into the sputtering mixture and touching it to the alcohol or ether spontaneous combustion immediately occurs.

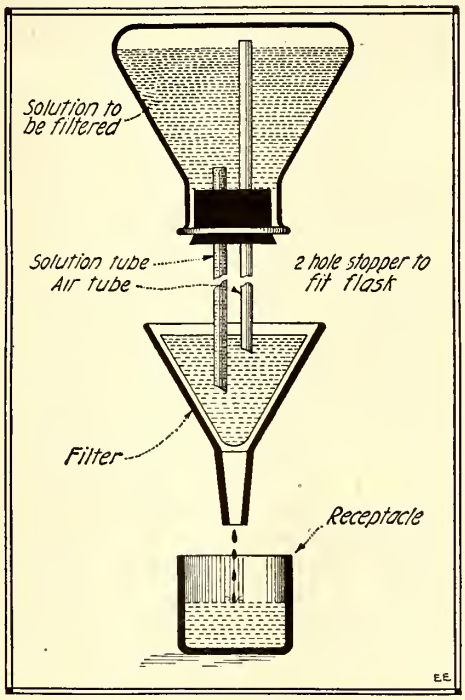
The potassium permanganate and sulphuric acid liberate ozone, a very concentrated form of oxygen, and resulting rapid oxidation quickly ignites the inflammable liquid.

If desired gasoline may be substituted for the alcohol and ether.

Contributed by FLOYD L. DARROW.

AN AUTOMATIC FILTER.

When filtering solutions which filter slowly it is very tiresome to keep refilling the funnel. The filter shown in the present drawing saves this trouble. As soon as the solution gets below a certain level in the filter, air is allowed to pass thru the air tube until the filter is filled, when the solution stops the flow of air. The air tube should be about one-half inch below the top of the filter; the length of the



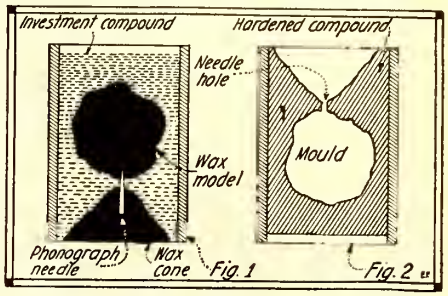
An Automatic Filter Which Once Started Will Run Without Attention Until the Last Drop Is Filtered.

solution tube does not matter. When properly adjusted this filter will refill regularly until the flask is empty.

Contributed by MORRIS TUTTLE.

MAKING SMALL BRASS CASTINGS.

Make a model of the desired size and shape from paraffin wax. Procure a piece of iron pipe about 2½ inches long and of a sufficient inside diameter to admit the model, with at least ⅛ inch clearance at all points. Now make a cone ot paraffin about ⅜ of an inch high and the base of a diameter a trifle larger than the inside diameter of the pipe. Into the vertex of this wax cone force a phonograph needle,



To Make Small Castings Without Much Trouble Will Be Welcomed by Every Experimenter.

blunt end first, so that there is ¼ inch of the point projecting from the wax. Then heat the cone around the edges and force it into one end of the pipe, with the vertex in (Fig. 1). The wax will harden and hold the cone in place.

From the open end of the pipe insert the wax model and stick it on the sharp point of the needle (Fig. 1). Procure some of the investment compound used by dentists in making gold inlays. Mix this with water until the mixture has the consistency of heavy cream. Take a small camel's-hair brush and paint the model with this. Then add a little more powder, so that the mixture thickens a trifle, but yet is not so thick that it will not run freely. Fill the pipe with the paste in this state (Fig. 1), and lay the whole on a wire screen far enough above the flame of a Bunsen burner so that the wax will not melt. Leave it for at least one hour, then lower it to a point about one inch above the flame. When the wax cone has melted and run out, pull out the phonograph needle with a pair of pliers, and let the melted wax of the model run out the hole left by the needle. Remove from the flame and invert. Pour the melted brass into the depression left by the cone, and it will run into the mould thru the needle hole. Allow it to cool, wash out the investment compound, and you will have a perfect reproduction in brass of the wax model.

Contributed by RODNEY H. GOTT.

MAKING A FUSE.

Prepare a saturated solution of potassium nitrate by dissolving a considerable quantity of the salt in a cup of hot water. While still hot place in the solution a long cotton string and strips of porous paper, as blotting paper. When they have become saturated remove and allow to dry thoroughly. Ignite either the string or the paper and the combustion will be identical with that of a fuse.

Try one on the following mixture: mix equal quantities of magnesium dust and potassium nitrate powder and place in a heap on asbestos paper or a piece of tin plate. In the top of the heap insert one of the fuses and ignite. An intensely bright light results.

Powdered potassium chlorate is even better than the nitrate for this demonstration.

Contributed by FLOYD L. DARROW.

www.americanradiohistory.com

RADIO DEPARTMENT

Carnarvon Radio Station

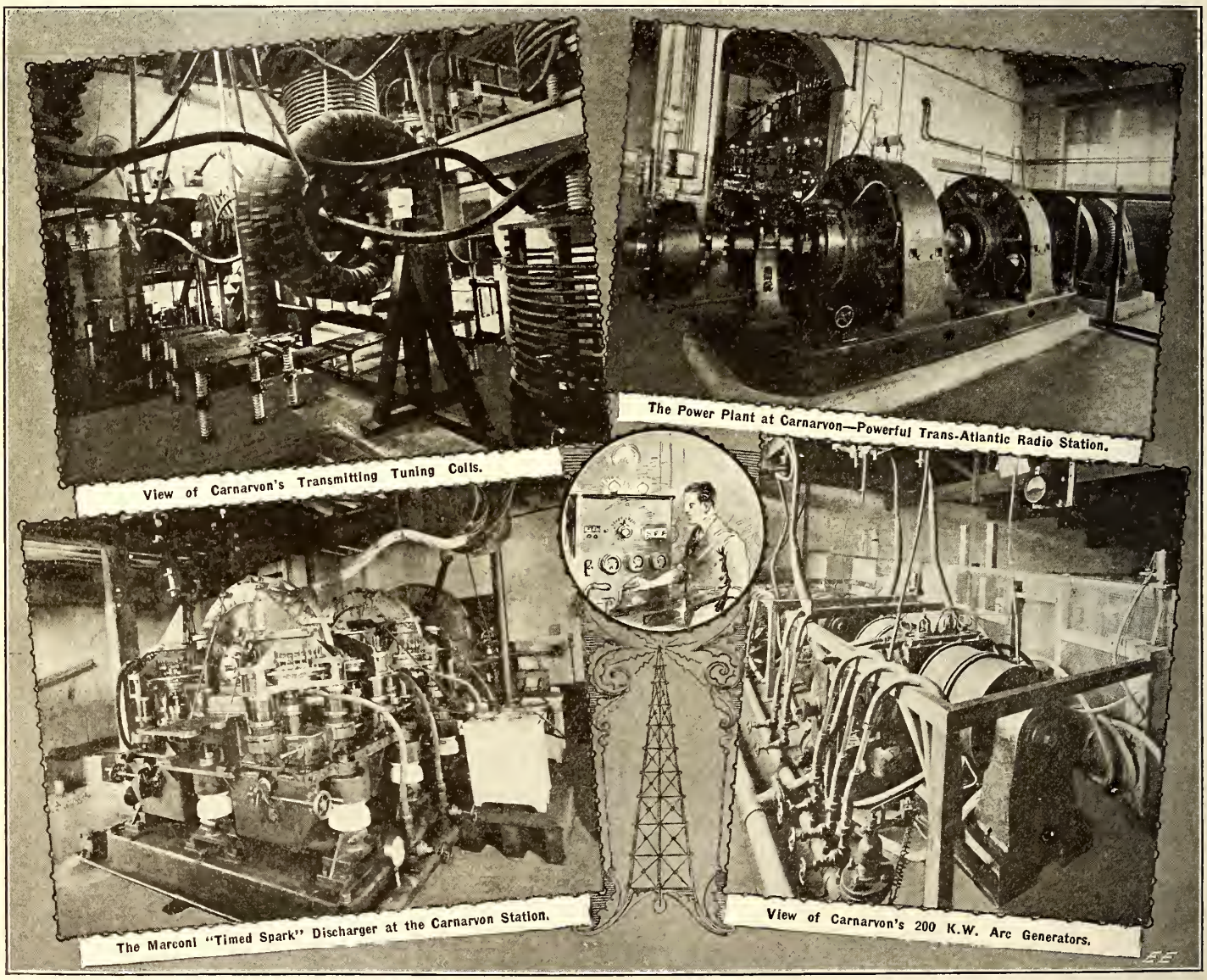
THE Carnarvon Wireless Station is situated at Ceunant, Llanrug, five miles from the historic town of Carnarvon. Built on the site of Cefn Du, 800 feet above the sea level, it commands a magnificent view of the Menai Straits, and on very clear days, of the Wicklow Hills. To the eastward, along the line of the aerial the ground rises about 1 in 10 to the top of the hill which is 1,450 feet high. The last set of masts supporting the aerial is 1,100 feet above the sea level and at this point a fine view of the Snowdon Range is seen, the Snowdon Peak being about six miles distant.

The aerial is of the Marconi directional type, so arranged that the maximum radiation is in the direction of New Brunswick, New Jersey, with which station commercial service will shortly be carried on. The wires, of which there are 20, are of 7/18 silicon-bronze, the breaking strain of which is 1,300 pounds. Each wire is 3,600 feet long and is separately hung by insulators from steel triatics supported by steel masts 400 feet high. There are 10 of these masts supporting the four triatics which have an average length of 500 feet, the distances between the triatics being 900 feet. Owing to the greater strain at the ends of the aerial three masts are provided to support the end triatics (which are split into two), two masts being provided for each of the inner triatics. The natural wave length of the aerial is 5,600 meters, and adjustable inductances to carry 300 amperes are provided for increasing this wave length to 14,000 meters. The effective capacity of the aerial at the latter wave length is .04 mfd and its resistance 2.1 ohms.

The electrical energy used for the wireless plant, heating and lighting, is obtained from the North Wales Power and Traction Co.'s Hydroelectric Station at Cwm-Dyli which is about two miles on the east side of Snowdon. It is of interest to note that here is one of the few places in the British Isles where we are able to use "white coal" or the natural energy of falling water, for this power station utilizes the waters of Llyn Llydaw which are led thru pipes to the water turbines 1,000 feet below the level of the lake. The turbines are direct coupled, the 3-phase alternators generating at 10,000 volts. Two aluminum power lines each of 500 k. w. capacity carry the current from the power station to the Marconi station, one being a line for the exclusive use of the latter, the other being the branch of a line supplying one of the slate quarries and used as a spare.

At the wireless station two 500 k.w.

(*Continued on page* 826)



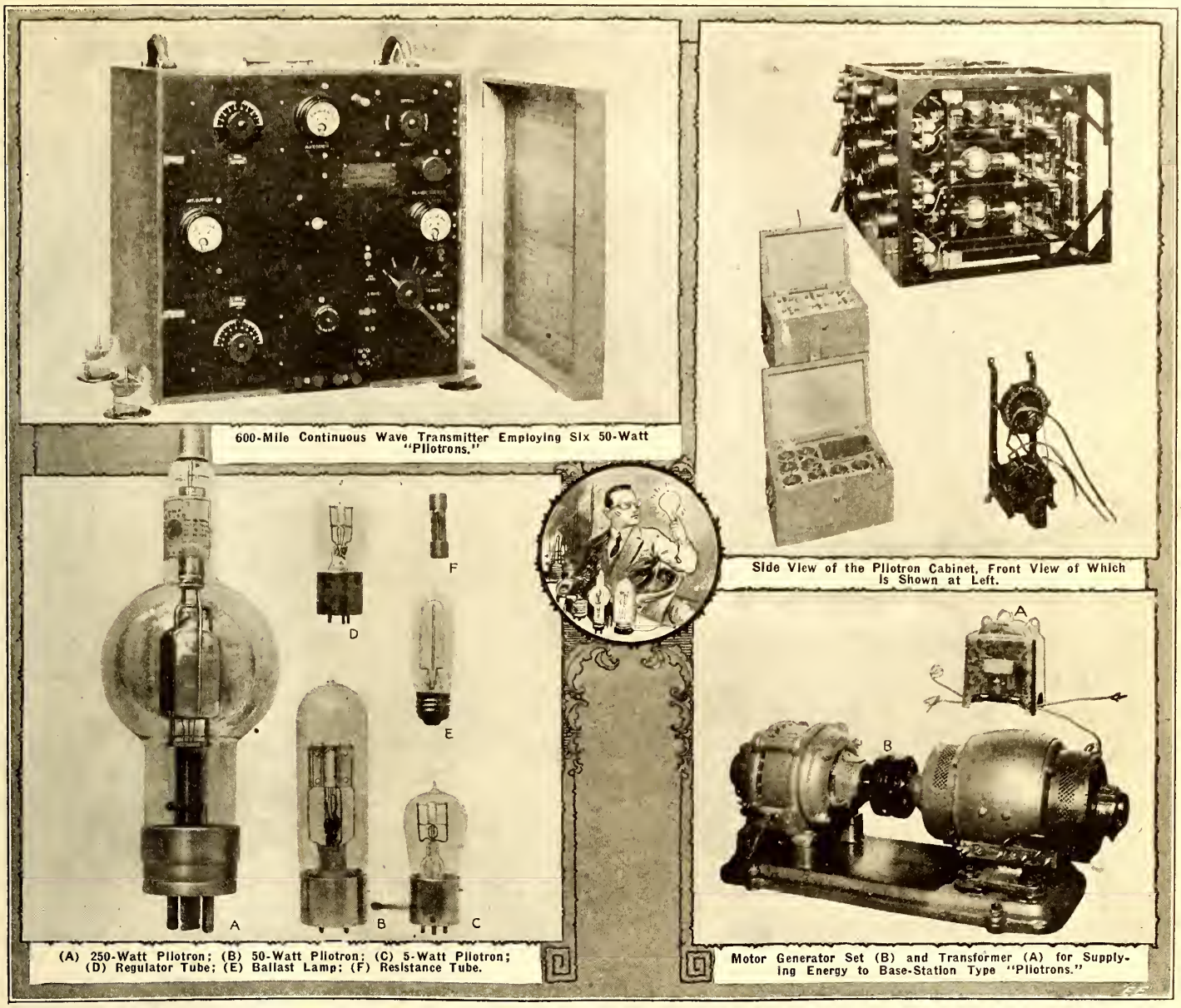
View of Carnarvon's Transmitting Tuning Coils.

The Power Plant at Carnarvon—Powerful Trans-Atlantic Radio Station.

The Marconi "Timed Spark" Discharger at the Carnarvon Station.

View of Carnarvon's 200 K.W. Arc Generators.

www.americanradiohistory.com



600-Mile Continuous Wave Transmitter Employing Six 50-Watt "Pilotrons."

Side View of the Pilotron Cabinet, Front View of Which Is Shown at Left.

(A) 250-Watt Pilotron; (B) 50-Watt Pilotron; (C) 5-Watt Pilotron; (D) Regulator Tube; (E) Ballast Lamp; (F) Resistance Tube.

Motor Generator Set (B) and Transformer (A) for Supplying Energy to Base-Station Type "Pilotrons."

Modern American Radio Apparatus

AMERICA'S accomplishments in radio work both in the field of telegraphy and telephony were many and varied. One of the striking technical results of the war that will probably have far reaching peace-time results is the development of Transatlantic radio communication into an accurate and dependable system that can be counted on every day of the year and almost every hour of the day.

The demands that are now being made on this system of communication can be shown by the recently announced policy of the government to send all government department dispatches by radio to relieve the congested cables.

Now that the bar of secrecy has been lifted it is possible to announce that during the last year the greater part of the government's dispatches were transmitted by a new radio system developed by the General Electric Company. The company equipt the high powered radio station at New Brunswick, N. J., with its newly developed apparatus for Transatlantic telegraphy and telephony and placed it at the disposal of the government for official dispatches early in 1918, to meet the urgent demand for communication. The continuous and reliable service by this station has since been favorably commented on from distant parts of the world and has caused the government to place orders with this concern for two transmitting sets.

It is a matter of historic interest to record that it was the New Brunswick radio station that directed the first message to Germany after America's participation in the war. It will be remembered that it was in this message that President Wilson demanded the abdication of the Kaiser. That series of history-making messages which followed one another in such rapid succession and finally led to the speedy conclusion of the armistice were also sent from the New Brunswick station.

This new system of radio communication is known as the Alexanderson system and includes very marked improvements in all four stages which are common in all radio systems. These stages are, first, the generation of high frequency electric oscillations; second, the modulation of these oscillations into the dots and dashes of the telegraph code, or into the modulation of the human voice; third, the radiation of these electric oscillations in the form of waves, which travel with the velocity of light over the surface of the earth, and the fourth stage is the reception or detection of these waves by suitable instruments.

(*Continued on page* 828)

In December Radio News

Underground Radio for the Amateur.
By E. T. Jones.

The Construction of Vacuum Tubes.
By R. S. Hawkins.

German Radio War Instruments.

The Priess Loop Set. By Walter J. Henry.

Amateur Ethics. By Pierre H. Boucheron.

Primary Batteries for Audion Filaments.
By R. H. Langley.

Describing Some Foreign Apparatus.
By Fred M. Gill.

A Wavemeter of New Design.
By W. S. Heppner.

A Triple Coil Receiving Transformer.
By H. E. Parsons.

Junior Radio Section.

www.americanradiohistory.com

Calculation of Tree Wavelengths

By A. N. Tenna, V. T., Q. R. S., H. F., K. W., A. C.

Proprietor of Tony's Fruit Stand

NOW you see it's all plain, Jim, just take your wavemeter and set it right under this oak tree and have your buzzer to excite the tree and —zingo—"The Wavelength." Of course, great errors occur in the wavemeter method, so I have devised a method of calculating mathematically the wavelength of trees, bushes, acres of trees, etc.

I have found also, that trees with fruit have a greater capacity than those without, and rosebushes without roses have greater resistance and less capacity—of course, this is all clear when you take into consideration the fact that trees with half the leaves dead (in the month of October) have less capacity. From this we see that the leaves length of any tree depends upon the season. For instance, a tree in June was found to have a wavelength of 650 meters, while in October only 450 meters and the same tree in December but 150 meters. Therefore you will have to have an automatic wavelength changing device inside your station to add inductance in the loading coil according to the changes in the thermometer.

Wavelength of Pear Tree.

A tree with 6,000,687,564,765,543,409 leaves and 72 large branches, 64 medium sized branches and 20 very thin branches had a wavelength of 750 meters. Now this same tree with four large branches chopped off gave a reading of 690—a recount of the leaves gave us—6,000,687,564,235,001,202 leaves. The counting of the leaves of course was the smallest part of the work. (Naturally) The formula for calculating the wavelength of a pear tree and found to jibe with the wavemeter readings, is:

$$\text{W. L. equals} \frac{H \times NL \times NF}{\text{Number of branches.}}$$

Where: H—Average height.
NL—Actual number of leaves.
and NP—Number of pears on the tree.

This has been found to vary with the season; for instance, this same tree without leaves or fruit with the same number of branches and height will naturally give you a lower wavelength as is evident from the above formula. In other words, the wavelengths fall off as the leaves and fruit fall. Simple eh?

Some people think this Tree Wireless is a joke; well, if they want to find it out just begin counting the leaves on any tree —and they will be convinced—that it's no joke.

Capacity of Same Pear Tree.

The formula for the capacity of the tree is as follows:

$$\text{Capacity equals} \frac{\text{Wavelength found from above.}}{(tl \times NL) \times (\text{area of } P \times NP) - H}$$

Where; tl—Thickness of the leaves.
NL—Total number of leaves.
P—Pears.
NP—Number of pears and H the height of tree.

Below is given a graph of the wavelength of trees for the various seasons—this is for pear trees 35 feet high.

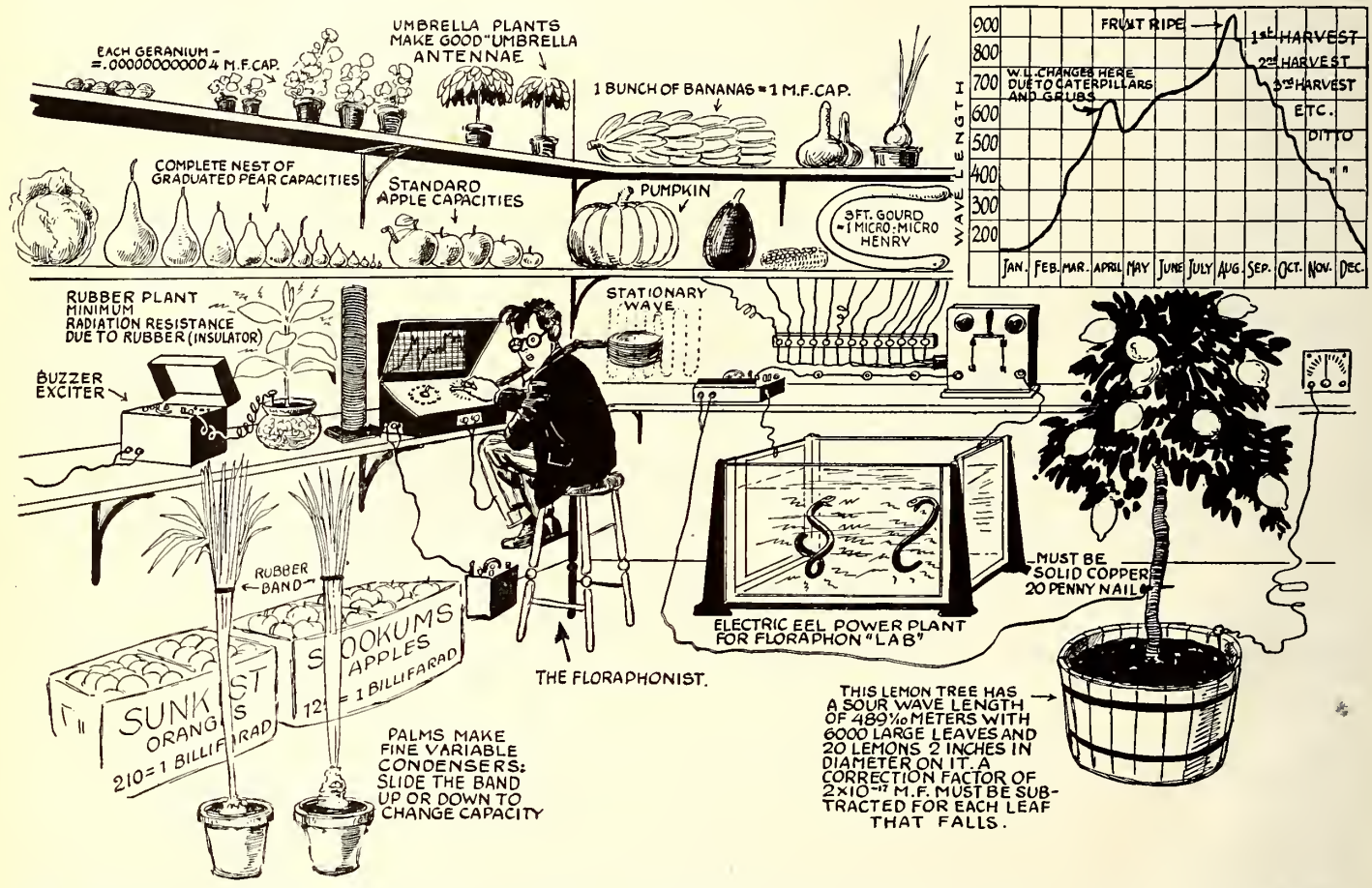
H. F. Resistance of The Tree

About the most suitable formula devised for the calculation of high frequency resistance of tree antennae is as follows:

$$\text{H.F.R. equals} \frac{drLB \times drMB \times drSB}{\div dr \text{ of trunk of tree}} \times \frac{NP}{\text{resistance of one leaf} \times NL}$$

Where; dr—Direct resistance.
drLB—Direct resistance of large branches.
drMB—Direct resistance of medium size branches.
drSB—Direct resistance of small branches.
NL—Number of leaves.
NP—Number of pears.

(Translated from the Hertzian Wave Nut-book by E. T. Jones.)



Well, Papa Squier Started Something When He Wished This "Tree Wireless" on Us. Here Is a Typical View of a Young and Enthusiastic "Floraphonist" Busily Engaged in His Frost-Proof "Lab.," Doping Out the Natural Wavelength of a Healthy Rubber Plant. It's a Man's-Size Job to Calculate the Wavelength of a Tree, Especially on a Windy Day, When the Leaves and Fruit May Be Blown off in Considerable Numbers. Each Leaf and Pear or Apple Can Be Compensated for in the Calculations, However, Once the Micro-Farad Capacity and Micro-Micro Henry Inductance, Values for Each Are Determined and Known. If Anyone Can Successfully Compute the Wavelength of a Healthy Young Pear or Plum Tree in Full Fruitage, He Should Certainly Be Awarded the "Nobel" Prize in Physics—We Said It,—"If" He Can Do It. We'll Wager He Will Need a Dozen "Einsteins" Before He's Thru. And Then the Wind Comes Along and Spoils All the Calculations. Gads, Tho!!!

www.americanradiohistory.com

Radio Guides Ships Thru Fog

"YOUR naval communication service, especially in its radio compass stations and their activities, is a great institution and a distinct boon to seamen. It ought to be maintained permanently," said Captain W. F. Wood, D.S.C., master of the steamship *Lancastrian* of the Leland line, recently, as he described what the U. S. Naval radio-compass service had done for him on his latest entry into New York Harbor. Consulting his log from time to time for the sake of accuracy, Captain Wood said:

"We were bound in from Antwerp to New York on the afternoon of October 3rd and had expected to make the Nantucket lightship by six o'clock. At 5:50, however, we ran into a dense fog. I slowed the engines to half speed and kept heaving the lead, which registered from thirty-six to twenty-five fathoms. We got the latter sounding at eight o'clock. This gave me a good line of soundings to compare with the chart, but we could not yet hear the foghorn aboard the lightship. At about half-past seven o'clock I had the radio officer sound our signal and call up the radio-compass station on Fire Island, the signal letters for which are N. A. H. The message we sent by wireless to Fire Island read:—'What is my true bearing?' It was signed, 'Wood, Master.'"



Photo New York Herald

Sandy Hook Got Captain Wood's Appeal at a Distance of Sixty Miles. Mantoloking Was Even Further Away. These Stations and Also That at Fire Island, by Their Land Lines Into New York, Reported the Bearings of the Lancastrian From Their Respective Positions. The Central Station, Within Ten Minutes Then Sent All Three Bearings by Radio to the Leland Line Ship and Her Master's Mind Was at Ease.

RADIO COMPASS LOCATION GIVEN IN TEN MINUTES.

"I was standing in the radio room at the time, looking over the shoulder of the operator, who kept sounding our letter code signal on his transmitter. Within ten minutes after we had asked for our true bearing from Fire Island the following reply came crackling back to us:—

"'Your true bearing at 7:39 P. M., from Fire Island, 109 degrees; Sandy Hook, 87; Mantoloking, 65.'

"This radiogram was dated from the *central compass control station* of the Naval Communication Service, at No. 44 Whitehall street, New York. When I wrote my message of inquiry and handed it to our Marconi operator I handed him along with it a slip of paper on which I had written my own estimate, by dead reckoning, of our position at that time. I had figured it to be a bearing of 108 degrees from Fire Island. When, as I looked over the shoulder of the receiving operator, I saw him write down, 'From Fire Island, 109,' I was pleased that I had estimated our position within one degree.

"Imagine my delight and surprise when, right on the heels of this bearing, came the additional readings for our direction from Sandy Hook and also from Mantoloking, N. J. It was then a matter of only a few moments to project these three lines upon the chart, and the point at which they *intersected* was, of course, our precise position at 7:39 P. M.

"So we carried on then with entire confidence, tho the fog continued dense. At ten o'clock I hauled my course to the northward and at 10:40 o'clock the fog lifted and revealed the Fire Island light abeam, exactly where it ought to be to prove the precisely accurate information flashed to us out there in the murk three hours earlier from the central compass control station in New York City.

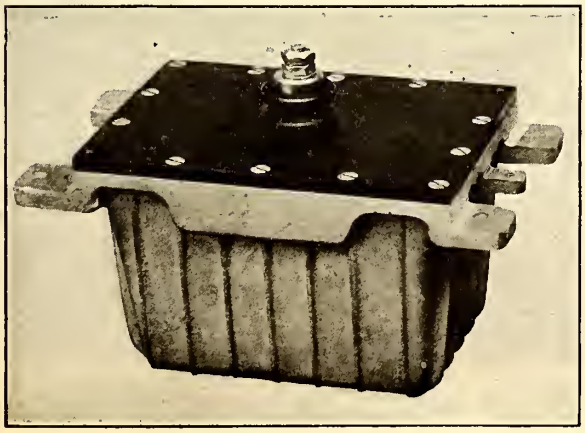
"There is not the slightest doubt of the inestimable value of these radio position finders. We have nothing of the sort installed as yet in England, but I hope we soon shall have them. The Admiralty, however, has instructed all masters concerning their use on this side and has emphasized their value."

Thus does the field of the "Radio Compass" expand daily almost.

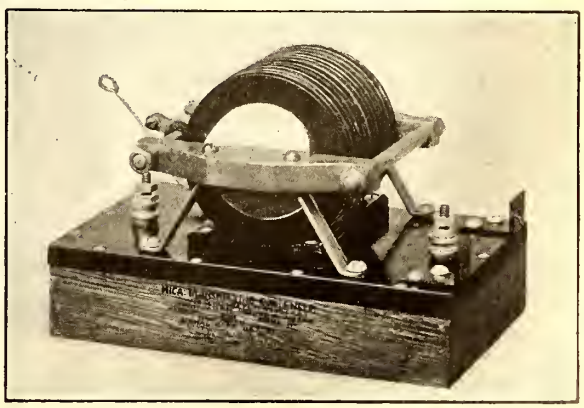
Mica Condensers for Radio Sets

A new mica condenser for radio equipments is now being made which the manufacturer states is in use by the United States and Allied Governments and many of the large companies manufacturing radio apparatus. The maker calls attention to the fact that since its invention in 1745 the Leyden jar has been used in practically its original style, without any radical improvements or changes. Practically every radio equipment is used to its capacity, and up to the time this new mica insulated condenser was invented Leyden jars were used especially for high potentials. When in operation the radio apparatus thus equipt was not safe and reliable, as the Leyden jar would crack and break down after a continued use for an hour or so making the apparatus inoperative.

Wherever metal containers are not suitable the condensers can be mounted in wooden or other insulating boxes, or the metal case can be insulated from the condenser itself and the condenser terminals mounted independently on two insulated posts.



A New Mica Condenser for Radio Equipments Which the Maker States It Is Practically Impossible to Break Down Even When Used for High Potentials.

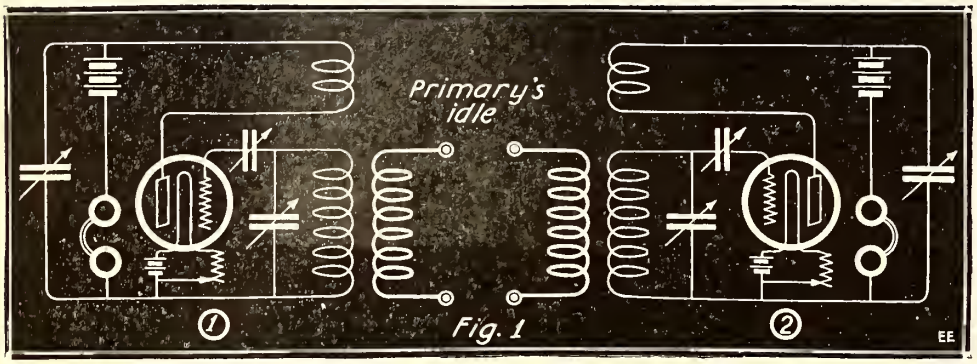


www.americanradiohistory.com

"Locating Submarines by Audion Syphoning"

By Edward T. Jones, A.M.I.R.E.

PRACTICALLY every one familiar with the present day types of audion circuits employing the feed back systems realizes the fact that if two such receivers in close proximity are tuned to the same wavelength "syphon-effects" of considerable magnitude are produced, and the oscillations emitted by one tube are picked up by the other receiver and vice versa.



Two Audion Receiving Sets Arranged Some Distance Apart Have, Under Actual Tests By the Author, Shown That When Both Are Tuned to the Same Wave Length, That Station No. 1 Can Hear the Note of the Oscillating Audion At Station No. 2, and Vice Versa. This Effect is Termed "Syphoning".

Recently, the H-2 (U. S. submarine) successfully demonstrated the ability of underwater craft to transmit and receive while submerged. The H-2 submerged and communicated with airplanes and vessels of the fleet. This naturally proves that during wartime a submarine can easily keep in touch with the ships and shore stations, and receive its radio compass locations at various intervals. However, it is to be expected that this system will come into general use on all the submarines of the foreign Navies, and that during wartime they will endeavor to exercise the use of such a system freely. We may then consider an enemy submarine as having submerged after having sighted its adversary; it then naturally maintains silence in respect to its transmitting apparatus, and continues to listen in for what the destroyers and other vessels may have to say. The fact is, that the vessel while endeavoring to maintain silence is defeating its own endeavors, for while listening in, the receiving bulb is actually *transmitting*, and if any of the destroyers tune their receiving apparatus to the same setting which the submarine is listening in on there will result the syphoning effect described previously. Should the destroyer be equipt with a direction finding apparatus it can without any difficulty run down this undersea craft without the latter knowing what is happening. This is only one of the many uses this previously dubbed nuisance can be put to.

POSSIBILITIES OF LOCAL COMMERCIAL STATION SYPHONING AMATEURS.

Since the general use of audions and their associated circuits was adopted, it has been heard from numerous sources that Amateurs who have copied a certain station one night could not receive this same station the following night. This further lends aid to my beliefs and as the reader shall understand from what follows, it was due to the fact that *the "Large Commercial Station" in that particular vicinity was syphoning the smaller stations* and the following night the effect was not present because the "Controlling" station was not listening on that same wavelength and no syphon effect took place; naturally the short range of the smaller Amateur installation did not permit it to copy signals from the extraordinary distances recorded the night previous. In figure 1 two receiving sets of the feedback type are shown and are separated in this instance fifty feet apart. Both sets are tuned to the same wavelength (say 1000 meters) and the two sets are then in resonance. Number One can hear the true clear note of the oscillating audion at station Two, and vice versa; this is caused by the receiver also acting as a transmitter and if a key is arranged in the circuit to vary either the inductance or capacity, intelligent signals can be transmitted between the two. This effect has been termed "syphoning" and is very pronounced at stations where the receiving apparatus are very near to each other.

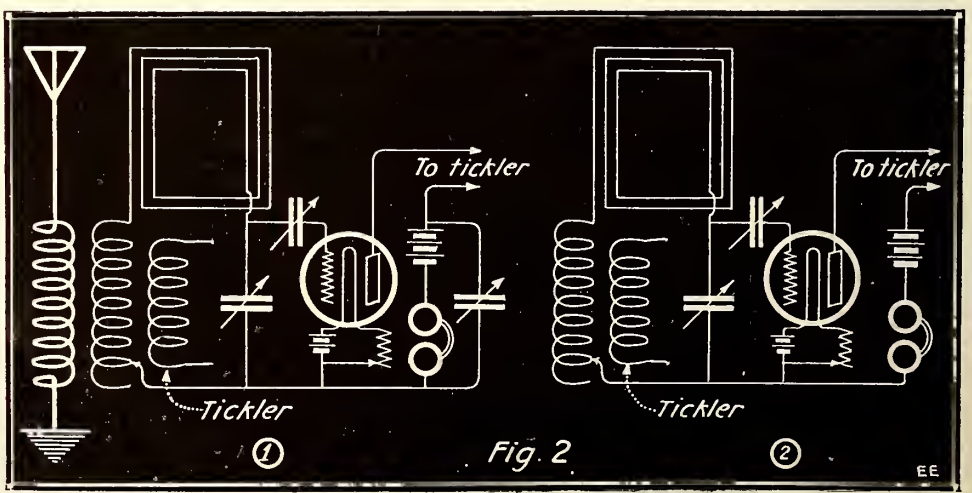
I have personally carried out experiments at distances up to two thousand yards and with suitable receiving apparatus informed the receiving operator the correct wavelength he was listening in on. Of course, as mentioned before, this depended upon the receiving operator having his bulb oscillating, and likewise my own, in order to pick up the undamped oscillations being emitted by his receiving apparatus.

Furthermore, I have, without an antenna connected to my receiver and same maintained in a state of oscillation, been syphoned by a large receiving station, when I was located some five hundred feet from the antenna and receiving apparatus. Now the MAIN FEATURE OF THIS PARTICULAR INCIDENT IS THAT THE SYPHONING EFFECT (WAVE) ACTED AS THE CARRIER OF THE SIGNALS BEING RECEIVED FROM THE OVERHEAD ANTENNA CONNECTED TO THE RECEIVING STATION SOME FIVE HUNDRED FEET FROM ME. This prompts me to believe that many of the Amateurs in and about a city where there is a large Commercial or Naval plant should not put too much faith in their own receiving apparatus in respect to the remarkable distances covered with the same; for it may be that they are being syphoned by the local station which has the apparatus to easily cover the distance.

Another fact which I may mention here is that, when a station is in the act of syphoning another, it tends to reduce the strength of signals received at that station, and tends to rob it of some of the signal's strength. It may be that the total is proportionately divided between the two, three or four, whichever may be the case.

ELIMINATION OF STATIC BY SYPHON METHOD.

I have also found thru my extensive experiments and investigations into the possibilities of this phenomena that when syphon waves act as the carrier of signals from the main receiver to another receiver installed some several hundred feet away, the static which is so pronounced in the first instance is hardly perceptible at the second receiving apparatus, although the signals have not undergone a great degree of weakening. It is my contention, that if a receiver, say number one in figure 2 had a coil of fairly large dimensions inserted in the secondary circuit so that this syphon wave could be directed to one certain point (where the second receiving apparatus is installed) that a maximum of the signal would be received there, in a greater proportion than the static. While I have no good theory to offer at present for this statement, it has proven so in actual tests and therefore there does not seem to be very much need for lengthy explanations.



"Static" is Reduced When the Signals are "Syphoned" from the Main Receiving Station to a Second Receiving Set, Says the Author. He Suggests the Use of Two Loop Aerials as Shown, to Transfer the Energy to the Second Receptor.

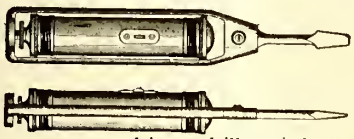
www.americanradiohistory.com

LATEST PATENTS

Illuminative Tool.

(No. 1,309,363, issued to Edward J. Meinke.)

We have seen illuminative pens and pencils, now comes the illuminative tool. This patent, recently granted, consists of a device which will hold various instruments such

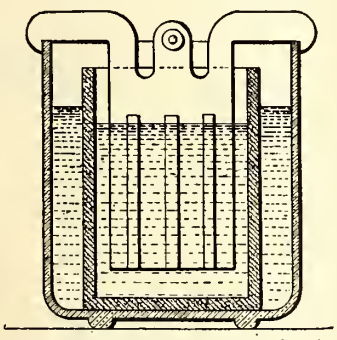


as a screw-driver, drills, gimlets, augers, chisels and the like, in the form of a handle or a frame, so that any well-known standard electric flashlight can be mounted therein. Hammering on the frame will not injure the flashlight, which can be removed if necessary, and a new battery inserted.

Primary Electric Cell.

(No. 1,310,695, issued to Harry E. Evans.)

Generally, in primary electric cells employing two fluids, the electrolyte and depolarizing fluid, a porous cap was heretofore necessary in order to separate the two liquids or else the gravity method had to be used. In this idea, however, a new use is given to the carbon inasmuch as it acts not only as the positive pole of the battery, but also as the porous cup separating the electrolyte placed within its recess, from the depolarizer outside. The zinc being suspended in the carbon cup. In this manner the cell is not only simplified, but cheapened, and the internal resist-

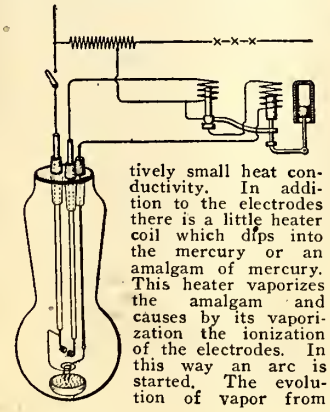


ance caused by porous cups in the past is greatly reduced.

Enclosed Electric Arc.

(No. 1,310,067, issued to Philip K. Devers, Jr.)

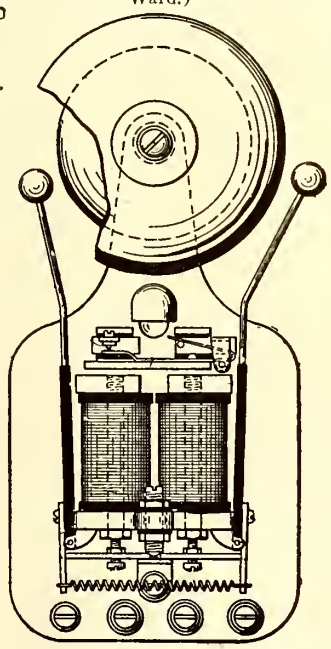
This relates to enclosed arc lamps in which an arc is operated between electrodes of refractory materials. The entire arc is enclosed in a chamber which has a constriction in its center and is filled with a gas at a pressure slightly above atmospheric. The gas contained within the globe has rela-



tively small heat conductivity. In addition to the electrodes there is a little heater coil which dips into the mercury or an amalgam of mercury. This heater vaporizes the amalgam and causes by its vaporization the ionization of the electrodes. In this way an arc is started. The evolution of vapor from the mercury or amalgam displaces the nitrogen or other gas into the upper chamber, and hence increases the efficiency of the lamp by supplying an atmosphere of vapor between the electrodes.

Novel Electric Bell.

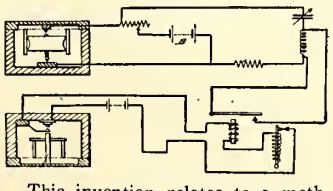
(No. 1,310,813, issued to Albert M. Ward.)



This idea comprises two bells, one over the other, with respective hammers to operate either of them. Each hammer may be attracted when an outside circuit is closed, energizing one of the coils. The make-and-break in this case is at the lower end of the bell in the form of a set screw. A winding is placed on both cores in such a manner that the third circuit in the form of a buzzer may likewise be operated. Inasmuch as this third circuit is of a much higher frequency than that at which the bells can operate, no noticeable effect is perceived, and the hammers do not actuate, altho the buzzer vibrates and the cores themselves are energized.

Acoustic Actuating Mechanism.

(No. 1,310,568, issued to A. C. Heap and O. B. Field.)

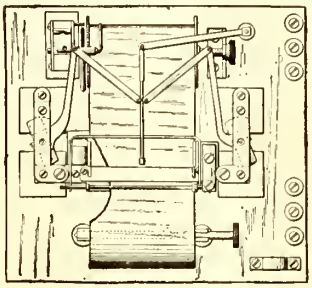


This invention relates to a method of detecting sound waves or pulses transmitted thru water and is attached to the surface of an under water mine, or submerged body, and either serves to operate a signaling device or cause the mine to explode. It only operates when it receives sound waves or impulses of a certain strength, and according to its inventors does not go off even if heavy explosive charges are detonated in its vicinity. A "dancing contact" is used, which responds to the sound waves, the entire case being filled with some liquid, such as oil. When sound waves of a certain pitch are received, the resistance between the electrodes varies, and the potential difference at the terminals of the condenser is varied, thus allowing a pulsating current to pass thru the device.

Telautographic Apparatus.

(No. 1,312,596, issued to George S. Tiffany.)

With this telautograph apparatus writing movements of the receiving pen are kept in unison with

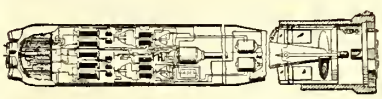


the transmitting tracer under which there is a system of tracer lines, affected by the movements of the sending pen. In this way, more or less, current is allowed to pass, and the movements of the receiving pen are affected by the magnetic coils, which are excited to a variable extent during the transmitting operation.

Sound Controlled Dirigible Torpedo.

(No. 1,312,510, issued to George Baker.)

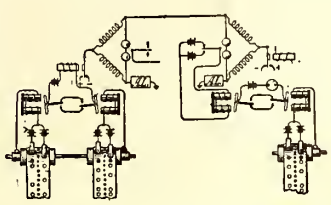
This invention seems very plausible. It consists of a torpedo which is discharged from a torpedo tube automatically; when it reaches the vicinity of some enemy craft the propelling mechanism is set into motion. The torpedo on becoming active, guides itself directly towards the enemy ship, due to the sound waves set up by the vessel. A plurality of microphones are arranged to the various circuits, so that when the sound, which comes in stronger at one microphone than at another, will affect the steering rudder in such manner until both sounds are of same intensity. The elevating rudder is likewise controlled in similar manner.



Secret Signaling System.

(No. 1,312,574, issued to Ralph E. Pierce.)

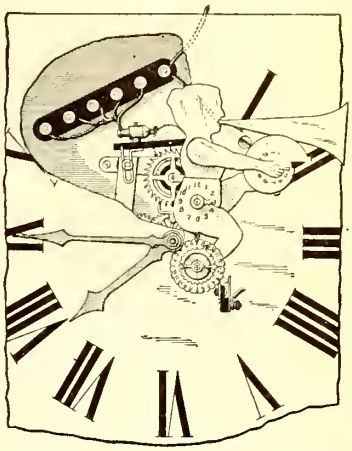
Many patents have been issued which have attempted to send secret messages by alternating or breaking up the current impulses into unintelligible signals by means of ciphering switches, all of which have some good and some bad features. A device which promises to become very popular is this one granted recently. It implies two systems of tapes which are run on a drum, the said tapes being perforated so that extra impulses may be sent, and the regular dashes or dots broken up by the action of relays operated by the tapes. At the receiving end another tape travels thru a like apparatus causing some signals to be inserted and others removed from the original message as transmitted over the line, as can easily be noted in the accompanying diagram. In this way, absolute secrecy is obtained by use of the key for ciphering and deciphering. Synchronizing devices are employed to control the speed of these keys.



An Automatic Sign.

(No. 1,313,757, issued to Samuel C. Swindler.)

This patent consists of a figure carrying a relatively stationary leg, a pivoted leg and a pivot body and is arranged in front of a dial. The pivoted body swings backward and forward during vertical movement of the plate. There is a spiral cam rotatively mounted between the arms carried by the body and which is provided with numerals, so that it may be moved under the indicating finger. In this manner the operator can regulate the duration of the operation of the sign or other

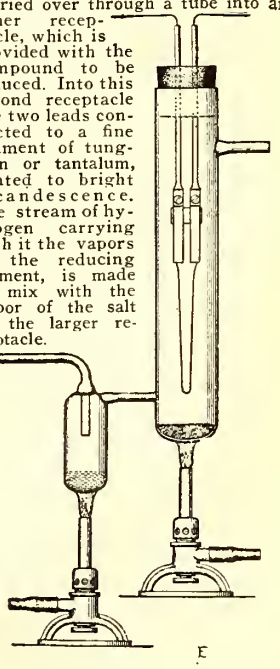


electric device controlled by the five or more circuits. For controlling another set of lamps another dial is pivoted on the body and still another at the foot. In this way a plurality of electric circuits may be operated.

Producing Pure Elements.

(No. 1,306,568, issued to Ezechiel Weintraub.)

This invention relates to a method of isolation of difficultly reducible elements, such as uranium, which were always very difficult to reduce. The reducing metal (sodium) is contained within a smaller receptacle, and it is heated and purified by a stream of hydrogen which enters at the inlet. When it is vaporized it is carried over through a tube into another receptacle, which is provided with the compound to be reduced. Into this second receptacle are two leads connected to a fine filament of tungsten or tantalum, heated to bright incandescence. The stream of hydrogen carrying with it the vapors of the reducing element, is made to mix with the vapor of the salt in the larger receptacle.



www.americanradiohistory.com

WITH the AMATEURS

Our Amateur Laboratory Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of apparatus unaccompanied by that of the owner. Dark photos preferred to light-toned ones. We pay $5.00 each month for the best photo or photos and $2.00 to each "Honorable Mention." Address the Editor, "With the Amateurs" Dept.

The Editors desire to call to the attention of all owners of "Electrical and Chemical Laboratories" the fact that hereafter the MONTHLY PRIZE WILL BE $5.00 CASH, instead of $3.00. ALSO $2.00 CASH WILL BE PAID TO EACH "HONORABLE MENTION" ENTRY PUBLISHT. We have not received any "Laboratory Photographs" of late. So "go to it" and send us your photo, together with that of your laboratory. If they are particularly good we may list some new and bigger prizes. So get busy, Boys!!! It's up to you. Here's a way to earn some greatly wanted laboratory apparatus at no cost whatever. Don't be afraid to send in too many photos, Boys.

"Amateur Electrical Laboratory" Contest

THIS MONTH'S $5.00 PRIZE WINNER— CHARLES AMBROSE YOCUM

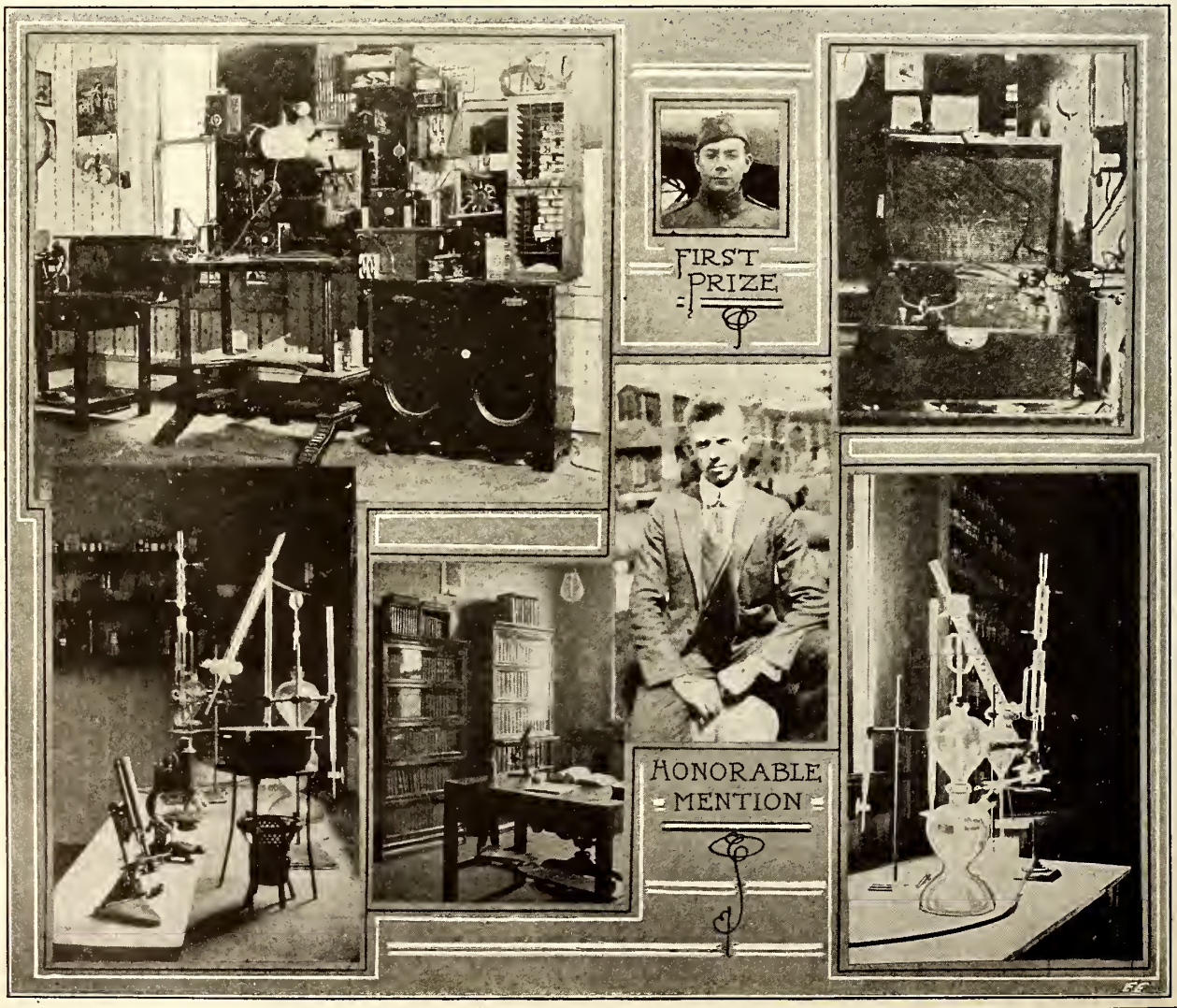
HEREWITH are a few photographs of my "Electrical Laboratory." I have a one-half kilowatt step-up transformer, a Tesla coil giving a six-inch spark, a one-inch spark coil, a water-power motor running a generator, a few small motors, rotary gap, 18" by 8" loading coil with 36 taps, step-down transformer, Brandes head set, 20 plate glass sending condenser, two mineral detectors, loose coupler of the navy style, telephone transmitter on swinging arm (in the middle of the switch-board), used for a speaking arc, which is also used on my telephone by utilizing a double-throw switch. I have electric meters, so I can always know how much power the apparatus consumes. There are two antennae, one 200-foot, two-wire, used for receiving, and one four-wire, 120 feet long for sending. I also possess a carbon rheostat, Murdock oscillation transformer, Murdock wireless key, with a shunt device under key, which shorts the detector when the key is pressed.

I have a good range in sending and with an Audion can receive about 2000 to 3000 miles. On top of the step-up transformer is seen a small box; it contains a small receiving and sending apparatus capable of transmitting one-half mile and receiving ten miles.—Charles Ambrose Yocum, 438 Fairview St., Pottsville, Pa.

HONORABLE MENTION—B. O. SHIFLETT—$2.00 PRIZE PAID EACH "HONORABLE MENTION"

MY "laboratory" is in a large, well-aired, spacious room on the second floor on a corner facing northeast and southeast. While it is equipt chiefly for chemical and microscopical work, yet it has five electric light connections or sockets for 110-volt A-C. There are numerous pieces of electrical apparatus, such as induction coils, telegraph apparatus, small motors, transformers, static devices, etc. I have spent a great deal of my time in the study of phonographs, cameras, telescopes and microscopes—trying to make improvements on phonographic devices; and in the field of lenses, making adaptations of different forms to certain kinds of conditions, such as the projection of "microphotographs" and "microphotography." One of the pictures shows one corner, in which is a lavatory, to the right of which is a work table, covered with some equipment set-up, burettes, Leibig still, Soxhlet extractor, Kipp's gas generator, separatory funnel, water-bath, Bunsen burner and alcohol lamp and two high-powered microscopes. The other photos show one end of the chemical cabinet, the top of which contains shelves filled with chemicals and reagents, the bottom being filled with apparatus.

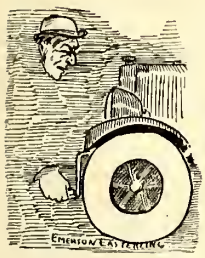
I have been reading the ELECTRICAL EXPERIMENTER ever since it first began.—B. O. Shiflett, 138 So. 55th St., Birmingham, Ala.



www.americanradiohistory.com

Science in Slang

By EMERSON EASTERLING



"IN the Fritzey again!" howled the chauffeur.

The benzine go-cart had just exhibited its muline instincts — or tendency toward inertia as far as locomotation was concerned.

The azurely, effluviated auto-engineer wandered into the depths of the unknown that lies beneath the hood and Punk turned to Jazz with:

"Say, Stazz Jokes, will you be so kind as to bust loose and put us ignorant honyots wise to the hidden mystery that most everyone knows about—but I don't——that makes the buses commence up the street without the herder pouncing out and doing the Henry Ford at the bow end of the land craft? I know how to jump on the self-beginner and how to keep the gas operated thumper rattling, after I do the fatal stunt —but what I crave is the *why* and the *wherefore*—dost thou getteth me, Sir Lunchalot?"

"The person spoken to doth," returned Jazz.

The story then runs something like this

"Once upon a time—in the first gray days of modern mechanical history, a boob sat at a pile of junk—we'll not give the guy away— waxing sore and emitting moisture under the hat. Ye olde inventor was working on a conglomeration of metal that was to furnish power by the expansion, or rather the concussion or pressure exerted from a series of explosions that were to take place in an enclosed chamber. But the question was to make the explosions in a true classical manner.

Juicing the Jazz Wagon

"Some score of bewildered brothers in the game had tried many means of bringing the probability into an honest possibility. But our hero—"

"You mean villian!" This from the besmeared driver who was—you know—up fore.

"But our ———," continued Stokes, "was working on another wise hunch. His graft was to harness the Goddess Electra along with the God. . . . (Editor, please insert here the name of some political enem . The writer is no political authority. Besides we might not agree. I'll take the blame of your choice—if blame falls. Enclosed in parenthesis is *not* intended for print.)"

"(Political enemy)?" wondered—out loud —Mr. Vote, our artist friend from Portland, "Why do you use him for some contribution God? What is he supposed to be god of?"

"Gas—along with hot air," smiled back Stokes.

"As I was about to say," Stokes went on, "our what-you-may-call-him, as he sat dripping over the model of his brain baby, thinking and sweating, doped out the spark ignition for gas engines. Before that the bums on the works had been using flint lock contraptions, flame, and everything.

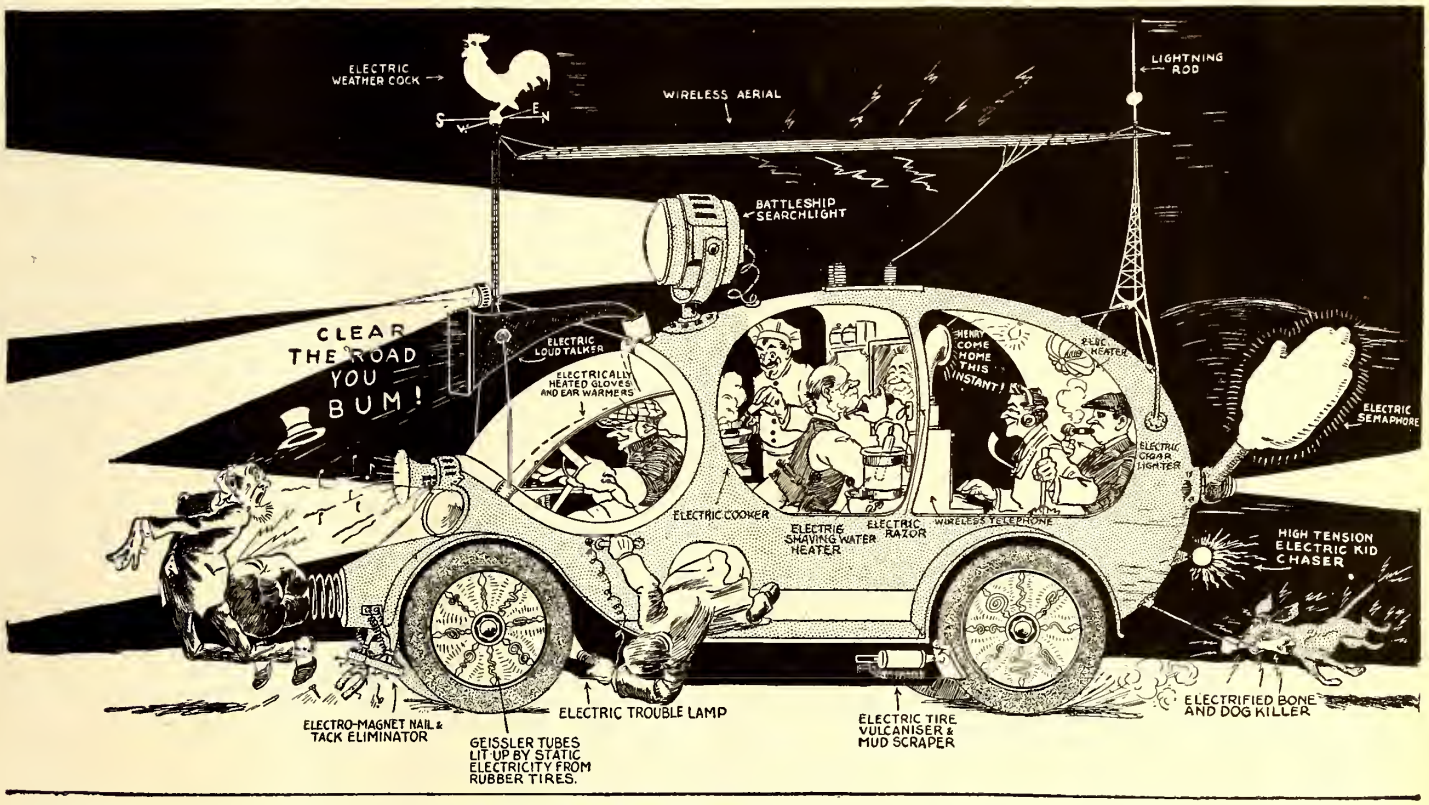
"The spark stunt proved to be *the* thing in the game. As time shapened out the ends —like Shakie averred divinity would do —spark plugs came into existence. If you care to see how far the inventors have wandered in the field, just meander into a spark plug emporium and gaze over the assortment. Every one is claimed to be a little better in some way or other for some purpose or other than the rest.

"Some manufacturers are not satisfied with one spark plug and jab in a couple—this is in the larger types of stationary engines. For the automobile engines *one* is a-plenty—at least *at a time*.

"To get down to the information of the situation: The thing is run like this: A source of juice, say a bank of batteries—a battery to be explicit, furnishes the V plus A for the induction—or spark—coil. The voltage—that's the capital V—up to a point where it is not hampered by a short air or gas gap, flashes right across and ignites the inflammable mixture in the cylinder chamber and does the same thing in a mechanical way that a lot of similar things do in a political way.

"Of course, the guy that uses the engine don't want the spark shooting across the gap steady, or at random, so the makers have devised all sorts of do-funny things they call timers and—you know, those cute lil trade names. All serve the same purpose—that of making the necessary arrangements to have the spark blaze away at the psychological, or rather the physiological moment. The revolving of the revolving parts of the motor cause the circuit to be opened and closed. As the engine speeds up it is more efficient to have the ignition take place a fraction of a second sooner than in the case of slow running or hard pulling. For this purpose there is installed on most cars the spark advance, or adjuster, with which we are all familiar.

(*Continued on page* 798)



If Your Flivver Has a Well Stocked Juice-Box Don't Be Bashful—But Go the Limit. This Being the Electrical Age—or Rage—Let's All Be Comfy. Take a Squint At the Above Portrait, But Don't Crack Your Lip Laughing. The Fact Is, There's Nothing Phoney About This 21st Century Buzz-Wagon. Step This Way, Boys, Right Into Any Automobile Confectionary Store. They Will Sell You All Your Electrical Rinktums—and Lots Besides. We Would Have Stuck a Few More Gross Onto Our Flivvernacular, Only the Artist Went Bluey and Struck for Less Art and More Pay.

www.americanradiohistory.com



THE ORACLE

The "Oracle" is for the sole benefit of all electrical experimenters. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be publisht. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., **must** be on separate sheets. Questions addrest to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of **25 cents** is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

ROGERS GROUND ANTENNAE.

(1030) H. I. Middleton, Hendersonville, N. C., asks several questions in reference to Rogers Underground Antennae:

Q. 1. If bare wires can be used as underground antennae (as per article in June, 1919 EXPERIMENTER), why can't waterpipes, etc., which are available and already buried, be used?

Q. 2. If a bare wire is used for underground antennae, how and why should it be connected to the regular "Ground" wire which diagrams in June article call for?

Q. 3. In what order of efficiency will the following styles of antennae rank, viz: Regular Tower Antennae, Tree Antennae, Underground Antennae?

Q. 4. Will the Tree Antennae and the Underground Antennae require specially constructed or sensitive receiving instruments (audion, etc.), or will they work just as well with the usual Amateur Receiving Sets?

A. 1. With reference to the Rogers underground antenna, and as to the reason why ordinary waterpipes, etc., cannot be used for aerials, would say that such piping systems buried in the ground have yielded very good results in some cases for the reception of radio signals, tho usually they do not correspond in efficiency to a well-laid Rogers antenna. Also in the case of the latter, there is an added advantage of high conductivity in the copper conductors as compared to ordinary waterpipes, and, contrary to the average opinion, common water is not a good conductor, but a very poor one, with a consequent high resistance.

A. 2. With respect to the connection of a bare wire Rogers antenna thru the receiving apparatus and then to the usual ground connection, would say that the Editor of the "Oracle" has personally heard signals coming in with a high audibility, using the antenna only, with no connection to the usual ground. But when the ground is also used in connection with one of these buried antennae, the signals come in somewhat louder. The whole philosophy of the Rogers underground aërial and its operation is, it would seem, based on the simple fact that the copper wires buried in the ground, whether bare or insulated, are many times higher in conductivity than the ordinary earth, and therefore due to this conductivity an appreciable radio current is induced and interpreted thru these conductors.

A. 3. The probable ratio of antenna efficiency would be (a) regular elevated antenna, (b) underground antenna, (c) tree antenna. The underground antenna does not always show as high an efficiency as some of the large elevated aërials in use at some of the Government stations, but it invariably has the advantage of the elevated antenna during periods when there is an appreciable amount of static, and signals can be copied on the underground aërial thru thunderstorms without the least danger, or without any interference from static.

A. 4. We cannot say as to the sensitivity required in the radio receiving instruments to be used with tree antennae as developed by Major General Squier, but would presume that any ordinary audion receiving set would give good results. The usual apparatus employing an audion detector may be used with great success with the Rogers underground antenna, and when the writer visited Mr. Rogers' laboratory he was using but one detector and amplifier, namely, an *audiotron* bulb. This bulb was connected up so as to oscillate when desired, in order to receive the undamped wave stations.

WANTED!!!

"ODD PHOTOS" AT $1.00 EACH

Here's what we want! What have you got?

ELECTRICAL PHOTOS—
New photos of Lightning; new and unusual Electrical Apparatus and Machinery; Electric Signs; Electric Autos; Electric Clocks.

SCIENTIFIC PHOTOS—
New Scientific Apparatus; Results; Effects; Motion Pictures; Stunts.

OPTICAL PHOTOS—
Peculiar stunts obtained with various lens arrangements; odd film effects caused by unusual conditions; novel micro-photographic subjects.

ASTRONOMICAL PHOTOS—
New eclipse photos; star and moon effects caught by the camera; comets; shooting stars; progressive moon studies; moon and star photos.

FREAK PHOTOS—
Odd double and triple exposure effects; novel and striking effects due to unusual exposures.

MECHANICAL PHOTOS—
Electrical and Mechanical apparatus of unusual news interest.

RADIO PHOTOS—
New stations, both commercial, government, and private. Owners of private or amateur stations will find a special contest for these photos on another page of this issue.

And don't send us plate or film "negatives"; send unmounted or mounted "prints", preferably a light and dark one. Enclose stamps if photos are to be returned and place a piece of cardboard in the envelope with them to prevent mutilation.

Address photos to—Editor "Odd Photos", Electrical Experimenter, 233 Fulton Street, New York City.

You will find an interesting article on the tuning of underground antennae to optimum wave lengths, by J. Stanley Brown, in the "Radio Amateur News" for July, 1919.

DATA ON FIVE-COIL LOOSE COUPLER.

(1031) M. R. Smith, Winnipeg, Man., Can., writes the "Oracle":

Q. 1. What are the dimensions and what size wire is used in the construction of the "Five-Coil Loose Coupler" shown on page 74 of the May issue of your excellent magazine, which is used by Samuel D. Cohen in his "New Regenerative Vacuum Tube Circuits"?

A. 1. We are pleased to give herewith information you request on the five-coil loose coupler.

L_1, 10 inches long, 7½ inches in diameter, wound with No. 20 silk-covered wire.

L_2, 8¾ inches long, diameter 6⅛ inches, wound with No. 26 silk-covered wire.

L_3, 8¾ inches long, diameter 5½ inches, wound with No. 20 silk-covered wire.

L_4, 4 inches long, diameter 7½ inches, wound with No. 20 silk-covered wire.

L_5, 4½ inches long, diameter 5½ inches, wound with No. 20 silk-covered wire.

PHAROAH'S SERPENTS.

(1032) E. F. Rightsell, La Grange, N. C., inquires:

Q. 1. Can you give me the formula for making the fireworks novelty called Pharoah's Serpents? It is a small pill or cube which when lighted will burn and the ashes will extend outward in the shape of a snake.

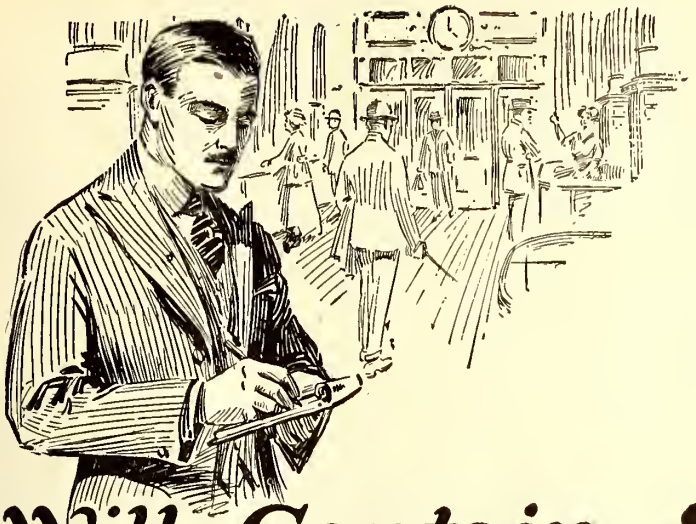
A. 1. The formula for making Pharoah's serpents, altho very efficient, is not generally used in the house, inasmuch as when these chemicals are combined to form the serpents they cause a strong odor of burning sulfur.

The following formula, however, may be adapted to both indoor and outdoor entertainments:

Potassium Chromat.....2 parts
Potassium Nitrat.....1 part
White Powdered Sugar.....2 parts

Powder each ingredient except the sugar very carefully. Then spread the powders on a piece of paper, and by carefully working with a spatula insure a thoro mixture of the ingredients. Moisten with a little alcohol and work into a paste. Now form into pellets about the size of a pea, or, in fact, any size desired, and allow to dry. These should be very carefully covered with a layer of tin-foil or tin-foil wrapping and placed in a large box, so that accidental friction will be almost impossible. Do not use a box with a slide cover, as friction when the cover is removed might cause harmful results.

www.americanradiohistory.com





Will Captain Smith return to Floorwalking?

There are thousands of men like Captain Smith who, before the war, were occupying relatively unimportant positions in the business world. Then, in a few months after the call to colors, they were holding commissions in the army. Millions of others found their way from positions in all walks of life into the various camps, where intensive training quickly turned a nation of business men into the world's finest fighting machine. It almost seemed incredible — but what this array of business men and workers did as "their bit" is now history. What took Germany forty years to prepare for was done in a few months by America. This record was made possible only by INTENSIVE TRAINING.

Though Captain Smith may return to his old job of floorwalker, it will be only for a short while — time enough to complete a course of intensive training in some line or other that will make him mentally fit for a better paid and more responsible position. He knows that intensive training will do this for him just as surely as it qualified him for a commission in the army.

Intensive training made him a leader of men. It enabled him to give orders instead of taking them. It enabled him to think, act and reason for himself and do the thinking for those under him—often a matter of life and death. No! Captain Smith couldn't be content in his old job, because he knows how to get a better one.

The War's Great Lesson

Every man who stepped from his job in civil life into an intensive training camp has learned a valuable lesson—a lesson that will make him a better business man if he but has the will to win. These men have witnessed the wonders of intensive training—have seen the metamorphosis in their own individual lives as well as in those of others, and it is but natural to assume that, if intensive training in military matters performed such wonders, it must have the same beneficial effect when applied to business. The history of business and of business successes points unerringly to the assistance rendered by intensive training.

Since the armistice was signed, and more particularly since the American troops began to arrive home, there has been a noticeable increase in the number of enrollments for intensive business training in all lines of endeavor taught by the American School. Thousands of men who were simply "getting by" instead of "getting on" before they joined the colors, have learned a lesson and they are not going to be content with the poorly paid jobs they held in the past. This fact is proved by the great increase in students who are availing themselves of American School training. In a few months these students who are now applying intensive training as a solution of "how to get on," will be able to qualify for the goal they have in mind. The spare time hours they devote to this training will bring them rich rewards in the form of bigger pay checks, better positions and more congenial work. The result of such training cannot be otherwise, for trained men are the scarcest commodity on the market.

After seeing what a few months of intensive training did for him from a military standpoint, he, and thousands like him, are going to avail themselves of the same method as a means of self-betterment in business life. There's proof below that it's the only way to secure promotion and much better pay.

An Investment Without an Equal

If you think for a moment that there is another investment that can equal the time and small amount of money spent in intensive training — get out your pencil and do some figuring.

If a course of intensive training in your chosen line costs you from $50 to $100 — and your spare time — how much would that money earn for you if invested in stock? From three to ten dollars per year would be the limit, wouldn't it?

The same amount invested in intensive training will double, treble or multiply your earning power several times, because it makes you a better business man and makes those who employ you aware of that fact. There's no sentiment in determining salaries. You get paid for what you can do—and that depends solely on what you know.

Your spare time does not earn you anything NOW — so you can't charge anything to a course of intensive business training but the actual cost of the course. If the result of this training only increased your earning power by ten dollars a week — and that is a conservative figure — you would net FIVE HUNDRED AND TWENTY DOLLARS a year from a small investment of cash and spare time. That is a small gain when compared with actual returns reported by American School students, but small as it is it serves to prove that there is no other investment in the world that pays so well as a trained brain.

Thousands Bettered by American School Training

It has been the privilege of the American School, a fully chartered educational institution, to prepare thousands of ambitious people for better positions in all trades and professions. For nearly a quarter-century it has been advocating intensive training and, today, there are thousands to testify to its efficacy—thousands who are now enjoying healthy incomes and congenial work as a result of the spare time they devoted to American School training. The same measure of success can be yours. Proof of scores of these successes will gladly be mailed you on request.

A School That Is Known by Its Guarantee

The American School believes that education, like merchandise, should be sold on a "make good" basis. Doing business strictly by mail demands some guarantee as a protection to the student. That is the belief of the American School — and it is on the basis of SATISFACTION OR MONEY REFUNDED that a student enrolls. All risk on the part of the student is eliminated. At any time during the first year of your enrollment we guarantee to refund your money in full if, after the completion of ten examinations, you notify the School that you are not satisfied with your course. Ten examinations will prove to you whether or not you are getting practical, money-making training. You are the judge.

Don't Dodge a Better Job

Whether you get a better position and better pay is up to you and you alone. The American School can help you get the position you want — just as it has helped its thousands of students. It will not obligate you to investigate what this training means to you. A Free Bulletin will be mailed you on receipt of the coupon. No agents will call on you — and it might prove the best thing you ever did. Check and mail the coupon while this matter is before you.

American School of Correspondence

Dept. G-269 Chicago, U. S. A.

TRAINING—THE KEY TO SUCCESS

Explain how I can qualify for the position checked. ASC

.....Electrical Engineer	.....Business Manager
.....Electric Light and Power Superintendent	.....Certified Pub. Acc'nt
	.....Accountant and Auditor
.....Hydroelectric Engineer	.....Bookkeeper
.....Telephone Engineer	.....Stenographer
.....Telegraph Engineer	.....Fire Insurance Expert
.....Wireless Operator	.....Sanitary Engineer
.....Architect	.....Master Plumber
.....Building Contractor	.....Heating and Ventilating Engineer
.....Civil Engineer	
.....Structural Engineer	.....Automobile Engineer
.....Mechanical Engineer	.....Automobile Repairman
.....Shop Superintendent	.....Airplane Mechanic
.....Steam Engineer	.....High School Graduate
.....Draftsman and Designer	.....Gen'l Education Courses
.....Lawyer	.....Common School Branches

Name .....

Address .....

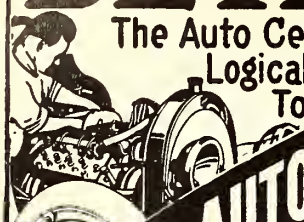
.....

www.americanradiohistory.com

DETROIT

The Auto Center is the Logical Place To

LEARN AUTO AND TRACTOR BUSINESS



Training for Head and Hand

Young Men of today are fortunate to live in the age of the Auto and Tractor Business. It is the greatest business in the world. Never before has there been such a wonderful future for ambitious men.

Big Demand For Trained Auto Men

Think of it!—Six million automobiles in use and thousands more being sold daily. Factories are rushed to the limit. Trained automobile men are wanted everywhere. The demand exceeds the supply. That's the business you can learn here at our school,—and such is the opportunity that awaits the trained automobile man.

Earn $100 to $400 Monthly

It is not at all difficult for a trained man to earn those salaries. Hundreds of our graduates are doing even better than that. Auto Factories, Garages, Service Stations and Tractor Factories are continually calling on us for graduates to fill responsible positions. Many of our graduates go into business for themselves. There are thousands of places where good garages and the services of competent, trained men are needed. These opportunities are unlimited.

Money-Back Garantee

We guarantee to qualify you for a position as chauffeur, repair man, tester, demonstrator, auto electrician, garage man, automobile dealer, or tractor mechanic and operator, paying from $100 to $400 monthly or refund your money.

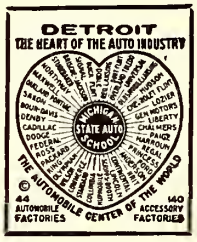
Complete Tractor Course Included

Complete instruction on the care, repair and maintenance of tractors is also included in our regular Auto Course. Tractor manufacturers give full co-operation. International, Moline and Emerson-Brantingham Co.'s have placed machines with us for the benefit of our students.

Brazing-Welding and Tire Repairing Taught in Separate Courses. Big Money Earned by Trained Competent Men in These Lines.

Big Factories Endorse Our School—In fact they assisted in the arrangement of our present Course. They know our equipment and our methods and heartily recommend our School.

Free Catalog—Gives complete information with views of school and equipment, also actual letters from satisfied graduates. Write for it. Better still, jump train and come as hundreds do. Our guarantee protects you.



MICHIGAN STATE AUTO SCHOOL

"Most Progressive Auto School in America"—"In the Heart of the Auto Industry"

Auto Building, 672 Woodward Avenue DETROIT, MICH., U. S. A.

POWER!

O! Boy! but my car runs fine with the ALSOP ALL-SPARK I have no more spark-plug troubles



EQUIP YOUR CAR AT ONCE WITH THE

"ALSOP-ALL-SPARK"

SAFE — SIMPLE — SURE

It eliminates the cost of new plugs, by causing old, cracked, carbonized and oil soaked plugs to give powerful sparks, which retards carbon, saves gas, develops greater power, and insures continued driving without misfires.

Control is from a handsome dial on dashboard, so that a low voltage hot spark can be used for starting.

NOTE:—This device does not contain **DANGEROUS EXPOSED SPARK GAPS**, which may **SET YOUR CAR AFIRE** and make your engine **HARD TO START.**



Controlled from a handsome dial on dashboard.
PRICE: 4 cylinder type $7.50 with money-back Guarantee

WRITE for our great Catalogue of GOVERNMENT TESTS.

DEALERS—AGENTS—SALESMEN—WANTED

ALL-SPARK IGNITION CO., Inc. - 13 Water St., New York

"The Eastern" is a Large Achromatic Telescope



MADE UPON NEW SCIENTIFIC PRINCIPLES.

Positively such a good Telescope was never sold for this price before. **Eastern Telescopes** are made by one of the largest manufacturers of telescopes in America; we control entire production; measure closed 9 inchss and open over 3 feet in 4 sections. They are nicely brass bound, with scientifically ground lenses. **Guaranteed by the maker.** Every sojourner in the country or at the seaside resorts should certainly secure one of these instruments, and no farmer should be without one. The scenery just now is beautiful, a Telescope will aid you in taking views. Objects are brought to view with astonishing clearness. Sent by mail or express, safely packed, prepaid, for only **99 cents.** Our new Catalogue of Watches, etc., sent with each order. This is a grand offer and you should not miss it. **We warrant** each telescope just as represented or money refunded. Send **99 cents** by Registered Letter, Post Office Money Order, Express Money Order, or Bank Draft payable to our order, or your newsdealer or store-keeper will order one for you. Whether consumer or dealer, send cash with order. **To dealers 6 for Four Dollars.**

EASTERN NOVELTY CO., 67: 172 E. 93d STREET, NEW YORK.

The Electrical Machinist

By H. Winfield Secor

(*Continued from page 775*)

moving any commutator, to note and record its exact position on the shaft; a center punch mark should be made on the armature drum or core, and another corresponding mark on one of the commutator segments. Thus, when the commutator is being replaced these two marks should be lined up. This is very important from an electrical standpoint, and it also is the best from a mechanical standpoint for obvious reasons.

Small commutators are frequently driven into place on the armature shaft by means of a piece of pipe which fits over the shaft, and then this pipe is hit with a heavy hammer or sledge, driving the commutator on in this fashion. Where the commutator does not make an extra tight fit on the shaft this method is quick, it may be said, but it is very poor practise, except when applied by an experienced mechanic who can judge when this process is requiring too heavy a blow. On small armatures there is a danger of bending the shaft. It is best to upend the armature and shaft in a vertical position when attempting to drive on a commutator in this fashion with a sledge and a piece of pipe. The commutator may rest on a piece of fiber or in some cases an iron plate is used, but the latter is liable to damage the end of the shaft.

When a shaft becomes bent, for one reason or another, one of the best methods of straightening it, is to place it between centers on a lathe. Small shafts can be easily straightened without applying any heat, but large shafts two or three inches in diameter and more, should have heat applied to them before attempting to bend them straight. The first thing to know is the actual position of the bend, and pressure should be applied on the opposite side of the shaft or armature drum from which the bend springs. Pressure may be applied in several ways. In some cases, a lever or a piece of plank is used on top of some blocking on the lathe bed, while in other cases, pressure may be applied by means of the lathe tool carriage, utilizing the slowest hand-feed possible on the carriage. Considerable pressure can be obtained in this way, but it is not advisable for any large work, as it is liable to strain the lathe machinery and either break or bend some of the gearing and connecting shafts on the tool-carriage.

MISCELLANEOUS COMMUTATOR CONSTRUCTION HINTS.

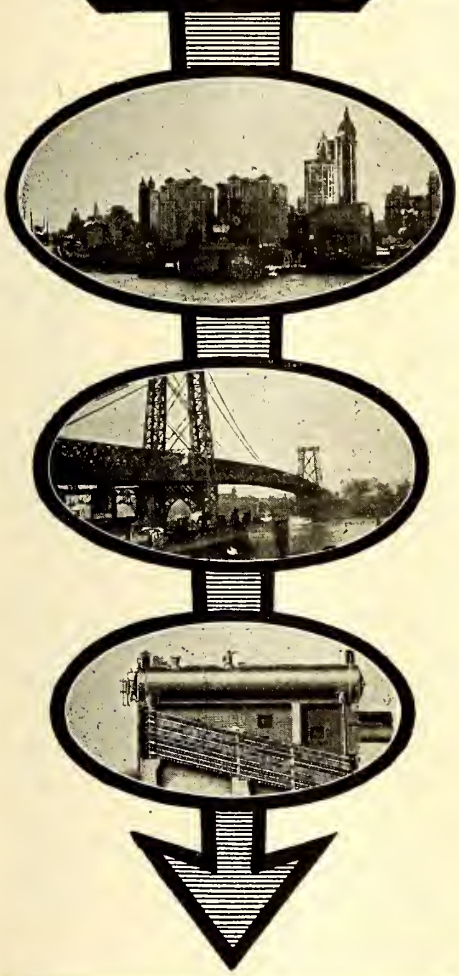
At figure 4 are illustrated several practical hints in commutator construction. At A, there is shown a method of building up cone-shape mica rings used in insulating the ends of the commutator barrel or drum. These rings are usually built of *shellacked mica,* a standard form of this material in the electrical trade, and which comes in the form of sheets of various thicknesses and sizes. This shellacked mica sheet is first cut out in segments or other shapes of predetermined dimensions, such that when they are heated above a Bunsen flame, they may readily be bent to the exact size and form of the cone required. In completing such a ring, the segments are overlapped as shown by the dotted and full lines in Fig. A. The segments are shellacked as they are built up in the cone form. A wooden form of the proper taper may be turned up for the purpose, or else the commutator shell itself may be used for the purpose. Cement mica is widely used in commutator work, but mostly where flat position of insulation, such as commutator segments, are required.

(*Continued on page 790*)

www.americanradiohistory.com



Be a Draftsman
Raise Your Income



Every Big Construction Job
Must Pass Through the Drafting Room

Do you realize what that means in the way of opportunity with big pay for Draftsmen? Think of the enormous volume of building operations now going forward all over the country with the return of peace—the big engineering, construction and manufacturing projects that must every one first go through the drafting room before the plans are ready for the workmen.

Never before in this country was there such a demand for skilled draftsmen—and this condition is true of European countries in which the destruction of war calls for vast re-building programs requiring the services of an army of draftsmen. All this world-wide demand means great prosperity for men who become trained in draftsmanship.

$25 to $100 a Week

All you need is training to be ready to accept a call that should mean $25 to $100 a week easily earned. You have the same opportunity to secure the valuable training in spare time at home or by personal attendance from the Chicago Technical College that many other men had who are now holding fine positions and earning big pay through their knowledge of draftsmanship.

Act Promptly—Now

The longer you wait, the longer you will postpone the time when you will begin to draw a tempting salary as an Expert Draftsman. Manufacturers, Architects, Contractors, Engineers, Builders, Railroads and other big employers of trained draftsmen are ready with the work—when **you** are qualified to handle it.

Come to the College or Train at Home

Whether you decide to take one of the resident courses or to study in spare time at home you will have the personal direction of practical engineers, builders and architects, who give you the benefit of their vast experience and the successful methods they use in their own work. No time wasted. Every minute counts under men like these—every one a specialist!

We train hundreds of men by the most modern methods and see them quickly succeed, because we give them a technical preparation that not only makes proficient draftsmen of them, but also enables them to fill higher executive positions in big construction enterprises. There is no limit to your progress after you have equipped yourself with what the Chicago "Tech" can give you.

Drawing Outfit



No Extra Charge

Every student of the Chicago "Tech" Home Study Course in Draftsmanship receives the drawing outfit—set of instruments in case, drawing board, T square, triangles scale, curve, drawing paper, pencils, etc., or a cash credit in case he already has an outfit. These instruments are of the same make and sizes as used by high salaried experts in drafting rooms of factories, shops, railroads, etc. You use them while learning—then take them right into your practical work.

Easy Payment

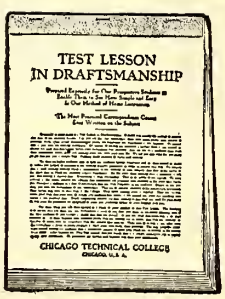
Chicago "Tech" training costs you little compared to the great benefits conferred, and payment of tuition fees may be made in easy installments, if desired. This splendid training will soon enable you to pay for the course from extra earnings.

Below, in the coupon, we list our principal courses. Just mark X in the ( ) to show which subject interests you and we will send you full information free. **Mail Coupon or write today.**

Free!

Drafting Lesson

The Chicago "Tech" method is the quickest, easiest way to become a skilled draftsman in spare time, without interfering with your present position. But we don't ask you to decide until you know how well qualified you are for this prosperous profession.



Other institutions ask you to pay first—and then find out later what their instruction means to you. We send the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything. And see for yourself just what Chicago "Tech" offers you in training which will bring a ready market for your services and open opportunities which are closed to the untrained man.

Send Coupon

CHICAGO TECHNICAL COLLEGE
CHICAGO, U. S. A.

AUTOMOBILE AND GAS ENGINE COURSE

All about automobile mechanism—its construction, operation and REPAIR—taught by mail. You train directly under the Chicago "Tech" automobile experts. Splendid opportunities open now.

Learn All This in Spare Time

All about the Principles of the Automobile; Gasoline Engines; Power Plants and Transmissions; Carburetors and Fuel Supply Systems; Lubrication and Cooling; Batteries; Magneto Ignition; Starting and Lighting Systems.

Know How To Fix Troubles

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men. Write—Send the coupon and get catalog and all information now.

CHICAGO TECHNICAL COLLEGE
1245 Chicago "Tech" Building, Chicago

Without obligation to me, send your Catalog on subject indicated below. Also FREE Lesson if inquiry is on Drafting or Plan Reading. Mark X opposite work in which you are especially interested.

[ ] Architectural Drafting	[ ] Plan-Reading—Buildings
[ ] Machine Drafting	[ ] Plan-Reading—Shop Men
[ ] Electrical Drafting	[ ] Estimating
[ ] Structural Drafting	[ ] Surveying
[ ] Sheet Metal Drafting	[ ] Autos and Gas Engines
[ ] Builders' Course	[ ] Aeronautics

Name .....

Address .....

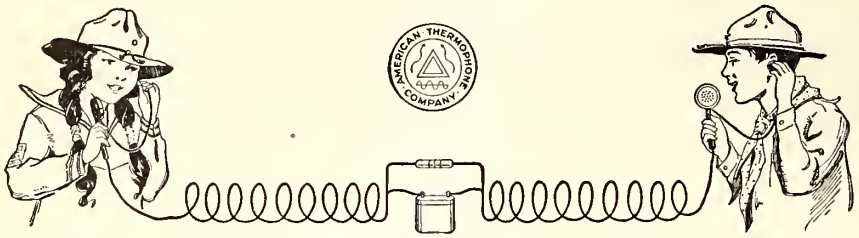
City..... State.....

College or Home Study? State which.....

www.americanradiohistory.com

KIDPHONE

TRADE MARK



Boys! Girls!! Grown-Ups!!!

The "Kidphone" is sold as a toy, but it is more than a toy—it is a practical, durable, superior telephone. Although it is much smaller and weighs much less (receiver weighs ¼ oz.), it talks better than the one you're used to. The idea of operation is different. It is based upon the correct theory of voice transmission, introducing to America for the first time a far-reaching, scientific principle, only recently perfected. Can be used for all sorts of purposes—in the house, in the play-room, on "Scout" duty, in games, etc.

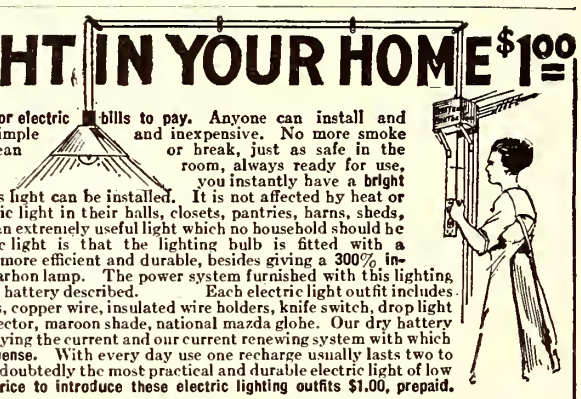
Ingenious! Instructive! Fascinating!

AN ALL YEAR 'ROUND CHRISTMAS PRESENT

Price $10 at your electrical dealer's, department store, or from us direct.

AMERICAN THERMOPHONE COMPANY—Department C
114-116 Bedford Street, Boston, Mass.

ELECTRIC LIGHT IN YOUR HOME $1.00



The latest electric light, no batteries to buy or electric bills to pay. Anyone can install and maintain this midget electric light. Safe, simple and inexpensive. No more smoke and smell, no wicks or oil, no chimneys to clean or break, just as safe in the barn, garage and clothes closet as in any open room, always ready for use, day or night. A touch on the switch and you instantly have a **bright electric light.** No matter where you live this light can be installed. It is not affected by heat or cold. Many homes have installed this electric light in their halls, closets, pantries, barns, sheds, cellars, garages, etc., with good results. It is an extremely useful light which no household should be without. The reason for this bright electric light is that the lighting bulb is fitted with a drawn Tungsten filament wire which is much more efficient and durable, besides giving a **300% increase in light** as compared with the ordinary carbon lamp. The power system furnished with this lighting outfit is somewhat similar to the electric power battery described. Each electric light outfit includes the following: Complete directions and plans, copper wire, insulated wire holders, knife switch, drop light fixture with socket, friction tape, battery protector, maroon shade, national mazda globe. Our dry battery compound, which assists in renewing and supplying the current and our current renewing system with which you can **renew the current at home without expense.** With every day use one recharge usually lasts two to three weeks. This electric lighting outfit is undoubtedly the most practical and durable electric light of low cost and long service ever devised. **Special price to introduce these electric lighting outfits $1.00, prepaid.** Outside the U. S. $1.25.

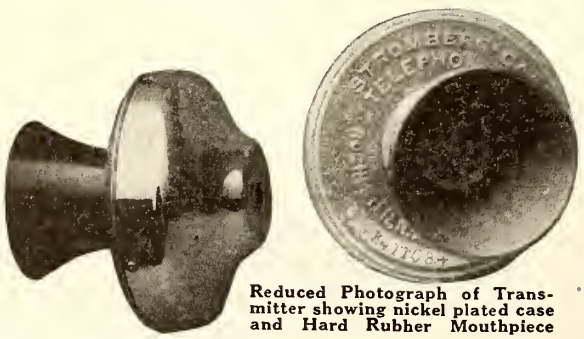
NOTICE

With the above Electric Light System it is possible for anyone to have their Christmas tree electrically illuminated, doing away with candles, oil lamps and danger of fire. It will assure you a brighter appearing Christmas tree. With this system, 8 to 16 lamps can be electrically illuminated. This system will be furnished free with the above Electric Light Outfit. Order at once direct from ad. Prompt and safe delivery guaranteed for 10c extra.

A. B. C. PRODUCTS CO., Johnson and 13th Sts., Chicago

SPECIAL SALE!

We have on hand 2,000 Carbon Grain Transmitters as per photograph. They are first-class instruments and may be used for all kind of experiments, especially for wireless telephone sets, where a heavy current is to be passed through. Slightly used, but in perfect working order. Money refunded if not satisfied. A real bargain. Order one or more today.



Reduced Photograph of Transmitter showing nickel plated case and Hard Rubber Mouthpiece

$1.00 ONLY

Postage extra.

Ship. Weight, 2 lbs.

Diameter, 3¼ ins.

THE ELECTRO IMPORTING CO., 231 Fulton St., NEW YORK

The Electrical Machinist

By H. Winfield Secor

(*Continued from page* 788)

In small commutators the segment insulators are usually made of pure mica punched out by a large motor-driven punch-press. It is usual in practise to make up a commutator gage stick as shown at Fig. 4—F. The mica punchings are assembled in the saw slits cut in this stick, the saw used in making the slits being of the exact thickness of the mica segment desired. One large motor concern uses wooden sticks, but they can of course be made up of other material. Several rubber bands are used in assembling small commutators as the mica and copper segments are put into place. At C, there is shown the method of scribing out the exact shape of mica segment for large commutators by laying the copper segment on the mica. At D and E, there are shown respectively, the use of a steel snap-gage having a slot of predetermined width and also the use of the *micrometer* for gaging the thickness of mica segment in thousandths of an inch or mils. In tightening up commutators some form of compression is generally employed, such as that shown at B. This is a wrought iron ring, several of which may be used on long commutators, and steel set screws are threaded thru the ring all around its perifery. These set screws may be spaced about two segments apart, and under the screws and over the commutator segments there is placed a thin band of iron or copper. The segments are thus tightened up and at the same time the lock nut on the end of the commutator is successively and periodically tightened. The commutator must in any case be just as tight as you can possibly make it, within reason of course, before any attempt is made to place it in the lathe and machine its surface, or otherwise there will be commutator segments in every corner of the shop, before many cuts have been taken.

(*To Be Continued*)

MAGAZINICALLY SPEAKING.

An *American, Country Gentleman,* wanting some *Variety* in his *Life,* and desirous of becoming an *Electrical Experimenter,* purchased at the *House Beautiful* a copy of *Popular Mechanics,* which contained many *Popular Current Events.* The *Engineering* in this *Journal* enabled him to become a good *Judge* of *Aircraft,* and consequently his *Outlook* for a *Success* was due to the *Modern Methods* taught by this *System.*

This *Craftsman,* having read some *Live Stories* in the *Scientific American* about the mines in San Francisco, decided to make a *Motoring* trip to the *Cosmopolitan* City. On arriving at the western city he did not heed the *Call* of the *Mining* center, but visited the *Motion Picture* studios, where he became acquainted with the *Photoplay.* The splendid atmosphere in this *Town* aided him to improve his *Physical Culture. Every Week* he would take a *Yachting* trip on the *Pacific* and enjoy the beautiful *Sunset.* One evening while a *Spectator* of a new *Film* at a leading *Theater* he met a young lady of *Fashion.* The next *Day* while at the town *Post* waiting for his *Mail* he again met the young woman. He liked her very much and soon became the *Woman's Companion.* They were soon married and went to live at the *Countryside.* The couple lived very happily and while the young woman was engaged in *Good Housekeeping,* the old gent sang extracts from *Musical America.*—*Art Mayers in the "Everett Herald."*

www.americanradiohistory.com



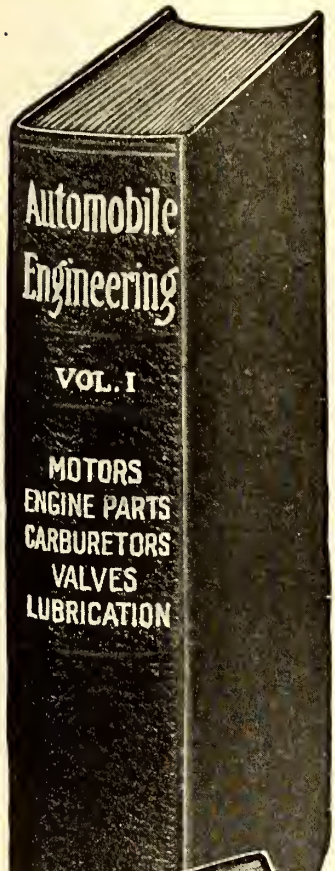






Take Your Choice of These Big Paying Jobs

THOUSANDS of men like you are wanted to fill these big-paying jobs in the automobile engineering field. Thousands of places are open, too, for chauffeurs and garage managers. It's easy to get one of these good jobs and to prepare yourself to hold it. You don't have to go to school. You don't have to serve an apprenticeship. Spare time only is needed. These great automobile books will teach you everything you need to know. Fifteen of the greatest engineers and experts in the business wrote them in simple language that anybody can understand.



Auto Books

6 Volumes Shipped Free

Just off the press—the 1920 model—an up-to-the-minute six-volume library on Automobile Engineering, covering the construction, care and repair of pleasure cars, motor trucks and motorcycles. Packed full of advance information on Lighting Systems, Garage Design and Equipment, Welding and other repair methods. Contains everything that a mechanic or an engineer or a motorcyclist or the owner or prospective owner of a motor car ought to know. Anybody can understand them. Tastefully bound in American Morocco, flexible covers, gold stamped, 2650 pages and 2300 illustrations, tables, blueprints and explanatory diagrams. A library that cost thousands of dollars to compile but that comes to you free for 7 days' examination. Over 50,000 sets of previous editions have been sold.

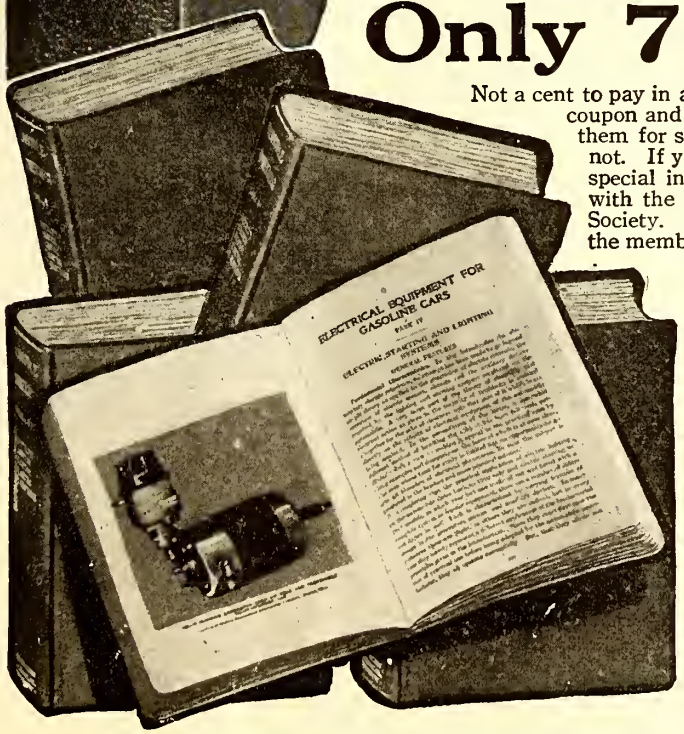
Partial Contents

Automobile Motors; Welding; Motor Construction and Repair; Carburetors and Settings; Valves, Cooling; Lubrication; Fly-Wheels; Clutch; Transmission; Final Drive; Steering Frames; Tires; Vulcanizing; Ignition; Starting and Lighting Systems; Shop Kinks; Commercial Garage; Design and Equipment; Electrics; Storage Batteries; Care and Repair of Motorcycles; Commercial Trucks; Gas Tractors.

128 Blueprints of Electric Wiring Diagrams

Only 7c a Day!

Not a cent to pay in advance. First you see the books in you own home or shop. Just mail coupon and pay express charges when books arrive. You can read them and study them for seven whole days before you decide whether you want to keep them or not. If you like the books, send only $2 in seven days and $2 a month until the special introductory price of $19.80 has been paid. (Regular price $30.) Along with the set goes a year's consulting membership in the American Technical Society. (Regular price $12.) This part of our offer will be withdrawn when the membership is filled. Mail the coupon without delay.



Don't Send Money Now!

Don't take our word for it. **See the books without cost.** Here is a chance for you to get a real man's job with a man's size pay. Don't waste a minute in sending the coupon. **Put the coupon in the mails today. Send no money—just the coupon!**

American Technical Society, Dept. A-259, Chicago, Ill.

FREE Examination Coupon

American Technical Society, Dept. A-259, Chicago

Please send me the 6-volume set of Automobile Engineering for 7 days' examination, shipping charges collect. If I decide to buy, I will send $2 within 7 days and the balance at $2 a month until the $19.80 has been paid. Then you send me a receipt showing that the $30 set of books and the $12 Consulting Membership are mine and fully paid for. If I think I can get along without the books after 7 days' trial, I will notify you to send for them at your expense. [*Please fill out all lines.*]

Name .....

Address .....

City ..... State .....

Reference .....

www.americanradiohistory.com

LEARN MUSIC AT HOME



Piano, Organ, Violin, Cornet, Guitar, Banjo, Mandolin, Harp, 'Cello, Trombone, Flute, Clarinet, Piccolo, Saxophone, Ukelele, Sight Singing, Viola, Tenor Banjo, Hawaiian Steel Guitar, Harmony and Composition.

Don't Be a "Wall Flower"

No longer need the ability to play be shut out of your life. Just mail coupon or postal to-day for our new Free Book. Let us tell you how you can easily, quickly, thoroughly learn to play your favorite musical instrument by note in your own home, without a teacher by our New Improved Home Study Method WITHOUT PAYING A CENT FOR LESSONS! Different, easier than private teacher way—no tiresome, dry exercises—no inconvenience, no trick music, no "numbers," yet simple, wonderful, amazingly easy for even a mere child.

U. S. School of Music
13312 Brunswick Bldg., New York

Please send me your free book, "Music Lessons by Mail," explaining how I can learn to play. I would like to learn how to play the following instrument

.....

NAME.....

ADDRESS .....

FREE Lessons

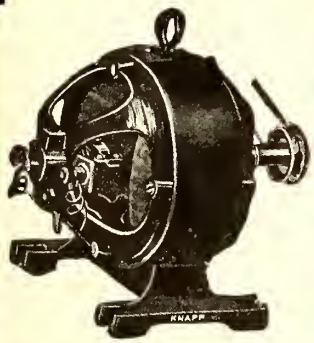
We want to have ONE PUPIL IN EACH LOCALITY AT ONCE to help advertise our wonderful, easy system of teaching music. FOR A LIMITED TIME we therefore offer our marvelous lessons FREE. Only charge is for postage and sheet music, which is small. Beginners or advanced pupils. Get all the proof, facts, letters from pupils. AMAZING OFFER and fascinating New Book just issued. ALL FREE! Write postal to-day. Instruments supplied when needed, cash or credit.

U.S. School of Music, 13312 Brunswick Bldg., New York

DEPENDABLE KNAPP ELECTRIC SPECIALTIES

Motors and Electrical Specialties Are Best

Knapp Goods have stood the test for 29 years. No detail in construction has been spared to make them the best that money can buy. The complete Knapp line includes Toy and Power Motors, Generators and Dynamos. Specialties and Novelties that amuse and instruct. Fans, Rheostats, Compasses, etc. And Knapp prices are always lowest. Always insist on Knapp Goods.



KNAPP DYNAMO MOTOR

Will electroplate, charge storage batteries, run lamps, motors, train of cars, induction coils,—in fact, the number of experiments it can be used for is unlimited. Runs on 4 to 6 Volts or can be connected to run on 110 Volts through a transformer.

Price, Complete, $8.00

KNAPP "LEARNELECTRICS"

A complete Electrical Laboratory, including a very valuable instruction book by H. P. Gorman, A.I.E.E. Covers all subjects clearly and concisely.

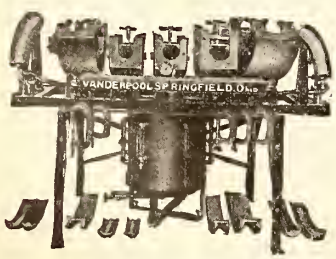


Price, Complete, $3.50

Order to-day. Or your dealer can secure them for you. DESCRIPTIVE CIRCULAR and CATALOG of celebrated **KNAPP MOTORS** *and Electrical Specialties from 10c up mailed FREE on request*

KNAPP ELECTRIC & NOVELTY CO., 523 West 51st Street, New York City

MEN WITHOUT PREVIOUS EXPERIENCE CAN GET INTO A VERY PROFITABLE, FAST GROWING BUSINESS



Everyone makes money in the TIRE VULCANIZING BUSINESS. Profits 100% or more. Small investment. We are the pioneers in the manufacture of the dry cure vulcanizer.

THE VANDERPOOL VULCANIZING OUTFIT

repairs tires by the correct method. The Vanderpool Principle is endorsed by the great tire factories, also by veteran repairers after trying others. We send you FREE TIRE REPAIRING MANUAL. If others have been successful so can you be. Write today for full particulars.

WM. VANDERPOOL CO., Dept. U 19, Springfield, Mass.

WHAT THE U. S. PRODUCES.

The United States has only six per cent of the population of the world and only seven per cent of the land, and yet we produce the following percentages of the world's supply:

Of copper	60%
Of lead	40%
Of zinc	50%
Of aluminum	60%
Of oil	66%
Of corn	75%
Of cotton	60%
Of silver	40%
Of coal	52%
Of gold	20%
Of iron and steel	40%
Of automobiles	85%
Of wheat	25%

and refine 20 per cent of the copper and operate 40 per cent of the world's railroads.

The Amateur Magician

By Joseph H. Kraus, Jr.

(*Continued from page* 771)

Again no movement on the part of the bell. "Well, I'll not fool any longer. The bell doesn't know." He was interrupted again by the "yes" ring of the bell. "How strange and yet—perhaps she does know. Was it a Diamond card?"

The bell answered in the affirmative.

Scratching his head the performer as tho choosing his words with great deliberation added, "Was it a picture card?"

The bell answered *yes*. "A King?" Two rings signified that this was correct.

"Not only does the bell tell me these things, but also tells fortunes. Now, bell, suppose that you tell me how many fellows that young lady down the aisle has. Four? Thank you."

In this way a long program may be mapt out and wound up in the following manner:

"The lady in the box there; yes, the married one. How many times has she been married?"

The hammer is seen to rise once, twice, but it only rises on the third occasion, not striking as it did on the previous occasions; while the magician watches with interest the next move, counting out loud.

"Twice, and almost the third time?" this with an inflection of the voice. "Here that will do." Separating the parts as before he bows to the audience.

THE CONSTRUCTION OF THE BELL AND STAND.

The stand consists of a long nickel-plated tube mounted on a tripod of the same material, with one wire running up each of two of the three legs, said wire connected to a large magnet made by winding eight layers of number eighteen doubl cotton covered magnet wire, on an iron core which does not extend all the way up the coil; but terminates within one inch of the end, a sleeve continuing the rest of the way. The coil is eight inches long and actuated by an assistant behind the scenes, a six volt current being used as the exciting force.

The hook is made of iron, nickel-plated, like the balance of the stand. When placed in position it acts as a core to the magnet concealed in the stand.

The bell is made of an ordinary electric light globe, which is fastened into a turned piece of wood (as shown in the illustration) with plaster of Paris. Thru a small opening in the ring on top is past a piece of soft iron bar, one end of which is connected to a lever-like piece of aluminum; the far end of this lever has a decorative piece of bone attached to its free end to act as a hammer.

(*Continued on page* 794)

www.americanradiohistory.com



Become a Doctor of CHIROPRACTIC

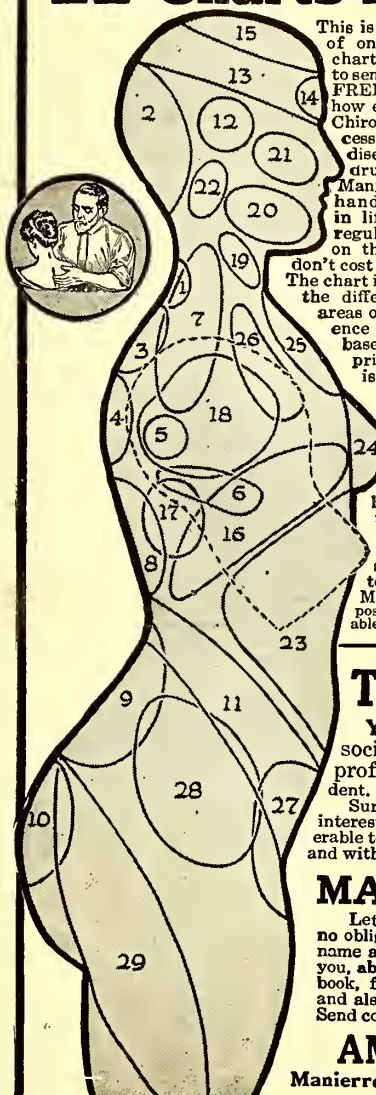
Advanced Science of Spinal Adjustment

The great profession that within the past few years has taken the longest forward strides ever known in the history of drugless healing. It has called to its ranks thousands of ambitious men and women from every walk of life. Today it is calling more insistently than ever because the tide has turned strongly in favor of drugless healing.

There is today a demand for one hundred thousand Doctors of Chiropractic in this country, according to a recent statement of a man who is himself a prominent Chiropractor and has intimate knowledge of the Chiropractic situation throughout the United States.

Even if this demand remained stationary, it would require many years to fill it. But the demand is **constantly increasing** because more and more intelligent people—those who do their own thinking—are becoming convinced that Chiropractic is the common sense and really scientific way to relieve pain and disease.

22 Charts FREE!



This is a small reproduction of one of 22 magnificent charts **all of which** we want to send you ABSOLUTELY FREE, just to show you how easily you can master Chiropractic and how successfully you can treat disease by this modern drugless healing method. Many of these charts are handsomely lithographed in life-like colors. Their regular value is $31.50, but on this special offer they don't cost you a penny. The chart illustrated here shows the different pain and nerve areas of the body. The science of Chiropractic is based upon the well known principle that when there is bone pressure on a trunk nerve where it leaves the spinal column there will be pain in the area it controls; and that by relieving the pressure the pain is banished. Chiropractic teaches you how to locate nerve pressure at any point along the spinal column and how to relieve it. Mail Coupon or write a postal today for this remarkable FREE CHARTS offer.

We Teach You By Mail

or in class. Our method of home study instruction places you under the personal direction of a splendid faculty of Chiropractic experts—men who have made notable records both as practitioners and instructors. There is no need for you to leave home or give up your present position. Your instruction will be thorough, practical and in accordance with the most modern methods of drugless healing therapeutics. From the moment you enroll we will work with you wholeheartedly, our one aim being to make you successful just as we have advanced the interests of thousands of others. In the shortest time consistent with thoroughness you can graduate with the degree of D. C. (Doctor of Chiropractic) receive your diploma **FREE**, and be ready at once to open your office. Your opportunities are as great as those of other ambitious men and woman. Why, then, shouldn't you be able to do as well as Doctors of Chiropractic who are today earning incomes of from

$3000 to $5000 a Year

and even more? What, for instance, is there to prevent you from doing as well as Dr. Condoluci, one of our recent graduates, who writes us that he earned from two to three times the cost of his tuition **as a student;** that immediately upon graduation he opened an office, began making money from the very start and is now earning **upwards of $12,000 a year!**

Another recent graduate, Allen Watrous writes: "Am contemplating opening a large office with 50 stretching tables. A man who is interested will put up $25,000 to make this possible." Dr. W. H. Wedell states that his practice averages ten patients a day and that he charges $25 for 13 treatments. At that rate he's making big money. Dr. M. D. Moore reports an income of $9000 a year; Dr. L. H. Roche, $5000. Dr. Hanna over $5000 yearly. Can you ask for more convincing proof that CHIROPRACTIC is indeed a great profession—a fertile field for men and women who feel that they can and **should** make more of their lives and are earnestly seeking broader opportunities?

Yes, the success of many Chiropractors has come so quickly as to be almost startling. And yet, it is not to be wondered at when you consider the scientific accuracy of Chiropractic methods, the constantly increasing demand for Doctors of Chiropractic and the comparatively few Chiropractors that are now in the field.

The Big Opportunity You've Been Waiting For!

You are ambitious. **You** would like to make more money—increase your prestige—advance socially—be **above** and not **of** the crowd. Then why not qualify **now** for this splendid profession which offers such remarkable possibilities for making you prosperous and independent. The time of preparation is short. The study is fascinating. The cost is small and terms are easy.

Surely a life of independence in a great, dignified profession, free to come and go as you like—a profession of absorbing interest and of rich financial rewards—surely this is far preferable to remaining in the same old rut—never getting ahead and with no outlook for the future. At least **investigate.**

MAIL COUPON TODAY

Let us send you all the facts. This places you under no obligation of any kind. Just mail coupon or send your name and address on a postal and we will at once send you, **absolutely free,** our beautiful new illustrated 72-page book, full particulars regarding the course, easy terms, and also our remarkable free charts offer. Don't put it off. Send coupon or write post card today.

AMERICAN UNIVERSITY
Manierre Building, Dept. 623 CHICAGO, ILL.

AMERICAN UNIVERSITY,
Manierre Bldg., Dept. 623 Chicago

Gentlemen:—Without cost or obligation, send me by mail, your new illustrated 72-page book and details of your easy payment plan and Free **Charts** Offer.

Name.....

Address.....

City..... State.....

www.americanradiohistory.com



NEW MOTORS



FACTORY GUARANTEED - ALL SIZES - IN ORIGINAL BOXES

Your Opportunity To Buy New Guaranteed Electrical Apparatus of Standard Manufacture.

Single Phase Motors
110-220 volts, A. C., 60 cycle, 1800 R. P. M. with pulley

1/4 H. P., 110 volts, induction, full load start - - $24.50
1/2 H. P., 110-220 volts, induction, full load start - $38.50
1/2 H. P., 110-220 volts, repulsion, for compressor $46.50
1 H. P., 110-220 volts, repulsion, with sliding base - - $67.50
2 H. P., 110-220 volts, repulsion, sliding base $108.50
3 H. P., 110-220 volts, repulsion, sliding base $124.50
5 H. P., 110-220 volts, repulsion, sliding base $164.50

Charging Generators
Suitable for all lighting Battery Charging and Power Requirements.

6 volts, 10 amp. $16.50
15 volts, 10 amp. $21.00
40 volts, 6 amp. $24.50
110 v, 2½ amp. $24.50
40 volts, 12 amp. $38.50
110 volts, 5 amp. $38.50
40 volts, 25 amp. $58.50
110 volts, 10 amp. $58.50
Moving Picture Arc Generator $85.00

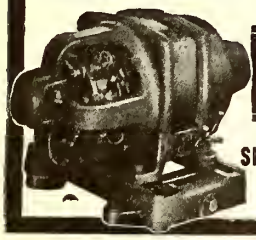
Polyphase Motors
2 and 3 phase, A.C., 220 v, 60 c. 1750 RPM., complete with base and pulley.

½ H. P. - $42.50
1 H. P. - $59.50
2 H. P. - $72.50
3 H. P. - $84.50
5 H. P. - $102.50
1 H. P., high speed, 3600 R.P.M., 220 v 2 phase only - $36.50

Battery Charging Outfits
To operate on A. C., 60 cycle, single phase voltage as specified.

110 volts, A. C., 100 watt. 24 volts, without switchboard $40.00
110 volts, A.C., 150 watts, 30 volts, with switchboard $68.50
110-220 volts, A. C., 250 watts, 24 volts, without switchboard - $75.00
220 volts, A.C., 300 watts, 30 volts, without switchboard - $85.00
110 volts, A.C., 375 watts, 30 volts, without switchboard - $85.00
220 volts, A.C., 500 watts, 40 volts, with switchboard $110.00
110 volts, A.C., 750 watts, 72 volts, without switchboard $125.00

WRITE FOR CATALOG. BARGAINS IN MOTORS AND GENERATORS



SPECIAL 1/4 H.P. 110 volts A.C., 60 cycle S.P., 1750 RPM. Complete, cord, plug & pulley



WASHING MACHINE MOTORS suitable for operating Small Compressors, Coffee Grinders, Bottle Washers, Etc. $19.75 EACH Reg. Value $32.50



MONEY BACK GUARANTEE

SHIPPING TERMS: 25% deposit required on all orders. Balance C. O. D. by Express. Sight draft with Bill of Lading attached by freight.

MANUFACTURERS' DISTRIBUTER

CHAS. H. JOHNSTON, Box 12 West End, Pittsburgh, Pa.

YOU HAVE A BEAUTIFUL FACE

BUT YOUR NOSE?

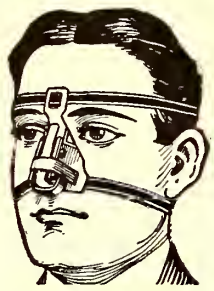




BEFORE



AFTER



IN THIS DAY AND AGE attention to your appearance is an absolute necessity if you expect to make the most out of life. Not only should you wish to appear as attractive as possible, for your own self-satisfaction, which is alone well worth your efforts, but you will find the world in general judging you greatly, if not wholly, by your *"looks,"* therefore it pays to "look your best" at all times.

Permit no one to see you looking otherwise; it will injure your welfare! Upon the impression you constantly make rests the failure or success of your life. Which is to be your ultimate destiny? My new *Nose-Shaper,* "TRADOS" (Model 24) corrects now ill-shaped noses without operation, quickly, safely and permanently. Is pleasant and does not interfere with one's daily occupation, being worn at night.

Write today for free booklet, which tells you how to correct ill-shaped noses without cost if not satisfactory

M. TRILETY, Face Specialist 1283 Ackerman Bldg., Binghamton, N. Y.

The Breakers

Atlantic City's Newest Fire-Proof Hotel

Ocean Front. Unusually attractive during the Autumn and Winter seasons.

American and European Plans



Luxurious lobbies, spacious verandas and sun parlors overlooking the ocean. Charming afternoon musicales and evening concerts. A palatial residence for those seeking rest and recreation. Sea water baths. Fireproof garage. Illustrated booklet sent on request.

MODEL AIRPLANE SUPPLIES

Build and fly  Model Airplanes ~

Send 5¢ for catalog of complete and knocked-down scale models of new machines, parts, fittings, and supplies.

Wading River Mfg. Co. 672 Broadway, Brooklyn, N.Y.

The Amateur Magician

By Joseph H. Kraus, Jr.

(*Continued from page 792*)

Two wires lead thru the stand and down each of two of the legs, making contact with two plates concealed by the heavy rug.

When the stand is brought forward, it is carefully placed in position so as to make contact with the two plates, the bell then being tried before proceeding with the balance of the performance. The trial is made under cover of a little phrase, asking the bell to show how it answers. A typical magician's forcing deck of cards being used, the assistant knows exactly what cards will be given out and goes thru the procedure as a regular matter of routine; pressing the key for each sound of the bell and the gong ringing at each break of the circuit.

It will be noted that when the soft iron core is attracted to the magnet, the hammer is pulled away from the bell, but on its sudden release the weight of the hammer allows it to swing downward, striking the bell just once.

A FEW TRICKS EASILY PERFORMED BY THE "FIXT PACK."

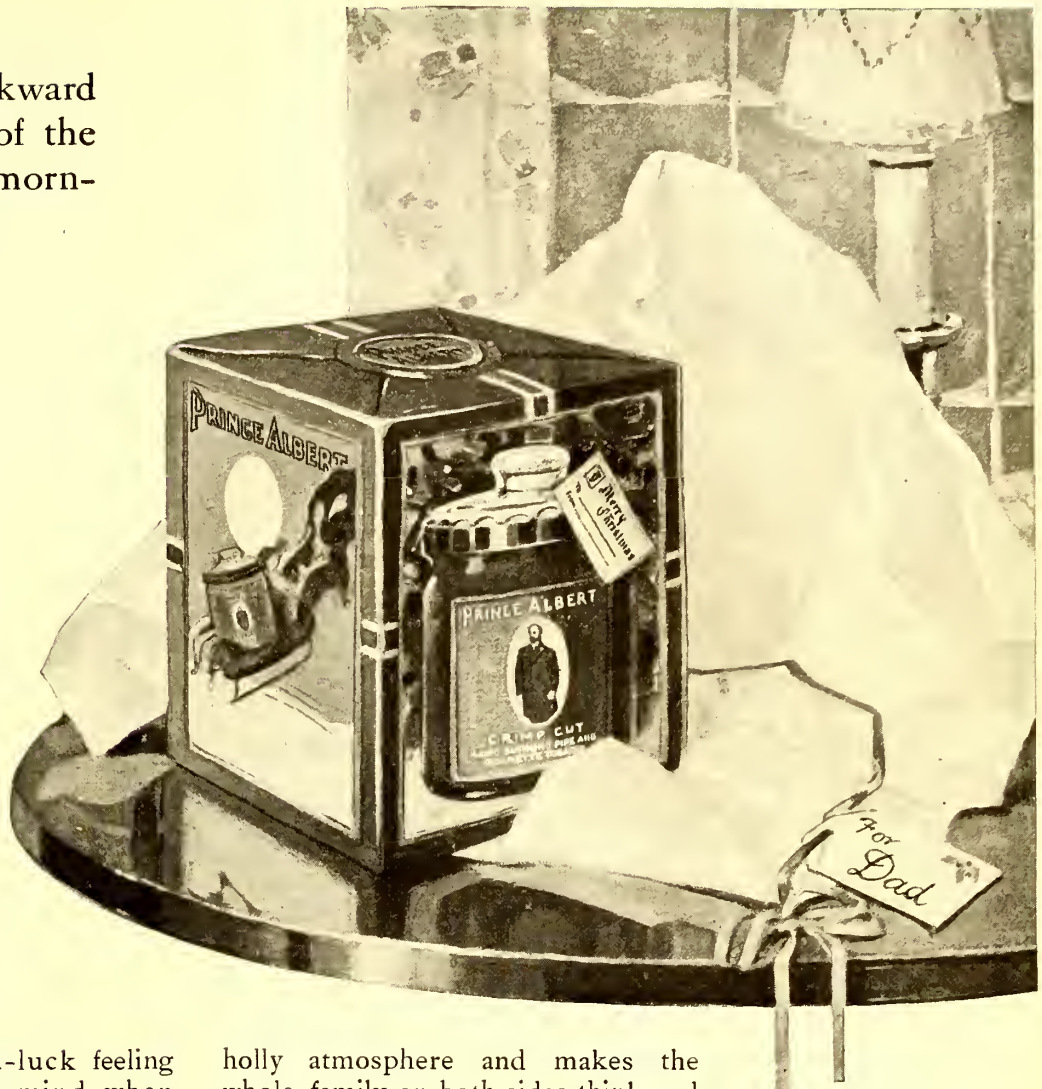
This trick originated many years ago. It never fails to produce results. The cards are fixt in an orderly manner, and this order preserved—*the deck never being shuffled.* This order is very easily learned, and it is only necessary to see one card in the deck, either the top or the bottom card, to be able—in this manner, to tell the name or the position of any card in the deck.

First—the suits are learned in the following manner: Hearts, clubs, diamonds, spades, and then the following arrangement will be found very satisfactory. The cards are separated by three numbers; that is, one, four, seven, ten, thirteen, three, six, nine, etc., in which the King is thirteen, Queen twelve, Jack eleven and the Ace is one. In arranging the cards, they will follow this manner: Ace of hearts, four of clubs, seven of diamonds, ten of spades, king of hearts, etc. In this way you can easily tell what the twelfth card in the deck will be and read the cards off without looking at them; also by giving a person a choice of any card in the deck, you will be able to discover just what that card was. For the "Q" trick, the cards are arranged in a definite manner. Any number in the circle and the number of cards in the tail changed after each performance. A person is instructed to count a certain number of cards up the tail and around the left side of the circular portion of the "Q" to suit himself. Then taking that card at which he stopt as number one, counting just as many cards, retracing his course, (except that this time he does not proceed down the tail), continues around the circular position of the "Q," stopping in a similar position, i. e. There are eight cards in the tail—the person will proceed up the tail, around the left side of the "Q," stopping at, say, the 17th card. Taking this card as number one, he proceeds backward again, stopping at the seventeenth card again. The performer instantly tells him this card before he comes back.

So much for the effect. Its mode of operation is simpler than the description of the trick and all that is necessary, is that the performer know the number of cards in the tail. Using the card from where the tail starts, as his starting point, he stops at the same card as the number of cards in the tail. In the example mentioned above, it would be the eighth card (inasmuch as there are eight cards in the tail) from your centre position, that, is, where the tail joins the "Q." A simple trial will readily convince.

www.americanradiohistory.com

TAKING awkward angles out of the early Christmas morning atmosphere!



HOW that low-on-luck feeling will peel off *his* mind when the happy-handout-happens Christmas morning; and, his keen eye sights the stage all set with the pound crystal glass humidor of Prince Albert tobacco gowned in the glories of a radiant holiday rainbow! Turkey takes to the tall timbers compared with the all-star-feast *you* spread so temptingly before his smokeappetite!

PRINCE ALBERT, for Christmas, lands on a man's tank-of-thanks like a spill-of-snow when the sleigh-bells are rusty from lack of jingles! P. A. as a *man gift* is the high-sign, the last word, the directest route to his comfort, his contentment, his smoke-happiness! It's the touch-that-lifts-the-lid; that takes the awkward angles out of the evergreen-and-holly atmosphere and makes the whole family on both sides think and talk in one language!

YOU'LL enjoy seeing *him* fuss his old jimmy pipe, all-brimful with Prince Albert! Or, *getting his* "rolling his own!" Never was such a delightful makin's cigarette as P. A. supplies. He can smoke the limit with Prince Albert *for it can't bite his tongue or parch his throat!* Our exclusive patented process fixes that! He'll just want to get thirty-six-smoke-hours out of the legal twenty-four, *that's all!*

FILL his smokecup to overflowing! Prince Albert is the glad-gift, the holiday-hunch that will hum him a smoke te-de, te-dum long, long after Christmas is but a merry memory!

PRINCE ALBERT is also sold in handsome pound and half pound tin humidors, in tidy red tins and in toppy red bags—wherever you buy tobacco.

R. J. REYNOLDS TOBACCO COMPANY
Winston-Salem, N. C.

PRINCE ALBERT

the national Christmas joy smoke

Copyright 1919 by R. J. Reynolds Tobacco Co.

www.americanradiohistory.com



What could you do?

Once to every man comes a time when he must fight for his life or the safety of a loved one.

It may come in the dead of night in your own home, burglars for instance; or on a lonely road or deserted street after dark, or even in broad daylight at the hands of passing bullies.

Suppose it should come to you tonight, what could you do?

Can't you see that it would not be just a question of bravery or strength but rather a question of whether you know how to box, how to defend yourself against the vicious blows of your assailant, how to disarm him if he tries to use a blackjack, club, knife or pistol, how to break his grip on your throat, how to stop the kick he launches at your stomach, and finally how to cripple him by a jiu-jitsu or bone-breaking hold?

Wouldn't you like to know how to play a man's part? Wouldn't you like to learn boxing and self-defense easily and quickly *at less than half the cost* of a single term of lessons by the old method?

Marshall Stillman has developed a unique principle of teaching boxing and self-defense. Two weeks after taking the course boys of twelve and fifteen, and men up to even fifty and sixty have been able to defend themselves against bigger and stronger opponents. He teaches the fundamentals of boxing in five lessons before your own mirror, so that when you meet your first opponent you know how to hit him, what to expect in return and how to guard against it. He teaches you sixteen bone-breaking holds and releases in jiu-jitsu and standing wrestling so that you can quickly put your assailant at a disadvantage and overcome him. For instance: "When opponent tries to use blackjack or other weapon, grasp his wrist with your left hand and immediately slip your other (right) arm well up under his arm and, reaching up, grasp his weapon-hand from behind. Then with both of your hands force his forearm back, as illustrated above. You can break his arm if necessary."

And while he's teaching you these things, he develops you physically and makes your daily exercise interesting as well as beneficial.

It is the first time boxing and self-defense have been successfully taught by mail, and it is only possible because of the Marshall Stillman principle of instruction.

The complete course *specially bound for home study* includes:

5 lessons in boxing—how to hit, duck, guard, feint, clinch, and use foot work.

3 rounds of shadow boxing.

1 set of daily exercises for muscle building.

8 jiu-jitsu holds and releases.

8 holds in standing wrestling.

1 free copy of Professor Mike Donovan's famous book, "The Science of Boxing," containing all of the scientific blows and guards known to the ring, the rules of boxing, suggestions on training, diet, etc.

There are 175 illustrations in this course. The *special Introductory Price* for this in Home Study Edition is, *until further notice*, only half of our usual price—$5.00 instead of $10.00.

It is almost unbelievable that you can learn these things by mail, but we are willing to take all the risk of convincing you. We will send you the complete course on 5-day approval. If you keep it send us $5.00 in full payment; if not, return it on the 5th day. Fill out the coupon *now*.

FREE APPROVAL OFFER

Marshall Stillman Association,
461 Fourth Avenue, Suite E-12, New York.

Send on approval the Marshall Stillman Course in Boxing and Self-defense including 5 lessons in the principles of boxing, 1 set of daily exercises, 3 rounds of shadow boxing, 8 jiu-jitsu holds and releases, 8 holds in standing wrestling, and a free copy of Prof. Donovan's book "Science of Boxing." I will either return them or remit $5.00 on the 5th day after I receive them.

Name .....

Address .....

"Slow Movies" Analyze Motion

(*Continued from page 751*)

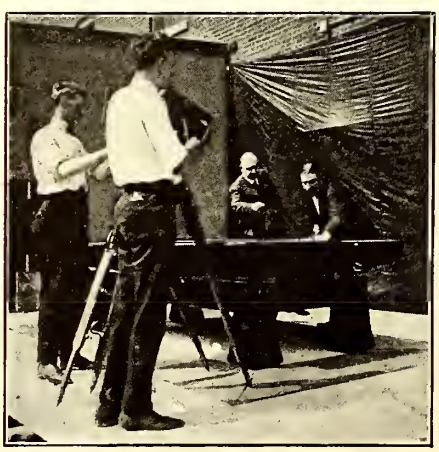
er in the light. This is so because our eyes can only perceive and analyze those movements which do not travel at a greater speed than sixteen times per second. Let us illustrate with an example: Suppose we look out thru a window at a man walking. If that man makes sixteen steps from the time he enters the left space until the time he leaves at the right margin of the window, we will be able to clearly perceive and count each one of these steps. However,



Taking a "Slow Movie" of a Motorcycle Race at 200 Pictures Per Second.

should that man travel at a greater speed than sixteen steps per second, his step movements will be blurred. Hence, when a camera takes pictures at such an extremely rapid rate, and projects them at the normal speed, it means a slowing down of the picture and the slow movement. Hence the twitch of all the muscles is instantly noticeable. If you have ever been to a theater which has exhibited a Novagraph production of diving, you will more than wonder at the gracefulness of the girl in this scene, as she executes some of the most difficult and wonderful dives. Compare these with the expert male swimmer, going thru the same dives—a striking contrast of his muscular movements with the gracefulness of the girl.

Hundreds of uses for this machine have already developed and suggested themselves. Aviators in flight have been photographed while executing tail spins, nose dives, etc. A movie of Ralph de Palma in his record-breaking Packard, moving at the rate of 130 miles per hour, produced a negative which even rendered the buttons of his uniform visible.



"Slow Movies" Permit of Accurately Analyzing Fancy Billiard Plays, Airplane Tail Spins, Etc.

HERE IT IS

Final Solution of the Vibrator Problem Absolutely Astonishing

NEWEST

and Greatest Invention



You know that Vibration means new life, power, health, beauty. You know it is Nature's way to banish pain and to give you new energy and vitality. You know all this, but do you know that the BIG problem of science has been to devise a hand vibrator that would be absolutely satisfactory in every way! That problem has vanished. We solved it. Our NEW, wonderful Vitapulser is GUARANTEED to effect ALL the astonishingly beneficial results made possible by this approved method of treatment.

THE VITAPULSER

Is practical. It requires no connection with electric wires—supplies its own power. Safe, light, compact, easy to handle and cannot get out of order. It is the modern choice of physicians and thousands of careful buyers.

EVERYONE CAN AFFORD This Marvelous Instrument

If you have not been able to afford a Vibrator on account of the high price, here is your opportunity to own one. *No income too modest to afford The Vitapulser;* sells for a fraction of price of others. Don't be dull, weak, mentally or physically depressed. Learn about the Vital Impulses; how to gain real health and Natural beauty. *The Vitapulser will make you over.* Give us a chance to prove it!

SENT ANYWHERE ON APPROVAL

for testing purposes. No obligation to buy. Write today for FREE remarkable book, "The Vital Impulse" and Special Approval offer.

Commonwealth Electric Mfg. Co.
731 Rialto Bldg., St. Louis, Mo.

Buy Clothes From Maker, Save 30%

That's one sure way to cut the cost of living. Every year thousands of men buy their suits and overcoats by mail, direct from the makers, thereby saving fully 30 per cent. of the cost, at the same time getting the same quality of cloth and workmanship they are accustomed to buy and with the added advantage of having all their clothes hand tailored to their individual measurements.

There is a successful concern in Chicago which has been making men's high-grade, made-to-measure suits by mail for over 15 years, and now has thousands of satisfied customers throughout the country. It would probably surprise the average man to go through their records and see the number of men, even in the big cities, who buy tbeir clotbes by mail from this concern.

If you send a postal card to the Ruby Tailors, Department 842, 329 South Franklin St., Chicago, Ill., they will send you free of charge tbeir latest up-to-date Fashion book, containing a number of actual samples of woolens—Fashion plates showing different styles of suits and full instructions for measuring and ordering.

Their long experience in dealing with thousands of men by mail has put them among the leaders in their line and enables them to guarantee to refund the full purchase price of any made-to-measure suit which is not perfectly satisfactory. A number of their customers annually earn substantial sums taking orders among their friends for Ruby Tailored Suits, and the concern makes a very attractive offer to men who desire to add to their income in this way, in addition to saving money on their own clothes. Lose no time in writing for their free Fashion book and complete outfit.

MONEY *for* YOU

Add to your Salary—Make extra Pin Money, Start a lucrative business of your own

Spend an hour each day taking subscriptions for the "Experimenter." We'll pay you well and you'll enjoy the work. *Write for full particulars.*

ELECTRICAL EXPERIMENTER
Circulation Dept., 233 Fulton St., N. Y. City

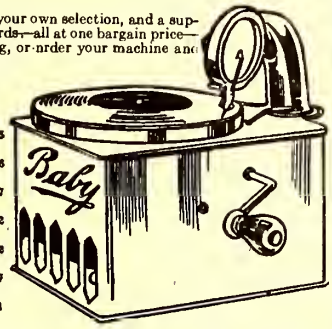
www.americanradiohistory.com

TALKING MACHINE Complete Outfit $5.98

With Three Double Face Emerson Records and Package of Needles

A real talking machine, not a toy. Plays real disc records just like expensive machines. It is constructed entirely of steel, with a wonderfully easy running motor. You'll like its clear, loud tone, particularly bringing out, as it does, the full charm of the music it plays. It can be adjusted to play fast or slow, soft or loud, as you prefer, but, above all, it has been so strongly constructed that it will stand lots of rough handling. A fine machine for indoors or to take with you outdoors, camping, canoeing, dancing—whenever you need music.

We include, FREE, three double faced records, your own selection, and a supply of needles. You get the machine, needles and records—all at one bargain price—**$5.98.** In ordering, select records from the following, or order your machine and select your records after complete list reaches you.



Select Your Records

I'm Forever Blowing Bubbles—**By the Campfire**—Duet	7485
Dear Old Pal of Mine—Solo—**Some Day I'll Make You Glad**—Solo	7466
If It Comes from Dixieland—**Rose of My Heart**—Tenor Solo	7497
Peter Gink—One Step—Band—**Some One Step**—One Step—Band	7472
How Ya Gonna Keep 'Em—One Step—Band—**What's That**—Fox Trot—Band	7492
How You Goin' t' Wet Your Whistle?—**St. Louis Blues**—Character Song	7477
In the Land of Beginning Again—**Oh, Promise Me**	7464

GENUINE GILLETTE



$4.59

The story is all in the headlines—this is a standard $5.00 razor, silver plated—with 12 Gillette Blades—the best money can buy. Order it either in leather case, or vest pocket pattern, at this very special price of **$4.59.**



Gillette Blades

These are standard Gillette blades—**40c** in ½ dozen pack—**79c** in dozen pack.

MUSCLE BUILDERS



Attach these easily to your wall and use them regularly. Watch your muscle grow. These splendid exercisers for developing muscles have extra coil springs, with Japanned handles, cut to fit the hands. They can be adjusted readily to the floor or wall, at all angles, and will be of enormous value in developing the muscles of the chest, back and arms.

$1.49

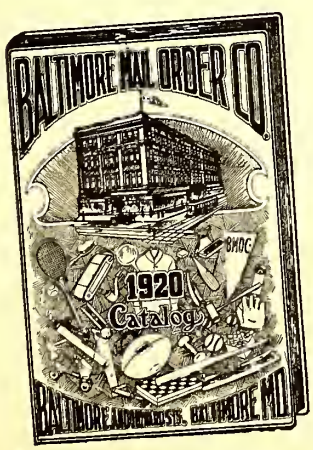
Men's Raincoat

Guaranteed Reinproof

$7.49



This is a sporty looking substantial raincoat at a price so reasonable no man can afford to risk getting wet, by going without one. It comes in a snug fitting model, becoming to young and old, with big patch pockets, adjustable military collar and a belt at the waist. Made of rubberized fabric, in olive drab color An unusual value.



Automatic Cigarette Case, 25c



Hands them out one at a time. The slickest thing you ever saw. Case is nickel-plated, in fancy design, strongly built to last you for years. Men find it most convenient style of cigarette case. Keeps cigarettes in good condition

HAMMERLESS REVOLVER

$10.50

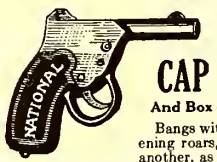


Not a "Baby" but a regulation man's size. Harrington and Richardson Hammerless Revolver. Order by calibre, either size, **$10.50** special.

22 calibre, rim fire, 7 shot, 3-inch barrel nickel-plated, 22 short, long or S. & W cartridge.

32 calibre, centre fire, 5 shot 3-inch barrel, nickel- plated, 32 S. & W. cartridge.

38 calibre, center fire, 5 shot, 3½-inch barrel, nickel-plated, 38 S. & W. cartridge.



50 Shooter Automatic

CAP PISTOL

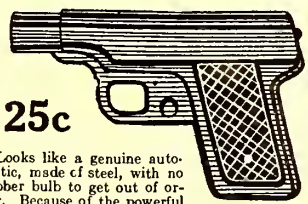
And Box of Ammunition

Bangs with 50 deafening roars, one after another, as quick as you can pull the trigger. **REPEATING CAPS,** to fit this pistol, come in rolls of 50 shots each at **5c** a box. Pistol alone without ammunition, **25c.**

29c

SOAK 'EM

WATER PISTOL



25c

Looks like a genuine automatic, made of steel, with no rubber bulb to get out of order. Because of the powerful air pressure of the cylinder it will squirt a large stream of water to a great distance. Can be carried in the pocket and used when the other fellow is not looking. Great for fun or self protection.

Catalog FREE With Every Order

With every order received, we will forward, FREE, a copy of our new 1920 catalogue containing many pages of valuable articles at bargain prices. Remit full amount of your order in currency, postal or express money order or 2c stamps. We prepay all postage and express charges

Satisfaction guaranteed, or money back

Handy Man Combination Pen Knife $1.69



Knife, screw driver, bottle end can opener—all in one. The handiest pocket knife a man ever had. Ideal for camping, outing and every-day convenience Made of finely tempered steel, brass lined and contains one large blade, screw driver, bottle opener and can opener. Has a stag handle, with ring for attaching to your key chain.

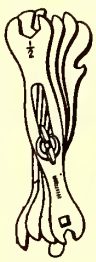
Jack Knife, 69c



An inexpensive, sturdy knife, built to stand constant use. Stag handle, one large and one small blade, both made from the best Wardlow English steel, with keen edges. It is lined with brass, and has nickel silver bolsters. A splendid knife at our special bargain price of **69c.**

Wrenches

10 In 1



These wrenches come with five nickel plated end wrenches, that, with the aid of the thumb bolt in the centre will fit ten size nuts. You'll find them compact and convenient, ready for any job, when you want them. **89c Per Set.**

STURDY ELECTRIC

MOTOR



99c

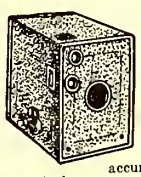
You'll find this a strong, sturdy, two terminal electric motor, just the thing for operating light running models and electrical toys. Can be run with one or more dry or wet cell batteries, depending upon the power desired.

Novelty Knife and Bottle Opener 98c



This knife is bound to appeal to the men. The handle is in the shape of a leg, with the shoe end forming a bottle opener. The two fine steel blades open easily, and fit back in the handle when not in use.

Genuine CAMERA



EASTMAN BROWNIE.

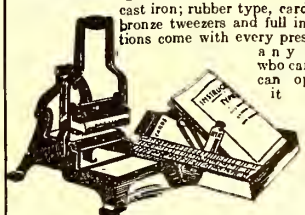
$2.86

Makes pictures 1⅝x2½ Is accurate, reliable, efficient and economical to operate. Anybody can make good pictures with it. Has the automatic shutter for snapshots and time exposures. Carefully tested lens and view finders, for vertical and horizontal exposures. These simple and reliable box cameras have stood the test of years and proved a delight to all who have used them

Complete PRINTING PRESS

$1.50

Every man and boy will find this printing press both useful and instructive. It will print cards, tags, envelopes and announcements. It is made of cast iron; rubber type, cards, ink bronze tweezers and full instructions come with every press and any child who can read can operate it



HUNTING KNIFE 60c



A great knife for hunting, camping, fishing and all sorts of outdoor work. It comes with a 4-inch heavy steel blade, finely tempered, with ebonized handle, fitted to your grasp. Every knife comes in a genuine leather sheath, with slits in the end through which to slip your belt.

Luminous WATCH

Shines in the Dark



The only cheap thing about this watch is the price, for you'll find it the all-round handiest timekeeper imaginable. It has the luminous dial that makes it easy to see the time, no matter how dark the night, and a nickel-plated case that will stand the hardest sort of usage. It is fully guaranteed, of course.

$2.75

Pocket

Flashlight 39c

Very Special



A flashlight that fits in your vest pocket, all ready for service, when you need a good, clear light. Comes with nickel plated case, equipped with a very bright bulb and a 2-cell battery. The price of **39c** is a very special one—for this occasion.

GIANT RAY

FLASHLIGHT

Very Powerful

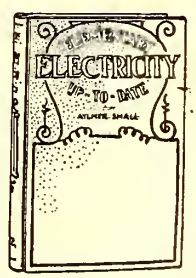


This is a genuine Tungsten flashlight, five inches long, with a powerful light, in a lightweight, vulcanized fibre case. It flashes on with a pressure of the button and will stay lighted by using the slide switch with which it is equipped. Carefully packed, complete for..... **99c**

LEARN A TRADE

With the Help of one of these Books

$1.00

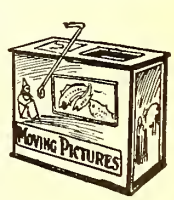


Modern Electric Illumination.
Elementary Electricity.
Wireless Telegraph and Telephone Handbook.
Telegraphy Self Taught.
Automobile Handbook.
Gas and Oil Engine Handbook.
Machine Shop Practice.

A complete catalogue of mechanical and trade books sent upon request.

MOVING PICTURES!

Great Fun



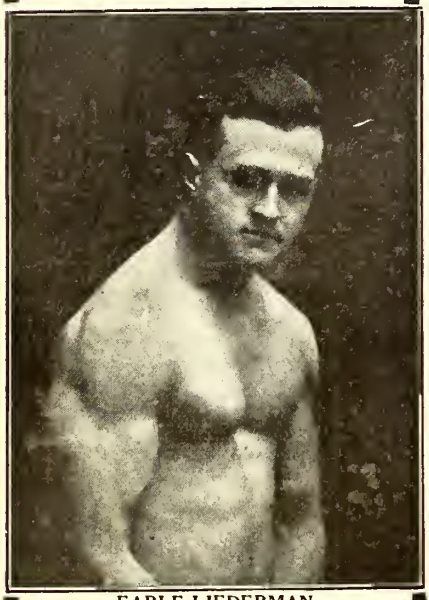
Turn the handle, look through the slot and see the moving pictures. No end to the amusement it will furnish. Great fun showing these moving pictures to your friends Price, **29c.**

GET OUR FREE PREMIUM OFFER

Baltimore Mail Order Co. Dept. 101 Howard & Baltimore Sts. Baltimore, Maryland

www.americanradiohistory.com

A Powerful Physique!



EARLE LIEDERMAN
The Acme of Physical Perfection

A 48 inch chest and 16½ inch biceps!

I HAVE THEM. HAVE YOU?

Hundreds of my pupils have obtained these measurements, and many of my pupils have exceeded them.

Why not let me do the same for you?

My methods never fail to produce results quickly.

I BEGIN WHERE OTHERS LEAVE OFF.
I PRACTICE WHAT I PREACH.

MY NEW BOOK
"MUSCULAR DEVELOPMENT"

will explain all about my system and will interest you.

It is illustrated with 20 full-page photographs of myself and of some of the finest developed atheletes whom I have trained. If you have not as yet read this book by all means get a copy.

Simply Tear Off Coupon Below and mail to me with 10c (stamps or coin) and you will receive your copy promptly.

EARLE E. LIEDERMAN
Dept. 215, 203 Broadway, New York City

TEAR OFF COUPON

DO IT NOW before you forget it

EARLE E. LIEDERMAN,
Dept. 215, 203 Broadway, N.Y. City.

Dear Sir:—I enclose herewith 10c for which you are to send me, without any obligation on my part whatever, a copy of your latest book "Muscular Development." (Please write plainly.)

Name .....

Street .....

City ..... State .....

El. Ex. Dec., 1919

HOW DID IT WORK?



This is a Portion of the Film of the Famous Rabbit Described in Our November Issue Who Stood Half a Million Volts, Never Batting an Eye-Lash. Can You Explain This Strange Film? The Editor Will Pay $20.00 for the Best Answer.

Turn to page 633 of our November issue. We told you last month how we electrified a rabbit with 500,000 volts, and how he never batted an eye-lash. Well, sir, the Gaumont Film people who got wind that we were pulling off a stunt were duly on hand with their trusted film cameras and while we made the experiment, the operator cranked away merrily. Of course, we wanted to see what the film looked like and we had our wish. The very mysterious sample slightly enlarged from the original film is printed along side here. At first we were somewhat puzzled and could not quite make it out how the long streamers after the third picture died away into a mere brush and in the fourth picture had almost entirely vanished only to bloom forth in a wonderful corona effect, showing the rabbit very plainly, in the sixth picture. In the seventh and eighth, however, nothing can be seen. Now what do you think happened?

500,000 volts at 20 kilowatts with a frequency of 200,000 was used in the film printed here, which is absolutely authentic. **We will pay $20.00 for the best answer explaining this phenomenon.** Anyone familiar with alternating current should have little trouble in solving the problem. The contest is open to all and will close promptly on February 1st, 1920. Not more than 300 words should be used. Answers will be publisht in our March issue. Address all replies to Rabbit Editor, care of this publication.

RADIO PROTECTION FOR CAMERON.

Citizens of Cameron parish are asking the government to locate a wireless station there, so that storm warnings may be given and farmers may have a chance to give whatever protection they can to their crops.

Cameron is an outpost of Louisiana for Gulf storms, and has suffered severe losses half a dozen times in the past 20 years. It has no railroads, no telegraph or telephone lines to the coast on account of the expense and difficulties of construction across the lowlands, and no method of receiving warnings.

The people of Cameron are industrious and enterprising. They have voted a heavy tax on themselves to construct roads. They have fertile lands which will produce valuable crops. As one of the storm outposts, the Weather Bureau needs to be in touch with Cameron, for the protection of the rest of the country.

Science in Slang—Juicing the Jazz Wagon

(*Continued from page* 785)

"The big idea is that when the piston reaches the proper point in the cylinder chamber the contact is made which closes the circuit that sets up a magnetic flux in the core of the coil, that attracts the vibrator arm and breaks the circuit and sets up an inductive reactive flow in the secondary, which breaks down the resistance—being the weakest place—between the points of the electrodes on the spark plug, which in turn ignites the gas in the chamber and causes the explosion that turns the motor over, that finally takes the joy rider to the court house or Police Headquarters. Whoof!

"Give 'em air boys"—this from Bender—"his carbureter leaks!"

"Such guys as Atwater-Kent have deviated from the old trodden paths and have rigged up an apparatus that is worked

(*Continued on page* 800)

www.americanradiohistory.com

AMPLIFY YOUR RADIO SIGNALS

ONE of the greatest drawbacks since the invention of wireless telegraphy is the receiving of weak signals at the receiving station. Many devices were proposed to improve this condition, but without success, on account of the mechanical difficulties encountered in these amplifying devices.

However, this was recently solved by the introduction of an exceedingly sensitive microphone transmitter, which is known to detect sound waves with great accuracy and magnify them through an intermediate telephone circuit.

By the employment of the new DETECTAGRAPH-TRANSMITTER, the amateur can amplify the radio signals to such an intensity that he can hear the signals about his station without the need of the telephone head set.

By the addition of a loud talking telephone he is able to hear the messages many feet away from the instrument. He is also able to demonstrate the operation of his wireless apparatus to his friends.

The super-sensitive DETECTAGRAPH-TRANSMITTER herewith shown is two and three-eighths inches in diameter, five-eighths of an inch thick and weighs less than three ounces. It is the most sensitive sound detecting device ever brought before the public.

The manner in which the amplifying process is attained is by attaching with tape the DETECTAGRAPH-TRANSMITTER to the regular wireless receiver as indicated in the diagram.

SUPER-SENSITIVE **Detectagraph** MICROPHONE DEVICES

Practical Instruments for Commercial and Scientific Purposes.

NOTICE

Although prices of raw material and labor have increased greatly in the last four years, we have continued selling our instruments at the pre-war prices, due to the fact that we had a large stock of material on hand. That material is now almost exhausted and we will be compelled to renew our stock at an increase in price, but for a limited time you can still get the benefit of the present low prices.



Our Super-Sensitive Detectagraph Transmitter. Price, $7.00 Complete

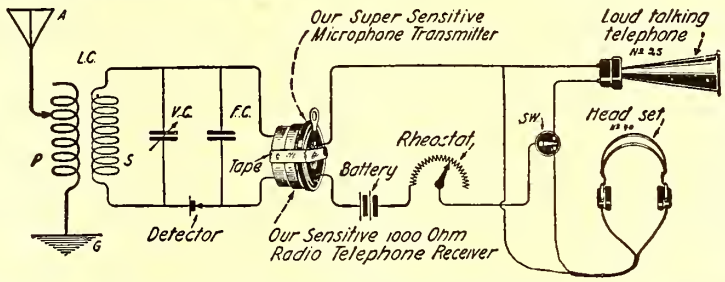
Other Uses

Not only is this instrument applicable for amplifying radio signals, but it can be used with equal satisfaction for magnifying other sounds. Phonograph music can be transmitted from one place to another by means of this instrument, and those who are afflicted with deafness will find enormous benefit by using this transmitter.





Our Special No. 25 Loud Talking Receiver Price, $4.50 Complete



It is the greatest device for building your own loud talking telephone, detectagraph and other devices. Can be used for any purpose where a sensitive detecting instrument is required.

Adjusted Model "B" Horn, with No. 20 high grade loud Talking Receiver. Cord Plugs and Desk Stand Base. Price, $12.00 Complete



Adjusted Model "C" Horn, with No. 20 high grade Loud Talking Wall Receiver. Price,

$12.00

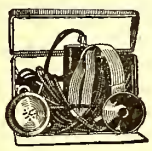
Complete

DETECTAGRAPHS

FOR THE EXPERIMENTER FOR DETECTIVES FOR THE DEAF

DETECTAGRAPH

This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord, Receiver, Headband, Case and Battery. **$15.00** Complete



DETECTAGRAPH JUNIOR DEAF-PHONE

The outfit consists of a Super-Sensitive Transmitter, with a cord connector; Super-Sensitive Ear Piece with small black cord; Black Single Headband; Black Case and two small Batteries. Transmitter 2⅜ inches in diameter, ⅝ of an inch thick, and weighs less than three ounces. **$15.00** Complete





Detectagraph Rheostat, especially made for amplifying circuits. Complete **$2.00**



Super Sensitive No. 40 Receivers to be used in connection with Detectagraph Transmitters.

$10.50

Order direct from ad. Or write for free descriptive circular. For your convenience use the coupon.

G. BOISSONNAULT COMPANY

26 CORTLANDT ST. NEW YORK CITY

Makers of Super-Sensitive Microphone Devices

G. Boissonnault Co., 26 Cortlandt St., N. Y. C.

As per your ad in Electrical Experimenter, please send me free circulars and full particulars about your Detectagraph Devices.

NAME .....

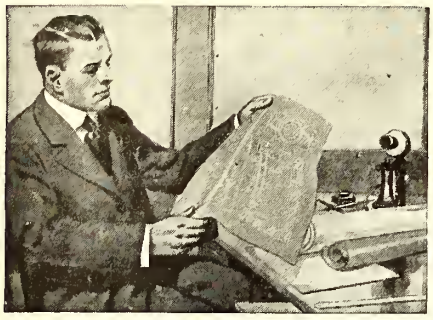
ADDRESS .....

CITY .....

STATE .....

www.americanradiohistory.com

Mechanical Engineering



Learn at Home!

Employers everywhere are looking for men with mechanical ability. Splendid salaries and rapid advancement are offered.

There is an easy, delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving men and women just the training they need for success in mechanical engineering and more than 200 other subjects. Hundreds of thousands have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6210, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

ELECTRICAL ENGINEER	CHEMICAL ENGINEER
Electrician	SALESMANSHIP
Electric Wiring	ADVERTISING MAN
Electric Lighting	Window Trimmer
Electric Car Running	Show Card Writer
Heavy Electric Traction	Outdoor Sign Painter
Electrical Draftsman	RAILROADER
Electric Machine Designer	ILLUSTRATOR
Telegraph Expert	DESIGNER
Practical Telephony	BUSINESS MANAGEMENT
MECHANICAL ENGINEER	Private Secretary
Mechanical Draftsman	BOOKKEEPER
Ship Draftsman	Stenographer and Typist
Machine Shop Practice	Cert. Pub. Accountant
Toolmaker	Traffic Management
Gas Engineer	Commercial Law
CIVIL ENGINEER	GOOD ENGLISH
Surveying and Mapping	STATIONARY ENGINEER
MINE FOREM'N OR ENG'R	CIVIL SERVICE
ARCHITECT	Railway Mail Clerk
Architectural Draftsman	Textile Overseer or Supt.
PLUMBING AND HEATING	AGRICULTURE
Sheet Metal Worker	Poultry Raising
Navigator	Automobiles
	Spanish
	French
	Italian

Name_____

Present Occupation_____ 7-25-19

Street and No._____

City_____ State_____

FREE



$20

TENOR BANJO Ukulele, Hawaiian Guitar, Violin, Mandolin, Guitar, Cornet or Banjo

Wonderful new system of teaching note music by mail. To first pupils in each locality, we give a $20 superb Violin, Mandolin, Ukulele, Guitar, Hawaiian Guitar, Cornet, Tenor Banjo or Banjo absolutely free. Very small charge for lessons only. We guarantee success or no charge. Complete outfit free. Write now. No obligation.

SLINGERLAND SCHOOL OF MUSIC, Inc. Dept. 41 CHICAGO, ILL.

The ROGERS
Violet Ray, High Frequency Generator

Does not burn out. No sparking—therefore all shocks are eliminated. An ideal outfit, fully guaranteed as to material and workmanship.

PRICE COMPLETE With One Surface Applicator **$25.00**

Send for free descriptive Booklet

The Rogers Electric Laboratories Co.
Dept. B, 2056 E. 4th St., Cleveland, Ohio

Science in Slang—Juicing the Jazz Wagon

By Emerson Easterling

(*Continued from page 799*)

like this," continued Jazz. "The contact on the distributor touches for an instant as the movable one passes over the stationary one. This makes a closed circuit. As the circuit is broken by the parting of the contacts the same thing happens that does when the vibrator arm flops up against the core—really, it don't touch the core. That would cause it to stick. A sort of anvil stops it just before it gets there.

"Some time back some bird stumbled onto the idea: that if generators could furnish juice for other purposes, why not stick one on the bus to squirt juice into the plugs? Since then we have had generators, generators, and some more generators, good, bad, and otherwise. In the Ford, Henry incorporates in the fly-wheel an A. C. revolving field generator. He must have run short of junk when he came to this part of his endeavors.

"In the old—I don't think it is the same in the newer types—Overland the self-starter, generator, and fly-wheel is one and the same.

"It was sure some ease on the autoist when the self-commencer came around. It led to other fine features, too. For one thing the electric lights have crowded the old carbide type off the boards.

"To-day we have our gas go-cart all rigged up with an electric self-starter that is operated from a storage battery. The battery is recharged in turn by the generator—sometimes the motor-generator, single unit; sometimes the two unit, one generator to charge the battery, and a motor to start the engine. Then, the lights, horn, cigar lighter, trouble lamp, spot light, and what else the general public care to stick on the layout, are run from the battery—and from the motor when it is running."

"What is this high frequency spark stuff I heard about?" spoke up Bender.

"It is some of James E. Seeley's and Lodge Brothers' ravings. It is just the employing of high frequency currents, like Nick Tesla has fingered around with, for the spark. The advantage is that the spark energy increases with the gas pressure—opposite from that of the other type—and carbon does not bother the ignition, as the spark is of short duration and the flash is not choked up by carbon.

"But getting back to magnetos—they are alternating current generators for the ignition. There are two kinds, low and high tension. The low tension is virtually an alternating current dynamo, and the high tension is a dynamo and step-up in one. The Bosch is one of the best—and it is not *bosh* either."

At that point the engine began to purr—like an angry sewing machine. Conversation somewhat dies away—especially on the part of the chauffeur. But Stokes had gas engines on the brain:

"You know the stationary engines that spat and spit and then hit once in a while? It is an automatic spark affair that is operated by the governor that causes that. When the engine attains a certain speed the governor cut-out stops the ignition. If it wasn't for that the thing would do the Bolshevik ———"

"And don't forget the electrically gear shifted and braked cars," interrupted Bender, "The kind where an electro-magnet jerks 'er from high to me'jum, an' so fort' —an' th' electro-magnetical tire burners—"

"The Livest Catalog in America"

Our big, new electrical cyclopedia No. 21 is waiting for you. Positively the most complete Wireless and electrical catalog in print today. 180 Big Pages, 500 illustrations, 300 instruments and apparatus, etc. Big "Treatise on Wireless Telegraphy." 20 FREE coupons for our 160-page FREE Wireless Course in 20 lessons. FREE Cyclopedia No. 21 measures 7x5¼". Weight ½ lb. Beautiful stiff covers.

WIRELESS

Send 6 cents in stamps or coin for which we will send our latest Cyclopedia Catalog No. 21 as described.

ELECTRO IMPORTING COMPANY
231 Fulton St., New York City

A STEFFEY MOTOR



on your wheel will convert it into a practical and successful high grade motorcycle that will cost you less to operate than the more expensive machines. Write at once and secure lowest factory prices. Excellent opportunity for agents. Send stamp.

STEFFEY MFG. CO., Dept. E. 5025 Brown St., Phila. Pa.

Fun, Magic and Mystery!

56 Feats in Magic, 250 New Jokes, 21 Puzzles, 1 Fortune Telling Tablet, 52 Money-Making Secrets, 15 Card Tricks, 71 Toasts, 58 Verses in Comic Poetry, 10 Funny Readings, 41 Epitaphs, and 11 Parlor Pastimes. You get all the above-mentioned and our big illustrated Catalog of 125 Magic Tricks for only 10 cents. Write today.

MYSTIC MFG. CO.,
909 Springwells Ave., Detroit, Mich.

NATIONAL TRADE DENTAL SCHOOL

506 S. Wabash Ave., Chicago, Ill.

LEARN MECHANICAL DENTISTRY—DEMAND UNLIMITED

A paying professional trade: You will be a trained dental mechanic and receive our diploma when competent. Students given advantage of thoroughly up to date laboratory, and services of graduate Dental Surgeons on practical cases. No effort spared to place graduates advantageously. No age limit. Day or Evening. Individual instruction. No educational requirements. No book or home study. Easy terms. Highest references. Especially attractive proposition to those who write at once for catalog H.

Electricians

Get up-to-date in House Wiring! Save Time, Money, Labor and Material by using our 99 Genuine Blue Print Drawings, containing all the latest diagrams and connections known in house wiring—every diagram and connection up-to-the-minute as used by first class electricians for wiring Bells, Burglar Alarms, Lights, Annunciators, Fire Alarms and Electric Gas Lighting. These drawings are bound in the form of a flexible book (9 x 12) for convenience in using on the job. Send for them, and if they don't make you more efficient as a wireman and save you many times their cost as a contractor, return them and money will be refunded—you can't afford to be without them. One Dollar postpaid. Send for circulars on other sets of drawings.

PATENT SPECIALTY COMPANY
P. O. Box No. 583 San Francisco, Cal.

UMAKEM

Airplane Workchest, containing aircraft work table with mitre cutting board and length gauge, steel drill, steel hammer, Model Maker's steel square, screwdriver, sandpaper block, 10" scroll saw, together with finest quality reed and bass wood, aluminum, silk, para rubber, full set of blueprints, directions, and all fittings for building one 36" Bleriot Model flying Monoplane. Price $10.00. Other UmakeM Outfits 50c to $50.

W. R. PRICE, Inc.
No. 2 UmakeM Building, 127 Fifth Avenue, New York



SMALL ENGINES

Perfected Gasoline Engines—½, 1 and 1½ h. p.—for Farm and Shop use. Price, $27.50 and up. Also,

WASHING MACHINES

We ship on trial. Send for Booklet and Special Offer.

SIEVERKROPP ENGINE CO.
1401—19th St., Racine, Wis.

STARTER for FORD CARS

Handwriting Tells You Secrets

Be successful. Find out what holds you back. Send us an ink specimen of your handwriting and $1.00. Our expert Graphologists will tell you your faults, virtues, talents, etc. Your $1.00 back if you are not satisfied.

ROBERT R. ROSS, 110 West 40th St., N. Y.



FREE BOOK ON AVIATION

Learn of the great opportunities in this new $1,000,000,000 industry. Thousands of men needed. Learn by mail—free book tells how. Write at once.

Nat. Aero Inst., Dept. 7449 916 S. Mich. Ave., Chic

www.americanradiohistory.com

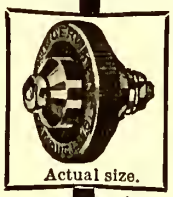
SKINDERVIKEN TRANSMITTER BUTTON

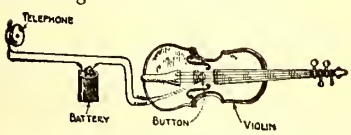
MOST SENSITIVE MICROPHONE

FOR $1.00

YOU can easily make a highly sensitive detectophone by using a Skinderviken Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. Think of the fun you would have with such an instrument! It's very simple, too, and inexpensive.

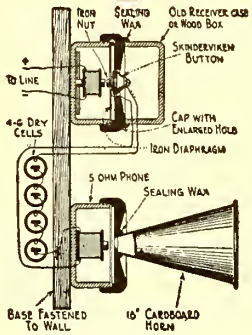
You can install an outfit in your home and hear the conversation being held all over the house. You can connect up different rooms of a hotel. *This outfit was used by secret service operatives during the War. It is being used on the stage.*


Actual size.



So much for its commercial adaptations! *You* can procure apparatus of the same type.

One of the main advantages of the Skinderviken Transmitter Button lies in its ultra-sensitiveness. You can place it in any position you like. It is the greatest invention in micro-phones and has won recommendations from men of high standing in the scientific world. It is being used all over the world. You can mount it most anywhere. Card board boxes, stove pipes, stiff calendars and hundreds of other places will suggest themselves to you. The buttons cannot be seen by any one in the room as they are so small and light. Only a small brass nut is exposed to the view.



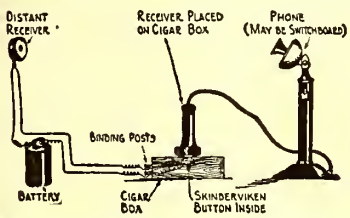
Full directions for connecting up the button for use as a detectophone are given in booklet which is sent with each button.

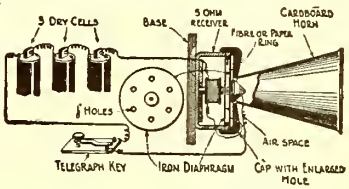






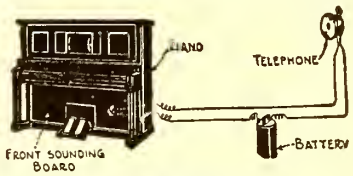
The only instruments needed to complete a detectophone outfit, in addition to a Skinderviken Transmitter Button are a receiver, battery, and, if desired, an induction coil.





AMONG electrical experimenters the button has created a sensation. It is not uncommon to receive unsolicited letters like these: "I received transmitter button today and I wish to inform you that it works great and is *the best I have ever seen or heard of for the price.* I will certainly recommend it to my friends. I wish to thank you for your good service."

"I have been using one of these transmitter buttons, and it has proved to be worth more than its value in my experimenting." "I received one (Transmitter Button) some time ago, and they are just O. K. for experimenting." "I have been using one of these transmitter buttons for experimental work and it certainly lives up to all you say for it *and then some.*"



Mr. H. Gernsback, editor of this magazine, who is the dean of electrical experimenters, said: "In the writer's opinion, obtained by actual elaborate tests, the Skinderviken Transmitter Button is probably the most efficient device of its kind on market today, due to its simplicity and other outstanding features. Should have a great future."

The same circuit connections apply to all experiments, regardless of how the transmitter button is mounted.

The Skinderviken Transmitter Button operates on one or two dry cells. It often happens that two cells produce too much current and the sounds are deafening. We recommend either one fresh cell or two worn out cells.

We have the utmost faith in this transmitter button. We guarantee satisfactory service or we will refund the purchase price. Boys—Young and old—send in a dollar bill RIGHT NOW! You can't lose. If you're not satisfied, you receive your dollar back. Isn't that fair?

JOHNSON SMITH & CO., Dept. E-12, 3224 N. Halsted Street, Chicago

USE THIS COUPON

Johnson Smith & Co., Dept. E. 12, 3224 N. Halsted St., Chicago, Ill.

Gentlemen:—Please ship at once to address below.....Skinderviken Transmitter Buttons for which I enclose $.....

Name .....

Address .....City .....State.....

www.americanradiohistory.com



"Battery Charging is my Biggest Money Maker"

"Only about a year ago I was a small garage owner, working hard to make a bare living and just paying expenses. Then one day I read an ad about HB Battery Chargers, and sent $15, ordering my charger on ten days' trial. The HB Company let me have easy terms on the balance.

"To my surprise, the first month I took in over $100 on battery charging work alone, and made $80 PROFIT. The second month was even better, and ever since then I have made big profits every month. Today Battery Charging is *my biggest money-maker.* It pays a bigger per cent of profit than any other line in my garage. An HB Charger takes no extra help, and runs day and night without any attention. My battery work is always satisfactory, and people keep coming to me for battery work, and soon start bringing *all* their other business. Without that HB Battery Charger I never could be making the money I am now. It's the finest investment I ever made."

You too, perhaps, are a small garage owner, and making a small profit, or perhaps you are still a mechanic and working for some one else, kept from starting out for yourself because you lack capital. *Don't let that stop you!* The HB Company helps you get in business. You can get an HB Charger for only $15 cash and have almost a year in which to pay the balance on easy terms. The profits alone should easily pay all the balance and yield a big surplus besides. If you are already in the Battery recharging business without $250 clear profit each month from your charging work, it will pay you to investigate the HB proposition.

HB Battery Charging is the BIG OPPORTUNITY. With an HB Charger success comes almost immediately. You can make about 400% profit on each battery you charge. The cost is only 10c to 15c with an HB Outfit, and your customer pays 75c to $1.50 for each battery charged. Besides that handsome profit, your Battery Charging will help you build a big business in every line of garage work. If you want success, money, and the comforts of life, then do not overlook this opportunity. Get into the game and push the lines that pay you the biggest money. Hundreds of garage men are making **big money** with the HB Charger in towns no larger than yours. YOU can do as well. Mark on the coupon below the HB Battery Charger you are interested in. Fill out and mail the coupon TODAY. This is your BIG CHANCE. Let us help you start your **own** money-making business. Don't wait until tomorrow when you can start increasing your income **today.** Delay pays no dividends. **Fill out and mail this coupon NOW.**

TEAR OFF HERE

HOBART BROTHERS CO., Box 128 E, Troy, Ohio

Date.....

Send me information about the HB Equipment checked below, and tell me about the HB Money-Back Guarantee and Free Trial Plan:

[ ] HB 8-Battery Charger. [ ] HB 16-Battery Charger.
[ ] HB 32-Battery Charger. [ ] HB Lighting and Charging Set.
[ ] HB Belted Charger (used where electrical current is not available).

Your name.....

Address .....

State .....

Thomas A. Edison Speaks to You

By H. Gernsback

(*Continued from page* 750)

few years he has worked more in the chemical laboratory than in any of the others, which are located in different buildings about the great Edison works.

I MEET THE GREAT INVENTOR.

Together we entered the laboratory, the first impression being mostly green fumes. A half dozen of Mr. Edison's assistants were to be seen busily engaged in performing various chemical experiments under the direction of their chief. Mr. Edison himself was nowhere to be seen. Advancing to the rear of the laboratory, I finally discovered Mr. Edison sitting at a little table busily engaged in writing notes upon a yellow pad, using a small pencil. To the right of Mr. Edison on the table was a big chemical dish containing some green solution, presumably copper nitrate. The table, which was rather small, measured perhaps four feet in length by three feet in width. Mr. Edison was seated on a simple wooden chair. Altho the inventor is 73 years old at the present time, I was surprised at his vigorousness and apparent strength. The first impression at close quarters is a kindly face of ruddy complexion, from which peer two light blue-gray eyes of unusual intelligence. There is an enormous broad forehead, over which falls some silver white hair, giving the characteristic Edison curl. The jaw as well as the ears are well formed, both denoting character and a strong will. Like all great men, Edison has a big and massive nose, which denotes the thinker and philosopher. The lips are rather thin, around which a smile is constantly hovering.

Mr. Edison rose and we shook hands. I was startled somewhat, for I expected a large, hard hand. On the contrary it was as small and soft as a woman's hand, and white except for green stains upon it caused by chemicals. There is perhaps no more famous right hand in the world than Edison's. *If the world were called upon to make an inventory of what Mr. Edison's hands have actually wrought in enriching this planet, there would not be gold enough to pay him.* This is not a mere figure of speech or written in order to make this review grandiloquent. It is the unvarnished truth, as anyone with a clear mind and a pencil can easily figure out to his satisfaction. There certainly has never been one man since the dawn of history who has contributed so much to the world's progress as has Mr. Edison. While of course the mind is supreme, Mr. Edison's hands are the tools that achieved his success, and that is why I place so much stress upon this phase.

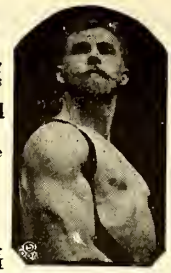
Mr. Edison spoke and welcomed me—a curiously high-pitched voice, unusual for one who has never heard it, but characteristic of the famous man.

MR. EDISON ANSWERS SOME IMPORTANT QUESTIONS.

Mr. Edison in late years has become hard of hearing, and it is necessary to speak quite loud in order that he may understand you. There being no second chair around, and Mr. Edison having seated himself again, I leaned against the laboratory table, being careful not to sit in the chemical dish, and taking other precautions not to disturb anything. After a few pleasant remarks on both sides, I immediately launched into the object of my visit, namely, to put up to Mr. Edison certain questions which had been in my mind, and which I knew would be of great interest to our rising generation and the world at large. I said to Mr. Edison:

(*Continued on page* 804)

Life's Backbone



The success of your life depends on your **Health and Strength**

In a short time you can **Double Your Strength** and improve your H E A L T H with the **Automatic Exerciser**

(The only one of its kind.) If you are battling with functional weakness in any form—if you want to acquire **More Resisting Power** and **Vim** than you ever had. Send for my booklet **Life's Backbone,** which gives full description of the automatic exerciser—how it works, and what it will do for you. Send for it now.

PROF. ADRIAN P. SCHMIDT Suite 308 1951 Broadway, N.Y



SLIGHTLY USED STANDARD MAKE TIRES

Size	New Tube	Price	Size	New Tube	Price
30x3	$1.85	$ 4.50	35x4½	$3.00	$10.25
30x3½	2.00	5.00	36x4½	3.50	10.50
31x3½	..	5.50	35x5	3.75	11.00
32x3½	2.25	6.00	36x5	..	11.50
31x4	2.75	6.50	37x5	4.00	12.00
32x4	2.40	7.50			
34x4	2.70	8.50	Special—Brand New		
34x4½	2.85	10.00	32x3½, Cord		$12.25

Order now. Shipment made the same day. $1 deposit required with each tire order, balance C. O. D., subject to your examination. Specify whether you desire to have clincher or straight side tire.

Special cash discount of 5 per cent if full amount accompanies order.

CENTRAL TIRE & VULCANIZING CO.,
2309 S. STATE ST., Dept. E. E. CHICAGO



Set in Solid Gold Set in Solid Gold

Send Your Name and We'll Send You a Lachnite

DON'T send a penny. Just send your name and say: "Send me a Lachnite mounted in a solid gold ring on 10 days' free trial." We will send it prepaid right to your home. When it comes merely deposit $4.75 with the postman and then wear the ring for 10 full days. If you, or if any of your friends can tell it from a diamond, send it back. But if you decide to buy it—send us $2.50 a month until $18.75 has been paid.

Write Today Send your name now. Tell us which of the solid gold rings illustrated above you wish (ladies' or men's). Be sure to send finger size.

Harold Lachman Co., 12 N. Michigan Av. Dept. T7449 **Chicago**



Dickson School of Memory, 101 Hearst Bldg., Chicago, Ill.

What 15 Cents Will Bring You From the Nation's Capital

The little matter of **15 cts.** in stamps or coin will bring you the Pathfinder **13** weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth and only the truth; now in its **27th** year. This paper fills the bill without emptying the purse; it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you would appreciate a paper which puts everything clearly, briefly—here it is. Send **15c** to show that you might like such a paper, and we will send the Pathfinder on probation 13 weeks. The 15c does not repay us, but we are glad to invest in new friends.

Washington has become the World's capital and reading the Pathfinder is like sitting in the inner council with those who mold the world's destiny.

THE PATHFINDER, Box 576, Washington, D. C.



Wrestling Book FREE

Be an expert wrestler. Learn at home by mail. Wonderful lessons prepared by world's champions **Farmer Burns and Frank Gotch.** Free book tells you how. Secret holds, blocks and tricks revealed. Don't delay. Be strong, healthy. Handle big men with ease. Write for free book. State age. **Farmer Burns,** 949 Range Bldg., Omaha, Neb.

www.americanradiohistory.com

Learn Wireless At Home

The Demand for Wireless Operators Far Exceeds the Supply

The U. S. Wireless Institute will make you an operator—AT HOME—in your spare time—quickly, easily and thoroughly. No previous training or experience required. Our Home Study Course has been prepared by Radio Experts. Experts able to impart their practical and technical knowledge to *YOU* in an *easy* to *understand* way. The graded lessons mailed you will prove so fascinating that you will be eager for the next one. The instruments furnished *free,* will make it as easy to learn the Code as it was to learn to talk. *All you will have to do,* is to listen.

BIG SALARIES

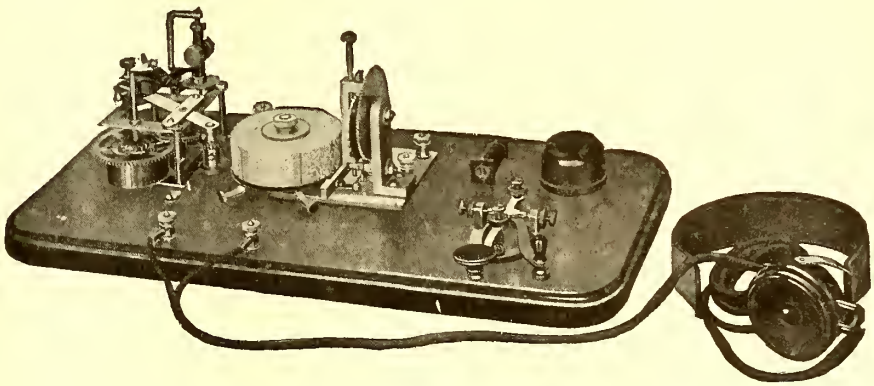
Wireless operators receive excellent salaries ranging from $125 to $200 a month and it is only a stepping stone to better positions. There is practically no limit to your earning power. Men who but yesterday were Wireless Operators are now holding positions as Radio Engineers, Radio Inspectors, Radio Salesmen at salaries up to $5000 a year.

Travel The World Over

A Wireless Operator can visit all parts of the world and receive fine pay and maintenance at the same time. Do you prefer a steady position without travel? There are many opportunities at the numerous land stations or with the Commercial Wireless or with the Steamship Companies.

FREE Instruments and Text Books

We furnish free to all students, during the course, *the wonderful receiving and sending set exactly as produced in the illustration.* This set is not loaned but *given* to all students completing the Course.



This wonderful Set for learning the Code furnished free with our Course

The Transmitter shown is the celebrated *Omnigraph* used by several Departments of the U. S. Government and by the leading Universities, Colleges, Technical and Telegraph Schools throughout the U. S. and Canada. Start the *Omnigraph,* place the phone to your ear and this remarkable invention will send you Wireless Messages, the same as though you were receiving them, through the air, from a Wireless Station hundreds of miles away.

When you apply for your license, the U. S. Government will test you with the *Omnigraph*—the same model *Omnigraph* as we furnish to our students. Ask any U. S. Radio Inspector to verify this.

FREE Post-Graduate Course

A one month's Post-Graduate Course, if you so desire, at one of the largest Wireless Schools in N. Y. City. New York—the Wonder City—the largest port in the World and the Headquarters of every leading Wireless and Steamship Company.

Easy Payments

A small payment down will enroll you. We will make the payments so easy that anyone ambitious to enter the fastest growing profession—Wireless—may do so.

Send For FREE Booklet

Without obligating you in any way, send for our booklet "How to become an Expert Wireless Operator"—it is free. Mail the coupon below, or postal or letter—*but do it to-day.*

U. S. WIRELESS INSTITUTE
Dept. 51, 258 Broadway, New York City.

Send me free of charge, your booklet "How to become an Expert Wireless Operator," containing full particulars of your Course including your *Free Instrument offer.*

Name .....

Address .....

City or Town.....State.....

www.americanradiohistory.com

BATTERY (HB) CHARGING PAYS BIG PROFITS

YOU CAN MAKE $100 to $350 EXTRA PROFIT EVERY MONTH

You can have from $100 to $350 profit monthly from charging batteries, in connection with your present business, by establishing a battery service recharging station. Users of HB Charging Equipment are earning big profits every month with almost no extra effort.

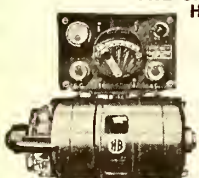
Practically every car today is equipped with storage batteries, which require recharging outside the car at least every two months. Ford cars are now being equipped with electrical starters and storage batteries. **Now** is the time to get into this work. Build up a profitable and ever-growing business.

You can readily handle a battery charging business, as no special electrical or mechanical knowledge is required. You can get an HB Charger in any size to suit your requirements, insuring maximum profits for you, whether the outfit is large or small.

An HB Battery Charger for Every Size Business

All HB Chargers are sturdy, dependable and absolutely reliable. Built of practically wearproof materials. Nothing to burn out, no expensive renewals or repairs. Plain, honest, profit-producing service 24 hours a day. No electrical or mechanical knowledge required to install or operate. No attention except occasional oiling. Uses power from your lighting lines. Big, quick, clean profits, easily made.

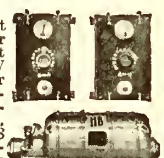
CHOOSE THE SIZE YOU NEED



HB 500-Watt Charger

Recharges 1 to 8 6-volt batteries or their equivalent at a time. Charger is 27 in. long, 26 in. high, weighs 280 lbs. Furnished complete with clear, black, electrical slate switchboard, with mountings of ammeter, field rheostat, voltage lamp, two controlling switches. A big money-maker for a small battery business.

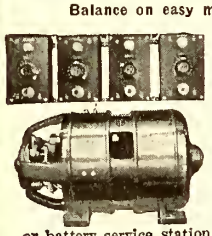
$15 Cash, Balance on easy monthly terms



HB 16-Battery Charger

Recharges 1 to 16 6-volt batteries at once or their equivalent in 12 or 24-volt batteries. Motor 1 KW capacity. Operates on 2 or 3 phase current only. Furnished complete with 2 independent charging panels, each with a capacity of 8 batteries. A splendid machine for any live, energetic garage owner wishing to get big profits.

Small cash payment
Balance on easy monthly terms



HB 32-Battery Charger

Recharges 1 to 32 6-volt batteries or equivalent at a time. Motor 2 KW capacity. Operates on any current. Four separate charging lines, each capable of charging up to 8 batteries. Permits individual attention to batteries on charge. Ideal equipment for big garage or battery service station. Will make as high as $250 to $450 a month Clear Profit.

Small cash payment
Balance on easy monthly terms

Sold on Trial Under HB Absolute Money-Back Guarantee

All HB Equipment is sold under our absolute guarantee of complete satisfaction. You run no risks. If not satisfied after using any HB Equipment 10 days, you may return it and receive all you pay us. The HB monthly payment plan is an additional guarantee.

Select the Charger You Need. Check the Coupon Below. Do it Now!

Mark on this coupon the HB Charger you are interested in. Tear it out and mail TO-DAY. This is your BIG CHANCE. Let us help you start your own money-making business. Be the first in your town to have an HB Charger. Don't delay. Act now.

TEAR OFF HERE

HOBART BROS. CO., Box 127E, TROY, OHIO

Send me information about the HB equipment checked below, and tell me about the HB Money-Back Guarantee and Trial plan:

....HB 8-Battery Charger
....HB 16-Battery Charger
....HB 32-Battery Charger
....HB Belted Charger (Used where electric current is not available.)

Your Name .....

Address .....*State*.....

Thomas A. Edison Speaks to You

By H. Gernsback

(*Continued from page* 802)

"Do you believe that the young man who embarks on his electrical studies today, has the same chances and opportunities which you had at the beginning of your career?"

Mr. Edison was very emphatic when he replied: "He has far greater opportunities than I had—infinitely more. There is absolutely no comparison to be made, for the world has grown larger, and therefore the opportunities have multiplied."

This prompted my second question: "In what branch of electricity, in your opinion, can the young man of today accomplish most—where is he most desired?"

Mr. Edison looked squarely at me and said: "There are thousands of men wanted in every branch of electrical engineering and hundreds of new branches based on new discoveries are being created continuously. The field is being enlarged every day and keeps growing. It would be difficult to pick out any one branch, since all are still in their infancy, and all have wonderful futures."

My next question was: "What training should the young man undergo? Should he acquire practical experience first in the shop or laboratory; or should he take a correspondence course or go to college; or all two or three?"

After a few seconds reflection, Mr. Edison replied: "I think one of the correspondence schools at Scranton, Pa., is the more available for most young men. After passing an examination, I think he should specialize in one branch and study it real hard. Then he should get busy and get a position. Any boy can be a success, providing he is willing to pay the price, which is continuous hard work. The trouble with a large number of young men today who are given positions is that they refuse to pay the price, and thus become a drag on the industry. Our young men today do not wish to work as much and as hard as they did when I was a boy. They want shorter hours and more pay, and too many amusements, the same as all workmen do; but I think this condition will be rectified when people come to their senses. It certainly cannot last."

"BE SURE YOUR IDEA WORKS, BEFORE PATENTING IT," SAYS MR. EDISON.

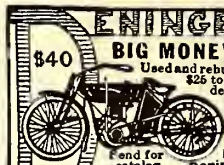
"Mr. Edison, what constructive advice can you give to our young and rising inventors? Is it worth while to patent every idea, or only certain ideas? How can the young inventor differentiate between good ones and bad?"

After a few seconds of meditation Mr. Edison answered: "I suggest that if the young inventor has an idea he had better reduce it to actual practise and be sure that it *works* before applying for a patent. Ideas are easy, but working them into commercial shape is generally a long, tedious and expensive job. After successful operation and the results warrant it, a search of the United States Patent Office should be made to learn if it has not been previously invented or patented by others. Here is where the young inventor will have his greatest disappointment. He will find many a time and, as a matter of fact, in a majority of cases, that the idea has been patented already in one form or another. But disappointments show the salt of the inventor. Only by such disappointments can he triumph finally."

This brought about my next question: "You have patented over one thousand inventions, Mr. Edison. How many of these have been actually worked?"

(*Continued on page* 806)

DENINGER WILL SAVE YOU $40



BIG MONEY SAVINGS FOR YOU

Used and rebuilt motorcycles, single and twins; $25 to $100. Used bicycles, $6.00; tandems, $10. All machines guaranteed in good working order. New bicycles and motorcycles at Factory prices. You save dealers' profits. Motorcycle and automobile tires too, $3.00. Complete line of parts and supplies.

Send for catalog

Deninger Cycle Co., Rochester, N.Y.

YOU 25 TO 50 DOLLARS

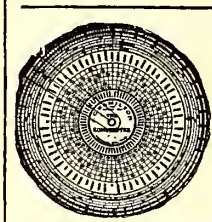
Learn Autos and Tractors



Wonderful opportunities constantly offered trained men; we train you thoroughly to start your own business or make good money as motor expert, driver, shop foreman, etc.

5000 Graduates making good. Catalog Free.

Cleveland Automobile School, 1807 E.24th St., Cleveland O.



SPECIAL KON-VER-TER SLIDE RULE

The Hamilton KON-VER-TER slide rule has over 8000 graduations and over 1800 characters on it, will handle anything in Arithmetic, Algebra, Geometry or Trig. This slide rule is in use in all parts of the world and is much simpler to operate than others of similar lines. Does not require a wizard to use it.

Eventually you will get this rule, get it now and save the extra bother and expense. Utility rules $1.00. Special De Luxe, white ivory celluloid $2.50. Instructions free. Leatherette case 50c extra.

J. C. HAMILTON & CO.,
Dept. B 7 Water St., Boston, U.S.A.

HEADACHES FLU NEURALGIA WOMEN'S ACHES
(AK) ASK FOR A-K TABLETS

ALL THE PARTS AND PLANS



Of Plein Model, 75c. Model A, $1.00. B, $1.50. Completed Model, A, $1.50, B, $2.00. Made like a SKEETER, no other will fly. No other can BEAT 'ER, others soon die. Made in a JIFFY, fly it in the Park. Made very NIFTY, strong as Noeb's Ark.

HERE BOYS

Prepaid—Don't send stamps.

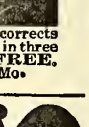
NIFTY NOVELTY & TOY CO. Newark, N. J.

BE AN EXPERT



Wonderful, new device, guides your hand; corrects your writing in few days. Big improvement in three hours. No failures. **Complete outline FREE.** Write C. J. Ozment, Dept. 44, St. Louis, Mo.

STAMMERER



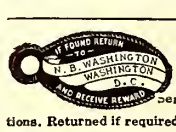
Send 10 cents for my remarkable book, "How To Stop Stammering." Kill the fear of stammering. Re education the key.

The Hatfield Institute, 109 N. Dearborn St., Chicago, Ill.

BE A BANKER

Prepare by mail in spare time for this attractive profession in which there are great opportunities for both men and women. Send at once for free book, "How to Become a Banker," by EDGAR G. ACORN, President.

American School of Banking, 114 McLene Bldg., Columbus, O.



EARN MONEY

Stamping Names on Key Tags. $50 Either sex. Spare time. Some make Send 25c for Tag with your name on and instructions. Returned if required. Exp. Key Tag Co., Cohoes, N. Y.



TYPEWRITERS

$10 AND UP. ALL MAKES. SAVE $25 TO $50 on rebuilt at the factory by the well-known "Young Process." Sold for low cash—installment or rented. Rental applies on purchase price. Write for full details and guarantee. Free trial. **YOUNG TYPEWRITER CO., Dept. 825 Chicago**

KNOW COSTS ACCOUNTANCY

Be a Cost Expert. Earn $3,000 to $10,000 yearly. C.P.A.'s teach you thoroughly in a few months by our New Home study system. Low Cost—FREE BOOK

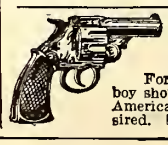
International Accountants Society, Dept. 39M 2626 S. Michigan Ave. Chicago



FINLAY Engineering College Kansas City, Missouri

Only School of the Kind in the West

Electricity, Steam, Gas, Armature Winding, A. C., D. C. Auto. Intensive training, courses, six weeks, three and five months, year and two year. Day and night. Enroll any time. Write.



BLANK CARTRIDGE PISTOL by mail prepaid **ONLY 50c**

For protection and sport, every man and boy should have one. Order at once. Get an American flag FREE. Money refunded if desired. **E. L. LEWIS CO., 1400 B'way, N.Y.C.**

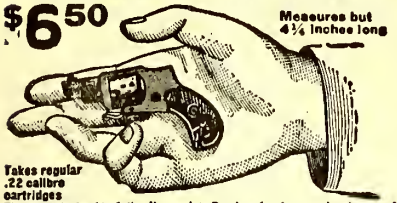
www.americanradiohistory.com

"The Baby" Double Action Hammerless Revolver

A HANDSOME AND MOST EFFECTIVE WEAPON

$6.50

Measures but 4¼ inches long



Takes regular .22 calibre cartridges

The new Baby Double Action Hammerless Revolver has been produced to meet the ever increasing demand for a revolver that would combine small size and light weight with the essential features of Efficiency and Practicability. It is small in size, yet is just as effective and serviceable as the most expensive weapon you can buy. Every lady should have a revolver and should know how to use it, and there is no safer or better one made than this. A great feature is its safety action that guards against accidental discharge, making it quite safe for young men and ladies. The illustration gives an idea of its appearance, but it must be seen and used to be thoroughly appreciated. The ammunition used is the standard .22-calibre (short) cartridge obtainable anywhere, or you may obtain the cartridges from us (cartridges can be shipped only by express). The revolver fires six shots in one loading. The operation of the charging mechanism is extremely rapid and absolutely reliable, as well aimed shots can be fired in as many seconds. The revolver is very well constructed, with finest nickel plated fluted barrel of cylinder, and it weighs only 4½ ounces. The Price of the Baby Revolver is only $6.50, sent by mail postpaid to any address.

SHARPEN-M-ALL SAFETY RAZOR STROPPER

SHARPENS EVERY KIND OF SAFETY RAZOR BLADE

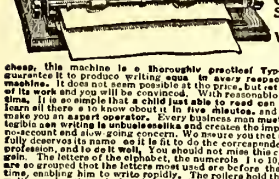
Sharpens the Gillette and Durham Duplex both edges at one time

ALSO SHARPENS THE GEM JUNIOR, EVER READY, KEEN-KUTTER, MARR CROSS, CLARK, AUTOSTROP, STAR CRUSTEEL, AND ALL OTHERS



By using the SHARPEN-M-ALL STROPPER, you will not only get BETTER SHAVES, but you will SAVE MONEY on blades, as you will be able to get from 150 to 200 shaves from one blade, and the last shave will be as good as the first. The construction is simple and will last a lifetime. There are no parts that can possibly get out of order. Any novice can use it but as well as the most expert barber. It is operated by simply turning the lever or handle as shown in the illustration. It has two spiral rollers that travel from heel to point as they are rotated, giving the CORRECT DIAGONAL STROKE. There are no screws, adjustments, or any kind of tinkering necessary to operate the machine. The rollers are made of a material that STROP AND HONE in the same time. The rollers turn only one way, so there is no fear of damaging the blade or the stropper. The SHARPEN-M-ALL is furnished in handsome case, 6x2½x1½ in. with three holders and full instructions. The weight of the complete machine is but eight ounces. Price, only $1.50, postpaid.

Price, $1.50 postpaid.



SIMPLEX TYPEWRITER ONLY $2.50

Cheap But Good. So Simple a Child Can Use It. We Guarentee the Writing.

Though so marvelously cheap, this machine is a thoroughly practical Typewriter. We positively guarantee it to produce writing equa to every respect to that of any $1.00 machine. It does not seem possible at this price, but write us and send you a specimen of its work and you will be convinced. With reasonable care it will last a lifetime. It is so simple that a child just able to read can write with it. You can learn all there is to know about it in five minutes, and an hour's practice will make you an expert operator. Every business man must have a typewriter. It doubles any writing is valuable and creates the impression that the firm is a no-account and slow going concern. We assure you that the Practical Typewriter fully deserves its name as it is fit to do the correspondence of any business or profession, and to do it well. You should not miss this chance of securing a bargain. The letters of the alphabet, the numerals 1 to 10, and punctuation marks are so grouped that the letters most used are before the operator most of the time, enabling him to write rapidly. The rollers hold the paper in positi n while writing and at the end of each line a slight turn of the roller moves the racket which makes a click and forces the paper forword, giving the proper line spacing, so that the lines are all an equal distance from each other, so desirable in letter writing. Each typewriter packed in a stone box, with full printed instructions for use. Price complete. $2.50 sent by mail postpaid.

THE EXPO WATCH CAMERA

The most wonderful and ingenious Camera made



It is but little larger than a watch, which it closely resembles. You can carry the Expo about in your pocket and take pictures without any one being the wiser.

One Cent a Picture

The Expo loads in daylight with 25 Exposure Films, costing 25c; thus the picture taking part of a whole day's outing may be had for the nominal sum of 25c—One cent a picture. 10 Exposure Films also obtainable. It is simplicity itself to operate. Takes pictures through the stem, where the Rapid Fire Lens is located. The photos (5/8 x 7/8) may be enlarged to any size.

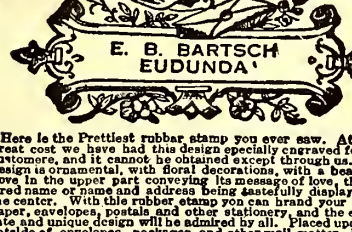
Price $3.00

QUICK AS A FLASH Time and Instantaneous shutters; weighs but 8 ounces, nickel plated. Endorsed by amateurs and professionals the world over. Thoroughly practical—printing and developing of films just the same as ordinary cameras—is daily use by the police, newspaper reporters, and the general public. Many important beats have been secured with the Watch Camera by enterprising reporters. Produces clear, sharp negatives indoors or outdoors equal to any camera on the market, else or price noteithtsteading.

Expo Watch Camera Postage 10c Anywhere

FILMS, 10 Exposures 15c, 25 Exposures, 25c
Leather Pocket Carrying Case, 35c

This Pretty WITH PAD RUBBER STAMP AND INK, 75c

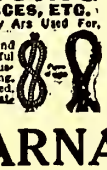


Here is the Prettiest rubber stamp you ever saw. At very great cost we have had this design specially engraved for our customers, and it cannot be obtained except through us. The design is ornamental, with floral decorations, with a beautiful dove in the upper part conveying its message of love, the desired name or name and address being tastefully displayed in the center. With this rubber stamp you can brand your letter paper, envelopes and postals and other stationery, and the elaborate and unique design will be admired by all. Placed upon the outside of envelopes, packages and other mail matter, it ensures their return to the sender in the event of non-delivery for any reason. It looks very pretty stamped on books, music, photographs, etc. With each stamp we include a self-inking stamp pad and a bottle of ink for re-inking the pad, and the PRICE of the COMPLETE OUTFIT, in box, is ONLY 75 CENTS, POSTPAID.

NEW BOOK ON ROPE SPLICING

USEFUL KNOTS, HITCHES, SPLICES, ETC.

How Different Knots Are Made and What They Are Used For. Knots to Use and Knots to Avoid.



A most practical handbook giving complete and simple direction for making all the most useful knots, hitches, splices, etc. Over 100 illustrations. All about wire rope attachments, lashing, blocks, tackles, etc. 37 Heraldic Knots illustrated. Of great value to mechanics, riggers, campers, boatmen. Price 200 p. pd.

Boys, you can have Movies at your own home with this latest model MOVING PICTURE MACHINE

Uses Standard Films same as the larger machines. Very easily managed. Simply turn the handle. Good Variety of Films always obtainable

PRICE Complete ONLY $3.00 Postage 15c. extra Including Film.

Extra Films, 15c each postpaid



THIS IS A GENUINE MOVING PICTURE MACHINE and the motion pictures are clear, sharp and distinct. The Moving Picture Machine is finely constructed, and carefully put together by skilled workmen. It is made of Russian Metal, has a beautiful finish, and is operated by a finely constructed mechanism. The projecting lenses are carefully ground and adjusted, triple polished, standard double extra reflector, throwing a ray of light many feet, and enlarging the picture on the screen up to three or four feet in area. The light is produced by a safety carbide generator, such as is used on the largest automobiles. This throws a dazzling white light on the screen.



It is a solidly constructed and durable Moving Picture Machine. The mechanism is exceedingly simple and is readily operated by the most inexperienced. The pictures shown by this marvelous Moving Picture Machine are not the common, crude and lifeless Magic Lantern variety, but are life-like photographic reproductions of actual scenes, places, and people which never tire the audiences. This Moving Picture Machine has caused a rousing enthusiasm wherever it was used.

ANARCHIST BOMBS



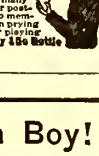
Consists of a little glass vial, containing in liquid form a chemical which will produce a most horrible odor. One dropped in a room full of people will cause more consternation than a Hungarian revolution. The smell will entirely disappear in a short time. 3 Boxes for 25c, shipped by express only with a Dollar's worth of other merchandise.

ITCHING POWDER



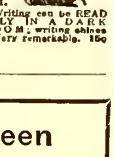
This is another good practical joke; the intense discomfiture of your victims to everyone but themselves is thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more. 3 Boxes for 25c. Sent only by express. (Must order at least One Dollar's worth of other merchandise.)

INVISIBLE INK



The most confidential messages can be written with this ink, and the writing MAKES NO MARK. Cannot be seen unless you know the secret. Invaluable for many reasons. Keep your poetry and other private memorandums away from prying eyes. Great fun for playing practical jokes. Only 15c Bottle

LOVE LETTER INK



Writing written with this remarkable ink vanishes entirely in a few weeks (sooner if desired), leaving the paper QUITE BLANK. 15c p. pd.

LUMINOUS INK Writing can be READ ONLY IN A DARK ROOM; writing shines like fire. Quite invisible at daytime. Very remarkable. 15c bottle; 3 for 40c postpaid.

Oh Boy! Have You Seen LITTLE EGYPT

THE ORIGINAL ORIENTAL DANCER AND THE WONDERFUL

SHADOW DANCER

If not, do not fail to send for these, it will be money well spent. In fact, we would go as far as to guarantee you more fun in showing these two novelties to your friends than you have had in a long time.

They Will Dance For A Life-Time

Price 30 cents each or both for 50c Postpaid

LOADED CIGARETTES

Just Like Ordinary Cigarettes, Sell Each Seal Blanket

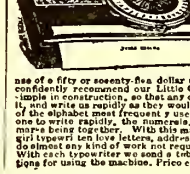


A box containing ten apparently genuine Cigarettes. They look like cigarettes which explodes when about one-third smoked.

They appear so real, and afford so good a smoke (while they last) that the victim is taken entirely by surprise. A great laugh producer and entirely harmless. Price, box of 5 cents, postpaid.

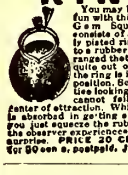
THE "LITTLE GIANT" TYPEWRITER

A First Class Writing Machine For $1.25



A per ect little typewriter for $1.25. There are thousands of persons who would like to use a typewriter but whose needs and business is such that they cannot the expense at sched to the purchase and use of a machine. To such persons we confidently recommend our Little Giant. It is strongly made, but simple in construction, so that any one can quickly learn to operate it, and write as rapidly as they would with pen and ink. The letters of the alphabet are frequent y used being so grouped as to enable one to write rapidly, the numerals, 1 to 10, and the punctuation marks being together. With this machine you can send your best girl typed ten love letters, address envelopes, make out bills, and do almost any kind of work not requiring a large expensive machine. With each typewriter we send a tube of ink and full printed instructions for using the machine. Price complete $1.25 by mail postpaid.

SQUIRT RING



You may have a lot of fun with this Sparkling Gem Squirt Ring. It consists of a handsome plated ring, attached to a rubber ball, so arranged that the latter is quite out of view when the ring is in the proper position. Such an attractive looking ring as this cannot fail to be the center of attraction. While the victim is admiring the ring a few moments, you just squeeze the rubber ball and the observer experiences a very great surprise. PRICE 10 CENTS, postpaid. 3 for 25c. 6 for 50 cents, postpaid. 3 for 25c. 6 for 50

MULTIPLYING BILLIARD BALLS.

The Best Feat of its Kind



The trick is as effective as it is surprising. The performer hands around the ball for examination, and immediately it is returned to him he seizes it by the tips of his thumbs and fingers and a second ball mysteriously appears. These are held a full view of the audience by the tips of the fingers of the left hand, and seen while being placed in position, another ball unexpectedly makes its appearance. Finally the magician appears by sufferance from some kind of cream and yet another ball is the result. The feat can then be reversed, the balls disappearing one after another until none remains. If is a very interesting trick that is quite easily performed by following the directions that accompany the apparatus. Price, 25 CENTS.

The CONJURER'S CASKET

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment

ANYONE CAN DO THEM

50c



It is great fun mystifying your friends. Get this Conjurer's Cabinet, and you will be the cleverest fellow in your district. It contains the apparatus for seven first-rate tricks, including The Disappearing Rose, that, when placed on the lapel of your coat, vanishes from sight at will; the Magic Vase and Ball Trick a Wooden Ball is placed inside, and upon replacing the lid has disappeared and is found in someone's pocket; The Magic Knot with which you can apparently cut your finger almost in two; the Wonderful Card Trick (a card is placed in an envelope, and when opened an entirely different card altogether is found); The Disappearing Coin Box (a coin is placed in the little wooden barrel, and when opened again, is found to have vanished entirely, or can be made to change into a coin of another denomination); The famous Mesmerized Penny that defies the law of gravitation (suspends from the palm of the hand, nose, cheek, wall, clothing, etc.); The Glass Goblet and Vanishing Coin Trick (a coin is dropped into a glass of water, and when the water is poured out the coin has vanished). With the seven tricks described above we send full printed instructions for performing each trick, so that anyone can readily perform all the tricks to the great amusement of their friends or the public. Any boy of ordinary intelligence with this Cabinet of Tricks in his possession, can give a parlor entertainment not inferior to some regular magicians. Besides the tricks contained in the Cabinet, there are twenty-two other feats and illusions fully explained with full printed instructions, for which you can easily make or procure the necessary apparatus. Among them are The Moose in a Pack of Cards, The Drawn Card, The Hat Trick, To Knock a Tumbler Through a Table, One Cent Rubbed into Two, To Find the Number Thought of, Mysterious Wedding Ring etc. We also send the secret of performing three wonderful stage tricks, as follows: The Act of Cremating a Woman, Walking on the Ceiling of a Room, and the Disappearing Lady, together with an article of legerdemain and valuable hints to amateur conjurer. PRICE COMPLETE ONLY 50 CENTS.

Genuine Original Photographs

If you are a lover of the beautiful in art, here is just what you have long wanted for your den or bedroom. For a short time we will make a special introductory offer as follows:



Send 25c and we will send you three Genuine Original Photographs as shown in this ad, size 4x6 in., all ready for mounting and framing, and our beautiful illustrated catalog. After seeing samples you will want more.





We guarantee all our photographs are original and are made in our own studio and can not be purchased elsewhere.

Paris Novelty Company

Dept. P 20 26 E. Adams St., Chicago, Ill.

BOOKS

THAT EVERYONE SHOULD READ. KNOWLEDGE AND FICTION

All Books Sent Prepaid

Cloth Bound

Dyke's Motor Manual	2.50
Automobile Troubles and How to Remedy Them.	1.50
Automobile Ignition, Timing and Valve Setting, Self-Starting and Lighting, including Ford System	1.50
Automobile Driving, Self-Taught	1.50
Motion Picture Making and Exhibiting	1.50
The Practical Handbook of Gas, Oil and Steam Engines	1.50
Electricity and Magnetism	1.25
Power Gas and the Gas Producer	1.25
A B C of the Motorcycle	1.50
Gas Engine Troubles and Installation	1.50
Motor Boats, Construction and Operation; Hydroplanes, Hydro-aeroplanes	1.50
A Practical Course in Mechanical Drawing	.65
Practical House Framing	.65
Hints for Carpenters	.65
Architectural Perspective	.65
Practical Concrete-Block Making	.65
Modern Cement Sidewalk Construction	.65
How to Measure Up Woodwork	.65
Easy Lessons in Architecture	.65
Hints for Painters and Paper-Hangers	.65
Hand-Forging and Wrought Iron Ornamental Work	1.25
Pattern-Making	1.25
Dustman's Book of Plans and Building Construction	2.50
How to Make a Wireless Set	$0.50
Metal Work and Etching	.50
Electroplating	.50
Wood-working for Amateur Craftsmen	.50
Gleason's Veterinary Hand Book	1.50
Famous Pictures—The Book You Should Buy	3.50
Complete Manual on Hypnotism	.90
Motor Truck and Automobile Motors and Mechanism	1.50
Johnson's New Handy Manual on Plumbing, Heating, Ventilating and Mechanical Refrigeration	1.50

Paper Bound

How to Become a Successful Newspaper Man	$0.25
Hunters' and Trappers' Guide	.25
The Star Amateur Electrician	.10
Electric Bells and All About Them	.35
Astrology Made Easy	.25
Hopson's Engineers Blue-Book	.25
English Self-Taught—For French	.25
Italian Self-Taught	.25
English Self-Taught—For Spaniards	.25
Norwegian Self-Taught	.25
German Self-Taught	.25
English Self-Taught—For Germans	.25
Spanish Self-Taught	.25
Polish Self-Taught	.25
Swedish Self-Taught	.25
How to Learn to Play the Banjo	.25
How to Learn to Play the Violin	.25
How to Learn to Play the Piano or Organ	.25
How to Learn to Play the Mandolin	.25
Stage Secrets	.50
How to Entertain at a Social Party	.25
How to Box	.25
Rare Coin Guide	.10
The Modern Dances (Tango Made Easy)	.25
How to Pitch Curves	.25
French, Self-Taught	.25
Up-to-Date Practical Letter Writer	.45
How to Make Poultry Pay	.40
Sex Science	$1.00
What All Married People Should Know	1.25
Girlhood to Motherhood, or Love, Marriage and Matrimony	1.25
The Blue Book, for the Girl, the Wife and the Mother	1.25
The Science of Eugenics and Sex Life	1.90

TAYLOR, BARNARD & CO. 24 East Adams Street Dept. 110—Chicago, Ill.

www.americanradiohistory.com



Learn to Fill BIGGER Shoes!

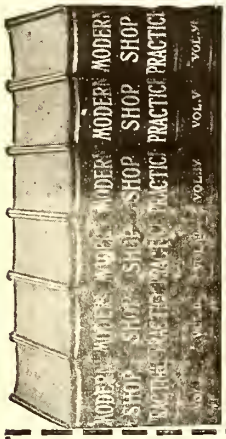
NO matter what kind of work you are doing now, a set of these great home study books will quickly fit you for a bigger and better paying job. We will send any set you select for one week's free examination, and if you want to keep them you pay only the special reduced price, at the rate of 50 cents a week. This is your opportunity to make more money—grasp it NOW. Use these books and a little spare time and LEARN TO FILL BIGGER SHOES.

Pay-Raising Books at Greatly Reduced Prices

Carpentry and Contracting, 5 volumes, 2138 pages, 1000 pictures. Was $25.00.....Now $19.80
Civil Engineering, 9 volumes, 3900 pages, 3000 pictures. Was $45.00.....Now 29.80
Fire Prevention and Insurance, 4 volumes, 1500 pages, 600 pictures. Was $20.00.....Now 15.80
Electrical Engineering, 8 volumes, 3000 pages, 2600 pictures. Was $40.00.....Now 24.80
Automobile Engineering, 6 volumes, 2600 pages, 2000 pictures. Was $30.00.....Now 19.80
Machine Shop Practice, 6 volumes, 2300 pages, 2500 pictures. Was $30.00.....Now 19.80
Steam and Gas Engineering, 7 volumes, 3300 pages, 2500 pictures. Was $35.00.....Now 21.80
Law and Practice (with reading course), 13 volumes, 6000 pages, illustrated. Was $72.00.....Now 44.80
Telephony and Telegraphy, 4 volumes, 1728 pages, 2000 pictures. Was $20.00.....Now 14.80
Sanitation, Heating and Ventilating, 4 vol., 1454 pages, 1400 pictures. Was $20.00.....Now 14.80
Practical Accounting, 4 volumes, 1840 pages, 800 pictures, etc. Was $20.00.....Now 14.80
Drawing, 4 volumes, 1578 pages, 1000 pictures, blueprints, etc. Was $20.00.....Now 14.80

Send No Money Shipped for 7 Days' Trial

Write the name of the books you want on the coupon and mail it today. We will send the books at once, express collect, and you can use them just as if they were your own for a whole week. If you decide you don't want to keep them, send them back at our expense.



50c a Week

If you like the books, as thousands of other men have after examination, just send us $2.00. You can send the balance of the special reduced price the same way—$2.00 each month (50 cents a week).

Start right now and learn to fill bigger shoes. There will be a better job looking for you if you do. Be ready to meet it when it comes. *Send the coupon now.*

American Technical Society
Dept. X-259 Chicago

American Technical Society, Dept. X-259, Chicago, U. S. A.

Please send me set of .....

.....

for 7 DAYS' examination, shipping charges collect. I will examine the books thoroughly and, if satisfied, will send $2 within 7 days and $2 each month until I have paid the special price of $ ..... If I decide not to keep the books I will return them at your expense at the end of one week. Title not to pass to me until the set is fully paid for.

Name.....

Address.....

Reference.....

Thomas A. Edison Speaks to You

By H. Gernsback

(*Continued from page* 804)

MR. EDISON HAS 1400 PATENTS.

Mr. Edison thought for a while—"Of the fourteen hundred patents which I have obtained, about four hundred were actually worked. This figure may be taken as proportionate for inventors. It is seldom that an inventor makes a success of his first invention. Usually he finds that altho he obtains a patent, for some reason or other the idea did not prove to be successful commercially, or could not be exploited otherwise. I have made it a rule in my later years, not to patent anything for which I knew there was no actual demand. Merely collecting patents is a waste of time, money and energy."

This answer of Mr. Edison's was of more than passing interest to me, and at the spur of the moment, I sang out: "Which is your pet invention?"

Mr. Edison smiled broadly, and it seemed to give him much pleasure when he said: "My pet invention I think is the phonograph first—and moving pictures second. Somehow or other these two inventions have taken hold of me more than my other ones, as I have probably spent more time upon them than upon any of the others." This naturally brought me to the next question, which was. "Are your inventions perfected first in your mind or perfected in your models? Or by actual experiments?"

Without hesitation Mr. Edison continued: "I always start out with a definite idea of accomplishing a certain result. I collect all the data possible, both scientific, commercial and otherwise. I then proceed to sketch out every possible and probable way of attaining results and carry it to success by experimenting. In other words, first plan—then act. I usually find that the first model is not at all what I had in mind when I conceived the idea first. Any inventor knows this of course. I have found it necessary for this reason to build many models, and only in the exceptional case is the first model a success."

MR. EDISON TELLS WHAT WORLD MOST NEEDS.

Knowing that Mr. Edison was perhaps one of the greatest authorities on what the world needs most to-day, I asked him: "What inventions does the world need most to-day?"

Becoming reflective, Mr. Edison thought for a few seconds and answered: "Automatic machinery, and systems for the quantity production of one-family houses so cheaply that every man can possess his own home. These two are the world's greatest and most pressing problems today. Take a city like New York, for instance. Conditions there are indescribable. There are too many people in New York at present, and but little new building can be done there. I am in great favor of a law being passed that no additional factories should be built in the city of New York after 1925. This would mean that the housing as well as transportation facilities would not be continually overtaxed as they are now. In other words, the city should be forced to spread out either towards Long Island or to the north."

At this juncture I mentioned to Mr. Edison a plan that was advanced some years ago, whereby it was advocated to build the so-called road house, i. e., a city running thru the country by having a single line of houses built one next to the other with a subway underneath. This would give us a city as well as country at the same time. There would be a sidewalk and roads on each side of the house running continuously without interruption and paralleling the houses.

Start a Garage

Make $100 to $400 a Month

Right in your own neighborhood. Be a Rahe Trained Motor Mechanic and get into a good paying business at once. 80,000 small towns and rural communities without a Garage of any kind.

Learn in 6 to 8 Weeks



Daily practice on Automobiles, Trucks, Tractors—Greatest Training Equipment in America. All you need is will to "Learn By Doing." (No colored applications).

Write for 7-Day Trial Offer and Big Book **FREE**

RAHE AUTO AND TRACTOR SCHOOL
Dept. 2420
Kansas City, Missouri

WANTED - TRAVELING SALESMEN

C. W. Birmingham's earnings for one year were $125 per week in selling. Before that he earned $70 a month as factory clerk. N. S. T. A. Training and Free Employment Service made this possible. We train you by mail in your own home. Salesmen are needed in every business.

EARN $2,500 TO $10,000 A YEAR

Get our FREE book, "A Knight of the Grip." It tells all about Salesmanship, how we help our members get good positions, how we have successfully taught star Salesmanship to thousands of underpaid men, both young and old.

Write today for FREE book—and line up for a big pay job. Address

NATIONAL SALESMEN'S TRAINING ASSOCIATION
Dept. 42W Chicago, Ill. U. S. A.

BE A TRAVELING SALESMAN



FUN

Noiseless Target Practice

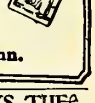
Fit your .22 with a Maxim Silencer and get no end of fun this winter practicing in your backyard and basement.

MAXIM SILENCER

MAKES YOU A BETTER MARKSMAN

It eliminates recoil and all noise of the report, and steadies your aim. Direct from Dealer or Factory $5.00. Write for Free Book of Stories.

FREE BOOK



MAXIM SILENCER CO.
89 Homestead Ave., Hartford, Conn.



POPULARITY FOLLOWS THE

UKULELE



If you play quaint, dreamy Hawaiian music or latest songs on the Ukulele you will be wanted everywhere. We teach by mail 20 simple lessons; give you free a genuine Hawaiian Ukulele, music, everything—no extras. Ask us to send the story of Hawaiian music. You will love it. No obligation—absolutely free.

The Hawaiian Institute of Music
1400 Broadway, Dept. 5L New York

INVENTORS HAVEN'T YOU SOME IDEA

that you can't just work out?

Give us the idea—we will develop it for you. Mechanical and electrical ideas developed. Experts in model and experimental work and in perfecting inventions. Designing and building labor-saving machinery a specialty. Get in touch with us—we can save you money.

ELK MFG. CO., INC.
1926 Broadway, New York

DIAMONDS ON CREDIT

Write for Free Catalog. Over 2,000 illustrations of Diamonds, Watches, Jewelry. Select any article desired, have it sent to you prepaid. If satisfactory, send us one-fifth of the purchase price and keep it, balance in eight equal monthly amounts. Write Today.

LOFTIS BROS & CO. Since 1858 — **National Credit Jewelers** Dept. C 22 108 N. State St. CHICAGO, ILL. — Stores in Leading Cities

DEAFNESS IS MISERY



I know because I was Deaf and had Head Noises for over 30 years. My invisible Antiseptic Ear Drums restored my hearing and stopped Head Noises, and will do it for you. They are Tiny Megaphones. Cannot be seen when worn. Effective when Deafness is caused by Catarrh or by Perforated, Partially or Wholly Destroyed Natural Drums. Easy to put in, easy to take out. Are "Unseen Comforts." Inexpensive. Write for Booklet and my sworn statement of how I recovered my hearing.

A. O. LEONARD
Suite 369, 70 5th Avenue - - New York City

www.americanradiohistory.com

"I do not think this idea is very practical," vouchsafed Mr. Edison. "I think it would be too expensive and would make the traveling distances uncomfortable."

While discussing the printers' strike, which just then had started in New York, paralyzing the entire printing industry, I put the question: "What known substitute is there for white print paper when our raw materials give out during the next twenty-five years?"

Mr. Edison's answer was surprising: "Print paper will never give out as long as wood grows in the Amazon and Congo river basins. It is simply a matter of transportation, and that, I believe, will soon be solved, as soon as the world is upon a peace basis once more."

I have always had a pet idea on the subject of *cold light*, so I ventured my next question. "Over 99 per cent of the energy is lost today in useless heat in our incandescent lamps. How near are we to 'cold light,' and do you think it will be invented at all?"

"I think we are slowly advancing in increasing the efficiency of light production," replied the inventor. "Any moment a discovery is liable to be made that will advance the efficiency of our present lighting methods enormously. The time is surely coming when 'cold light' will be a matter of fact. What shape this invention will take, it is impossible to predict today."

"On which of our dormant and unworked sources of energy should our coming generation work most intensely, Mr. Edison?" I asked. "In your mind, is the exploitation of the following sources of energy chimerical or are they within the realm of possibility from the standpoint of modern electrical engineering:

Power derived from the earth's internal heat.

Power derived from the earth's atmosphere.

Power derived from the tides.

Power derived from the sun's heat."

"UTILIZE EARTH'S NATURAL VOLCANIC HEAT," SAYS MR. EDISON.

"Volcanic power to the extent of 5,000 H.P. is utilized already in Italy, and 20,000 H.P. more is being arranged for," explained Mr. Edison. "Italy probably has more in her volcanic regions to work all her machinery and heat every house, carry on every metallurgical process and in fact make coal unnecessary in that country. My impression is that in Nevada and the Yellowstone region there is available volcanic energy greater than that given by all the coal mined in the United States. 'As to solar energy' we are getting there step by step. It is a long and weary road we have to travel, but we are making it slowly. I am an urgent advocate of water power. We are using already too much coal without adequate returns. Water power in the United States is not at all developed as it should be, and I see a great future in its proper development. I have advocated many times that the coal should be burnt at the mine instead of shipt by cars over long hauls. Electric power can be sent much cheaper thru electric wires than over the railroads; in other words, first hauling the coal which is then burnt at the destination."

This prompted my next question: "What are your ideas, Mr. Edison, as to atomic energy?"

Mr. Edison smiled broadly and, with a twinkle in his eye, said: "You know, Mr. Gernsback, I am an inventor, and as such I do not concern myself overmuch with philosophical research, and altho I have my own ideas on atomic energy I am not at present making them public."

My next question was: "What shall America do to prevent Germany from flooding the world with its cheap goods, and winning the war commercially twenty years hence?"

Learn Mechanical Drafting

Earn $35 to $100 a Week

"Get into the profession of big pay and Rapid Advancement with the help of the school that has started hundreds on the Road to Success. I am ready to help you." Roy C. Claflin, President, Columbia School of Drafting.



Learn at Home in Spare Time

You don't have to stop work or leave home in order to become a trained Draftsman. Through our practical Home Study Training we teach you in your own home, and enable you to qualify as a practical Draftsman.

No Previous Training Required

Owing to the comprehensive nature of our course, you need no previous training in the subject. Though you have never done any kind of drawing before, you can become a thorough Draftsman by following our instructions.

Can Learn in Short Time by Our Methods

The reason for this is that we eliminate unnecessary theoretical work and concentrate upon the PRACTICAL problems such as confront the professional Draftsman. We do not require you to spend months of your time on "preliminary" work, but start you on REAL DRAFTING at once. That is one reason why our students "make good" so readily.

Our Graduates Get to the Top

The universal success of our graduates as Professional Draftsmen, many of whom have advanced rapidly to positions of Chief Draftsmen, is evidence of the REAL VALUE of the training given by the COLUMBIA SCHOOL OF DRAFTING. Large numbers of our students have secured excellent positions even before completing their courses. We gladly cooperate with our students and graduates in securing desirable positions, which has been easy for us owing to the many demands upon us to supply our "product" for these positions.

Draftsmen Get $35 to $100 a Week

Our graduates have shown their ability to reach high salaries RAPIDLY, owing to their practical training. They secure excellent salaries AT THE START, as high as $2,000 a year. The usual pay of Draftsmen is $35 to $100 a week.

The Demand is Greater Than the Supply

The demand for properly trained Draftsmen has always been greater than the supply, but this is more so today than ever before, owing to greatly increased construction and mechanical development. The Draftsman is an essential connecting link in all engineering work. This great demand is indicated by the long lists of want ads for Draftsmen in the daily papers, especially those of industrial centers.

Specialists in Mechanical Drafting

The COLUMBIA SCHOOL OF DRAFTING not only trains Draftsmen by mail but also maintains a large local institution of the highest standing. For many years it has been the leader in SPECIALIZING on the teaching of DRAFTING. This is an obvious advantage over teaching Drafting only as a side issue.

Drawing Outfit Furnished

We supply all our students with a drafting outfit for use throughout the course. There is no extra charge for this, and it becomes your personal property when the course has been paid for in full.

Book of Particulars Sent FREE

If you are interested in becoming a practical Draftsman through the thorough training of the COLUMBIA SCHOOL OF DRAFTING, whereby you can enter a Profession in which your services will always be in demand, you are invited to write us for our free book of particulars, which describes our school and methods. For your convenience you can fill out and

Mail This Coupon To-day

COLUMBIA SCHOOL OF DRAFTING,
14th & T Sts., N.W., Dept. 1071,
Washington, D. C.

Without obligation to me, please send me full particulars of your practical home study training in Drafting.

Name .....

Address .....

City ..... State .....

www.americanradiohistory.com



Be a Draftsman!

Make $30 to $75 a Week

Your name and address on the coupon brings this great Cyclopedia of Drawing without a penny down. Pay only net shipping charges when books arrive. With these books and a low price "school set" of drawing instruments, obtainable at any store, a man can become master of drawing and earn $30 to $75 weekly.

LEARN AT HOME—Good paying positions open everywhere. Intense activity in manufacturing, railroading, building, etc., calls for more draftsmen.

Shipped on 7 Days' FREE Trial

CYCLOPEDIA OF DRAWING

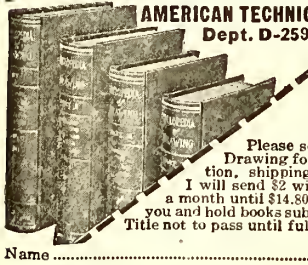
4 Volumes. 1650 Pages. Thousands of Illustrations.

Bound in genuine American morocco. Pages 5½ x 8½ inches. Covers all branches of Drafting—Architecture, Electrical, Structural Steel, Sheet Metal, etc. Teaches pen-and-ink rendering, lettering, free-hand, perspective, shades and shadows, working shop drawings, machine design, etc., etc.

50c a Week Only $2 a month if you keep the books. Coupon explains offer, good only within borders of U. S. and Canada.

Free Membership In This Society.—A Consulting Membership **given free** with each set—worth $12.00.

AMERICAN TECHNICAL SOCIETY
Dept. D-259 Chicago



AMERICAN TECHNICAL SOCIETY
Dept. D-259
Chicago, U.S.A.

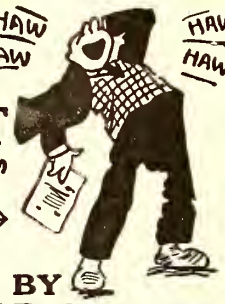
Please send Cyclopedia of Drawing for 7 days' examination, shipping charges collect. I will send $2 within 7 days and $2 a month until $14.80 is paid, or notify you and hold books subject to your order. Title not to pass until fully paid.

Name .....

Address .....

Reference .....

BE AN ARTIST



DRAWN BY 14-YEAR-OLD BOY

The above cartoon was drawn by Master Bob Brenman of the Washington School of Art. Bob writes that he is selling his work and that he is cartoonist on a small paper in Evansville, Ind. He is but one of our many students and graduates who are making money as cartoonists, illustrators and designers.

Learn By Mail at Home!

By our new method of teaching drawing by mail you can learn in your own home, in a short time. Get into this fascinating work yourself and earn $50 to $100 or more per week! The study is fascinating. Only a few minutes a day! Have your own studio or secure high-salaried position. Or work in spare time. Many students earn while they are learning.

FREE! BOOK AND ARTISTS' OUTFIT! WRITE TODAY

A complete outfit *free* to all students. Includes everything required to produce hundreds of dollars' worth of pictures. Write today. Special terms to a limited number of new students. Mail postal or letter for beautiful Booklet, "How to Become an Artist," filled with drawings and full particulars of our extraordinary offer. Do it now—Before you forget.

WASHINGTON SCHOOL OF ART, Inc.
1465 H Street, N. W. Washington, D. C.

Music Lessons UNDER MASTER TEACHERS At Home

Complete Conservatory Course by Mail

Wonderful home study music lessons under great American and European teachers. Endorsed by Paderewski. Master teachers guide and coach you. Lessons a marvel of simplicity and completeness.

Any Instrument Write naming course you are interested in: Piano, Harmony, Voice, Public School Music, Violin, Cornet, Mandolin, Guitar, Banjo or Reed Organ —and we will send FREE CATALOG. **SEND for it NOW!**

University Extension Conservatory, 6113 Siegel-Myers Bldg., Chicago

Here, too, Mr. Edison's reply was surprising as well as illuminating: Germany never has and never will flood the United States with cheap goods or undersell us if we make up our minds to beat her at that game. Out of thousands of articles, she is only efficient in two, to wit: chemical dyes and toys. This is due to our indifference to going into these lines of manufacture. I am happy to note, however, that American manufacturers are beginning to see the light, and are protecting themselves adequately."

We then discust various other subjects, and it soon became apparent that Mr. Edison thought that every prophet is honored save in his own country. Mr. Edison was of the opinion that before the war, and particularly during the war, American inventors had not received their due credit, most of the fame having gone across the water. Mr. Edison felt particularly strong about a recent patent decision, where the honors of the vacuum tube used for radio purposes went to an English inventor. It is an incontrovertible fact that the "Edison effect" was known years before the Fleming valve was discovered, having been publisht in American and foreign scientific papers. Mr. Edison was certainly right in his contention that the honors for the invention of the vacuum tube should go to America, and there seems to be no doubt as to this.

My final question to Mr. Edison was, "What is your hobby, and how do you relax from your work?"

GREAT INVENTOR'S HOBBY IS "EXPERIMENTING."

"Just now my hobby is 'experimenting.' I like experimenting better than anything that I know of. As for my relaxation, I like to camp out in the mountains, which I do every summer. This makes me fit for another winter's hard work."

Mr. Meadowcroft by this time was beginning to look at his watch, which I took for a gentle hint, and shaking hands with Mr. Edison, I took my leave.

While shaking hands I was again imprest with Mr. Edison's hand, and I subsequently made a special request of Mr. Meadowcroft to let me have a photograph of the great inventor's hands for publication. I was much astonished to learn that no photograph of Mr. Edison's hands existed, none having ever been taken, the inventor feeling rather sensitive about this. I had seen many sketches of Mr. Edison's hands, but I only then remembered never having seen an actual photograph. It took several weeks to secure permission from Mr. Edison, but finally the photograph of his hands was taken, and it is here presented to the readers of the ELECTRICAL EXPERIMENTER for the first time.

I also made another discovery, namely, that there was no oil painting in existence of Mr. Edison. True, several of these had been made by certain artists after Mr. Edison had patiently sat for them, but he was more or less displeased with the result, and on one occasion did not hesitate to put his foot thru one of them. After securing Mr. Edison's permission, I charged Mr. Howard V. Brown with the delicate mission of making an oil painting of the famous man. It is reproduced on the front cover of this magazine in full colors. It is the only oil painting in existence of Mr. Edison today, and the inventor, who inspected it, was very much pleased with it, declaring it a perfect likeness.

As I past out of the laboratory I caught a last glimpse of Mr. Edison. He had risen from his chair, making his way to a little room containing delicate scales and apparatus. The tall, white-haired figure, somewhat stooped under its 73 years' load, clad in a duster, bespotted with chemicals, slowly faded out of view into the adjoining room.

BE AN EXPERT



Auto and Tractor Mechanic Earn $100 to $400 a Month

Young man, are you mechanically inclined? Come to the Sweeney School. Learn to be an expert. I teach with tools not books. Do the work yourself, that's the secret of the

SWEENEY SYSTEM

of practical training by which 5,000 soldiers were trained for U. S. Government and over 20,000 expert mechanics. Learn in a few weeks; no previous experience necessary.

FREE Write today for illustrated catalog showing hundreds of pictures men working in new Million Dollar Trade School.

LEARN A TRADE
Sweeney
SCHOOL OF AUTO-TRACTOR-AVIATION
66 SWEENEY BLDG. KANSAS CITY, MO.

GLIDE "O" PLANE



Learn the principles of Aviation by flying our famous glide O plane. Not a toy, but a scientifically constructed gliding model, which may be thrown by hand on the field or launched from the top of the hill. Will circle, loop and glide gracefully with a light throw. Constructed of best materials, finished in Bright colors with the insignia of the U. S. Army on the Main Plane. Very durable and easy to fly. All wood, adjustable. Price 55c Postpaid in U. S. Send for catalogue H3.

H E C Aeroplane Co., 345 E. 49th St., New York City

PLATINUM MAGNETO POINTS BOUGHT

HIGHEST CASH PRICE
Paid for Platinum—Old Gold

Jewelry—Watches, Silver and Diamonds. Cash by return mail—Packages held 4 to 12 days for your approval of our offer, and returned at our expense if our offer is refused.

UNITED STATES SMELTING WORKS
120 South State St., Dept. 73, CHICAGO, ILL.

"Playing the Game"

is a fascinating booklet. It tells how a man accumulated $10,000 in ten years on a total investment of $3,000, putting in an average of $25 monthly.

"Playing the Game" was originally sold at $1.00 per copy, but is now reprinted and we send it free to anyone ambitious to achieve financial independence. It contains nothing for the man who wants to get rich in a hurry, but will be helpful to all who wish to save from $5 to $100 monthly and invest by a safe method.

KRIEBEL & CO.
INCORPORATED
Investment Bankers
141 W South La Salle St., Chicago

Telegraph Pictures
BY ELECTRICITY



Complete sets of two machines of this marvelous equipment at ridiculously low prices. Instructive, mystifying and useful. This picture of President Wilson was telegraphed by these machines. Will transmit pictures, maps drawings and band writing. Picture telegraphing is the coming science. Write today.

J. LEISHMAN CO., Dept. T Ogden, Utah

www.americanradiohistory.com

FARMERS!! WHAT A CENT'S WORTH OF ELECTRICITY WILL DO.

Shell corn	8 bushels
Grind corn	½ bushel
Cut fodder	200 pounds
Cut ensilage	300 pounds
Thresh barley	1 bushel
Separate milk	60 gallons
Churn butter	33 pounds
Groom horses	2
Stuff sausages	200 pounds

Submarines to Salvage Sunken Ships

(*Continued from page* 745)

light projectors, which would be of inestimable service to the divers, while they were engaged on the wreck and also a better supply of air can be supplied them owing to the shorter hose necessary. If it is not desired to submerge the pontoons for this part of the preliminary work in the salvaging operation, it would be economical and feasible to provide a small submarine which can sink to the level at which the wreck was lying, and by providing special air-locks on the submergible, divers can walk right out on the watery bed. It may be mentioned here, that in such a case, and provided the divers do not have to stay away from the submergible too long at one time, that they would not have to be tied fast to it with a rubber air-hose, for there is now available an independent oxygen and air-diving apparatus which can be carried on the diver's back.

HOW THE DIVER GETS OUT UNDER WATER

An interesting problem here arises, and that is—how are we going to get the divers in and out of the pontoon-submersible or any form of sub-sea craft when it is closed and under the surface of the waves? The illustration herewith illustrates one form of air-lock chamber which can be employed for the purpose. With the arrangement delineated the operation of getting out of a submarine by means of this air-lock is as follows:—the diver dons his costume in the inside pontoon quarters, where the crew is lodged. He then passes thru the right-hand water-proof door, into an air-lock chamber, which chamber has its outer door closed, rendering it dry. The cabin compartment door is closed, and the sea-cocks opened and the water allowed to rush into the air-lock chamber. The diver adjusts his oxygen apparatus and prepares to pass thru the outer door when the chamber has become full of water, this door then opening easily. As he passes out into the stair-well, he locates the usual air-hose terminal by means of a red electric light marking its position, and connects it to a valve on the top of his helmet. He tries the air, and ascertaining that everything is all right, he proceeds to climb up the iron ladder to the deck of the pontoon. He is then ready to descend down a steel cable to the scene of the wreck. The air-hose, as he descends, unwinds from a reel placed in a water-tight compartment underneath the stair-well in the manner here illustrated. And here is the way the divers can come back into the pontoon for lunch. They climb up the steel cable or ladder which is sometimes used, and once they arrive in the stair-well in the pontoon, they disconnect the air-hose and the water is prevented from entering the diver's suit by means of automatic valves in the helmets. The diver then walks into the air-lock chamber and closes the outer door. By

(*Continued on page* 819)



Learn Public Speaking

10 LESSONS FREE

Write — quick — for particulars of this extraordinary offer; an opportunity you will never forget if you take advantage of it. Ten lessons in effective public speaking absolutely FREE to those who act promptly, to introduce our course in localities where it is not already known.

We teach you by mail to become a powerful and convincing speaker—to influence and dominate the decisions of one man or an audience of a thousand. We have trained hundreds and helped them to increase their earnings and their popularity. Learn, in your spare time at home, how to overcome "stage fright" and conquer fear of others; how to enlarge your vocabulary; how to develop self-confidence and the qualities of leadership; how to RULE others by the power of your speech alone; how to train your memory. Our

WHAT THE COURSE TEACHES YOU.

How to talk before your club or lodge;
How to address board meetings;
How to propose and respond to toasts;
How to make a political speech;
How to tell entertaining stories;
How to make after-dinner speeches;
How to converse interestingly;
How to write better letters;
How to sell more goods;
How to train your memory;
How to enlarge your vocabulary;
How to develop self-confidence;
How to acquire a winning personality;
How to strengthen your will power and ambition;
How to become a clear, accurate thinker;
How to develop your power of concentration;
How to be the master of any situation.

New Easy Method

perfected and taught only by Prof. R. E. Pattison Kline, former Dean of the Public Speaking Department of the Columbia College of Expression, can be learned in 15 minutes a day. Prof. Kline is one of the foremost authorities in the country on public speaking and mental development. Do not let this chance escape you.

Offer Limited

Send This Free Coupon Now

This Special Offer of TEN LESSONS FREE is made strictly for advertising purposes and will be withdrawn without notice. Write now, before it expires, and receive full particulars with enrollment blank by return mail. No obligations of any kind. Just tear off and mail this free coupon—or a postal will do.

FREE LESSONS COUPON

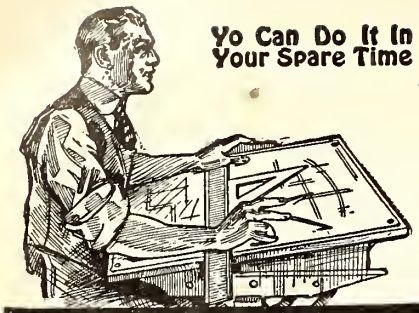
North American Institute,
7449 Manhattan Building, Chicago

I am interested in your course in Effective Public Speaking and your offer of ten lessons free. Please send particulars. It is understood that this request places me under no obligation of any kind.

.....

.....

www.americanradiohistory.com



Yo Can Do It In Your Spare Time

The Dollar Value of Draftsmanship

THERE are no "slack periods" for the trained draftsman—no limitations to his earning power—no drawbacks to his advancement to bigger things. Why? Because the manufacturer, builder, architect and engineer must have working blueprints before they can build factories, skyscrapers, railroads, machinery and homes. Drafting also has a positive dollar value to those engaged in all branches of engineering, because it qualifies them to direct those who can't make plans and read blueprints.

Be a Master Draftsman

Whether you want to be a professional draftsman, or add drafting to your knowledge of engineering, the American School course, specially prepared by noted experts for home study, will give you just the training you need. Drafting is the A B C of all engineering work. As you learn the practical working principles of Mathematics, Mechanics and Drawing, the broader field of engineering opens up to you. You are ready for a bigger job and better pay.

Read This Guarantee —Then Act!

"We guarantee at any time during the first year of your enrollment to refund the entire amount paid if, immediately upon the completion of ten examinations, you notify the School that you are not satisfied with your Course."

AMERICAN SCHOOL of Correspondence
Dept. D 269
CHICAGO

TRAINING—THE KEY TO SUCCESS

Please send me booklet and tell me how I can fit myself for position marked X ASC

...Draftsman and Designer	...Lawyer
...High School Course	...Business Manager
...Western Union Course	...Certified Pub. Accountant
...Telephone Engineer	...Accountant and Auditor
...Automobile Engineer	...Bookkeeper
...Automobile Repairman	...General Education Course
...Airplane Mechanic	...Com. School Branches
...Sanitary Engineer	...Electrical Engineer
...Heating and Ventilating Engineer	...Electric Light and Power Superintendent
...Master Plumber	...Hydroelectric Engineer
...Civil Engineer	...Wireless Operator
...Structural Engineer	...Architect
...Mechanical Engineer	...Building Contractor

Name.....

Address.....

Build Your Own PHONOGRAPH

It's Easy With Our Help

A few hours interesting work saves many dollars and gives you a machine exactly to suit your ideals. We furnish motors, tone arms, case material, blue prints and full instructions. Plays any record. You can make fins profit building phonographs for your friends.

Write Today for Our Free Blue Print Offer. Agents wanted for our ready built Choraleons.



SAVE OVER HALF

Choraleon Phonograph Co.
127 Monger Blg., Elkhart, Ind

"The Ellis Music Master Reproducer"

made for all phonographs. Pleases the most exacting music lover. Eliminates twang. Perfect harmony of accompaniments, individuality of artists' voices and instruments reproduced from records in life like reanimation. It sells on its merits. Send 10c for booklets E, "Hints to Music Lovers" and "Music Masters." Agents wanted.

J. H. ELLIS, P. O. Box 882, Milwaukee, Wisconsin

WHY NOT "BEAT" RECEPTION OF INSECTS' SOUNDS?

It is fairly well known that the human ear is sensitive only to waves of frequencies between about 30 and 25,000, and that therefore sounds produced by air disturbances at higher or lower frequencies are inaudible to us, tho in certain cases the physical effect of the vibration can be felt. The ear, as a detector, may be said to have "flat" tuning, being operative only over a limited range. Bats and certain insects are said to emit sounds which are much too high pitched for us to be sensible of them, and an English writer puts forward the suggestion that by means of employing the well-known "beat" method of wireless telegraphy this disability may be overcome. To entomologists this experiment should prove of considerable interest, but for ourselves, having "chicken-keeping" neighbors, we have no desire to eavesdrop on beetles and butterflies. Providence obviously intended us to be deaf to certain noises—and we presume to agree with the proposition.—*Wireless World.*

Statisticians say that ninety per cent. of all the electricity supplied by central generating stations is alternating current.

40 M. P. H. PONY DIRIGIBLE COMING.

The advent of a new kind of aircraft called the "Pony Dirigible" was announced recently at Cleveland, Ohio, at the reception given for the special commission of the Aero Club of America and the Aerial League of America which is organizing the first aerial derby around the world.

Mr. Upson said an Akron company was about to put on the market a small two-passenger dirigible balloon equipt with a forty-horse power engine which will attain a speed of forty miles an hour and will be so easy to pilot that anybody can do so on short instruction.

Mysteries of Stage-craft

By H. Winfield Secor

(*Continued from page 752*)

one of the three platforms can be moved either into or out of its position before the foot-lights.

WATER, SNOW AND RAIN EFFECTS.

The "Disappearing Divers" have long proven a complete mystery to most patrons of theaters such as the New York Hippodrome. In such productions, as the reader probably is aware, a considerable mystery is evolved by having several people (sometimes as many as 20 or 30) dive into a large water-filled tank and they disappear completely, not coming up again for a space of twenty minutes or more. There are several ways of accomplishing this trick, and two of them which have been successfully adopted are illustrated herewith at figure 4. The first is that utilizing *diving bells.* These diving bells, one or more of which may be used as required, according to the size of the tank, are made of steel and must be air-tight. They act on the same principle that when you place a drinking glass or cup into a basin of water, the water will not rise all the way up in the glass, due to the compression of air within the glass. Thus, when the divers plunge into the water, they are enabled to see the position of the bell, owing to the fact that it has electric lights inside of it, which lights up the water at the bottom of the tank, and indicates the hulk of the diving bell very plainly. When they reach the bottom of the tank, they swim towards the bell and pull themselves up inside of it, under the rim. Comprest air is forced into the bell thru a pipe in order to keep the

The Day After Christmas



ONE GIFT stands out above all others—the one you can use at once for good, hard play. Jump on it on Christmas morning, and you'll know it's Christmas. And the next day, and on through boyhood, Auto-Wheel is your most dependable friend. Always ready for fun or work. It coasts faster than others, and is easier to pull with a load.

The Auto-Wheel has real roller bearings, and the steel tires and axles make it strong and long-wearing.

TWO TYPES

There's the Auto-Wheel Coaster—the old reliable—a marvel for coasting and general use. And there's the Auto-Wheel Convertible Roadster—two wagons in one. One minute a hox-wagon, the next the snappiest roadster you ever saw. Put the Auto-Wheel on your Christmas list. The other fellows want it too. Form your Auto-Wheel Coaster Club when you get your wagons. We'll send a cap for each member, and a special cap for the Captain.

Felt Pennant FREE—Also Auto-Wheel Booklet. Just send us names of three local coaster dealers, telling which handles Auto-Wheel.

Buffalo Sled Co.,
163 Schenck St., N. Tonawanda, N. Y.
In Canada: Preston, Ont.



½ Price $2.50
SEND NO MONEY
If You Can Tell it from a GENUINE DIAMOND Send it back

To prove that our blue-white MEXICAN DIAMOND closely resembles the finest genuine South African Diamond (costing 50 times as much), with same DAZZLING RAINBOW-FIRE, (Guaranteed 20 yrs.) we will send this Ladies Solitaire Ring with one carat gem, (Catalogue price $4.98) for **Half Price to Introduce, $2.50,** plus War Tax 13c. Same thing but Gents. Heavy Tooth Belcher Ring, (Cataloge price $6.26) for $3.10, plus War Tax 15c. Mountings are our finest 12 karat gold filled. Mexican Diamonds are GUARANTEED FOR 20 YEARS. **SEND NO MONEY.** Just mail postcard or this ad., state size and we will mail at once C. O. D. If not fully pleased, return in 2 days for MONEY BACK, less handling charges. Act quick; offer limited; only one to a customer. Write for FREE Catalog. AGENTS WANTED.

MEXICAN DIAMOND IMPORTING CO.
Dept. F-1 Las Cruces, N. Mex.
(Exclusive controllers Mexican Diamonds)

Delivered TO YOU FREE



Your choice of **44 styles,** colors and sizes in the famous line of **"RANGER"** bicycles. We pay the freight from Chicago to your town.

30 Days Free Trial allowed on the bicycle you select, actual riding test. **EASY PAYMENTS** if desired, at a small advance over our Special Factory-to-Rider cash prices.

Do not buy until you get our *great new trial offer* and low Factory-Direct-To-Rider terms and prices.

TIRES LAMPS, HORNS, pedals, single wheels and repair parts for all makes of bicycles at half usual prices. **SEND NO MONEY** but write today for the big new Catalog.

Rider Agents Wanted
Boys make big money

MEAD CYCLE COMPANY Dept. L-107 CHICAGO

Learn Shorthand, 5 Hours

You will be amazed at the ease and quickness with which you learn the wonderful K. I. Shorthand. In a few hours you'll know the whole system and can then gain speed in taking down dictation, conversation, speeches, orders, etc., as fast as a person talks. Two free lessons will be mailed by KING INSTITUTE, EB-300, Station F, New York, N. Y. Just write for these and see how easily you learn. Astonish everybody with your ability.

www.americanradiohistory.com

water at as low a level as possible within it, and where a number of swimmers have to remain in the bell for any appreciable time, proper air outlet and inlet pipes have to be provided, so that an exchange of air is made possible within the bell chamber. For a shorter period, and when not many people breathe the air within the bell, they can get along without fresh air being supplied. With fresh air under pressure being pumped into the bell, some of the air and its products, such as carbon dioxide gas, will bubble out thru the water and thus help to refresh the atmosphere within it. Mirrors are arranged inside the bell so that the fair swimmers may adjust their hair and clothes.

Another stunt for accomplishing the "Disappearing Diver" trick is that employing one or more tubes leading out from the tank to a place on the rear of the stage. The position of the tube running into the tank is either known to the swimmers, or in large tanks they are lighted up by blind bullseyes or lamps, which only the divers can see, and by holding their breath for a few seconds, they manage to swim for the tube-opening as soon as they dive into the water, up thru which they crawl by means of ribs on the wall of the tube, to the stage floor level. As is well known, the water in the tube will not rise higher than it is in the tank. When it is time for the divers to appear, they pass down thru the tube and, Wonder of Wonders! they come popping right out of the water as fresh as a daisy. In the case of the diving bell, they simply hold their breath, slip out from under the bell, and swim to the surface of the tank. In one of these productions a Viking ship slowly rose to the surface of the water on which the swimmers, about 20 in number, stood, as the deck eventually cleared the water. Truly a wonderful spectacle! To produce this astonishing display, the ship has wheels running on an inclined track up to the surface of the water. A gripping tackle is provided at the bottom of the tank to pull the ship up at the desired moment. The masts which are quite high are made telescopic and these are raised under the control of one of the men in the diving bells. Then, when the masts have been raised about half-way out of the water, all of the swimmers pop out from under the diving bells, holding their breath and stand on the deck of the good ship "Viking". The captain of this mysterious craft pulls the lever releasing the clutches, and the ship rapidly rises to the surface, the heads of those standing on the deck appearing thru the water first, the water running from their clothes and shoulders as they emerge from the watery depths.

At figure 5 is shown an interesting snow scene in the production of "Way Down East", the play that has successfully "held the boards" for many years. The snow in practically every show is produced in the form of small bits of cut up white paper. The "snow" is spilled down from the fly gallery 40 feet above the stage, or in some cases, it is simply thrown from the stage floor level by some other means. At figure 5 it is shown being dumped from trays along the fly galleries and as it reached a point several feet above the stage floor, it was caught by the breeze from powerful electric fans placed between the wings on either side of the stage, which caused it to be blown out on the stage in a very realistic manner. At the same time the "wind" noise is caused by the whirring of the fans.

A very realistic rain and river scene with real water was produced several years ago in a traveling or road production, with which the writer had some experience—in fact he had the pleasure of "controlling the rain," and that is some pleasure, "Believe me, Xantippe!" Well, to cut short the suspense, the rain was made by simply having a pipe extend across the front of

A Home and Income
For You in Sunny Florida



Be Independent- Own a Grapefruit and Orange Grove—A Truck or Poultry Farm. Increase Your Income

You Can Start a Grove Today Under Our New Plan

Develop a profit-earning fruit farm without leaving your present position—provide for your future. A small payment now and a few dollars invested each month should reap large and increasing dividends from year to year. You can now secure the land you want on payments as low as **$1 per acre per month.** A profit-producing fruit grove is a permanent investment and provides protection against old age.

THE RIGHT LAND IN THE RIGHT LOCATION AT THE RIGHT PRICE

We Have It—Any Size Farm

From 10 to 640 acres or more. These splendid lands are suburban to Tampa, the metropolis of South Florida. Here you find the most healthful, the most delightful climate in North America. For eight years we have been right here helping develop Hillsboro—the banner agricultural County of Florida, and we are still here to serve you and to help you obtain the farm you want. Whether it's ten or twenty acres, for a Fruit Grove, Poultry or Truck Farm, or from 80 to 640 acres for General Farming, Cattle and Hog Raising, we can give it to you on very easy payments extending over 2 or 3 years' time to suit purchaser.

Groves Developed for Non-Residents

If you want to remain in your present position for a few years we can develop a grapefruit and orange grove for you. When you are ready we will clear your land, furnish fruit trees, plant and care for your grove until you are ready to look after it.

We Raise Our Own Guaranteed Citrus Trees in Our Own Nurseries

This insures every purchaser the best fruit trees that can be grown. This also insures a successful grove. We can save you money on planting and caring for your grove.

Fill out and mail us the coupon today and receive our large descriptive book FREE!

NORTH TAMPA LAND COMPANY
C. E. THOMAS, Pres.
Suite 3021, Mallers Bldg. Chicago

$300.00 to $500.00 Per Acre Profit

May be made growing truck. This is not an unusual return for truck farmers in the Famous Tampa district. All kinds of vegetables can be grown. Big prices are paid for early potatoes, Winter cabbage, Bermuda onions, tomatoes, celery and dozens of other vegetables during the Winter and early Spring, when the north is covered with ice and snow. Strawberries, Melons, and other small fruits also yield large profits.

Poultry a Big Money-Maker

Hillsboro County is without question, one of the most favored locations in the United States for poultry raising. Tampa affords an unlimited market for chickens, eggs and ducks. Commission houses right here in Tampa City do a tremendous export business in poultry and eggs and the local demand is also very large. This insures a steady cash market at good prices.

Stock Raising and General Farming

We also have lands especially adapted to general farming, Long Staple Cotton Corn, and Live Stock. Hog and cattle raising has never been so profitable before. High prices for all meat and pork products must continue—Florida stock raisers should make big money for many years to come.

Write for Facts About Sunny Florida

IT COSTS YOU NOTHING TO LET US PROVE TO YOU that we have the land you want—in the location you want—at a price you can afford to pay and on the easiest terms you can imagine. Let us show you.

Coupon for FREE Book on Florida

NORTH TAMPA LAND CO.,
Suite 3021, Mallers Bldg., Chicago.

Please send me your large Illustrated Book "The Call of the Southland" on choice Citrus Fruit and Truck Farms suburban to Tampa, Florida, and information on how I can have a grove developed on the monthly payment plan. EE 1-20

Name .....
St. No. .....
City .....
State .....

FOUR FAMOUS BOOKS

Wireless Course in 20 Lessons

By S. Gernsback, A. Lescarboura and H. W. Secor. E. E.

A course that tells you everything you can possibly want to know about "Wireless". The mysteries of "Wireless" are unfolded to you by the use of such simple language so skillfully used that of necessity you must understand every word. The subject is not treated superficially, however, for there is a whole lesson devoted to the Theory and Mathematics of this epoch marking subject.

Size of book is 7 x 10¼ in., 160 pages, 350 illustrations, 30 tables.

Flexible cloth cover....per copy $.75
Stiff cloth cover .....per copy 1.25
Postpaid

Experimental Electricity Course in 20 Lessons

By S. Gernsback and H. W. Secor. E. E.

A Course of the theory and practice of Electricity for the Experimenters. This is undoubtedly one of the most complete and comprehensive treatises of this special subject ever published. The book is written by the same authors as the famous "Wireless Course in 20 Lessons".

Every phase of experimental electricity is treated comprehensively in plain English.

The book contains 160 pages and more than 400 Illustrations.

Flexible cloth cover...per copy $.75
Stiff cloth cover.....per copy 1.25
Postpaid

No. 1. How to Make Wireless Sending Apparatus
No. 2. How to Make Wireless Receiving Apparatus

By 20 Radio Experts.

Two Remarkable Books

Book No. 1 contains 100 pages, size 7 x 5 in. and 88 illustrations, paper bound.

Book No. 2 contains 100 pages, size 7 x 5 in. and 90 illustrations, paper bound.

These two books have been written and published entirely for the wireless enthusiast who wants to make his own radio apparatus.

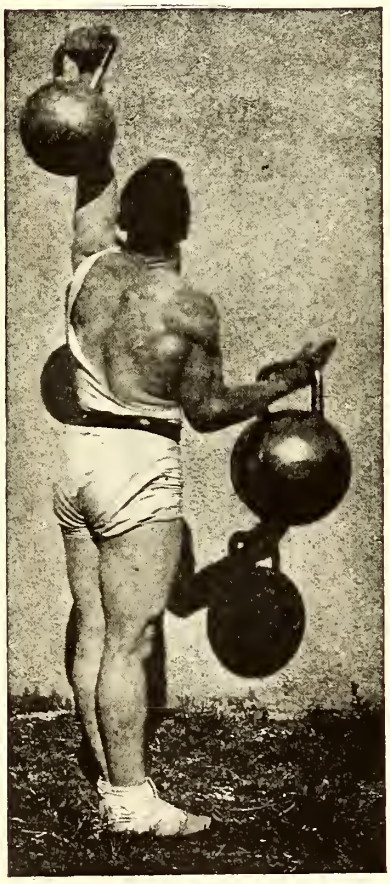
Book No. 1—How to make Wireless Sending Apparatus 25c
Book No. 2—How to make Wireless Receiving Apparatus.....25c
Postpaid

THE EXPERIMENTER PUBL. CO. Book Dept. 233 Fulton St., New York

www.americanradiohistory.com

Health, Strength and Development

can be gained by exercising with adjustable bar bells and dumbbells



We are the originators of progressive graded weight exercises, and during the last seventeen years have developed thousands of men and boys, producing more physical marvels than all other systems combined.

Our bar bells and dumbbells are instantly adjustable to suit the strength of a weakling or a Hercules; and we give a complete course of training suited to the individual's needs.

Let Us Show You

SEND FOR Catalog of Adjustable Bar Bells. Booklet describing courses of training.

Both Free

The Milo Bar Bell Company

Third and Diamond Sts., Dept. 1, Philadelphia, Pa.

the stage, and which pipe was perforated with several dozen small holes. This rain-making pipe was then connected with a hose to a water pipe at one of the fly galleries, where the person controlling the rain is standing. When he gets the cue from the stage manager, to "let 'er go", he immediately opens the valve and the water descends from the openings, dropping to the tank or rubber apron below, in the form of "sure enough, honest-to-goodness" rain! This forms a sheet of rain and for most purposes gives a very satisfactory effect.

This show had a most exciting water scene, and the method for staging it was one of the most wonderful that the writer has ever come in contact with. The production carried a large flexible rubber tank, the full length of the stage and about one foot deep, which would thus hold enough water to float row-boats or a small launch. In the center of the tank there was a deeper pocket, measuring about 10x7 feet which projected down into a wooden frame under the stage, and into which the hero proceeded to dive in the second act in order to save the beautiful blonde heroine. If the "villiun" had felt real interest in, or had been jealous of the affection of the hero for the heroine "off stage", he could move the "phoney" canvas-covered "rock", and if our hero dived he would then make a miscalculation and end by dropping into one foot of water, instead of ten. With this improvised and somewhat shallow tank of water, a very exciting melodrama was "put-on"; the scenery was hung over the sides of the tank so that just the water line appeared to the audience, and in fact no part of the tank whatever. A band of counterfeiters floated up the river in a launch, while the police boat, chasing them, fired several dozen revolver shots thru a phoney machine gun. It was some exciting plot and very realistic.

SUN, MOON AND STAR EFFECTS ON THE STAGE.

In the "Garden of Allah", one of the most pretentious scenic productions put on in New York in several years, there was a very realistic *desert sand storm.* Real sand was used in producing this storm scene and as shown in figure 7, the sand was caused to be blown upward, and then caused in turn to whirl in eddies by means of electric blowers placed at the proper points about the stage. These electric blowers were camouflaged under small stage props, which were colored and arranged to fade in with the sand of the desert. The twinkling stars were created by a large number of tiny electric lights being hung against a dark blue background, the various circuits of lamps being rapidly switched on and off by an automatic flasher. As the lights were staggered and placed in an irregular formation, and as the lights in different levels were alternately illuminated and extinguished, no regular coherence of effect could be gathered and the audience was thus charmed with the display.

At figure 8 is shown an arrangement in use for producing the best type of moon or sun-rise, or also the setting of the moon or sun. In the ordinary production no attention is paid to the well known fact that the moon or sun is always larger when down near the horizon, growing smaller in diameter as it mounts to the heavens. The moon effect, for instance, is produced in the following manner:—a powerful lamp, such as 1,000-watt incandescent gas-filled bulb, is placed in a light-tight box. In the front of this box there is arranged a slide in which colored screens can be placed to give a yellow or other tint to the light, and across this opening there is mounted an iris diafram, similar to that used in camera shutters. This diafram is fitted with a lever extended from the side of the box, and from which a cord depends downward. The box is now carefully elevated by means of a rope, or two ropes, such as will allow

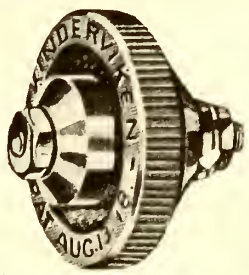
www.americanradiohistory.com

it to be pulled upward in a slow manner. At the same time the operator controlling the moon-rise slowly closes the iris diafram, causing the "moon" to gradually grow small as it mounts up from the horizon painted on the scene.

Figure 9 shows how *open fire place* effects have been produced as well as *blazing fire* from other stage mountings. It is seldom that a real fire is used on the stage, both because it is not necessary and also because it is somewhat dangerous where there is so much canvas scenery about, altho these are fire-proofed as best they can be. The *flame* of such fires is produced by thin red silk ribbon or else by pieces of red silk. An electric blower or fan is so placed as to blow these silk strands and cause them to resemble a flame, especially when lighted from behind or beneath by means of red lamps. Figure 9 shows also how windows in small houses, appearing in the back of the settings in certain scenes, are lighted up. In a recent Belasco production, "Dark Rosaleen", all such stage effects as this are very carefully worked out so as to produce an exact and true scenic setting. The electric lamps for lighting up the windows are shielded by a canvas flap in the manner shown, so that no light flashes up above the frame of the house or reflects back onto the scenery, which would, of course, spoil the scene. The windows are made of celluloid or similar material, either colored or painted. Where scenery glass is required, and unless some desperado is to do the "business" of jumping thru a window to the accompaniment of crashing glass, then ordinary window screening is used. In one of these large windows containing about 20 openings, it was surprising to note how well this screen resembled glass, and moreover it had been painted around the edges so as to give the effect of a long accumulation of dust and dirt. Flags are often used in spectacular productions, dramas, etc., and of course the best effect is created by having the flag wave. This is usually done by placing an electric fan near the flag and just behind a piece of scenery so that the fan is out of sight with respect to the audience.

MISCELLANEOUS STAGE TRICKS.

Some of the more elaborate stage productions carry with them a portable electric switch-board of their own, as shown at Fig. 10. One of these switch-boards which the writer recently saw, contained a whole battery of dimmers (rheostats) for controlling the lamps of various border and spot lights—this portable switch-board rolling about on wheels, and being connected to the electric supply mains by means of a flexible rubber covered cable. At Fig. 10, there is also shown the three stage revolving spot-light platform which is used in some of the spectacular productions produced on large stages. The spot-light operators are located on the different stages



Skinderviken Transmitter Button

The most efficient little Transmitter in the world.

Over 15,000 sold in less than a year. Use it on your Phonograph, Wireless, long distance telephone, etc.

Hundreds of interesting experiments.

Make your own detectiphone.

Send $1.00 for super-sensitive Button. Three booklets free containing circuit diagrams. Order now from

J. SKINDERVIKEN

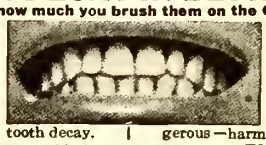
335 Broadway, New York City
or 154 W. Randolph St., Chicago, Ill.



TEETH DECAY IN BETWEEN

No matter how much you brush them on the OUTSIDE

Dentists place 75% of all fillings between teeth where food particles decompose, cause bad breath and tooth decay.



We all *must use* FLOSS. But NEVER *by hand.* That's awkward, wasteful and dangerous—harmful as toothpicks.



Use new safety floss guide just invented called FLOSSY. Carries a spool of the best flat pure medicated silk floss. *Always* sanitary. Approved by dentists everywhere as the *only* device to clean BETWEEN the teeth. Slides the silk naturally, easily and *safely*. Beautifully moulded. Ivory finish. Costs only **50c** complete. Will keep your teeth safely clean a lifetime. To remove stains from the surface of your teeth easily,

Use LIQUID TOOTHWHITE. Wonderful liquid. Harmless. Full size bottle **75c.** Both of the above for **$1.00;** refunded if not *perfectly* satisfied. Special sample bottle **25c.** Stamps accepted. Send your order TODAY. **TOOTHWHITE LABORATORIES, Dept. 45, EVANSTON, ILL.**

LEARN WIRELESS TELEGRAPHY

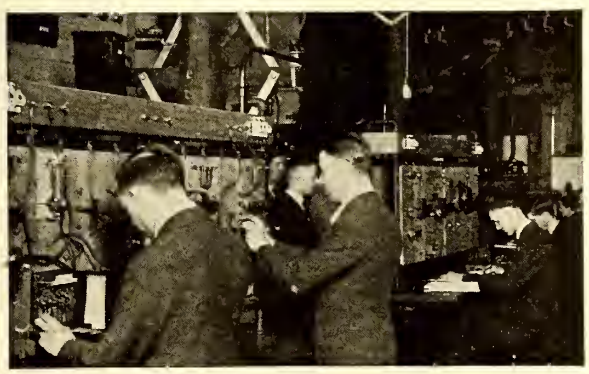
Fascinating and Educational Work—Big Salaries—Prepare Now

The United States Shipping Board is making heavy demands upon us for **Dodge-trained** wireless operators. Travel all over the world, secure, free, unsurpassed living accommodations and earn a big salary.

We Also Teach Morse (Wire) Telegraphy and Railway Accounting

School established 45 years. Endorsed by wireless, railway and telegraph officials. Low rates. Students can earn living expenses while attending school. **Catalog Free. Write Today.**

Dodge's Telegraph and Wireless Institute 26th St., Valparaiso, Indiana



A Practical Electrical Education

in the splendidly equipped laboratories and shops of the School of Engineering of Milwaukee, combined with the advanced methods of instruction as taught by this school's faculty of 55 experts will fit you to become a *trained* master electrician in *one year.*

New Facilities - Greater Accommodations

are at the disposal of students beginning the new Winter Term at this school, together with a wide range of specialized technical and electrical studies.

Institute of Electrotechnics

Junior Division (18 mo.) for graduates of 8th grade. Senior Division (18 mo.) for students with 7 high school credits. Prepares for entering College of Electrical Engineering or to assume well paying, responsible positions in the electrical field, immediately upon graduation. A strong faculty of practical men assures the student of a thorough and useful training.

School of Electrical and Mechanical Drafting

A one year course, covering all the essentials and details of standard drafting room practice. Trains the student to assume positions of importance immediately upon completing this course.

6 Months Armature Winding

and Motor Generator course. Short but thorough, taking up the practical study of this high grade, remunerative trade.

Automotive Electrotechnics

A 6 months short course and a more extensive 2 year course in automobile, marine and airplane starting, lighting and ignition. The repair and maintenance of gas engines of all types is likewise taken up. An up-to-the-minute thoroughly modern and practical department.

Extension Department

Home Study courses in electricity, drafting, mathematics, English and wireless telegraphy.

New Term Opens Jan. 2nd, 1920

Athletics, R. O. T. C. (optional). Amusements of all kinds, students Fraternity House with room and board at cost. Send NOW for latest bulletins and full information FREE. Mention age, education and course of interest.

SCHOOL OF ENGINEERING OF MILWAUKEE

133-373 Broadway Milwaukee, Wis.

CLIP HERE

School of Engineering of Milwaukee,
133-373 Broadway, Milwaukee, Wis.

Gentlemen:—I am interested in the course or courses checked below. Kindly mail your latest bulletins and full information.

....School of Practical Electricity. 1 year course.
....Institute of Electrotechnics.
....Junior Division (8th grade) 18 mo.
....Senior Division (2 yrs high school) 18 mo.
....School of Mechanical and Electrical Drafting. 1 yr. course.
....Automotive Electrotechnics. ... ...
....6 mo. course. ....2 year course.
....6 mo. Armature Winding and Motor Generator Course
Extension Department.
....Electricity. ....Mathematics.
....Drafting. ....English
....Wireless Telegraphy

Name .....
Address .....
Age ..... Education.....

www.americanradiohistory.com

YOU MUST GET STRONG

Don't think you can't do it, no matter how weak and watery blooded you may be now. Don't let constipation poison your system, dyspepsia upset your digestion, neuralgia put your nerves on edge, or any other chronic ailment make your life a burden. **You don't have to.** You can free yourself from these physical and mental handicaps, develop your body, strengthen your vital organs and BUILD YOURSELF UP into a strong, vigorous, MAN again, if you will only face the facts and take proper steps to remedy them.



STRONGFORT
The Perfect Man

The Simple, Safe, Sure Way

There's only one way out for the weak, sickly man and that is NATURE'S WAY. Nature is the greatest curative power in the world; every reputable medical man will admit it. Give Nature half a chance, by living life as it ought to be lived, and she will banish your ailments, redden your blood, put good solid beef on your bones, oil up your internal machinery and make you a two-fisted, healthy happy member of society again.

STRONGFORTISM

Strongfortism is a simple, plain system of strengthening your vital organs and developing your body and brain in Nature's own way, as I have learned it in my lifetime of study and experience. No patent medicines or dope of any kind in the Strongfort way. No complicated gymnastic apparatus. No castiron, rigid routine of tiring exercises. Strongfortism is living life in the way to get the greatest enjoyment out of it, and you can practice it in the privacy of your own bedchamber if you like.

I KNOW I can improve you, so as to become normal in every respect if you will follow my directions for a few months. I GUARANTEE IT. Send for my FREE BOOK, **"Promotion and Conservation of Health, Strength and Mental Energy."** It will tell you all about Strongfortism; how it has built up and is building up weak, ailing men in every part of the world; how YOU can build yourself up and regain your health and strength and confidence and enthusiasm. DON'T PUT IT OFF. You can't afford to be without that book, whatever your condition. If you are weak it will show you HOW TO GET STRONG. If you are strong already, it will show you how to stay so.

IT'S FREE. Enclose three 2c stamps for postage and packing and I will mail you a copy at once.

LIONEL STRONGFORT *Physical and Health Specialist*
1103 Strongfort Institute, NEWARK, N. J.

Ten Reasons
WHY YOU SHOULD BECOME A

DOCTOR OF CHIROPRACTIC

1. Because Chiropractic is the foremost drugless profession of the day.
2. Because Chiropractic brings results quicker and with greater frequency than any other healing method now known.
3. Because Chiropractors invariably enjoy greater financial prosperity than practitioners of any other method.
4. Because YOU cannot hope to achieve economic independence and the feeling of security that you desire by working for others.
5. Because YOU thereby become one of the pioneers of a profession than which there is none more promising today.
6. Because Chiropractic is in line with evolution of Science, and is in accord with natural laws.
7. Because Chiropractors are gradually winning universal recognition thru their achievements.
8. Because the Chiropractic field is absolutely unhampered by competition.
9. Because the demand for Chiropractors is nationwide, and is growing with tremendous strides.
10. Because YOU owe it to YOURSELF and to society to be of maximum benefit to both, potentially and actually.

Do not accept our word for the above.
Write for Booklet X and details, or call personally.
Second fall class registers Nov. 1-15.

The NewYork College of Chiropractic
1416 Broadway **New York Ctiy**

of the platform which has a total height of thirty feet or more. Flexible rubber covered cables supply current to the spot-lights from the stage floor pocket. Arc lamps for stage spot lights are rapidly going into disfavor and the new 500- and 1,000-watt gas-filled tungsten lamps are taking their place. At Fig. 11, there is shown a motor-driven scene raising and lowering mechanism installed in one of the New York theaters. All large theaters today have what is known as a grid-iron, and fly gallery above the stage, the height of the grid-iron being about 80 feet above the stage floor. Large drops, ceilings of rooms, house roofs, and all such scenic effects are hoisted by means of ropes and suspended from the grid-iron, so that they hang about 40 feet above the stage, and just over the particular setting which happens to be in use. Sometimes 40 or 50 scenes may be seen hanging from the grid-iron and above the Actor's heads. In the usual theater, these scenes are correctly balanced by heavy iron weights, so that they can be raised and lowered by one man, without undue exertion. At this particular theater, however, an electric motor drives the shaft which runs along one side of the fly gallery. The ropes coming down from the various pulleys up on the grid-iron, and by means of which the scenes are raised, pass down to this motor driven shaft, each rope being secured to a suitable winding drum. By means of a clutch attached to each rope hoisting drum, it is possible to quickly raise or lower any scene desired, the electric motor doing all the work. By throwing in several clutches at once, as many as four or five scenes can be raised simultaneously. When the scene is raised to its proper height and in order to prevent breaking the ropes and dropping the scene, an automatic electric cut-off is fitted to the hoisting ropes which stops the motor if the scene is raised too far up.

SCENE PAINTING

Little is known regarding the life of the *Scene Painter*. Painting scenery is a profession by itself, and naturally the first requisite is that the scene painter shall be an artist. Also, to be successful, he should be an engineer, an architect, and a thoro student of electric lighting effects, especially with respect to colors. The brilliant colors which are sometimes seen in stage productions are very flat and commonplace looking when seen in daylight. All of these things the scene painter must take into consideration constantly, while he is painting the scene.

Figure 12 shows a scene painting bridge at a large New York playhouse. The colors are made up in large quantities in dishes and bowls placed on long tables along the bridge,—this bridge being 40 feet above the stage floor and having no rails on it. The canvas on which the scene is to be painted is mounted on a large and fairly heavy wooden frame, which is swung on ropes from the grid-iron 40 feet above the bridge. By means of ropes on either end of the bridge, the scene painters can raise or lower the canvas as desired. Large scenes measure about 85 feet long by 40 feet high. All of the scenes, no matter of what building or other view they may represent, are invariably laid out on the canvas with chalk lines and scaled off from a miniature scene, in much the same manner as a house builder constructs a house from the architect's plans. Room scenes where elaborate sets are used, are sometimes provided with heavy wooden doors and framed windows; these are also constructed at first in miniature, even down to the tables and chairs and the vases and clock on the mantle. These parts are scaled off and constructed to exact detail and size by the stage carpenters from the scenic artist's master model. These models are generally but a few feet in length and some of the miniature views, from which back

SELENIUM CELLS

THE

Construction, Care and Use of Selenium Cells with Special Reference to the Fritts Cell

By THOMAS W. BENSON

The lack of definite information relative to the construction of Selenium Cells has led the writer to record the results of some of his experiments and to fully describe the apparatus as developed by him.

CONTENTS OF CHAPTERS

1. Selenium The Element
2. Consideration of Cell types and their Characteristics; The Bildwell Cell; The Ruhmer Cell; The Mercadier Cell; The Bell and Taintor Cell; The Gripenberg Cell
3. Construction of Fritts Selenium Cells
4. Testing and Maturing Selenium Cells
5. Applications of Selenium Cells
6. The Care of Selenium Cells

73 pages, 15 diagrams and 3 halftone page plates, 7½ x 5¼ inches. Cloth.

PRICE $1.50

SPON & CHAMBERLAIN
120 G Liberty Street, New York

NUXATED IRON

To Help Make Strong, Keen Red-Blooded Americans



NOW
Being used by over three million people annually. It will increase the strength of weak, nervous, run-down folks in two weeks' time in many instances. Ask your doctor or druggist



The Electric Safety razor makes shaving a pleasure. Blade vibrating 7,200 times a minute cuts the beard smoothly and without slightest pull or irritation—feels like a gentle massage. Can be used with or without electric current.

All users of the Lek-Tro-Shav speak well of it

A barber says—"Have shaved for years and have never used any shaving device near its equal."
A home user says—"The most pleasing shave I've ever had in my life. Shaves my face closer than I used to shave, but there is no after irritation or ill effects as I usually get from another razor."

No. 1 Made for use from Light Socket.
No. 2 Made for use from Dry Battery.
Write for illustrated circular describing Lek-Tro-Shav Safety Razor fully.

VIBRATING ELECTRIC RAZOR CO.
Dept. 122, Omaha, Nebr.

www.americanradiohistory.com

drop scenes like the one shown at Fig. 12, are painted, are no larger than an 8x10 inch photo. Photos are often used to paint scenes from or to help the artist in depicting correctly certain foreign views, such as Chinese buildings, et cetera.

Stage scenes are painted in strips, i.e., when several painters are working upon the bridge, they all work across the canvas at an average height of say 6 feet. After this 6 foot strip across the canvas has been painted, the frame is lowered this amount, and a new six foot strip across the scene is painted, and so on, until the whole canvas is finished.

A new departure in scene painting is that involving the use of a large *air brush* which is shown at Fig. 12. One of the most successful scenic artists who was the first to make use of the air-brush in painting scenes on such a large scale as this, is Mr. D. M. Aiken of New York. The beautiful and truly magnificent color effects known only to the air-brush artist, have been available for a number of years in connection with small photograph retouching; and now that these wonderously beautiful color creations are available to the stage scene painter, we can expect to see some extraordinarily entrancing stage settings.

New York Electrical Show

(*Continued on page 761*)

brush at the front of it, which was rubbing the soap suds and water thru the rug faster than Aunt Jemima ever thought of doing it in her palmiest house-cleaning days. The gentleman in charge of this exhibit asked us to come right up and inspect the operation, and we did. The rug was quite dirty where the machine had started, but the path over which it had slowly past and washed, as well as dried, was astonishingly clean. Now, thanks to this invention, rugs and carpets in large hotels, theaters and dwelling houses can be cleaned right on the floor *without removal.*

All kinds of electrical kitchen utensils were exhibited, some of them in actual operation, from electric toaster up to gigantic five horse power dough mixers in the electric bakery, which cuff and swatted the 100-pound batch or bread dough, as if it had been only as big as a finished loaf of bread. The bread was baked in this bakery in electric ovens and served with "current" jelly to the hungry crowd. The bread was good, we tried it, and we did not feel any ill effects from the "current" jelly, altho we did expect a shock or two. See Figure 5. The new electric reflection heaters, composed of a small electrically heated coil placed in the focus of a copper reflector, were displayed at many spots. You can feel the blast of heat reflected from these, even when the heaters are at a distance of 10 to 15 feet, whenever you pass one of these heaters. Shown at Fig. 6.

One of the electric washing machines of particular efficiency, and which appeared to be extraordinarily "full of pep," is that illustrated at Fig. 7. This was called the "Locomotive" Washer. The glass tank rushed back and forth with startling velocity, forcing the hot soapy water *thru the clothes* with a natural pressure and in a way which would not injure them.

Passing on, we finally arrived at the corner where the electrical "Docs" held forth. The air in this region was surcharged with high tension electricity as the powerful Coolidge X-ray tubes shot forth their penetrating rays, while now and then a crashing spark jumped across a one-foot gap on the transformer exciting the tube, not to mention the crashing of several dozen small high-frequency machines, which were being



"Don't tell me you never had a chance!

"Four years ago you and I worked at the same bench. We were *both* discontented. Remember the noon we saw the International Correspondence Schools' advertisement? That woke me up. I realized that to get ahead I needed special training, and I decided to let the I. C. S. help me. When I marked the coupon I asked you to sign with me. You said, 'Aw, forget it!'

"I made the most of my opportunity and have been climbing ever since. You had the same chance I had, but you turned it down. No, Jim, you can't expect more money until you've trained yourself to handle bigger work."

There are lots of "Jims" in the world—in stores, factories, offices, everywhere. Are *you* one of them? Wake up! Every time you see an I. C. S. coupon your chance is staring you in the face. Don't turn it down.

Right now over one hundred thousand men are preparing themselves for bigger jobs and better pay through I. C. S. courses.

You can join them and get in line for promotion. Mark and mail this coupon, and find out how.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6209, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

ELECTRICAL ENGINEER	SALESMANSHIP
Electric Lighting and Rys.	ADVERTISING
Electric Wiring	Window Trimmer
Telegraph Engineer	Show Card Writer
Telephone Work	Sign Painter
MECHANICAL ENGINEER	Railroad Trainman
Mechanical Draftsman	ILLUSTRATING
Machine Shop Practice	Cartooning
Toolmaker	BUSINESS MANAGEMENT
Gas Engine Operating	Private Secretary
CIVIL ENGINEER	BOOKKEEPER
Surveying and Mapping	Stenographer and Typist
MINE FOREMAN or ENG'R	Cert. Pub. Accountant
STATIONARY ENGINEER	TRAFFIC MANAGER
Marine Engineer	Railway Accountant
Ship Draftsman	Commercial Law
ARCHITECT	GOOD ENGLISH
Contractor and Builder	Teacher
Architectural Draftsman	Common School Subjects
Concrete Builder	Mathematics
Structural Engineer	CIVIL SERVICE
PLUMBING AND HEATING	Railway Mail Clerk
Sheet Metal Worker	AUTOMOBILE OPERATING
Textile Overseer or Supt.	Auto Repairing
CHEMIST	AGRICULTURE
Navigation	Poultry Raising
	Spanish / French / Italian

Name_____

Present Occupation_____ 7-26-19

Street and No._____

City_____ State_____

WANTED!



Rapid advancement to high Government Positions. "No layoffs" because of STRIKES, WARS, or the WHIMS OF SOME PETTY BOSS. Pleasant work. Traveling constantly. Vacation at full pay. THE POSITION IS YOURS FOR LIFE.

Country residents and city residents stand the same chance. Common-sense education sufficient. Political influence NOT REQUIRED.

Write immediately for free list of Government positions now open. Don't delay. Every day you lose means the loss of just so much chance of your early appointment.

AVERAGE $117 MONTH

MAIL THIS COUPON TO
FRANKLIN INSTITUTE
Dept. M 101 ROCHESTER, N. Y.

This coupon filled out as directed, entitles the sender to (1) free sample examination questions; (2) a free copy of our book, "Government Positions and How to Get Them;" (3) free list of positions now open; and (4) to consideration for Free Coaching for the examination here checked.

COUPON

..Railway Mail Clerk ($1300 to $2150)	..Bookkeeper ($1100 to $1800)
..Postoffice Clerk ($1200 to $1650)	..Customs Positions ($900 to $1500)
..Postoffice Carrier ($1200 to $1650)	..File Clerks ($1100 to $1800)
..Rural Mail Carrier ($920 to $2160)	..Stenographer ($1100 to $1500)
	..Clerk in the Departments at Washington ($1100 to $1500)

Name .....

Address ..... M 101

Use this before you lose it. Write plainly.

TRICKS, PUZZLES, JOKES, TOYS, games, novelties, doll and cane racks, plays, wigs, stage supplies, escapes and illusions. Large 1919 catalogue free.
OAKS MAGICAL CO.
Dept. 549 Oshkosh, Wis.

Learn Watchwork, Jewelrywork and Engraving A fine trade commanding a good salary, and your services are always in demand. Address HOROLOGICAL Department, Bradley Institute, Peoria, Ill., for our latest catalog.

www.americanradiohistory.com

demonstrated by experts for the benefit of a "long-suffering" public. This exhibit also included electric lamp heat baths in the form of cabinets of various shapes and sizes fitted with mirrors and several dozen high candle-power lamps inside of them, as well as nifty, small-size X-ray outfits for dentists. You know, now-a-days, they say a patient knows as much about his tooth as a dentist does, unless the "Doc" has an honest-to-goodness X-ray machine and can examine the "interior" of your roots and jaw bone to see whether or not you have any tumors or abcesses sprouting there. So, this year, more than ever before, everybody that was up on the technique of modern denistry, was particularly interested in this display. One of the special tooth-jerkers' X-ray tooth analyzers, is illustrated at Fig. 9.

WIRELESS HOLDS SWAY AT THE ELECTRICAL SHOW.

At one corner of the radio exhibit we ran into the latest thing in wireless, the radio-goniometer or wireless direction finder. See Fig. 10. This comprises a coil of several turns of wire mounted on a pivoted frame, so that the coil can be turned around to any degree of the compass. The shaft is fitted with a pointer and scale, so that the exact point of the compass to which it points can at once be determined. Thousands of these devices were used during the war to locate enemy wireless stations, when the latter were fired on by our artillery, sometimes when they were many miles away and out of sight. Wireless telephony was demonstrated at the Electrical Show, also, as shown at Fig. 15. Audion bulbs were used in practically all of the wireless instruments exhibited both for transmitting and receiving. A new and interesting "direct current" wireless transmitter, giving a musical note without a rotary converter, was demonstrated.

As before mentioned, a complete electric dairy was exhibited, with several choice cows which were milked with an electric vacuum milker several times a day, for the edification of the cityites, who occasionally manifest the idea that our lacteal products come from so lowly a source as the country roadside milkweed. Some extremely interesting and clever "coin-in-the-slot" dispensing machines were exhibited. The company supplying these machines have made them as nearly human and fool-proof as possible. Not only do these machines dispense everything imaginable—from a "cootie-proof" hair brush to a theater ticket to see a Mary Pickford six-reeler, but they are fitted with one of the most marvelous scientific coin rejectors ever conceived. They are guaranteed to refund your money unless you feed them with guaranteed solid U. S. coin, and this coin must not have any holes in it; no smoothed out edges and no figures or designs missing. Also, the weight must be right, the composition must be right, and the size must be correct. Apparently, this machine has got the eagle-eyed bank cashier backed off the map when it comes to telling a "counterfeit" from a "real" coin. See Fig. 12.

Electric sirens were exhibited (see Fig. 13) in various sizes, some of which can be heard for several miles, and which are used with great success by fire departments. Many electric devices and attachments were shown to aid the seamstress and tailor and a new line of cloth-cutting machines were demonstrated. One of these machines, in the hands of an experienced operator, will cut thru a hundred thicknesses of cloth at once. One style has a motor operated steel wheel which does the cutting, while another larger type has a knife shaped like a razor blade which is oscillated vertically several hundred times per minute. See Fig. 14.

Electric auto trucks operated with powerful storage batteries were exhibited and caused much comment among those who were interested in transportation and freight haulage problems. See Fig. 16.



Get an Ideal Model Aeroplane for Christmas!

Building and Flying Ideal Model Aeroplanes is real sport because Ideal Models are accurate, scale-reduction duplicates of real Aeroplanes. They look like the machines they are copies of; have parts and fittings like real ones, and rise from the ground or water by their own power and fly in the air. Build one. Learn about aeroplanes, how they are built and how they fly. Ideal Model Aeroplane Construction Outfits make building easy. They contain all parts, fittings, materials, plans drawn to scale and full building and flying instructions. You make and assemble the parts like a real Aeroplane mechanic.

You Can Build and Fly Accurate, Scale-Models of These Famous Aeroplanes

You can get a Complete Construction Outfit to build an absolute duplicate, scale-reduction Model of any of these well-known machines:

NC-4 (Naval-Curtiss Seaplane). The first 'plane to fly across the Atlantic Ocean. 4½ ft. Model. Shown above.
DeHAVILLAND Battle 'Plane (DeH-4). The fighting 'plane used by the American Aces in the World War. 3 ft. Model. Shown below.
Curtiss Military Tractor. The 'plane used to train our Aviators. 3 ft. Model.
Bleriot Monoplane. The first aeroplane to cross the English Channel. 3 ft. Model.
Nieuport Monoplane. A famous French 'plane used in the War. 3 ft. Model.
Taube Monoplane. The early German dove-like machine. 3 ft. Model.
Cecil Peali Racer. A racing-type aeroplane with a record for distance flights.

Ideal Model Aeroplane Construction Outfits for building any of the above Aeroplanes are sold by Leading Toy, Sporting Goods and Department Stores. Ask for them at your store. Be sure you get IDEAL Model Aeroplanes because they are the only ones that are true copies of actual Aeroplanes.

Send for the Ideal Aeroplane Book Tells all about Ideal Aeroplanes and Flying Toys; gives complete descriptions and prices; contains list of stores where you can get them. Get this book, sure. 48 pages. Sent Postpaid for 10c in stamps.

Ideal Airplane & Supply Co.
Making Model Aeroplanes Since 1911
159-161 Wooster St., Cor. W. Houston St., New York City.



Don't Lick Stamps



Move Moistener Like a Sponge

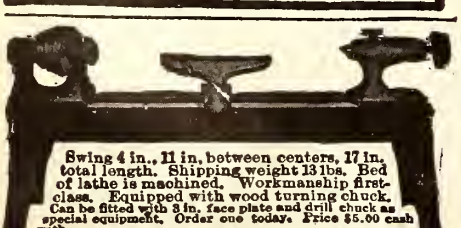
or Envelopes

Moisten them with THE ARGUS MOISTENER. Always ready for use. Sanitary. Moistens flap or stamp neatly, quickly—in series or singly. Beautifully nickel-plated. Highly desirable for **OFFICE OR HOME**

Useful Xmas gift. Will be keenly appreciated by social letter writer or office employee.

PRICE, PREPAID $1.50 Ask your stationer or send us $1.50. Money refunded if not satisfied.

ARGUS MFG. CO. 402-6 N. Paulina St. Dept. 27 CHICAGO



Swing 4 in., 11 in. between centers, 17 in. total length. Shipping weight 13 lbs. Bed of lathe is machined. Workmanship first-class. Equipped with wood turning chuck. Can be fitted with 3 in. face plate and drill chuck as special equipment. Order one today. Price $5.00 cash with order. SYPHER MFG. CO., DEPT. C TOLEDO, OHIO

COPPER AERIAL WIRE



We have just received several thousand pounds of No. 14 pure copper aerial wire which we are selling for 40c per pound. This wire runs 80 feet to the pound and is guaranteed to be satisfactory by us. Postage and insurance must accompany all orders, otherwise they will be shipped by express collect.

We are listing a few more of our exceptional bargains below:

Telephone Relays—with six contacts and dust proof cover—shipping weight, 2 lbs.....each $1.50
Powerful Horseshoe Magnets—made of high grade Norwegian iron 5 inches high—shipping weight, 2 lbs. .....each .30
Condensers—½, 7/10, 1, 1½ and 2 Micro Farads—all types contained in indestructible metal case—shipping weight, 2 lbs.....each .50
Resistance Coils—wound to 4500 ohms resistance with German silver wire—shipping weight, 1 lb. .....each .40
Induction Coils—primary one ohm, secondary 55 ohms—shipping weight, 1 lb.....each .50
Telephone Receivers—standard 75 ohm bi-polar, complete with cord—shipping weight, 2 lbs., each .....each .80
Dry Cells—slightly used—shipping weight, per doz., 26 lbs.....per doz. 1.25
Small Complete Telephones—ready for mounting on your wall—work on two dry cells—shipping weight, 4 lbs.....each 3.00
Telephone Ringers—630 ohms—shipping weight 2 lbs. .....each .80

Send 5c for our illustrated catalogue showing many other items at our bargain prices.

ELECTRICAL SPECIALTY COMPANY
Dept. E—48 So. Front St., Columbus, Ohio

REAL INDOOR FOOTBALL



A new game that gives you all the sport and thrill of a regular outdoor contest.

The players must make their own choice of moves and direct the operation of their teams just as if they had live men on the field.

Every point in the real game is covered and every move can be duplicated.

The most exciting game on the market to-day. You'll never grow tired of it. Attractively put up—with full directions.

Shipped Anywhere in United States $1.00 postpaid

Order today while they last

UNIQUE GAME & TOY SERVICE
1328 Broadway, New York City

Battery Charging Your Biggest Money-Maker

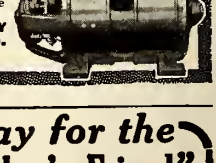
$150 TO $350 CLEAR PROFIT A MONTH WITH THIS HB-32 BATTERY CHARGER

You can recharge 32 6-volt auto batteries, or equivalent in 12- or 24-volt batteries, at one time, for 10c to 15c each. Customer pays 75c to $1.50. Figure the profits yourself. Others are making BIG PROFITS with HB Battery Charging.



Why not YOU? Get busy NOW—add those extra profits to your income.

Small Investment Puts This Money-Maker in Your Garage. Balance on easy monthly terms. Outfit easily pays for itself. Absolute Money-back Guarantee. No burn-outs, or renewals. Easy to install and operate. Only attention needed is occasional oiling. Write TODAY for full information.



HOBART BROTHERS COMPANY
Box 123 E Troy, Ohio.
Successful Mfrs. since 1893

Send To-day for the "Electrical Worker's Friend"

An electrical book of 66 motor drawings with complete instructions for rewinding and reconnecting A.C. motors. Special at **$3.50**

Or write for full particulars of this valuable book.

SMITH & SMITH PUBLISHING CO.
Dept. B. 1524 LOWRIE ST., N.S., PITTSBURGH, PA.

www.americanradiohistory.com



In this Department we publish such matter as is o interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries addrest to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are publisht here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

Automatic Non-Leak Oil Can.

(356) L. Scales, Tusla, Okla., asks our advice on an automatic self-closing spout for oil cans. When the bottom is prest, a rod fastened to it opens and closes a plug or valve in the tip of the spout.

A. We have looked over your drawing carefully, showing your suggestion for an automatic oil can, and it would seem to have several good merits, particularly from the fact that no oil can leak out of the can when it may happen to be knocked over or upset. There is only one weak point which you probably have or can overcome in the design or manufacture of this oil can, and that is the small metal bar or pear-shaped plug at the spout of the nozzle, which has to be screwed on to the light rod secured to the bottom. It would seem that after the can had been used for a while, that the wear and tear on the thread, etc., would lower the efficiency of the device, causing it to leak oil when upset, in spite of the attempt made to overcome this objection.

If you can, however, overcome this weak point and provide a sufficiently heavy rod to make the oil can reliable and suitable for constant usage, we believe you have a very good device and one worth applying for a patent on.

Thermometer.

(357) John Schmidt, Long Island, N. Y., writes: "Having read in the current issue of ELECTRICAL EXPERIMENTER of the patent advice you give to readers, I submit to you the following: I have perfected a thermometer constructed by winding a spring made from a certain metal called by some thermostatic steel. The spring is wound, one coil on top of the other, similar to a watch main-spring. A shaft of a predetermined height is soldered to the spring. Next a bearing is fastened to a case of suitable size for the shaft to lay into (the top bearing is merely a hole drilled into the dial of the instrument). The dial is properly calibrated, with which I am thoroly familiar. As you will notice by the sample which I sent you, one side of the metal is nickel, which makes it expand with heat and contract with cold, which in turn rotates the shaft to the end of which a pointer is fastened. This determines the correct temperature of the room into which it is hung. I have constructed a model which has stood up with any mercury thermometer that I hung along side of it. To my knowledge there is not another instrument built along these lines. Please advise if a patent can be obtained on this invention."

A. To our mind this is a very good idea, and we are inclined to think that a patent can be obtained on this invention. Providing a large temperature range can be had on such a thermometer, we should think that it would be quite a practical instrument and one that would commend itself readily to the public.

Protected Switch.

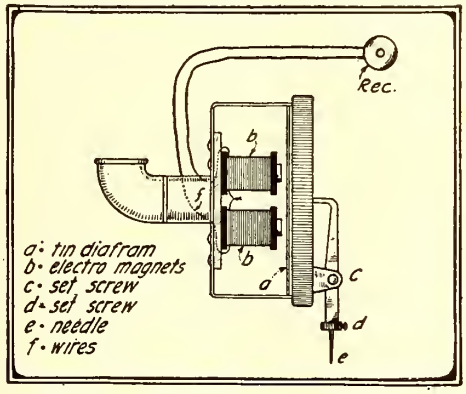
(358) Onni Koskin, Dollar Bay, Mich., says: "It is claimed that a large share of the accidents from electric shock are caused by open knife switches. I think that this could be prevented by insulating all the exposed metal parts, except the contacts with some material such as the enamel used on some electric wires. I would like to know if this idea could be patented."

A. Switches of this kind are in use now. For this reason we do not think that you could obtain a patent.

Electric Recorder and Reproducer.

(359) Marion W. Taylor, Buechel, Ky., submits an idea, shown in the illustration, which works as follows: The recorder and reproducer works as a telephone receiver. A person speaking in a transmitter connected to this instrument causes the vibrator or diafram to vibrate, thus making the impression upon the record. Then, when run over the second time the same will be reproduced in a pair of receivers, this being done by having a direct current between recorder and phones, so that when the diafram vibrates it breaks the lines of magnetic force producing sounds. He wishes to know if this is a patentable feature and if we think that the idea is valuable.

A. This seems to us as a good idea, and we think a patent can be obtained on it, altho we do not see the exact use of the instrument, but, of course, there may be some uses for it, such as for transmitting phonograph music at a distance, etc. You seem to think that it is necessary to have a battery in connection with this device, but this is not necessary, providing the electro-magnets have a steel horseshoe magnet. Then, in that case, no battery is required, as the music or words



from the phonograph would be transmitted "electro-magnetically"; the same as when you take two receivers and connect them together without a battery. This arrangement, as is well known, will then "talk." The coils, however, must be mounted on soft iron pole-pieces, not on the steel magnet frame proper. These pole-pieces or cores are then securely clamped to the steel magnet.

Wireless Device.

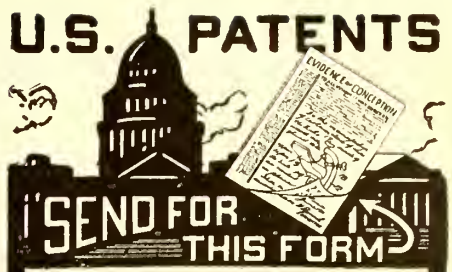
(360) W. J. B., Philadelphia, Pa., sends in a description of a design of a new system for wireless telegraphy, and would like to know if a patent could be obtained upon it and, particularly as it requires no aerial, what its advantages are. Several other pertinent questions are asked.

A. We have carefully looked over this invention, but we fail to see how it could possibly work, as no circuit is provided for the secondary discharge of the spark gap; hence we feel certain that it could never work successfully.

Scale Dividers.

(361) Elmer Knitter, Cleveland, Ohio., writes: "I submit herewith a sketch of an idea on which I would like to have your opinion along such

U.S. PATENTS



Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.

LANCASTER & ALLWINE

255 OURAY BLDG.,
WASHINGTON, D. C.
"Originators of form Evidence of Conception"

PATENTS

TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enahle me to accurately advise clients as to probable patentability before they go to any expense.

Booklct of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
164 Owen Building, Washington, D. C.
2276-8 Woolworth Bldg., New York City

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE ON CONCEPTION." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention we will give our opinion as to its patentable nature. Electrical cases a specialty.

Our illustrated Guide Book, "HOW TO OBTAIN A PATENT," sent Free on request. Highest References Prompt Attention Reasonable Terms

FREE COUPON VICTOR J. EVANS & CO., Patent Attorneys

Chicago Offices: 1114 Tacoma Bldg. Pittsburgh Offices: 514 Empire Bldg. Philadelphia Offices: 135 S. Broad St. New York Offices: 1001-1007 Woolworth Bldg.
MAIN OFFICES: 779 NINTH, WASHINGTON, D. C.

Name..... Address.....

www.americanradiohistory.com

? HOW TO MAKE

MONEY WITH YOUR PATENT
HOW TO SELL
HOW TO KEEP CONTROL
HOW TO ORGANIZE
HOW TO RAISE MONEY

These and hundreds of other vital questions the inventor must know to make his invention a financial success, fully answered in

The Inventors' Manual of Valuable Information

$1.00 per copy, postpaid

If you have a patent or are thinking of taking out one, protect yourself by getting all the information this valuable book contains.

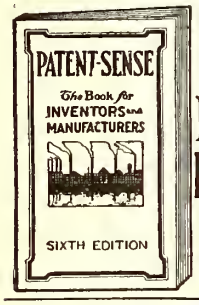
Write for free circular and table of contents.

G. E. Perry Company, Publishers, 1324 Broadway N. Y.

Free Book on PATENTS

Write today for a Free Copy of "How to Obtain a Patent." Contains valuable information and advice to inventors. Tells how to secure Patents. Send model or sketch of your invention for opinion of its patentable nature—Free. (20 years experience.) Talbert & Talbert, 4287 Talbert Bldg., Washington, D. C.

How to obtain a Patent



"The Book for Inventors and Manufacturers"

SIXTH EDITION.

By return mail FREE. Write LACEY & LACEY Dept. K. Washington, D.C.

Competent Patent Service

By a Former Examining Official of the U. S. Patent Office

NORMAN T. WHITAKER

Lawyer and Engineer

480 Whitaker Bldg. Washington, D. C.

Branch Office, 52 Wall St., New York City.

INQUIRIES INVITED

PATENTS

Record your invention. Upon request, I will forward to you my form "Fixing the Essential Dates of Invention" together with full information concerning its use and the best way to secure patent protection. Prompt, personal, efficient service, by an attorney-at-law, having over twelve years experience in patent matters. Reasonable pre-war charges. B. P. FISHBURNE, 324 McGill Bldg. Washington, D. C.

PATENTS C. L. PARKER Formerly Member Examining Corps, U. S. Patent Office. PATENT LAWYER McGill Bldg. Washington, D. C.

Patents, Trade Marks, Copyrights, Patent Litigation

Handbook for Inventors, "Protecting, Exploiting and Selling Inventions," sent upon request.

PATENTS

Hand Books on Patents, Trade Marks, etc., sent free. Our 70 years of experience, efficient service, and fair dealing, assure fullest value and protection to the applicant. The Scientific American should be read by all inventors.

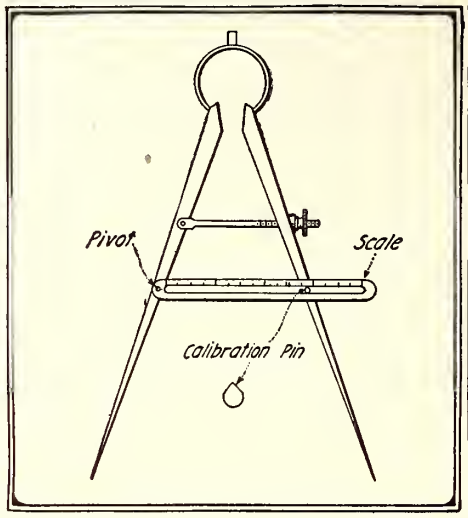
MUNN & CO., 622 Woolworth Bldg., N. Y.

Washington Office, 622 F St., Washington, D. C.

LEARN WATCHMAKING

By our PROFIT SHARING plan watchmakers earn from $40 to $80 per week and the demand for competent men is greater than the supply. Write for free book. CHICAGO SCHOOL OF WATCHMAKING, Dept. 30, 190 N. State Street, Chicago.

lines as you publish in the ELECTRICAL EXPERIMENTER. The idea contains a provision of a scale on dividers, calipers and similar instruments so as to obtain quicker measurements than we do now, for the simple reason that it does away with the slow method now in use. I would like to know if this device could be patented."



A. This seems like a good idea, altho we think we have seen a similar device once before. Of course, it would be necessary to make the calibrations so that the scale would read in inches for the distance at the end of the dividers, but this, of course, is a mere detail. Our advice is to have a search made in the Patent Office for patentability.

"Perpetual Motion."

(362) Werner Kretschmer, Demarest, N. J., submits a scheme whereby a motor is connected to dynamo with a belt and with wires attached to the brushes. It is first started by an outside source of current, such as a storage battery. The motor then works the dynamo thru the belt and a current is generated in the dynamo. Then the outside circuit is broken and the dynamo supplies the current to run the motor, which, in turn, runs the dynamo. If there is nothing fundamentally wrong with this plan, the apparatus would work indefinitely. Of course, some energy would be lost thru friction and other resistance, but I see no reason why that could not be overcome by using a powerful, yet easy-running dynamo. If this plan were possible, I believe it would do a great deal toward making the electric automobile more of a success. Only a weak current would be needed to start the action.

A. This scheme is just as feasible as lifting oneself up in the air by one's own boot straps. This idea is a favorite one among young inventors, and it crops up every once in a while. The idea, however, is entirely fallacious, as you cannot possibly obtain energy for nothing. Too much energy is lost in friction and other losses, making it impossible for such a scheme to come even near working.

Fly Swatter.

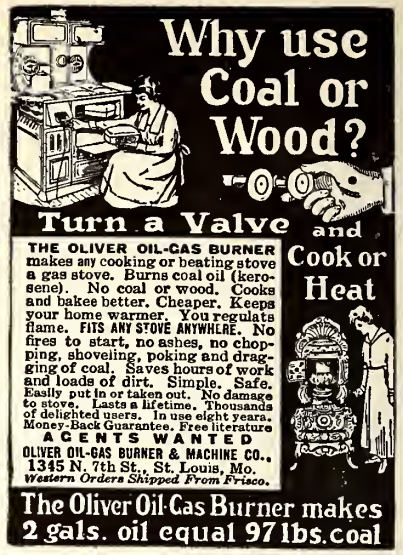
(363) John F. Carlson, Irwin, Pa., sends us a sketch of a new fly swatter, which is made of a piece of screen with a soft rubber frame molded around the edge to protect scratching the furniture, etc. The wooden handle could be cemented into the rubber. He would like to know if a patent can be obtained on this article, and if there is such a swatter on the market.

A. There is nothing new whatsoever in this invention, and you can buy such swatters in many stores handling household goods. They sell for about fifteen or twenty-five cents. It is quite an old idea.

Ignition Device.

(364) Clyde Stewart, Beldenville, Wis., says: "I submit herewith a drawing of a supposed ignition outfit. The drawing is almost self-explanatory. The secondary coil, which could be similar to the one used on wireless spark coils is fastened firmly to the cam shaft C. The magnets N S are, of course, rotating all the time the engine is in operation. When the engine is on the compression stroke the cam shaft moves up, carrying the coil with it. On account of the magnetic field set up by the rotating magnets a high tension current would be set up in the coil. I am rather in doubt as to how much current could be produced, but I should think if the secondary were larger than most secondaries on gas engine coils enough current could be induced. The device could also be applied to automobile engines by means of a special device, which I have. The question of timing the discharge could be solved by moving either the coil or magnets. Do you think the device would work? Could a patent be obtained on such a device?"

A. This seems to us a good idea, altho it should be tried out first in practise. We are also afraid that more magnets than shown will have to be used in order to get a sufficiently strong spark. We also are afraid that unless the magnets are very powerful little current will be realized. When it is considered that even a small spark coil takes as much as five or six amperes it will be realized that in order to get sufficient electro-magnetic flux the permanent magnet would have to be exceedingly powerful.





PROTECT GOOD TOOLS

Keep them safe from knocks, bangs, rust—yet handy and all together. The New Utility Chest illustrated is for garage and home use, for machinists, tool makers, masons, carpenters, repairmen, etc.

UNION TOOL CHESTS



19 Styles and Sizes

Write for Catalog. Prices and name of nearest dealer. Ask about "Satisfaction or Money-Back" Guarantee. If no dealer near you, write for special offer.

UNION TOOL CHEST CO., Inc.
36 Mill Street
Rochester, N. Y.

PATENTS

Inventors Invited to Write for Information and Particulars

Highest References. Best Results. Promptness Assured.

WATSON E. COLEMAN

Patent Lawyer

624 F Street N. W. Washington, D. C.

PATENTS

If you have an invention and desire to secure a patent, send for our Free Guide Book, HOW TO GET YOUR PATENT. Tells our Terms, Methods, etc. Send model or sketch and description for our opinion of its patentable nature.

RANDOLPH & CO.

Dept. 172 Washington, D. C.

Patents Promptly Procured

Send sketch or model for actual search of U. S. Patents. Highest references. Personal service. Moderate fees. Write for Free Patent Book.

GEORGE P. KIMMEL, Patent Lawyer
99-A Loan & Trust Bldg. Washington, D. C.

www.americanradiohistory.com

Submarines to Salvage Sunken Ships

(*Continued from page* 809)

means of a push button he gives the signal to the crew and comprest air is admitted to this chamber which forces or blows out all the water in it. Owing to the high air pressure, about 150 pounds to the square inch, a large opening can be used for blowing out the water, as with this heavy air pressure the water can be kept out of the chamber even with the valves left open to the sea. If this high air pressure was left passing into the chamber, once the water has been blown out of it, however, and then the inner compartment door opened, the diver would be quite likely forcibly ejected into the pontoon quarters. A better procedure is to close the sea-cocks as soon as all the water is blown out of the chamber. The comprest air would then be shut off, and allowed to lower itself to atmospheric pressure, or a pressure corresponding to that within the pontoon, if a higher one than normal happened to be in use at the time. The inner or right-hand door can then be opened, and the diver can pass into the regular quarters, remove his ponderous suit with its 100 pound, lead weighted shoes, undo his massive steel helmet, and sit down to a bowl of steaming clam chowder.

HOW SUNKEN SHIPS ARE RAISED.

Assuming that a large number of steel cables have been past around the wreck and that the time has come to attempt to raise it, the action is as follows:—When it is time to begin the raising operations, the pontoon sections are submerged to a reasonable depth and when everything is ready and the signal given by means of under-water sound telegraph or otherwise, the water is blown out of the submerged tanks of the pontoon and their buoyancy is re-established. Providing they have sufficient lifting power to raise the sunken ship, then they will slowly begin to rise, bringing up the wreck with them. In a great many locations advantage is taken of the rise and fall of the tide where such salvaging operations are undertaken and when the wreck has been raised a certain amount above the bed of the harbor or bay, the pontoons or vessels supporting the wreck by means of cables and so forth, steam toward the shore, so as to lodge the wreck on the sand in a more shallow location. The pontoons are submerged when they are favored by the low tide of the day, and they then draw up all cables tight. By submerging during this period for a certain depth they can then raise the wreck for another appreciable amount, and as the submarines can propel themselves along at a speed of several miles per hour, they can carry the wreck still further into more shallow water, etc., etc. Such a device as this would at least be a great help in salvaging operations, in conjunction with regular salvaging vessels and derricks, to say the least.

In some cases a sunken ship could be caused to almost (and in some cases) actually float itself by pumping comprèst air into the hull of the wreck. Naturally, it is necessary to effectually close up any holes in the particular sections of the hull which are to be blown out by air and this is the work of the expert divers.

A competent English authority says that English central station managers realize that lighting is fast becoming the small end of the electric central station's income, and power and appliances are to be the main sources of revenue in the future.

To cut down the cost per cut

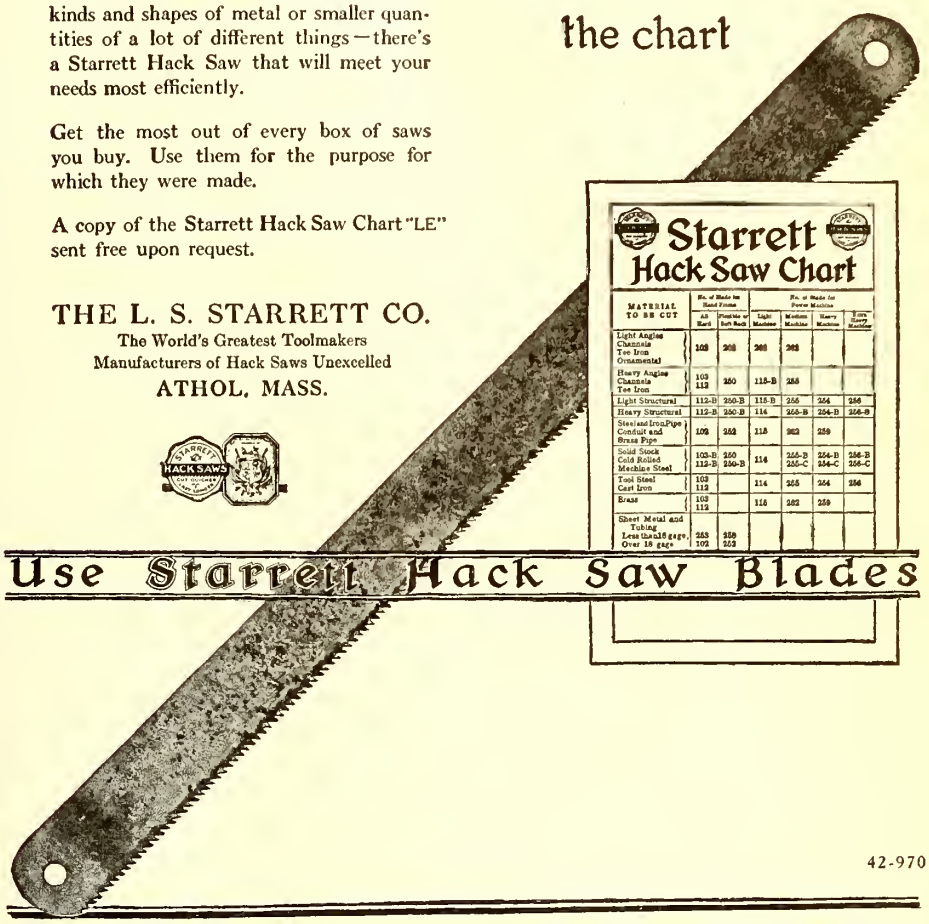
Follow the Chart

Make your hack sawing just as efficient as any other machine tool operation. Choose your blade according to your work. You can't cut cold-rolled and heavy angle iron with the same blade without a waste. Whether you are cutting by power or by hand, big quantities of a comparatively few kinds and shapes of metal or smaller quantities of a lot of different things—there's a Starrett Hack Saw that will meet your needs most efficiently.

Get the most out of every box of saws you buy. Use them for the purpose for which they were made.

A copy of the Starrett Hack Saw Chart "LE" sent free upon request.

THE L. S. STARRETT CO.
The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.



Use Starrett Hack Saw Blades

42-970



The Safest, Speediest Sled—
Flexible Flyer

Its patented, grooved steel, non-skid runners make steering easy and coasting safe, comfortable and fast. Has an all-steel shock absorber front.

Saves shoes, prevents wet feet. 7 sizes, 38 to 63 inches. Only the genuine bears the flying eagle trade mark.

FREE Cardboard Model shows how Flexible Flyer steers. Write for it.

S. L. ALLEN & Co., Inc. Box 906K Philadelphia

AMAZING OPPORTUNITIES in the Airplane Industry

Right now is your opportunity to get into the greatest industry the World has ever known. Thousands of new positions opening up everywhere in this attractive new field. Never before have ambitious men had such a glorious chance. Send Coupon at once—find out how our wonderful Course in Practical Aeronautics will give you the knowledge to enter this new field. Learn at home by mail during your spare time.

Prepare NOW for these positions
Aeronautical Engineer
Aeronautical Instructor
Aeronautical Contractor
Aeroplane Repairman
Aeroplane Mechanic
Aeroplane Inspector
Aeroplane Salesman
Aeroplane Assembler
Aeroplane Builder

Enormous Demand for Men—Big Pay
If you know Practical Aeronautics, some big Airplane Corporation will want you. Unheard of Salaries are being paid trained men. Act at once. The pioneers are going to reap the big rewards. Automobile history, railroad history, movie history will repeat itself in Aviation

Special Offer NOW—Send Coupon
Send the Coupon at once for full particulars of our remarkable offer open to you now. We will also send you our big new book "Opportunities in the Airplane Industry." No obligation. Be sure to tear off and mail coupon today.

AMERICAN SCHOOL OF AVIATION
431 S. Dearborn St. Dept. 7749 Chicago

FREE BOOK COUPON

American School of Aviation
431 S. Dearborn St., Chicago
Dept. 7749
Gentlemen: Please send me full particulars of your remarkable offer, also your new big book "Opportunities in the Airplane Industry." I assume no obligation.

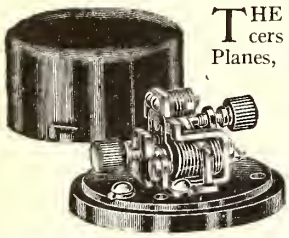
Name.....

Address.....

www.americanradiohistory.com

Mesco Radio Buzzer

With Shunt Resistance —
U. S. Navy and U. S. Army Standard



THE Radio Officers of the NC Planes, after testing all other buzzers, decided to use the "Mesco" on their radio equipment. The R-34 was equipped with two Mesco Radio Buzzers.

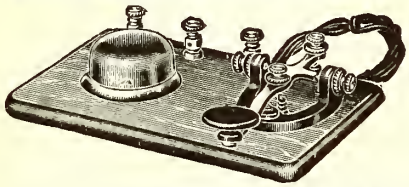
Why? Because of its reliability and constancy in operation; greater output efficiency; ease of adjustment; unaffected by extreme variations in weather conditions; exposed wires eliminated.

Sparking is almost entirely eliminated, so that the energy lost in light and heat in the operation of other buzzers is here conserved and radiated in the form of oscillating energy.

This buzzer maintains a constant note and is recommended as an exciter for checking wavemeters where pure note and ample energy are required.

List No. 55, Mesco Radio Buzzer
Price $2.05

MESCO WIRELESS PRACTICE SET



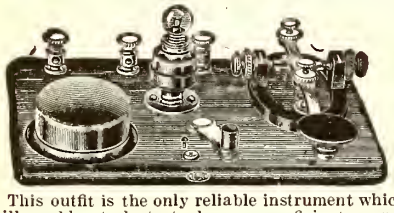
The Practice Set comprises a regular telegraph key without circuit breaker, a special high pitch buzzer, one cell Red Seal Dry Battery, and four feet of green silk covered flexible cord.

The key and buzzer are mounted on a highly finished wood base, and three nickel plated binding posts are so connected that the set may be used for five different purposes.

List No.		Price
342	Telegraph Practice Set, with Battery and cord	$3.24

Weighs 4 lbs. packed.
Price does not include postage.

MESCO Combination Practice Set for Learning the Mo. and Cont. Visual and Audible Codes



This outfit is the only reliable instrument which will enable students to become proficient operators in the U. S. Naval Service, because it is equipped with a buzzer and miniature lamp enabling the user to master both the visual and audible signals quickly.

List No. 52—Practice Set with Red Seal Battery and Cord.....$4.05
Weighs 4 lbs. packed. Price does not include postage.

We carry a Large and Complete Line of Standard Wireless Material Recognized by Experts as such with Competent Experienced Wireless Attendants in Charge.

Send for the New Edition of Our Catalog W28

It is pocket size, contains 264 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Wireless Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

Manhattan Electrical Suppy Co., Inc.
17 Park Place, New York, N. Y.
CHICAGO 114 S. Wells St. ST. LOUIS 1106 Pine St.
SAN FRANCISCO OFFICE: 604 Mission St.

Airplane Super-Charger for High Flying

By Charles M. Ripley

(*Continued from page 757*)

curiosity on land—how much more of a wonder it becomes four miles up in the sky!

It was confidently predicted by Major Schroeder in an interview, that the *airplane supercharger* will effect wonderful commercial development in aerial transportation, and for two reasons:

Due to the higher speeds possible at the upper levels, one can make the New York-Chicago trip without a stop; and owing to the fact that flights can now be made with full power above the storm zone—seldom over 4 or 5 miles high at most—schedules can be maintained regularly, regardless of weather conditions.

Special propellers are being developed to greatly exceed all previous altitude performances.

In making his flight, Major Schroeder had his plane equipt with an extra long propeller designed to obtain better efficiency with the rarefied air encountered at 18,000 ft. altitude. The speed of the plane at this altitude without the supercharger was 92 to 96 miles per hour, tried on separate flights using several different types of propellers.

Popular Astronomy

By Isabel M. Lewis, M.A.

Is the Moon Dead?

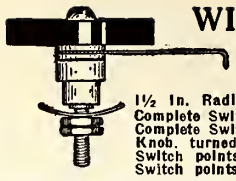
(*Continued from page 768*)

delicate clefts or rills, also in the appearance of dark spots from time to time and the darkening of the floor of craters as the altitude of the sun increases which cannot be shadow effects since at lunar mid-day when the darkening is most pronounced there are no lunar shadows.

The only plausible explanation of this periodic darkening during the lunar day is that it is due to the growth of some form of vegetation.

One of the most interesting and most convincing evidences of change in lunar markings is associated with the noted Ariadaeus and Hyginus cleft system which we note particularly since it is so well shown in the accompanying photograph taken at the Mt. Wilson Observatory. These two clefts in the lunar surface can be seen just above the northern edge of the photograph. The Ariadaeus cleft or rill originates well over to the west at the small crater Ariadaeus faintly visible in the lunar shadows and runs first north east then north to the edge of the photo. It will be observed that it cuts directly thru all craters and ridges in its path, a peculiar characteristic of all clefts. A careful examination of the photo will show that it is connected with the coarse Hyginus cleft to the south east (so named because it passes in its course directly thru the depression known as Hyginus, four miles in diameter) by a much fainter canal-like cleft. It is this connecting cleft that has shown evidence of change. Gruithuisen, a diligent lunar observer, detected this connecting cleft in the early part of the nineteenth century and noted that at times it appeared perfectly straight and at other times very irregular altho observed under the same conditions of phase and definition. Lohrmann and Mädler who later observed this region frequently never saw a trace of it. It was rediscov-

(*Continued on page 822*)



WILCOX PANEL SWITCH
"The Best"

1½ In. Radius — Postpaid Price
Complete Switch, polished brass finish.50c
Complete Switch, nickel plated finish..60c
Knob, turned and polished.....25c
Switch points, brass finish..... 2c
Switch points, nickel plated finish ... 4c

THE WILCOX LABORATORIES, Lansing, Mich.

SUPERLATIVE RADIO EQUIPMENT
THE BEST KEY IN THE COUNTRY
10 Amp. $7.75—20 Amp. $8.25
A three cent stamp will bring bulletins of this and other higher grade apparatus.
THE RADIO ENGINEERING COMPANY,
22 St. Paul St., Baltimore, Md.

SPECIAL OFFER

Until further notice we will furnish our switch points complete with brass screw or nut at catalog prices. Agents for Brandes, Clapp-Eastham, Murdock, DeForest, Grebe, Thordarson and others. Send us your inquiries and orders. Prompt shipment and attention guaranteed.
Send 5 cents today for new catalog H.
SHOTTON RADIO MFG. CO., Box 3, Scranton, Pa.
Branch—8 Kingsbury St., Jamestown, N. Y.

Universal Radio System

Up to the minute radio apparatus for progressive users who can recognize quality.
Send stamp for catalogue.
Universal Radio Mfg. Corp.
Dept. W Elmira, N. Y.

SELENIUM CELLS

Made by entirely new process. Highly sensitive and quick-acting. Suitable for all experiments. From $5 up.
Write for Catalog
Selenium Laboratories
Good Ground, Long Island, N. Y.

WIRELESS

On account of increased demand for Radio Operators, we have concluded to give a correspondence course aside from our regular day and night classes. Write for rates. FREE learning instruments.
Write for Literature, SOUTHERN WIRELESS INSTITUTE, 22 St. Paul St., Baltimore, Maryland.

WIRELESS Apparatus, Raw Materials, Magnet wires, motors, experimenters' needs, novelties listed in our Catalogue C-3. Assure yourself of prompt service and right prices by buying from this world famed, reliable, Experimenters' Supply House. *99 of every hundred orders received shipped within 24 hours. Catalogue C-3 FREE on request.*
THE NEWMAN-STERN CO., Cleveland, O.

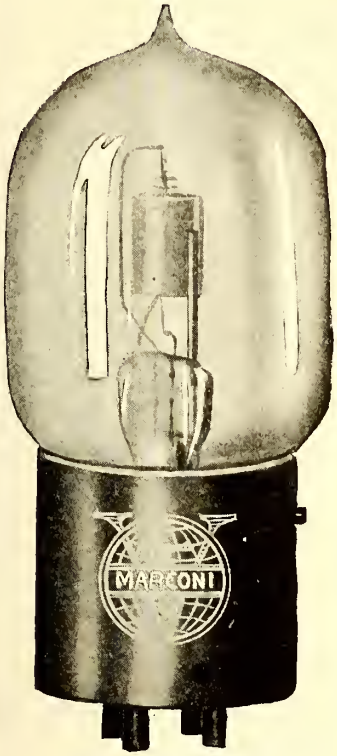
SEND TO-DAY
For Catalog for Complete Line of
Receiving Apparatus
REMLER RADIO MFG. CO.
163 Sutter St. San Francisco, Calif.

Arnold
Loose Couplers
Combination Loose Coupler Parts and accessories.
Send 3c stamp for literature which is sure to interest you.
J. F. ARNOLD **2082 Lexington Av. N.Y. Established 1910**

MARKO
STORAGE BATTERIES
ARE GOOD—TRY ONE
Paul M. Marko & Co., Inc.
1402-1412 Atlantic Ave.
Brooklyn, N. Y.

www.americanradiohistory.com

THE HEART OF THE WIRELESS



Fleming Pat. No. 803684
De Forest Pat. Nos. 841387-879532

An Amateur Station Without a Vacuum Tube is Years Behind the Times

MARCONI V.T.

$7.00 each

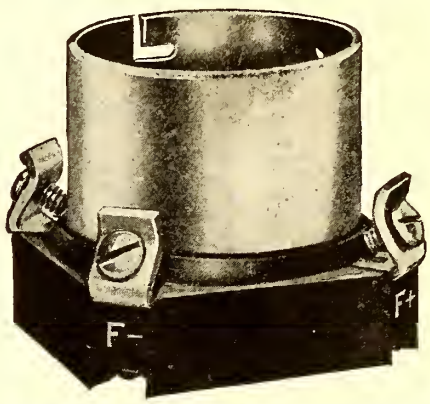
Under agreements recently effected the Marconi V. T. is the only vacuum tube, or audion, which may be sold to amateurs, laboratories, schools of instruction and experimenters.

The approximate operating life of the MARCONI V. T. is 1,500 hours.

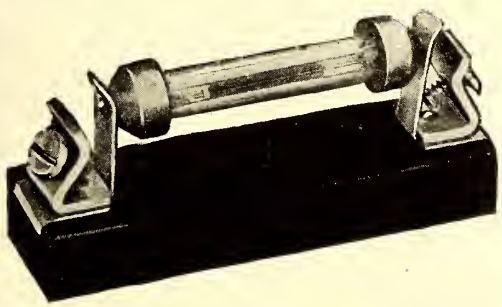
FEDERAL-AUDIO FREQUENCY TRANSFORMER

Designed for use with the Marconi V. T.

$7.10



Standardized Socket $1.50 additional



Standard Resistance, Complete $1.00

The Marconi Resistance, connected in the circuit between the grid and the filament of the Marconi V. T., is made in the following standard sizes:

½ megohm, 1 megohm, 2 megohms, 4 megohms, 6 megohms.

Resistances of any special fractional values up to 6 megohms can be supplied.

Send all remittances with order to COMMERCIAL DEPARTMENT

MARCONI WIRELESS TELEGRAPH CO. OF AMERICA 225 BROADWAY, NEW YORK

Retail Office and Exhibition Rooms—25 Elm St., New York

Sole Distributors for De Forest Radio Telephone & Telegraph Co.

BRANCH OFFICES:

Schofield Bldg., Cleveland, Ohio
American Bldg., Baltimore, Md.
Insurance Exch. Bldg., San Francisco, Cal.
136 Federal St., Boston, Mass.
301 Commercial Bank Annex, New Orleans, La.
109 South 2nd St., Philadelphia, Pa.

www.americanradiohistory.com

THE BEST

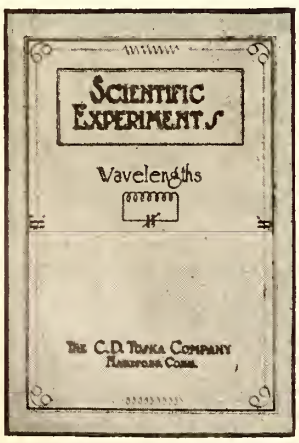
Yes, the best and only the best is cheapest in the end. Then why not apply this rule when taking a course in wireless? Our correspondence course is simple, easy to master, up to date and consists of 15 lesson books prepared by our expert theory instructors. All practice and transmitting apparatus for mastering the code is furnished free.

We Operate the One Big

radio school of the world, and this correspondence course is an extension of our activities, a Post Graduate Course in our Washington School being given you free, if you desire. You see we are not *A RADIO SCHOOL,* but actually and absolutely *THE RADIO SCHOOL*—the top one, the biggest one—the one that *HAS BEEN* and *IS* turning out the *WINNERS* every week. You can't compare us with any other school, because we are head and shoulders above all—the very top. You get the idea? You can't get a better or higher course, we are the final—the finish. Act now. Get a grip on yourself—take the big important step. Settle your career today. Our new catalogue, just out of press, will tell you how. Send for it.

SERVICE RADIO SCHOOL

Dept. E, 900-2 Pa. Ave. Washington, D. C.



TUSKA'S SCIENTIFIC EXPERIMENTS

Special Offer

Five Scientific Experiments on Resistance, Inductance, Capacity, Detectors and Wavelength. Each book contains explanation of theory, description of measurements, data sheets, blank forms, notes, and laboratory instructions. Price, $0.25 each. Special offer 5 for $1.00 postpaid. Order today.

Send 6 cents for our catalogue E of experimental apparatus.

THE C. D. TUSKA COMPANY

Hartford, Connecticut

Popular Astronomy

By Isabel M. Lewis, M. A.

IS THE MOON A DEAD WORLD?

(*Continued from page* 820)

ered by Schmidt in 1862. Klein, later, saw this cleft very clearly at times and again looked for it in vain under similar observing conditions. Elger found it an easy object with a 4-inch telescope. The latter observer, a noted selenographer who has also observed changes in the appearance of other clefts queries whether these are not instances of recent change difficult to "explain away." He says in part—"The more the study of minute detail is extended the stronger becomes the evidence that in spite of the absence of an appreciable atmosphere there may be something resembling low-lying exhalations from some parts of the surface which from time to time are sufficiently dense to obscure or even obliterate the region beneath them." Of the nature of the lunar clefts or rills he feels we are "supremely ignorant." They are generally regarded as huge cracks in the surface due to shrinking and contraction of the moon.

A most interesting rill system, partly traceable in this same photograph, is known as the Triesnecker system. It can be found to the southeast of the Hyginus cleft and west and north of the conspicuous ring-plain Triesnecker which can be seen about an inch above and a little east of the northern rim of the photograph.

Photographs fail to show the great complexity of this remarkable system. In studying all the intricate detail of the lunar markings the human eye is vastly superior to the photographic plate. Moreover, all these minute details are only revealed piece-meal, as it were. A cleft or rill that is very distinct under a low sun will usually disappear entirely under high illuminators.

The best time to study the details of the lunar surface is therefore *not* at or near the time of full moon, but when the object in question is illuminated by a low sun.

Changes of tint in the interior of the Hyginus cleft were noticed by Klein. At some points the reflected sunlight was decidedly yellowish, at others white as if the cliffs were snow covered.

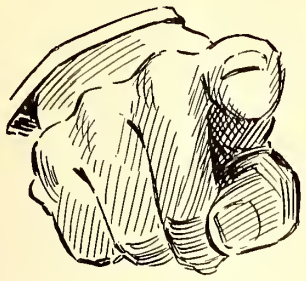
Tho on the whole the lunar atmosphere is comparatively rare it is by no means impossible that certain dense and heavy gases may exist locally in considerable quantities, in fact that carbon dioxide and water vapor so essential to the growth of organisms may occur within the lunar cracks, crevices and numberless pits and depressions in even greater quantities than they are found in the earth's atmosphere of which they form a relatively small proportion, the amount of carbon dioxide in the earth's atmosphere at sea level being only three hundredths of one per cent.

If certain forms of life do exist on the moon it is certain they would be found on the low-lying maria and within the gigantic cracks of the lunar surface and all of its pits and depressions rather than upon the high snow-covered plains and ramparts of the southwest quadrant.

That a sort of vegetation may exist in the deeper seas is not so improbable. Elger noted a decided sepia color in the Mare Foecunditatis and within certain ring-plains and craters and many observers have recorded that some of the seas are darker than others and that all show local changes of tone. Networks of streaks intermingled with dark spots and minute brilliant points of light have been observed on the maria under good atmospheric conditions and many have noted in addition that certain of the "seas" appear yellowish or green.

(*Continued on page* 824)

www.americanradiohistory.com



Do You Want A Complete, Compact Receiver at a Reasonably Low Price?

Here is an Outfit with Eight Distinct Features You Will Appreciate.



DE FOREST TUNER
Type T-200—$77.50
Wave Length
150 to 25,000 Meters



DE FOREST
Combination Audion-Ultra Audion and One-Step Amplifier, $73.50
(Type P-300)

1—That will respond to any and all wave lengths.
2—That is more flexible in coupling than any other system.
3—That has a lower distributed capacity, far less high frequency resistance and decrement values than any other type.
4—That eliminates cumbersome switches, inefficient taps and losses from dead ends.
5—That employs Vernier variable air condensers of unusual design, eliminating capacity effects due to operator's body.
6—That makes signals come in always louder and clearer than other types.
7—That cannot be surpassed in general efficiency, workmanship and beauty at any price.
8—That possesses the decided advantage of minimum table space. The Tuner measures 13⅜" x 12½" x 8". The P-300 measures 12½" x 9⅜" x 7¾".

DE FOREST Agencies are located in all Principal Cities. Ask your regular Electrical Dealer to get you DE FOREST Apparatus.

A 64-page Radio Manual containing circuits and many useful facts about Radio work and the best Apparatus will be mailed to you for 10 cents in stamps.

No longer is it necessary for you to have two or three expensive, cumbersome tuners cluttering up your operating table, when working all wave lengths.

Ask yourself when you buy your receiver, does it cover any and all wave lengths? Does it possess the other advantages of minimum table space and convenience in coupling embodied in ours? Do the electrical principles employed equal the Genuine DE FOREST "Honey Comb" Coil System of tuning? Then, compare prices!

The DE FOREST Company enjoys the distinction of being the first to inaugurate this unique tuning system which has met with such rapid favor, and you, the progressive Radio Experimenter, should take this opportunity to be among the first to install it in your laboratory. Find out more about it now. Write to

DE FOREST RADIO TELEPHONE & TELEGRAPH CO.
Inventors and Manufacturers of High Grade Radio Apparatus
1415 Sedgwick Avenue **New York City**

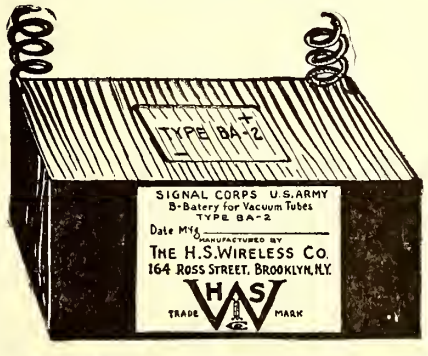
B-BATTERIES
"Better Quality"

AMATEURS

Write for descriptive literature and prices that cannot be duplicated on our B-Batteries.

THREE SIZES
Small size, 22½-Volt, 15-Cell
Large size, 22½-Volt, 15-Cell
Large size, 45 -Volt, 30-Cell

Or enclose a dollar bill with your name and address and we will send you one 22½-Volt, 15-Cell B-Battery same as illustration.



DEALERS

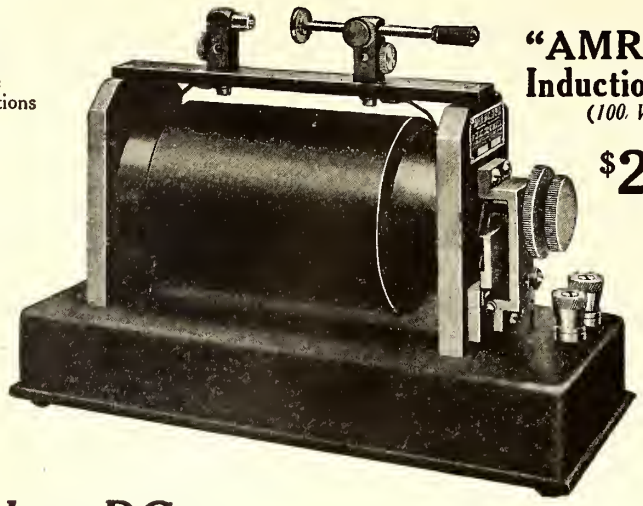
Write for Proposition

Territories
Now Being Allotted

THE H. S. WIRELESS CO. 164 Ross St., Brooklyn, N. Y.

www.americanradiohistory.com

Folder giving complete specifications sent at your request



"AMRAD" Induction Coil
(100 Watt)
$28.50

Makes DC as good as AC

For radio stations depending upon farm lighting current, storage battery or dry cells for power, the

"AMRAD" Induction Coil

works as consistently as a transformer

Essentially the same as the coil used overseas during the great war, the AMRAD Induction Coil—as designed for amateur use — overcomes successfully all the difficulties experienced with other induction coils.

Built throughout on a high standard of workmanship, the AMRAD Induction Coil is guaranteed to give entire satisfaction.

Ask your dealer today to show you the AMRAD Induction Coil. If he does not have it, order from us direct, but send us his name and address.

Other AMRAD high grade radio specialties are:

AMRAD QUENCHED GAP
a commercial gap that lowers decrement and gives three to four times your present antenna energy. Strongly approved by your government inspector. Does not require a 500-cycle generator $17.50

AMRAD DETECTOR STAND
a rugged, accurate and reliable standby, invaluable for use alone or as an auxiliary to vacuum tubes. Duplex stand with selecting switch $4.50
Single stand, $2.50

For laboratory use these AMRAD products are standard:

MICA DECADE CONDENSER
Capacity .0999 mfds., thoroughly tested and accurate.

VARIABLE AIR CONDENSER
An exceptionally high type of air condenser with Vernier scale and automatic looking device.

VARIOMETER
An instrument of extremely fine workmanship and unusually wide range.

"TRANSMIT" "RECEIVE" SWITCH
A new type switch of extreme utility for radio work.

Folders describing any and all of the AMRAD products will be sent on request. If your dealer does not carry AMRAD goods, order direct from us, but send us his name and address.

AMERICAN RADIO AND RESEARCH CORPORATION

21 Park Row (*Factory at Medford Hillside, Mass.*) New York, N. Y.

Popular Astronomy

By Isabel M. Lewis, M. A.

IS THE MOON A DEAD WORLD?

(*Continued from page 822*)

The Mare Crisium containing about 70,000 square miles and considered to be the deepest of all the seas appears a light green under certain conditions. The central part of the Mare Humorum which is well shown in the accompanying photo taken by Ritchey with the 40-inch Yerkes refractor (see just south of the center of the eastern edge of the photo with the conspicuous ring-plain Gassendi on its border) has been described as a dusky green under good seeing conditions. This "sea" contains 50,000 square miles and is therefore about equal in area to New York State.

A class of lunar objects apparently very subject to change are the crater-cones that appear so frequently on the floors and walls of ring-plains and craters. Under high illumination they usually appear as white spots and the fact that they are associated with light streaks on the floors of craters seems to imply that they are volcanic vents. The lunar observer Klein firmly believed them to be volcanic and more recent observations substantiate this belief.

In October, 1916, Maggini observed reddish shadows spreading over part of the floors and walls of the crater Plato hiding temporarily one of the minute craters that dot the floor of this crater.

If active volcanic vents do exist on the moon we have here a source of supply of carbon dioxide and water vapor for the growth of lunar organisms in low-lying regions.

The blanketing effect of the carbon dioxide and water-vapor in our own atmosphere is well known and would tend there as well as here to mitigate the extremes of heat and cold at low levels.

A most interesting region of the lunar surface is to be found just north of the Hyginus cleft (see Mt. Wilson photo near center of the north edge). Here a mysterious black spot was discovered in 1877 by Klein which he described as a dark depression without a rim and one which he was sure he had never seen before tho he had scanned this region frequently during his twelve years of lunar observations. This spot was later observed by others under various solar altitudes appearing to many as "an ill-defined object with a somewhat nebulous border." In its vicinity lie two small craters and several low ridges. Whether this is really a new lunar marking is uncertain tho the evidence of change seems very strong.

Prof. W. H. Pickering, one of the chief selenographers of the present day, has recorded frequently many observations of lunar changes and his photographic atlas of the moon is well known. His observations are in accord with those of a number of other selenographers in indicating that activity upon the surface of the moon has not entirely ceased and that in fact our satellite may support certain forms of vegetation and even presumably of animal life in low lying regions where a comparatively dense gaseous medium whose chief components are carbonic acid gas and water vapor may well be found.

The high plateaus in the south west quadrant of the moon and the walls and peaks of the walled plains, ring-plains and craters that are massed there in the greatest profusion, most all observers are agreed, owe their dazzling brilliancy to a perpetual mantle of snow. The same dazzling whiteness also exists in the north and south polar regions of the moon.

On the whole, we may say that evidence that the moon is not an absolutely cold

www.americanradiohistory.com

and lifeless world is accumulating from many sources.

The most powerful telescope and the best seeing conditions are necessary to settle many of the questions of suspected changes as they are associated largely with the more minute markings.

Yet there are markings wherein changes are suspected that lie well within reach of very moderate instruments.

A four inch refractor or a six or eight inch reflector will show a number of lunar features not yet recorded on lunar maps.

There are many excellent and valuable lunar maps, in fact, the surface of the moon has been more carefully and accurately mapped than certain terrestrial regions, and there are in addition excellent photographic atlases obtainable so that the amateur who wishes to become acquainted with our nearest neighbor in space will find much helpful and valuable material at his disposal and if he pursues this line of study systematically and carefully he may find that his observations are of real scientific value.

The unsolved problems of the moon are many and perplexing and the true nature of its rays and rills, its craters and its maria still remains very uncertain in spite of many conflicting theories and so a wide field of investigation lies open to all.

QUESTIONS AND ANSWERS.

Question 1. Are the Pleiades the center of our stellar galaxy?

Answer 1. There is absolutely no foundation for this belief.

The Pleiades form what is known as a "loose moving star cluster" that cannot be, at the most, more than a few hundred light years from the solar system.

According to the recent investigations of Shapley the center of our galaxy lies, most likely, among the star clouds of Sagittarius at a distance of more than sixty thousand light years from the earth.

Question 2. Is the sidereal universe fathomless?

Answer 2. So far nothing is known to the contrary. We have as yet no reason to believe that the most powerful telescopes have penetrated to the limits of the universe and even if we were able to say definitely that we had reached the limit of our own particular sidereal system and that all the stars, star clusters and nebulae visible in our telescopes were units in one vast organization we would still be in doubt whether other systems might not lie beyond the confines of our own hidden from our view by some absorbing medium.

Question 3. What are "irresolvable" nebulae?

Answer 3. In small telescopes nebulae and star clusters cannot be distinguished from each other. As the magnifying power of telescopes increased it was found that many formations that had been formerly believed to be nebulae could be "resolved" by powerful telescopes into star clusters. Some astronomers then jumped to the conclusion that all nebulae could be resolved into star clusters in sufficiently powerful telescopes.

When spectroscopy was applied to astronomical research and the light of the irresolvable nebulae was analyzed, it was evident that some of these formations were truly gaseous and so never could be resolved into star clusters. The term irresolvable nebulae therefore has no special meaning at the present time when nebulae are classified as gaseous or continuous according to the type of spectrum they show. The continuous type to which the spiral nebulae belong might still be considered irresolvable to a certain extent since they have never been resolved into the stellar components of which they doubtless largely consist. Their true nature and relation to the stellar system is not yet definitely known.

"ASK ANYONE WHO HAS USED IT"

"THE BEST I EVER WORKED"

"The Brandes Headset Is The Best I ever Worked. Others Look Like a Plaything Beside It." (Testimonial from an expert. Name on Request.) Professionals as well as amateurs, the world over, are enthusiastic about the range and absence of blurring in the

BRANDES WIRELESS HEADSET

CLEAR TONE
LIGHT WEIGHT
DEPENDABLE SERVICE

Score 100% efficiency in actual use. Sharp, Unblurred, Readable Signals assured by



"Superior" Set, 2000 ohms, $7

"BRANDES MATCHED TONE"—

Exactly matching the tone of both receivers in each set and thus eliminating all confusion due to unmatched harmonics.

TRIAL OFFER

Buy a Brandes Superior Headset and use it critically for ten days. Then, if it doesn't come up to our claims or your expectations, return it and your money will be cheerfully refunded. Test it—compare with others—for sensitiveness, clearness, distance. Prove for yourself the fine quality, the "matched tone." The two diaphrams, toned exactly alike, strengthen the signals and prevent blurring. Used by many U. S. Government experts, and experts abroad; by colleges and technical schools; and by professional and amateurs everywhere.

SEND 4c FOR CATALOGUE E.

C. BRANDES, Inc.
Room 814
32 Union Square
New York City, U. S. A.
WIRELESS RECEIVER SPECIALISTS

Complete Line of Brandes Receivers for those in Canada. Send stamp for Pamphlet "E"
Radio Electrical Supply Co., 43 McGill College Avenue, Montreal, P. Q., Can.

POSITIONS GUARANTEED

TO EVERY GRADUATE OF OUR SCHOOL
By FOUR LARGEST RADIO CONCERNS

$125 per MONTH PLUS ALL EXPENSES

MODERN EQUIPMENT—SPECIAL SHORT COURSE
INDIVIDUAL INSTRUCTION
FINEST STAFF OF TEACHERS AVAILABLE
DORMITORY — SWIMMING POOL
CALL OR WRITE FOR ILLUSTRATED BOOKLET

Y.M.C.A. RADIO SCHOOL

Department R
152 East 86th St. New York, N. Y.
"BEST RADIO SCHOOL IN THE EAST"

MATHEMATICS MADE EASY

The Arcascope—the Combination Triangle with a Brain—will multiply, divide, figure percentage and proportion, solve all problems in trigonometry and geometry, draw symmetrical figures, plot arcs, etc. Superior to any slide rule. Simple to operate. Also includes a TRANSPARENT TRIANGLE, PROTRACTOR and THREE RULES. Used at Columbia University, West Point, U. S. Aeronautic Schools, etc. Only 85 cents Postpaid. Order today before you forget.
Dept. J, L. J. LEISHMAN CO., Ogden, Utah

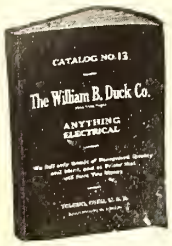


Hang Your Own Lighting Fixtures

Semi-Bowl $5.85. Plate & Ball 85c. 4 light shower $5.35. Completely wired including glassware. Send for new catalogue, complete line.

ERIE FIXTURE SUPPLY CO.
Sta. C Erie, Pa.

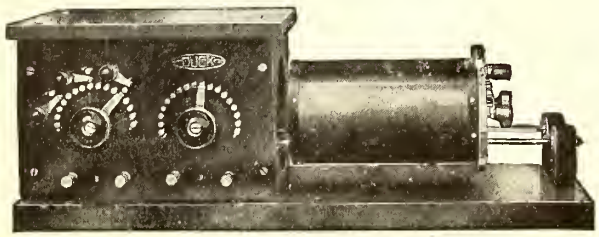
www.americanradiohistory.com



DUCK'S New Big 264-Page Wireless and Electrical Catalog Just Out—Now Ready

It is mailed for 12c in stamps or coin which may be deducted on first order of $1.00. Catalog not sent otherwise.

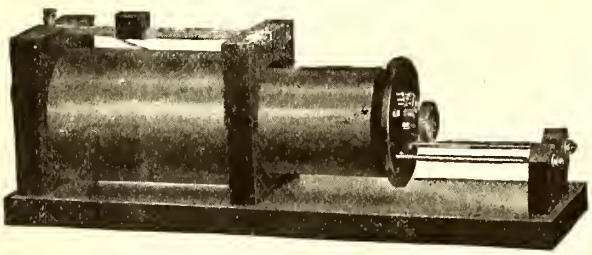
We regard this catalog as our greatest effort. It embraces everything in wireless worth while. 172 pages with no waste space devoted exclusively to wireless instruments. Your amateur friend will tell you that there never has been any wireless catalog to take the place of catalog of this company and above all that you can absolutely depend on our goods. There is no need for any other catalog when you have this big catalog.



A big improvement over our former model. Primary divided into four sections, with three dead end switches, greatly improving selectivity.

Secondary divided into three sections, with two dead end switches, eliminating harmonics. The change in the construction of the guide rod support makes it possible to obtain a looser coupling. It is a wonderful improvement over our old model both in performance and appearance. Only $23.50.

NEW MODEL 5BB. NAVY TYPE RECEIVING TRANSFORMER



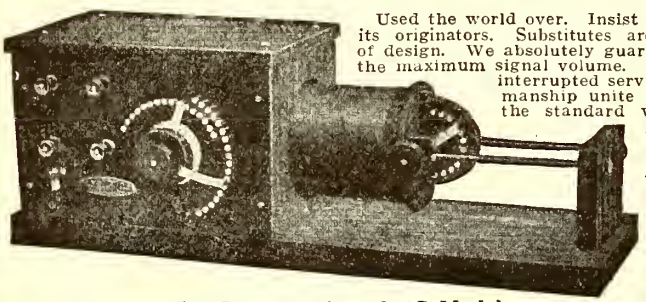
The secondary on our new type Arlington is divided into two sections with one dead end switch eliminating dead end effect and harmonic and giving greater selectivity. The end support similar to that on our Navy type permitting a looser coupling. It is a beautifully finished instrument and will be sold by us at the same price as the old model. $9.00.

OUR IMPROVED ARLINGTON RECEIVING TRANSFORMER

THE WILLIAM B. DUCK CO., 230-232 Superior St., Toledo, Ohio

TRACO QUALITY

RECEIVING TRANSFORMERS

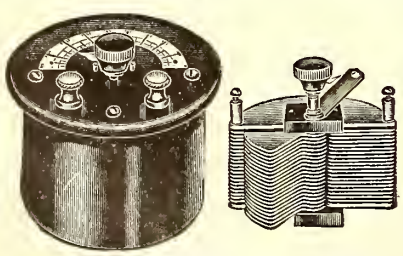


Used the world over. Insist on the genuine, built by its originators. Substitutes are expensive, irrespective of design. We absolutely guarantee our tuners to give the maximum signal volume. Delicate refinement, uninterrupted service and high class workmanship unite to make TRACO tuners the standard whereby all others are judged. If you Dealer does not handle them, order direct from us.

LIBERTY DETECTOR VALVES. RADIO AMPLIFYING PHONES, type used by the **UNITED STATES, BRITISH** and **FRENCH GOVERNMENTS,** now in stock, for sale. Send stamps for bulletins.

The Famous 5A and 5C Models

THE RADIO APPARATUS CO., Pottstown, Penna., U. S. A.



BEEKO VARIABLE CONDENSER
Size, 3¼x4¼ inches.
Price each
Mounted (postage weight 2 lbs.).....$5.40
Unmounted (postage weight, 1 lb.)..$4.60

Manufacturers and Distributors of
HIGH GRADE
Amateur Wireless Apparatus
Send Stamp for Catalog 40E
J. H. Bunnell & Company
32 Park Place
New York City, New York

Rohlfs Flies 34,610 ft.—New World's Record

(*Continued from page 760*)

never perfected until recently, and which practically *doubles the efficiency of an airplane engine at high altitudes.*

"In the future," said Chance M. Vought, Chairman of the American Flying Club Contest Committee, "airplanes equipt with these super-compressors will be able to attain heights hitherto regarded as impracticable; levels at which are found constant trade winds. These winds at various high levels can be found following courses suitable to almost any international trade route and can thus be utilized to tremendous advantage in aerial commerce. The airplanes equipt with this super-charger device will fly at greater speed at high altitudes than is now possible, and will have almost the same performance of speed and climbing power as at around sea level. Among the technical experts this invention is called 'a constant power device.'

"The Lepere biplane, equipt with a Liberty motor, which Major Schroeder used in the altitude flight, has a horizontal speed at sea level of 136 miles an hour. At an altitude of more than 20,000 feet this speed, owing to the rarity of the atmosphere and the decreased engine power, falls to 105 miles an hour. Equipt with the supercharger device, the horizontal speed at 28,250 feet was maintained at more than 130 miles, or almost equal to the best possible at sea level. Major Schroeder found the compressor consumed only 5 or 10 per cent of the engine's horse power, while at 15,000 feet altitude it added 40 per cent to the power-plant's effectiveness. At 20,000 feet, 48 per cent was added and at 28,000 feet, 60 per cent was gained.

"The super-compressor is a device to utilize the waste exhaust gases of the engine itself to operate a small centrifugal air-blower which forces an air stream into the engine at a constant pressure about equal to the normal suction of the motor at sea-level pressure and thus maintains engine functioning approximately the same as under the best conditions at sea level.

"Major Schroeder and his passenger wore electrically-heated clothing and oxygen helmets. The record shows that the temperature at 28,250 feet was minus 29 degrees centigrade.

Carnarvon Radio Station

(*Continued from page 778*)

transformers connected to each power line transform the current down from 10,000 volts to 440 volts at which power it appears on the main switchboard.

The main switchboard is of the Ferranti type and consists of 12 panels. From the feeder panel cables are taken to the main switch panel on which is mounted a hand-operated oil switch provided with *no volt* and *overload time limit* releases, a voltmeter, ammeter, kilowatt meter, power factor meter and frequency meter. The remaining panels on the board are equipt with switches and gear for the control of the motors driving the high tension direct current generators, the motors driving the alternator sets, the motors driving the low tension D.C. auxiliary machines, the high tension alternators, direct current motors, and of all the lighting, heating and various other circuits.

There are three distinct types of transmitters installed (1) the synchronous alternating current sets; (2) Marconi

www.americanradiohistory.com

"timed-spark" continuous wave machinc; (3) the arcs.

The synchronous A.C. sets are in duplicate and are of 300 k.w. capacity, each consisting of a 450 B.H.P. 440 volt 3-phase asynchronous motor driving a 300-k.w. single phase alternator, the working voltage of which is 1,750 volts. An extension of the alternator shaft drives the disc discharger thru an insulating coupling. The primary condenser bank has a capacity of 2.5 mfds and is charged by step-up transformers, the field of which can be adjusted so that the studs on the disc discharge the condenser at each peak of the alternation.

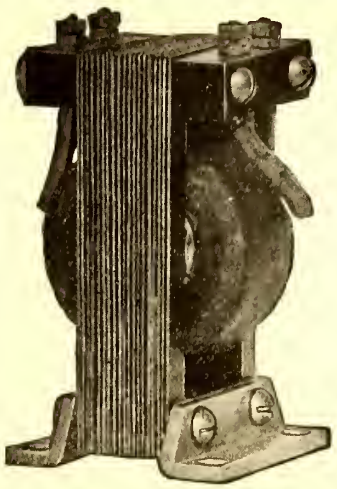
The timed spark continuous wave transmitter has two distinct primary circuits tuned to the same frequency and coupled to the aerial circuit. The condensers of these primary circuits are charged by 5,000 volt D.C. dynamos and discharged alternately by means of a special form of disc discharger so arranged that the trains of oscillations produced in the acrial by the successive discharges of the two condenser banks take place in phase with one another. This timing of the discharges is controlled by a trigger circuit which at a given instant ionises the gap between the studs and electrodes of the main circuits and enables them to discharge, special adjustments being provided for determining the moment of discharge. Signaling is effected by making and breaking the charging current of the trigger circuit, and as this current is only .5 amp. a very high rate of working is possible.

One of these transmitters of 300 k.w. capacity, capable of working at 200 words per minute, is already installed at the station and a duplicate set is in course of erection.

The 200 k.w. arcs are of the horizontal type and are fed thru choking coils and starting resistance from an 800 volt D.C. dynamo. The field of the arcs is separately excited from an auxiliary 110 volt D.C. dynamo which also supplies current for the pump motors, cathode motors, and spirit relays. Methylated spirit is automatically fed into the arc chamber which, with its lid, anode and cathode, is water cooled, a relay being provided in the water circuit to cut off the current to the arc should the water supply fail.

A special receiving station at Towyn is intended for all the receiving and operating work, and is provided with apparatus for duplexing the service. At Carnarvon, however, for special war purposes, recciving apparatus has been installed with a range of from 3,000 meters to 16,000 meters. The aerial is inductively coupled to an intermediate circuit which in its turn is coupled to an amplifying and self-heterodyning valve circuit. By means of magnifiers in the telephone circuit arrangements are made for either automatic reception at high speed, or to enable the operator to receive without wearing telephones. The signaling key for operating by hand is placed in the receiving room, where there is also a Wheatstone automatic transmitter capable of working at a speed of 200 words per minute. For this high speed working high tension signaling switches worked by a Creed comprest air engine is used for slow transmission. Galvanometer type signaling switches are provided, but both types can be operated from relays, either by the hand key or by the Wheatstone transmitter.

Altho the Carnarvon station is primarily intended to work to America it has successfully communicated with Sydney, Australia, thus proving that it is powerful enough to cope with any distance up to the limit of possible long-distance transmission on the earth, it being understood that modern receiving apparatus is employed at the Antipodes.—*Photos courtesy Marconi's Wireless Telegraph Company, Ltd.*



Vacuum Tube Socket
(Type Triode F)

The base of this socket is bakelite dilecto and will not crack and break like the moulded material of the usual socket.

Contact springs are stamped with identifying letters. Base is provided with three rubber feet and four countersunk holes for panel mounting.

Price $1.25 postpaid

AUDIO FREQUENCY TRANSFORMER

Type P

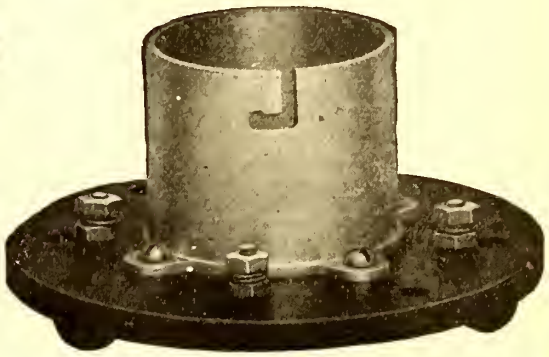
This transformer provides a maximum of low frequency amplification and is superior to all others. It may be used with the Marconi and all standard vacuum tubes.

Permits reliable daylight reception from European stations.

Establishes new amateur long distance records.

Renders remarkable amplification of all signals.

Price $7.00 postpaid



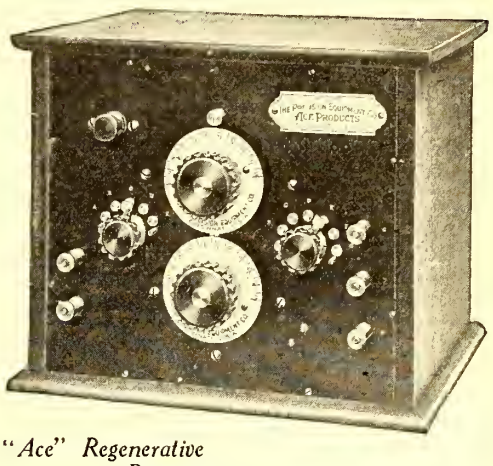
EATON OSCILLATORS TWO STEP AMPLIFIERS
DAMPED AND UNDAMPED RECEIVERS
FARADON MICA TRANSMITTING CONDENSERS

WIRELESS SPECIALTY APPARATUS CO.
ENGINEERS, DESIGNERS, MANUFACTURERS
Boston, Mass., U. S. A.

AMATEURS!

"ACE" Radio Equipment is a line of professional quality. Comprises complete radio telegraphic and telephonic transmitting and receiving apparatus for any power or wave range. Also all accessories and parts. **"ACE" Regenerative Receivers.** "ACE" Audion Control Cabinets. Undamped Wave telegraphic and telephonic equipment for use with standard V.T. tubes. Audion Amplifyers using standard V.T. tubes.

We supply anything and everything the radio experimenter requires in wireless equipment and build complete outfits to order. We do not furnish any cheap or competitive materials.

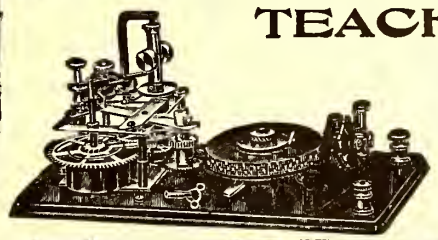


"Ace" Regenerative Receiver

THE PRECISION EQUIPMENT CO., 2437 Gilbert Ave., Cincinnati, O.

"THERE'S MONEY IN IT"
AT HOME **LEARN TELEGRAPHY** AT HOME
MORSE AND WIRELESS

TEACH YOURSELF



In half the usual time, at trifling cost, with the wonderful Automatic Transmitter, **THE OMNIGRAPH.** Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would.

Adopted by U. S. Gov't. 4 styles. Catalogue free.

OMNIGRAPH MFG. CO.
39L Cortlandt St. New York

www.americanradiohistory.com

Receiver Efficiency

Don't be deceived by manufacturers who imitate the distinctive appearance of Grebe apparatus. The Grebe standards of efficiency, design and workmanship are found only in

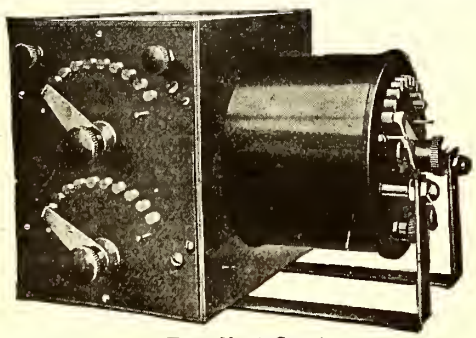
GREBE RADIO APPARATUS



Short-Wave Regenerative Receiver

Type CR-2 is characteristic of Grebe standards. Designed since the armistice, this receiver embodies a highly developed circuit of the continuously variable inductance type; capacity effects and other losses reduced to an absolute minimum. Designed especially for long distance work on amateur wavelengths, its operating range is from 170 to 580 meters. If you want *results*, this receiver will get them for you. Send for free bulletin describing this and other models operating up to 20,000 meters; —complete catalogue, 10c.

A. H. GREBE & CO., - 70 Van Wyck Blvd., Richmond Hill, N. Y.



Type-Y673-Coupler

TYPE Y673 Coupler
200 to 3000 meters
Price $14.00

Camb. Rectifier, for storage battery charging
Price $22.00

Three-cent stamp brings bulletins of both these instruments

CLAPP EASTHAM CO.
131 Main Street, Cambridge, Mass.

Pacific coast representatives: Remler Radio Mfg. Co., San Francisco
Canadian representatives: Radio & Electric Supply Co., Montreal



Rectifier

Attention AMATEURS

You may want to purchase a coil, a transformer, a pair of phones, a battery or one of the many pieces of apparatus necessary to properly operate your set. What do you do? You write for catalogues—the result is you have a mass of data and just can't make up your mind what to buy and who to buy it from.

Our advice is DON'T BUY IT until you secure some expert's opinion on the piece of apparatus just suited to your needs.

Because we are partial to no particular manufacturer of wireless apparatus and because years of study and sales has enabled us to select wireless products with discrimination, we offer you absolutely without charge, the benefit of our FREE INFORMATION BUREAU which is maintained solely for the purpose of guiding the experimenter in the choice of apparatus which will, in our expert opinion, serve him best.

Of course we sell apparatus and there again our knowledge manifests itself because we carry the products of over 70 of the leading manufacturers of American made apparatus—therefore you are assured that what you buy is the attainment of modern efficiency in apparatus production.

We wish to strongly emphasize the fact that whether you buy of us or not, we want to help you in your problems, and the cost to you is but a two-cent stamp. Write to-day for our catalogue.

NATIONAL RADIO SUPPLY CO.,
"The Nation's Clearing House," Dept. 103, 14th and U Sts., Washington, D. C.

Wireless Amateurs, Dealers and Manufacturers!

Have You Seen the

"DEPENDABLE"

Line of Radio Instruments and Complete Sets?

We manufacture a large line of **DEPENDABLE** apparatus—not the cheap mail order variety, yet our prices are low. Tuners, Couplers, Detectors, Fixed and Variable Condensers, Loading Coils, etc., also Binding Posts, Switch Points, Switch Levers, etc., etc.

Send for New Catalog No. 9
To our New York Office, 19 Park Place, New York City

DORON BROS. ELECTRICAL CO. Hamilton, Ohio

Modern American Radio Apparatus

(*Continued from page 779*)

In this new system the machine that generates these electrical oscillations is known as the *Alexanderson alternator* which has the advantage of giving a *pure wave* by virtue of which messages sent by different stations do not interfere with one another. There is just as much improvement in this new system over the older method as there is between the modern balanced telephone line and the old single-wire telephone on which the cross talk of neighbors could be overheard.

A new device known as the magnetic amplifier is employed as a modulator of the electric oscillations. This new device has no moving parts and this fact, coupled with its magnetic properties, renders it so quick as to make possible the transmission of telegraph messages at the rate of several hundred words a minute and also enables the amplification of the modulations of the telephone currents into oscillations sufficiently powerful to carry the human voice across the Atlantic. In all the different radio systems the radiator is called the antenna and up to the present time the antenna has been very inefficient, the useful energy radiated amounting to from 5 to 10 per cent. In the Alexanderson system a multiple tuned antenna is an important feature and increases the radiation efficiency from 20 to 50 per cent.

The company has developed such high frequency alternators for radio work in capacities of 1, 2, 50, and 200 kilowatts. It was one of these 200 kilowatt machines that did such good work at the New Brunswick station during the war, so it is interesting to note that a unit of this size *radiates approximately 250 h.p. of energy into space when it is sending a radio message.* The peculiar advantages of this type of generator is that it gives out an undamped wave and puts such a large amount of energy into the antenna; factors which led to the rapid extension of the use of radio communication during the war, and also led to the building of so many new transmitting stations as well as the use of this means of communication for spreading propaganda.

Over and above the radio work referred to the company's radio developments were many and varied. A description of all the work done seems impractical, so to give a general idea of some of this work that had been completed or was nearing completion at the time the armistice was signed, it will be well to classify it as follows:

(a) Large size vacuum tube apparatus
(b) Medium size vacuum tube apparatus
(c) Small size vacuum tube apparatus
(d) Receiving apparatus

All these new developments were carried out under war-time conditions, at high pressure, and under numerous difficulties caused by the rapid change of requirements.

The term "vacuum tube apparatus" may need a word of explanation: it refers to that type of transmitter and receiver which makes use of the vacuum tube as an oscillator, amplifier and receiver. Such tubes are usually made of glass and generally contain three electrodes. The tube is exhausted and the Research Laboratory at Schenectady has done much notable work in producing a tube of higher voltage and greater power output than hitherto had been found possible. The physical properties of the tube, which is termed a "pliotron," are dependent upon the motions of the electrons set free from the heated filament in a nearly perfect vacuum. We shall refer at greater length further on to this subject.

www.americanradiohistory.com

Most radio apparatus, previous to the development of these tubes, employed what are commonly termed "damped waves," which means that for a portion of the time there was no activity. With the vacuum tube undamped waves are used in which there is no period of inactivity; this results in a higher efficiency.

In pre-war days the advantages of the undamped oscillations were well recognized and apparatus of this description had largely displaced the older damped apparatus on the score of greater efficiency, the ability to use the lower voltage, small size, and also because of certain advantages in reception; but this new type of apparatus had not been used to any large extent in the smaller radio outfits.

The war-time requirements of both the army and the navy were of a very special nature and called for a great number of small sized, short range radio sets of light weight and small cubic capacity; these features being particularly valuable in aircraft outfits. To meet these requirements, the vacuum tube apparatus was developed and was applied in several unique ways to the aircraft service, particularly in its application to telephonic communications. All sets developed by the company were arranged for telephonic communication on the continuous wave and telegraphic communication on both continuous and "chopt" wave.

Aircraft are of various sizes and therefore several different types of apparatus were designed to meet the differing requirements, but finally the design settled down to three types, each particularly suitable for a certain class of airplane. Thus the large size vacuum apparatus was primarily intended for bombing planes, flying boats, and balloons; the medium size for such craft as seaplanes and biplanes; and the small size for the smallest class of flying machines, which usually carry only one aviator.

SMOKE IT BEFORE YOU PAY FOR IT

Order on your Business Stationery



To introduce this new and better way to make a pipe we make this extraordinary offer, we will let you smoke this pipe before you pay for it. More than 10,000 BANKERS HAVE BOUGHT BY MAIL. Genuine French Briar, solid Vulcanite mouth piece. Its simple construction makes cleaning easy. Try it. If it is not satisfactory you may return it. Price $1.50. Straight or Bent Models. You breathe, not pull through this excellent pipe and we guarantee satisfaction.

THE CALUMET CO.
CINCINNATI, OHIO
(Mail Sales Division Dept. A)

BATTERY CHARGED AT HOME

Do it yourself. Save money and keep battery at highest eF-Ficiency by getting a

NEW F-F BANTAM BATTERY BOOSTER

This 8 ampere rectifier charges any 6 volt storage battery from 100 to 130 volts 60 cycle, Alternating Current Lamp Socket and at an expense equal to burning an electric lamp for a few hours.

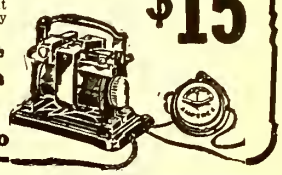
Simple—safe—sure acting. Infusible and long wearing carbon electrodes rectify the current. No drop in efficiency with continued use. This new size F-F rectifier already wonderfully popular—light in weight—10 lbs. complete ready for shipment—includes ammeter and battery clips. Get one and enjoy immunity from battery troubles.

Send check for prompt shipment by Express. For parcel post include postage and insurance charges.

Also F-F rectifiers of larger capacities as well as Charging Rheostats that operate from Farm Lighting Plants or Direct Current Service.

Ask for Circular No. 12

THE FRANCE MANUFACTURING CO., Cleveland, Ohio



$15



CHANGE OF PRICES

With Quantity Production and adoption of Automatically Wound Coils, we are glad to announce a Reduction in prices of our Amplifying Transformers as follows:

Type A-2 fully mounted with Aluminum Supports, Engraved Bakelite Dilecto Panel, and Nickel Plated Bind Posts.....$7.00

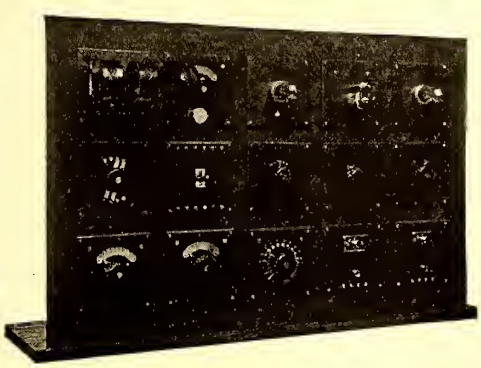
With Supports, but without Panel and Bind Posts $5.00

Assembled, but Unmounted.....$4.50

Although originally designed for use with VT-1 Tubes, these are now being used extensively and with excellent results with Marconi V. Ts.

ACME APPARATUS CO., 28 Windsor St., Cambridge, Mass.

DE FOREST
Unit Receiving Set
Gives You Better Apparatus at Low Cost.



This is a typical 15-Unit DeFOREST Receiving Set. Consists of a Tuner with wave length range from 150 to 25,000 meters; a Crystal and an Audion Detector, and a One-Step Amplifier. This Unit Set is the most-complete and-efficient receiving apparatus ever put out under $150.00. The entire set of Units shown above total only $133.57. They can be bought separately at their various prices.

The DE FOREST Unit Receiving Set offers the only practical system of securing accurately designed, efficient Radio apparatus without paying for expensive factory assembly and costly cabinets. You buy individual units and assemble them yourself; saving money and becoming more expert in practical work.

You can start with a few, inexpensive Units and increase as you progress, adding new Units as additions to the old. No junking of old apparatus. For the beginner, the DE FOREST Unit Receiving Set offers the most highly developed Radio instruments obtainable. And for the Amateur, Student, or Experimenter, this Unit Set holds even greater possibilities because by assembling and wiring the Units yourself you will become more expert and understand the principle of operation of the apparatus you are using. Find out more about the DE FOREST Unit Receiving Set.

Send for Catalogue E. E.

A 64-page book of Radio Apparatus that is more than a catalogue. Sent postpaid for 10 cents.

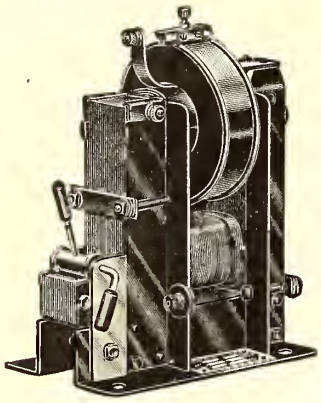
DE FOREST RADIO TEL. and TEL. CO.
Inventors and Manufacturers of
Amateur and Commercial Radio Apparatus
1415 Sedgwick Avenue, New York City

Ask Your Dealer for DE FOREST Radio Apparatus

These dealers in principle cities, as well as many others not listed here, sell genuine DE FOREST Apparatus. Consult local telephone directories for street addresses.

Boston, Mass.
F. D. Pitts & Co.
J. W. Poole, Inc.
Hartford, Conn.
Bauer & Co.
New York City
Bunnell & Co.
Philadelphia, Pa.
Central Elect. & Lock Co.
Quaker Light Supply Co.
Frank H. Stewart Co.
Baltimore, Md.
Maryland Elect. Supply Co.
Washington, D. C.
Geo. W. Parezo & Co.
Pittsburgh, Pa.
Doubleday, Hill Elect. Co.
Toledo, Ohio
Wm. B. Duck & Co.
Canton, Ohio
Wireless Mfg. Co.
Chicago, Ill.
A. A. Howard
St. Paul, Minn.
Pioneer Elect. Co.
Minneapolis, Minn.
Sterling Elect. Co.
Milwaukee, Wis.
Dewey Sporting Goods Co.
St. Louis, Mo.
Linze Elect. Supply Co.
San Francisco, Cal.
Leo. J. Meyberg & Co.
Los Angeles, Cal.
So. California Elect. Co.
Brode Elect. Co.
Seattle, Wash.
Ralph Krows Elect. Co.
Houston, Texas
Hurlburt Still Elect. Co.
Mobile, Ala.
Ungar Elect. Co.
Atlanta, Ga.
Haight Accessory Co.
Norfolk, Va.
Meeks Collins Elect. Co.
Toronto, Canada
Duncan & Russell
Montreal, Canada
Perkins Electric Co.

www.americanradiohistory.com



RADIO AMATEURS

Do you want your radio station listed among the "long distance" amateurs? Our new type "R" 1 K. V. A. 25,000 volt Wireless Transformer will make your station efficient for "long distance" relay work. Write for our catalog 20 T describing complete transmitting apparatus.

Thordarson Electric Mfg. Co.
501 S. Jefferson St. Chicago, Ill.

AMERICAN ELECTRO TECHNICAL APPLIANCE COMPANY
235 FULTON STREET NEW YORK CITY

FOR THE AMATEUR, we have a full line of very interesting and suitable parts and sets, all of the best manufacture and sold at lowest prices.
A very interesting feature is a COMPLETE RECEIVING SET IN A NEAT CARRYING CASE, without phones $6.00
LARGER SET for $15.00
Mail orders will receive prompt attention, WE HAVE THE GOODS. Our Catalog has been delayed on account of the printers strike, those who have sent for it will receive same as soon as it comes to our hands.


20c


$1.10


18c per doz.

STORAGE AND "B" BATTERIES WE HAVE AT SPECIAL PRICES

Switch Points, Variometers, Loose Couplers, Tuners, Detectors, Condensors, Army Head Bands, Brandes Superior Phones, Binding Posts, Levers, Lever Knobes, Bakelite and Hard Rubber for Panels, cut to order. Amplifying Transformers, Spark Coils, Rotary Spark Gaps, Small Motors, Wire, all kinds. Our Hard Drawn Copper is best for Aerials, Insulators. Lightning Switches, Small Switches, Panel Sets for sending and Receiving, De Forest Type Time Signal Sets, $27.00

RADIO APPARATUS

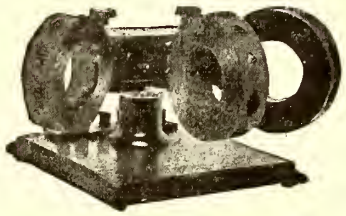
Distributors of All Prominent Makes:—
De Forest, Wireless Specialty, Murdock, Grebe, General Radio, Clapp-Eastham, Brandes, etc., etc.

Largest and Best Stock of any House in New England.

For real prompt delivery send us your orders. For Honey-Comb Coils, Unit Panels, Vacuum Tubes, Baldwin Telephones, Murdock 55's, Grebe Developments, etc., etc.

F. D. PITTS CO.
DEPT. D
12 PARK SQUARE BOSTON, MASS.

TYPE LC-101 INDUCTANCE COIL MOUNTING



Are You Listening to Hawaii?



RADIO — Splendid opportunities now in the Merchant Marine for Wireless Operators. Big salaries! New Schedule: Junior operators, $100 per month; Chief operators, $125; food and quarters besides. Equivalent ashore from $40 to $50 a week. Graduates in all parts of the world as Inspectors, Instructors, Engineers, Operators, etc.

The oldest, largest and best equipped radio school in New England. Recommended by Marconi and Government officials. DAY AND EVENING CLASSES. START ANY MONDAY.

CORE WIRE

At Pre-war Prices, 20cts. lb.

We have been fortunate in securing thru auction several tons of guaranteed pure, double annealed **Norway Iron Core Wire** and are selling this wire to "Experimenter" readers at 20c lb.
This wire is just the thing for spark coils, transformers, etc., and it is, of course, a very much more superior product than the usual iron wire. We have only one size left:

24 INCHES LONG. Thickness about No. 21 B and S

If this size should be too long we advise cutting the wire down yourself by means of shears.
As long as the supply lasts we offer this wire as described above to our customers at the very low price of 20c a pound. Add postage or we will ship express collect. Order at once.

ELECTRO IMPORTING CO., 231 Fulton Street, New York City

The large size vacuum tube apparatus uses the largest type of pliotron that the company has developed and is adapted for use at fixt land bases for controlling the fleet movement of a large number of planes by telephone. Such sets radiate about 1½ horse power of energy and are capable of giving telephonic communication with a flying boat at a distance of at least 200 miles. Similar units were designed for installation on army tractors for field operation. These also had a range of 200 miles, and at the time the armistice was signed a number of orders were under way for radio telephone sets for this service. An aircraft unit using this large vacuum tube was designed which only weighed 70 pounds, exclusive of the storage battery.

An aircraft radio telephone unit using the medium size vacuum tube was developed, and is now being produced in large quantities. It has a telephonic range from plane to ground of a hundred and fifty miles and weighs only about 40 pounds, exclusive of the battery.

A great amount of work was done on a radio telephone set using the smallest size of vacuum tube and the weight had been brought down until the complete transmitter, exclusive of the battery, weighed only 25 pounds. This set had a range of 60 miles from the fixt station and communication was obtained over a distance of ten miles between two similar planes.

The vacuum tube, commonly called the *pliotron*, and mentioned so often in this story, deserves many chapters to cover the fascinating story of its development; particularly the truly wonderful scientific laws which govern its action and the almost unbelievable amount of work that was accomplished by this concern in supplying the needs of the army and navy with these tubes. The amount of progress that the world owes to these tubes is a source of just pride to the workers of the Research Laboratory at Schenectady where so much of the development work was done that led to their present highly developed state. But owing to there being so much that is of interest, we shall have to confine our remarks to one or two brief paragraphs.

The practical long distance telephone really owes its development to the pliotron, and the advances it has enabled to be made in wireless telegraphy are great and far reaching.

These tubes depend for their action on the emission of electrons from a heated cathode which crossing a gap arrive at the anode, thus conveying an electric current across the gap. The ability to produce high power tubes depends on many factors, but the most important is to obtain a very high degree of vacuum.

As soon as America entered the war and the requirements of the government were learned, two lamp factories were started on the wholesale production of the vacuum tube and provided equipment to turn out 20,000 per week. This concern supplied the army and navy with many thousands of pliotrons for the airplane and seaplane service and many hundreds of the complete wireless outfits already described.

Men talking across the broad expanse of the Atlantic ocean without a wire is romantic enough of itself, but what of an "Ace" with his radio set controlling the fleet action of a mighty host of flying battleships engaged in deadly battle miles up in the air.

It seems fanciful, but it is real that today we send men miles up into the air to obtain meteorological information of distant points and have the information telephoned back to us on earth. These are indeed messages from the ethereal blue.—*Photos courtesy General Electric Co.*

www.americanradiohistory.com

MURDOCK No. 55



2000 Ohm Set.....$4.50
3000 Ohm Set..... 5.50

WHY PAY MORE?

Here are receivers that will respond to the feeblest signals. They are unquestionably

SENSITIVE

Here are receivers so rugged in construction that they will keep their sensitive adjustment longer than any others made. They are unquestionably

DURABLE

Here are receivers fitted with every accessory tending to comfort and convenience. They are unquestionably

COMFORTABLE

Here are receivers designed to have 100% perfect appearance. They are unquestionably

GOOD LOOKING

They fill every requirement in every respect, at prices considerably under any obtainable anywhere.

WHY PAY MORE?

The demand for our receivers and other MURDOCK apparatus has been so great that we advise early orders if you wish to secure prompt service.

Bulletin 19B sent free on request

WM. J. MURDOCK CO.

55 Carter Street, Chelsea, Mass.
509 Mission Street, San Francisco

WIRELESS AMATEURS

Send a 2c. stamp for full description of

The Barr Mercury-Cup Detector

the most efficient detector in the wireless field today.

Tested by Marconi Wireless Telegraph Co. and U. S. Government.

Increases the efficiency of every wireless receiving set by making the signals clear, sharp and distinct. Instantly adjustable at a constant pressure.

THE BARR MERCURY-CUP DETECTOR
Dept. A, The Wyoming, Washington, D. C.

Bliss Electrical School

ELECTRICAL ENGINEERING
Condensed Course—Complete in One Year. Sound, scientific, practical—without frills. For young men of energy and character. 26th year **opens September 25th.** Write for new catalogue.
260 Takoma Avenue, Washington, D. C.

Ships Guided by Electrified Cable

(Continued from page 746)

to the experts of the navy who have tested it, and recommended its use, is fool-proof and as reliable as the telephone. It will work in all conditions of water and weather and no amount of electricity in the air or power of the wireless can affect it in any way.

Earl C. Hanson, who is only 28, has been granted basic patents on the system. During the war he donated to the government all his inventions.

Gen. Pershing directed Col. John H. Parker to secure the use of the device for communications in the first battle lines and trenches, and only the signing of the armistice prevented its universal use in the American Expeditionary Forces, it is said.

The cost of installation will be much less than the installation of lighthouses, buoys, lightships, and other fog signals, with the added advantage that the system works without interruption from storms or fogs or other atmospheric conditions, claims the inventor.

It is difficult to estimate the economical saving that will be brought about by the universal installation of the Hanson system, which is applicable to any type of harbor. It may be considered as a refining feature of the *radio compass* which was developed under the direction of Capt. S. C. Hooper, of the radio division, bureau of steam engineering, Navy Department. R. H. Marriott, expert radio aid of the Navy Department, has conducted tests using the audio system for guiding ships in tests on the Pacific Coast with gratifying results.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of Electrical Experimenter, publisht monthly at New York, N. Y., for October 1, 1919.

State of New York, County of New York—ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Hugo Gernsback, who, having been duly sworn according to law, deposes and says that he is the Editor of the Electrical Experimenter, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations:

1. That the names and addresses of the publisher, editor, managing editor and business managers are: Publisher, The Experimenter Publishing Co., 233 Fulton St., New York City; Editor, Hugo Gernsback, 233 Fulton St., New York City; Managing Editor, H. W. Secor, 233 Fulton St., New York City; Business Manager, R. W. DeMott, 233 Fulton St., New York City.

2. That the owners are: Experimenter Publishing Co., 233 Fulton St., New York City; Hugo Gernsback, 233 Fulton St., New York City; Sidney Gernsback, 233 Fulton St., New York City; H. W. Secor, 233 Fulton St., New York City.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is —(Required only of daily publications.)

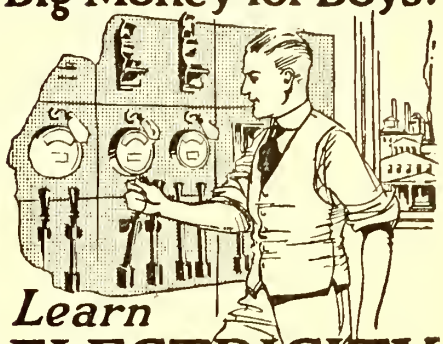
(SEAL.) H. GERNSBACK.

Sworn to and subscribed before me this 9th day of Oct., 1919.

BEATRICE K. OWEN.

(My commission expires Mar. 30th, 1921.)

Big Money for Boys!



Learn ELECTRICITY

There is a wonderful opportunity right now for boys who like electricity. Boys who are ambitious and will train themselves in spare time can step into positions just as soon as they are ready. Good salaries are offered to start with splendid chances for rapid promotion.

For 28 years the International Correspondence Schools have been training boys for success in electricity and over 200 other subjects. They will help you prepare right at home for a position in the line of electrical work you like best—or in any other work that appeals to you. Thousands of boys, through I. C. S. training, have stepped into fine jobs, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least, and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6211, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

ELECTRICAL ENGINEER	CHEMICAL ENGINEER
Electrician	SALESMANSHIP
Electric Wiring	ADVERTISING MAN
Electric Lighting	Window Trimmer
Electric Car Running	Show Card Writer
Heavy Electric Traction	Outdoor Sign Painter
Electrical Draftsman	RAILROADER
Electric Machine Designer	ILLUSTRATOR
Telegraph Expert	DESIGNER
Practical Telephony	BUSINESS MANAGEMENT
MECHANICAL ENGINEER	Private Secretary
Mechanical Draftsman	BOOKKEEPER
Ship Draftsman	Stenographer and Typist
Machine Shop Practice	Cert. Pub. Accountant
Toolmaker	Traffic Management
Gas Engineer	Commercial Law
CIVIL ENGINEER	GOOD ENGLISH
Surveying and Mapping	STATIONARY ENGINEER
MINE FOREM'N OR ENG'R	CIVIL SERVICE
ARCHITECT	Railway Mail Clerk
Architectural Draftsman	Textile Overseer or Supt.
PLUMBING AND HEATING	AGRICULTURE — Spanish
Sheet Metal Worker	Poultry Raising — French
Navigator	Automobiles — Italian

Name_____

Present Occupation_____

Street and No._____

City_____ State_____

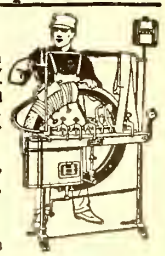
AN EASY WAY TO MAKE MONEY

Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business. One man says "I made $60.00 the first day." Others average $200 to $500 a month. Very little capital needed. Jobs plentiful. Every motorist a possible customer. No experience needed. We teach you.

SHALER Tire Repair Outfit

Improved Wrapped Tread Method Used by Tire Manufacturers

Does as good work as the big high priced vulcanizing outfits. A boy can use it. It's the only vulcanizer that has Automatic Heat Control, and can't undercure or overcure a tire. Requires no watching or regulating.

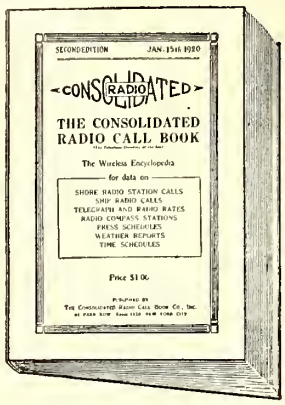


FREE Book

"How to Open a Tire Repair Shop." It tells how to make big money. Don't delay. Write quick.

C. A. SHALER CO.
2211 Fourth St. Waupun, Wisconsin

www.americanradiohistory.com



WIRELESS MEN:

The Second Edition of

THE CONSOLIDATED RADIO CALL BOOK

will be out January 15

Meets a timely and urgent necessity among radio and steamship companies, professional and amateur radio operators, and those having need of authentic and practical information on radio calls; radio, telegraph and cable rates, special signals and general radio procedure.

All Amateur Calls Now Listed

In addition every vessel and land station in the world is represented and listed alphabetically, according to names of vessels or land stations, and according to call letters; Revision of American coastal stations under U. S. Naval control, and their new calls.

That new and great aid to navigation—the radio compass—is explained and is a unique feature of this publication, that will be of special value to masters of merchant vessels. This book contains all calls listed in the new book to be published by the Department of Commerce.

Price, $1.00 Prepaid

Cash, money order or check. Act quickly as after supplying Commercial Wireless Companies with copies already ordered, individual orders will be filled in order of receipt.

CONSOLIDATED RADIO CALL BOOK CO., Inc., 41 Park Row, New York City

This book will also contain the advertisements of practically every leading company in the radio field.



Special Sale of U. S. Army Air Service Hot-Wire Ammeters

Imagine the increase in transmitting range one of these highly efficient Roller-Smith Hot-Wire Ammeters will bring you. A sharp wave, with maximum energy on one hump under all weather conditions; rapid adjustment to various wavelengths; increase or reduction of energy to work a certain station,—these are some of the advantages that can be yours.

Regularly $13 Our Special Price, $7

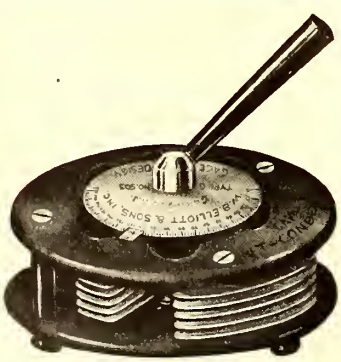
These Ammeters are of the flush type and were made for the U. S. Army Air Service for use on fighting planes. With the Armistice came a cancellation of contracts and these Ammeters, which had successfully passed the exacting Government tests, were returned to the manufacturers. Each is in perfect condition, packed in its original carton and ready for immediate shipment.

The scale reading is: 0-2.5 Amperes.

Shunt giving double or triple this range, 75c extra.

By buying the entire surplus we are able to sell these Ammeters at less than the Government paid for them in lots of one thousand. Better order one today as they are going fast. Remit by check or money order. Dealers write us, we have an attractive proposition for you.

A. H. GREBE & CO., 70 Van Wyck Blvd., Richmond Hill, N. Y.



VT CONDENSER
TYPE G
CAPACITY .0003 MFDS.
PRICE $2.75

VACUUM TUBE CONDENSER

For Oscillating Circuits

This condenser has been especially designed for us by E. G. Gage, well known in Radio circles for many years as a designer of Government Radio Apparatus. For oscillating circuits it will be found particularly valuable owing to the following features:

Adjustable constant pressure bearings giving smooth adjustment with light touch.
Angular handle which prevents body capacity.
Adaptability to panel mounting.

WM. B. ELLIOTT & SONS, Inc.

Mfgrs. of Small Machine Parts
114 LIBERTY ST., NEW YORK, N. Y.
FACTORY, GARWOOD, N. J.



Raise Belgian Hares for Us

Wonderful profits easily made at home. We furnish class A stock and pay you $7 to $11 a pair and express charges. Interesting illustrated catalog and contract FREE.
United Food & Fur Association
329 W. 48th St., Dept. E, New York

YOU Can Double Your Ability to Earn Money! Hold Friends! Win Love and Happiness! Our System of Personal Efficiency tells you **how**! Success Studygram and Personality Sketch for 10c and birth date. Thomson-Heywood Company. Dept. 350, Chronicle Building, San Francisco.

FOR RADIO OPERATORS.

An S. O. S. call for radio operators has been sent out by the United States Shipping Board.

All Shipping Board vessels carry one or two wireless operators. During the war many radio operators were trained. Any who desire employment, Shipping Board officials recently stated, have only to secure a radio operator's license, which is issued by the Department of Commerce after passing the required examination.

Under the new wage scale of the Shipping Board the first operator, who is in charge on vessels where two operators are employed, is paid $125 per month and the second operator $100 per month, *in addition to all expenses.* The radio operator is considered an officer and is provided superior accommodations.

All radio men who are qualified radio operators and who desire to be considered for the service should communicate with the Radio Department Division of Operators, United States Shipping Board, Washington, D. C.

Did the Romans Have Wireless?

(*Continued from page* 747)

Solaro, 1,980 feet. Signals were probably not sent from here, but from the eastern headland. The Pharos was about 1,000 feet above sea level. A line drawn from the Pharos to Monte Circeo, on the Campanian coast, just grazes the Island of Ischia; but the line of sight would be well above the island, as the summit of Circeo is 1,775 feet.

"A suggested line of stations with no range more than 44 miles long is submitted to those of a speculative turn of mind. (See illustration herewith.) Rome to Monte Cavo, in the Alban Mountains, 18 miles; thence to Monte Circeo, 39 miles; thence to Monte Massico, 44 miles; thence to Capri, 44 miles. A Pompeian fresco of quite recent discovery shows Monte Cavo as being very conspicuous when viewed from the Palatine Hill. The clear summit is boldly visible. Perhaps the Palatine Hill was the 'sending' station in Rome."

Sound and Flash Ranging in the A. E. F.

By Prof. Augustus Trowbridge

(*Continued from page* 759)

A survey by means of sound is based on the assumption that sound travels from the gun in a spherical wave at a known rate (about 1100 feet per second) in still air at a given temperature; an increase in temperature increases this rate by a known amount; if the air is not still but blowing with a known speed in a known direction the apparent speed of sound under these conditions may be calculated. If the *time of arrival* of the sound of a gun is measured at three surveyed points on the ground, the position of the gun can be calculated as will be evident from the accompanying diagram in which G is the gun, P_1, P_2 and P_3 any three surveyed points within the friendly lines at which instruments are placed capable of indicating electrically on a recorder at a central station the times of arrival (t_1, t_2 and t_3) at them, of the sound of the enemy gun.

www.americanradiohistory.com

These Up-to-Date Books Will Save You Money



No 5—WIRELESS CONSTRUCTION AND INSTALLATION FOR BEGINNERS describes in detail with working drawings, how to make simple but efficient sending and receiving sets at lowest possible cost. 73 pages. 66 illustrations.



No. 3—LESSONS in WIRELESS TELEGRAPHY should be owned by every amateur. 35 clear lessons covering all principles from aerials to end losses and audions, so you can understand how they work.



No. 6—EXPERIMENTAL WIRELESS CONSTRUCTION with working drawings and detailed instructions for building spark coils, transformers, tuners, couplers, condensers, detectors, etc. (More advanced than No. 5 book.)



HOME MADE ELECTRICAL APPARATUS (in 3 parts), with details and working drawings, taken from real apparatus. Vol. 1—Static machines, batteries, storage cells, rectifiers etc., etc. Vol. 2—Voltmeters, ammeters, telegraph and telephone instruments, shocking coils, spark coils, experiments, etc. Vol. 3—Dynamos, motors, electric engines, miniature lighting, wireless, Tesla coils, electroplating, etc.

Get Them Now—Price May Have to Advance Any Day

Price now 30c each. Postpaid

COLE & MORGAN, Inc.
Publishers
Dept. 4, 19 Park Place, New York, N. Y.



Complete Radio Outfits

Learn wireless telegraphy with real radio outfits that receive messages up to 1,000 miles and send them from three to five miles. Complete sending sets contain spark coils, condensers, spark gap and oscillation transformer. Radio receiving sets composed of loose coupler, Radio or Audion detector, telephone receivers, insulator and ground wires. Authoritative book on wireless and instructions in each set give the wireless code and tell you how to rig up your outfit. These are radio outfits of the most approved type. Write to-day for complete catalog.

Sending and Receiving Outfits

One of our complete sending and receiving sets is shown at the left. It has a very sensitive receiving outfit of the most modern type and a sending set, with aerial switch and key, that conforms to Government regulations in every way. We'll send you sets direct if your dealer hasn't them. Price $5 to $65 (Canada $7.50 to $97.50).



The A. C. Gilbert Company
311 Blatchley Avenue New Haven, Conn.
In Canada: The A. C. Gilbert-Menzies Company, Limited, Toronto
In England: The A. C. Gilbert Company, 125 High Holborn, London, W. C. 1

If the sound arrives at P_1 at time t_1 and at P_2 at time t_2, then the interval t_2-t_1 must be the time necessary for the sound to travel the distance r_2 where $r_2 = V(t_2 - t_1)$ if V is the velocity of sound in still air at some standard temperature. Also $r_3 = V(t_3 - t_2)$. One can of course reverse the above reasoning if the intervals $(t_2 - t_1)$ and $(t_3 - t_1)$ be known, by drawing circles of radii r_2 and r_3 around P_2 and P_3 respectively and drawing tangent to these circles and through the point P_1 a third circle $P_1 Q_1$, at the center of which the gun must lie if there be no wind or temperature corrections; if these have to be made a slight and calculable shifting of the point G results.

The method just described would be an entirely correct graphical one to employ in calculating a gun's position from the observed time intervals, but it was found too slow and slightly too inexact for practical use, and therefore *plotting boards* were prepared by a method involving the principle of that just described but which permitted the use of strings in place of lines drawn on the board; also in practice six instruments P_1, P_2, P_3, P_4, P_5, P_6, were used instead of the three theoretically necessary in order to insure greater accuracy and to allow of work being carried on while one or two of the instruments might be temporarily out of order because of the electrical connections to "central" being cut by shell fire.

One of the accompanying illustrations gives an idea of the character of the photographic records from which sound ranging locations were made; the six horizontal lines between the two rows of perforations are the records of the six instruments P_1 — P_6; the heavy short vertical lines, the rather faint long lines and the very faint long lines are respectively half-seconds, tenth seconds and hundredth seconds recorded by the means of a very accurate tuning fork. When the sound of a gun reaches the instrument P_1 (for example) the top element of the record shows a "nick" in the line, and as the sound reaches the other instruments "nicks" appear in the corresponding lines and the time intervals $t_2 - t_1$, etc., may be quickly read off by counting the number of tenth and hundredth seconds between the "nicks."

An idea may be formed of the accuracy of sound ranging locations from the accompanying diagram in which the actual gun positions are plotted from a survey made after the position had been captured by our troops; this survey was made by army topographic officers who were not themselves interested in proving or disproving the accuracy of sound ranging. The surveyed gun positions are marked with a small square. The locations made by the sound rangers had been rated when reported to the artillery according to the actual probable error as follows: A location reported "P" (none in the case of this battery) was probably accurate to within fifty yards; a "Q" location (marked with a small circle) accurate to within a hundred yards; an "R" location, 150 yards and a "RR" location, 200 yards, marked respectively as dots and crosses. Had the estimate of probable accuracy been correct, all the crosses should have been *outside* the outer oval figure; all the dots should have been between the outermost and the next oval; the circles should have been in the next region, etc. It will be seen that the estimate of accuracy was much too conservative. The triangle marks the average of all the sound ranging locations on this battery and is less than 20 yards in error. The scale of the drawing is such that the large square represents a square kilometer. The sound ranging instruments were about eight kilometers (five miles) distant from the battery.

Sound ranging was also used to direct the fire of the friendly artillery on invisible



One of the Greatest Achievements of Science and Invention.

Hammond
MULTIPLEX

"Many Typewriters In One"

For the Mathematician, Engineer, Chemist, Astronomer, Surveyor, Navigator—there is no typewriter like the Multiplex Hammond! The Multiplex does many things that *no other typewriter* can do!

The Mathematical Multiplex contains the characters and signs used for writing in higher and lower mathematics, and for engineering, mechanics, etc., as well as for all the ordinary work that can be done on any typewriter. Just note these fine styles of Multiplex type—

TWO STYLES OF TYPE, or *two to five different languages,* carried on the machine AT ONCE. "JUST TURN THE KNOB" and change *instantly* from Roman Type, to *Italics,* or Miniature Roman, or our Beautiful Script Type, or from English to Greek, Russian, German, French, etc. *Any other type or language can be substituted in a few seconds.*

The above gives a slight idea of the versatility of the Multiplex which has literally revolutionized typewriting—has changed it from monotonous commercial work to the beauty of fine printing and engraving.

WRITE FOR FREE BOOKLET showing the many languages and type sets of the Multiplex—there's a type for every profession, every business, every science, including technical signs and symbols and chemical keyboard.

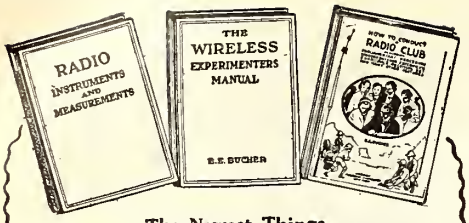
Fill out the Coupon and mail to us *now*—before you turn this page and possibly forget. You incur no obligation.



Also—an Aluminum PORTABLE Model
For Traveling—for home. Weighs about 11-lbs. Full capacity. Ask for special folder.

THE HAMMOND TYPEWRITER CO.
589 East 69th Street New York City
Name .....
Address .....
.....
Please write your occupation below.

www.americanradiohistory.com



The Newest Things
IN WIRELESS
Are in These Three Books
Just Off The Press

RADIO INSTRUMENTS AND MEASUREMENTS
Every amateur should have this book as it answers the questions you want to ask and covers all phases of the subject matter indicated by its title.
Cloth Bound, 320 Pages. Price $1.25

THE WIRELESS EXPERIMENTERS' MANUAL
By E. E. Bucher
Mr. Bucher's latest book. The only one that comprehensively covers all phases of wireless work, including the latest practices in both Radio Telegraphy and Telephony. Most complete text book on these subjects yet published.
Cloth Bound, Approximately 300 Pages. Price $1.75

HOW TO CONDUCT A RADIO CLUB
By E. E. Bucher
One of the most popular wireless books ever published. Covers parliamentary procedure, indoor and outdoor experiments, 5,000-mile receiving sets, use of vacuum tubes and many other subjects.
Paper Cover, 148 Pages. Price 50c

THE WIRELESS AGE
A monthly magazine that will keep you posted on the up-to-the-minute things in wireless communication. Official organ of the National Amateur Wireless Association.
Price Per Year $2.00

SPECIAL COMBINATION PRICE
All Four for Only $4.50

WIRELESS PRESS
1850 Woolworth Building, New York

Announcement

Leo J. Meyberg Co.

Announce they have bought the business of

Haller Cunningham Electric Co.

428 Market St.
San Francisco

and that they have no connection with any other concern.

Send 4 cents for our catalog of Amateur Wireless Apparatus

20,000 Meter Long Wave Tuner
3,000 Meter Arlington Tuner
200 Meter Amateur Tuner

They work on any aerial or loop. Wiring diagrams on bottom. Coils machine wound and set in wax. No delicate tuning. Foreign orders solicited. Catalog free. Agents and dealers wanted. Price $15 delivered to you.



TRESCO, Davenport, Iowa



THE MIDGET SLIDE RULE will solve any problem in addition, subtraction, multiplication, division and proportion. A Log-Log Scale gives any root or power of any quantity. Gives Logarithms, Sines, Tangents, Cosines, Cotangents and the decimal equivalents of fractions to six figures. It is grease and water proof and will give years of service. This rule is not to be compared with the paper utility rules which sell for $1.00 and are put together with paper fasteners. It is accurate, simple to operate and comparison shows that it is undoubtedly the fastest and most complete rule made. Our refund guarantee protects you from loss or disappointment. An instruction book 16 pages, 12 illustrations, is sent with each rule. Diameter of rule 4 in. Made in two models: Metal (white coated steel), $1.00; White Celluloid, $1.25. Leather Case 50c extra. Send for catalogue of Slide Rules. Your money back if you are not satisfied. **Gilson Slide Rule Co., Niles, Mich.**

targets; the method was similar to that employed for the location of the enemy guns but with the difference that it was the report of the burst of the friendly artillery's shells that was recorded instead of the report of the enemy gun. When the target was an enemy gun which had recently fired and been located by the sound rangers, the accuracy obtained in ranging the friendly artillery was extremely great, since no uncertain wind and temperature corrections had to be applied, as the effect of wind and temperature on the records of enemy gun and the shells of the friendly artillery was the same and therefor could be disregarded.

An idea may be gained of the *amount* of artillery information supplied by the flash and sound ranging sections from the following extract taken from the report of the artillery information officer of one of the American corps. This officer had at the time as sources of information three American sound ranging sections, two American and three French flash ranging sections (later three American and two French flash ranging sections) aviation and observation balloons. During a period of three weeks of rapid advance, 425 separate locations of enemy batteries were made; of these the two American flash sections reported 63 per cent; the three French flash sections reported 16 per cent, and the three American sound sections reported 21 per cent. In a period of two weeks, when the advance had been temporarily checked by the enemy, the total number of locations was 392, and the percentages were: From the three American flash sections 38 per cent; from the two French flash sections 8 per cent and from the three American sound sections 54 per cent. In another and very active sector the figures were: During a period of three days' preparation for an advance, sound locations 22, flash 22; balloons, 0, aviation, 0. During a period of sixteen days of rapid advance; sound 4, flash 46, balloons 30, aviation 15. During a period of four days of stabilization; sound 6, flash 34, balloons 13, aviation 15. These figures are fairly characteristic. During preparations for an advance, both the sound and flash sections are very useful sources of information. During rapid advance the sound rangers do not get into action as often as the flash, because of the greater technical difficulties. During this period the major part of the information comes from the aerial observation.

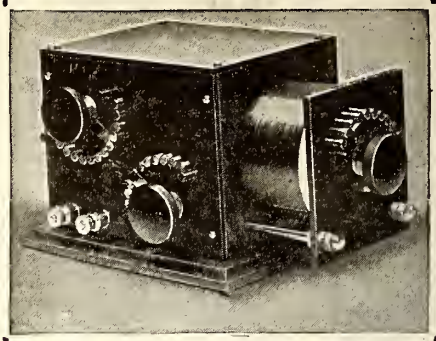
American flash and sound ranging sections were operating on the front from March, 1918, until the armistice and always in sufficient numbers to cover the sectors held by American troops, except for a portion of the front of the Argonne offensive when the line was moving extremely rapidly. The work of the officers and men of the 74th Engineers engaged in this service was of a very high order, and their untiring watchfulness was often the indirect means of saving the lives of countless of their fellow soldiers by affording the information needed to silence the fire of the enemy guns.

SOUND AND FLASH RANGING IN THE A. E. F.
[Editorial Notes.]

No microphones were used by the A. E. F. in sound ranging. Also no earth-borne vibrations used.

The Bureau of Standards made exhaustive tests for several years, not to mention hundreds of tests conducted by the U. S. Army Corps of Engineers, which have demonstrated that it is not practicable to endeavor to use sound wave transmission thru the earth. This is so for one basic reason, viz.: That the velocity of sound varies for each different kind of earth, such as damp earth, wet earth, dry earth, rock, sand, chalk, etc.

Buy the Best When You Buy



THE BEST COSTS YOU LESS WHEN YOU BUY FROM US.
This 200 to 2500 meter loose coupler costs $18.00. You cannot buy a better instrument if you pay more.
RADIO EQUIPMENT CO.
6302 Washington St. Boston, Mass.



3-INCH DIAL INDICATOR

Black Composition with Brilliant White Filled Engraving

Dial No. 66 only post paid $.75

Dial No. 67 with Bakelite Knob, postpaid, $1.30.

For Sale By All RADISCO Agencies and by

A. H. CORWIN & CO.
4 West Park St., Newark, N. J.



Here is a sign that will make your friends shudder. Your den is incomplete without it. Fill out order in pencil and send it NOW! Price only 20c, 3 for 50c, postpaid anywhere. Sent unbent.

LEONARD BECK, 1298 Carroll St., B'klyn, N. Y.
I enclose ..... cents for which send me ..... DHV signs. 7¼"x11¾". Printed in bright red on stiff cardboard.
Name .....
Address .....
State..... E.E.-12



Going Up!
It gives dandy results and is worth much more than $10.50. Order one now. Send 2-cent stamp for bulletin.
COLBY'S TELEGRAPH SCHOOL, AUBURN, N. Y.

STAMPS
50 diff. Belgium (large bi-color), China, Jamaica, Portugal, Venezuela, etc., 10c; 100 diff., nice packet, 20c; 1,000 well mixed, 40c; 106 var. U. S., 50c; 1,000 hinges, 10c; Agts. wanted, 50%. List free. I buy stamps. L. B. Dover, Overland, Mo.



INSYDE TYRES Inner Armor for Auto Tires. Double mileage, prevent blowouts and punctures. Easily applied in any tire. Thousands sold. Details free. Agents wanted. Amer. Accessories Co., Dept. 53, Cincinnati

www.americanradiohistory.com

Ideal Xmas Gift
For
Father, Son or Friend

Flashlight Battery Outfit

Serviceable "Make-UR-Own" $1.00

Easy to Make—In 3 Minutes

Instructive—Practical—Useful. Every boy should have one. A Xmas Gift that any friend would more than appreciate.

Make Flashlight Batteries Know They Are Fresh!

Do it Yourself and see the mystic charm of making your own light. Have fun doing it. So simple any child can make them. Outfit comes packed in neat Xmas box. Fully guaranteed or your money back.



Something New — Nothing like it on the market.

Better Light—Lasts Longer

400% more flashlight service for less money and your flashlight is always ready when you want it. Fits 1½ x 6¼ in. tubular flashlight case. Only satisfactory thing to use around house, car, garage, anywhere Order one of the following outfits today:

Serviceable Flashlight Outfit—Flashlight case, heavily nickeled, mazda lamp, complete with 6-cell "Make Ur Own" battery outfit $2.35

Renewal Outfit—Parts and Chemicals to make 6 cells complete . . . $1.00

Add 15c to cover postage.
Attractive Proposition to Agents.

SERVICEABLE BATTERY & SUPPLY CO.
Exclusive Sales Agents
30 N. Michigan Ave. Dept. 16 Chicago, Ill.

Your Future

The demand for Radio operators both at sea and in land positions still persists. Better inducements are constantly offered. Our brief course equips you thoroughly for the best paying positions.

Terms moderate and payments arranged to suit your circumstances.

SCHOLARSHIPS TO EX-SERVICE MEN

Call or write for descriptive literature.

Y. M. C. A. RADIO SCHOOL

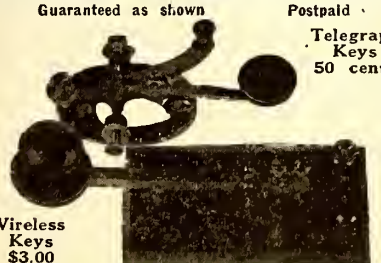
Marcy Avenue near Broadway

Brooklyn

Tel. Williamsburg 3800

Ex-Government "UNUSED" KEYS

Guaranteed as shown Postpaid



Telegraph Keys 50 cents

Wireless Keys $3.00

Test Buzzers 45c Spark Gaps $1.35
Detector Stands $1.35
We can supply any wireless apparatus you require.
THE VIMY SUPPLY CO.
585 College Street Toronto, Ont., Canada

READ THE CLASSIFIED ADS. ON PAGES 843-846

What was used, then, in the A. E. F., when the U. S. Army Corps of Engineers who took charge of all this work during the war on the whole American front (every yard of which was fully protected by this apparatus for accurately locating the German guns from the time that the first American troops went into action) until the close of the war? No sound vibrations thru the earth, to begin with, and no microphones.

When Colonel Trowbridge arrived in France, he was given charge of this work for the A. E. F., and was appointed to the staff of Gen. Pershing at Headquarters. Very shortly, and in conjunction with some laboratory work which has been carried on in the Palmer Physical Laboratory at Princeton University, an entirely new method of "Sound Ranging" was developed. In the first place, sound vibrations as transmitted thru the *air* were used in contra-distinction to the sound waves originally used, which were transmitted thru the *earth*. A new sound translating device was constructed for the purpose, which yielded wonderful results. This instrument comprises nothing else than a series of fine, electrically heated wires, forming a *grid*. This grid of fine wires which were heated red hot by a strong current transmitted from the central station of a given sound-ranging sector, was suddenly cooled *by the blast of the onrushing sound wave* transmitted thru the air whenever a German gun was fired, even though it was four to five miles away.

To begin with, the velocity of sound wave propagation was constant to a very close degree, and this insured the success of the new system from the start. When the sound wave reached the location of the thermal sound detector, several of which were installed on well charted locations, there was caused a variation in the air at this point.

To intensify this effect, the next step was to place the grid device, which was a small affair, on to some acoustic resonating chamber which would be affected in a more or less pronounced manner so as to reinforce pneumatically the local effect of the air wave variation when it arrived.

At first, English "whiskey jugs" were used, and the grid thermal detector was clamped to the top of the jug. When the sound wave arrived in the vicinity of these jug detectors, a puff of air would rush into the jug, and out again, thus causing a variation in the heating of the wire and this partial cooling and change in the heating would change the resistance of the line, and cause the recording apparatus at the central station to register a "wiggle" on a rapidly moving photographic paper strip such as here shown, which corresponds to the enemy gun or guns. Later, several important and unique features in connection with this very interesting sound detector, were observed and put into effect. Due to the fact that the soldiers used to smash the jugs repeatedly in an effort to see whether there was any whiskey inside, researches were quickly made, and finally gasoline and kerosene cans came into use. The grid was now clamped on the opening of the can, and presently it was discovered that in order to render the device more quickly damped in its operation, and to give but one deflection on the record, that this quality could be effected by simply punching some small holes around the can, so that the opening where the air enters the can when the sound wave arrives, did not tend to keep vibrating; but due to the air escaping thru the small holes, it would damp out quickly.

The only really special apparatus required, was the recording instrument which comprised an Einthoven string galvanometer provided with six strings or wires

Go to School at Home!



HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY HANDICAPPED if you lack High School training. You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE This Course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and *meets all requirements* of a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY

Most people *idle* away *fifty* hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within *two years*. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

TAKE 10 LESSONS FREE So that you may see for yourself how thorough and complete our training is. We invite you to take *ten lessons* in the High School Course—or any Course of specialized training in the Coupon below—before deciding whether you wish to continue. If you are not then satisfied you are not out one cent. *We absolutely guarantee satisfaction.* On that basis you owe it to yourself to make this test.

Check and mail the coupon NOW for full particulars and Free Bulletin.

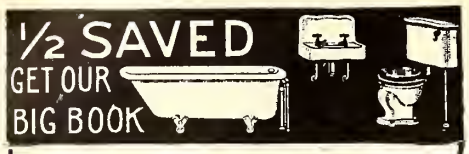
AMERICAN SCHOOL OF CORRESPONDENCE
Dept. H. 269 Chicago, Illinois

TRAINING—THE KEY TO SUCCESS

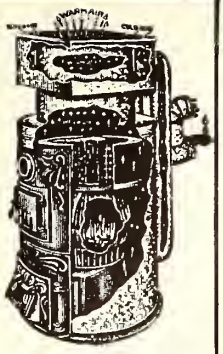
Please explain how I can qualify for the position marked X

....High School Graduate	.....Lawyer
.....Electrical Engineer	.....Business Manager
.....Elec. Light & Power Supt.	.....Certified Pub. Accountant
..Hydroelectric Engineer	.....Accountant and Auditor
.....Telephone Engineer	.....Bookkeeper
.....Telegraph Engineer	.....Stenographer
.....Wireless Operator	.....Fire Insurance Expert
.....Architect	.....Sanitary Engineer
.....Building Contractor	.....Master Plumber
.....Civil Engineer	.....Heating and Vent. Engineer
.....Structural Engineer	.....Automobile Engineer
.....Mechanical Engineer	.....Automobile Repairman
.....Shop Superintendent	.....Airplane Mechanic
.....Steam Engineer	.....General Education Course
.....Draftsman and Designer	.....Common School Branches

www.americanradiohistory.com



DO YOUR OWN PLUMBING AND HEATING AT LOW COST



Any handy man can install a complete plumbing or heating plant in his own home by our new easy method. Every part comes Cut-to-Fit your needs. Our Engineers draw your plans. You can easily do the rest with a few simple tools. You save time, labor and unused materials.

SEND FOR HANDY MAN BOOK

This big book tells you what to install and how to install it. It shows over 10,000 different fixtures at wholesale prices. Every builder, home owner, carpenter or contractor needs one. Save the high cost of labor on needed improvements. We have spared no time or expense in the preparation of this valuable book. To keep from sending it broadcast to uninterested persons we request a temporary deposit of 25c which will be refunded on your first order. Send for it Today.



BURN LESS COAL

and heat the whole house with an improved all-cast pipeless furnace. No expensive pipes or heating equipment. Makes mussy, unsightly stoves unnecessary. Costs no more than a stove. Can be installed in a day by anyone. They are described at wholesale prices in The Handy Man Book. Send for it today.

HARDIN-LAVIN CO.

4510-20 Cottage Grove Ave., Chicago, Ill.

We Guarantee Our Every Product



Big Band Catalog sent free

Whatever you need—from a drumstick to the highest priced cornet—is in the world. Used by the Army and Navy. Send for big catalog; liberally illustrated, fully descriptive. Mention what instrument interests you. Free trial. Easy payments. Sold by leading music stores everywhere

LYON & HEALY

58-81 Jackson Boulevard, Chicago

Learn the Sign-Show Card Business



Big field—unlimited possibilities—increasing demand for men with creative ideas. Our course develops ability and originality. Work intensely interesting.

EARN $25. TO $75. WEEKLY

You can do it if ambitious. Successful graduates everywhere. Our course covers every phase of work completely and thoroughly. Our graduates command big salaries. Write for catalog, samples, guarantee and Free Outfit Offer.

DETROIT SCHOOL OF LETTERING, 691 D. S. L. Bldg. Detroit, Mich.

ARE YOU BASHFUL, TIMID

Self Conscious, Embarrassed in Company. Let us tell you how you can overcome these troubles and acquire Poise, confidence, assurance and a magnetic personality. Address The Veritas Science Institute, 1400 Broadway New York, Desk 15.

tightly suspended in a very powerful magnetic field. These galvanometers were built by a large American telephone concern under rush orders from France. Time division marks on the charts on which the records were made, were produced by a clever revolving toothed disc driven synchronously in front of the beam of light from a 24 C.P., 6 volt, battery lamp, and projected on to the photographic paper strip. All of this apparatus was straightway provided. This photographic recorder carries a large roll of sensitized paper strip, and when set in motion a large drum carries the paper around in front of the shutter, exposes it, cuts the exposed section off, puts it thru a developing and fixing solution and turns it out on the receiving tray—all of these operations taking place in about *three-quarters of a minute!* So much for this recording apparatus at present.

The next point of interest leads us to the front line trenches and their vicinity, where sound ranging posts were stationed. The observers were sometimes stationed in dugouts *in advance* of the front line trenches. Each observer had a switch or key, and a telephone of course. Whenever he saw or heard the enemy's gun fired, he immediately prest his key, which operated a series of relays connected by means of wires running back to the recording station of that particular sound ranging section. One of the relays closed the grid current circuit thru the hot wire grid on the whiskey jugs or gasoline cans, which were sprinkled over the field in the vicinity of the front line trenches. Another relay started the recording apparatus in motion. The incandescent lamp burned all the time in front of the galvanometer telescope. Thus, it is shown that by the time the sound wave arrived from the gun fired, which may have been anywhere from two to eight miles away, the apparatus was in full operation and ready to record the "bursts." The method of arranging the various sound wave detectors along the arc of a circle is described in the article by Prof. Trowbridge.

The American type of air wave "sound detectors," were arranged of course to deflect the rain and other elements. The proper current was maintained thru each hot wire grid in the following manner. When the grid was installed, its resistance was noted as marked on a tag accompanying it. All circuits operated in the A. E. F. were full metallic (two wires), and no ground circuits were used under penalty of court martial and a possible sentence of death. This was done to prevent the enemy from intercepting any signal (telephonic or telegraphic) due to leakage from grounded circuits. The wires were No. 12 heavy rubber covered conductors.

This is the first authentic account of what a wonderful branch of military science "Sound Ranging" has become.



BUSH AGENTS WANTED

This 6-Passenger, 4-cylinder, 37 H.P. BUSH Car—Timken Bearings—Willard Batteries—2-Unit Starting & Ltg.—116-inch whl. base. Write at once for the best Automobile Offer in existence—Don't wait—Cars guaranteed or money back—prompt Deliveries—now.

BUSH Address J. H. Bush, President, Dept. 815 MOTOR CO., Bush Temple, Chicago, Illinois

AVIATION Information FREE

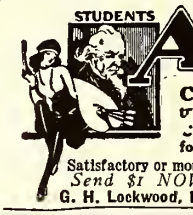
Send us your name and address for full information regarding the Aviation and Airplane business. Find out about the many great opportunities now open and how we prepare you at home, during spare time, to qualify. Our new book "Opportunities in the Airplane Industry" also sent free if you answer at once.

AMERICAN SCHOOL OF AVIATION
Dept. 7759 431 S. Dearborn St. CHICAGO

Become a
MOTION PICTURE OPERATOR

Prepare yourself for an all-year-round, steady, well-paying position; salary $30 weekly and upward; cost of instruction, $15; $5.00 will start you. Day and Evening Classes. No charge for positions secured.

Moving Picture Operators School
644 8th Ave., Near 42d St., New York



Publishes cash art assignments, lessons and articles on Cartooning, Designing, Illustrating, Lettering and Chalk-Talking. Criticises amateurs' work. Full of information for artists and art students.

Satisfactory or money refunded. 20c a copy, $1 for 6
Send $1 NOW, Thrift Stamps Taken
G. H. Lockwood, Editor, Dept. 548, Kalamazoo, Mich.

DOLLAR ADDING MACHINE $1

Adds and multiplies with speed of expensive machines. Seven columns capacity. Remarkably simple in construction. Nothing to get out of order. Weight one ounce. Made of metal and celluloid. The ideal pocket, desk or home machine. Order today. The best way not to forget is to do it now.



L. J. LEISHMAN CO., Dept. 142, Ogden, Utah

CLEARTONE PHONOGRAPHS
$4.00 to $200.00 Retail



Needles 45c per thousand in lots of 500,000 Motors $1.35 to $14.75 each. Tone Arms and Reproducers $1.30 to $5.75 per set. Main Springs 20c to 90c each. Records, Needles, Sapphire Points and Parts at reasonable prices.
Write for our 84 page catalogue, the only one of its kind in America, illustrating 33 different styles of Talking Machines and over 500 different Phonographic Parts.
LUCKY 13 PHONOGRAPH COMPANY
Export Dept. 46B E. 12th St., N. Y., U.S.A.

158 Genuine Foreign Stamps—Mexico War Issues, Venezuela, Salvador and India Service, Guatemala, China, etc. Only 10
Finest Approval Sheets 50% to 60%. AGENTS WANTED. Big 72-p. Lists *Free*. We Buy Stamps. Established 25 yrs.
Hussman Stamp Co., Dept. 67, St. Louis, Mo.

STUDY HUMAN NATURE Learn to recognize the marks that nature has stamped all over the human form. Look through and beyond the deceptive smile. Know the strong and weak points of those you meet. Send 5 cents in stamps for "PERSONAL POWER", a little book that tells how. Address Y. B. Koss, Secretary Progress League, 31 Union Sq., N.Y. City

YOU CAN BECOME AN ELECTRICAL ENGINEER

with B.S. degree in three years at this school. The demand for **trained** executives and directors in the profession of Electrical Engineering is constantly increasing. You can prepare here to take a place of importance in the shortest possible time.

Greater Faculty—Extended Facilities

Fifty-five specialized experts, leaders in their professions will personally train you in the fully equipped laboratories, shops, drafting, chemistry and class rooms of this school. Join the body of earnest electrical knowledge seekers now and be ready to take your place early in the steadily progressing electrical and industrial world.



CLIP HERE

School of Engineering of Milwaukee
Milwaukee, Wis.

Gentlemen:—Without obligation, send me catalog and particulars concerning your 3-Year Electrical Engineering Course with B.S. Degree.

Name .....
Address .....
City .....State.....
Age .....Education.....

SCHOOL OF ENGINEERING OF MILWAUKEE
135-373 Broadway, Milwaukee, Wis.

JOIN JAN. 2d

When the new term opens. "Earn While You Learn." An opportunity to quickly secure deficient high school credits.
Clip the coupon **Today** for latest bulletins and full particulars **FREE!**

SCHOOL OF ENGINEERING OF MILWAUKEE
College of Electrical Engineering
135-373 Broadway Milwaukee, Wis.

INDEX TO
ELECTRICAL EXPERIMENTER SCIENCE & INVENTION
FOR VOLUME 1, 2, 3, 4, 5

This index contains 24 pages and shows every article of interest that has been published since the inception of the magazine up to and including April, 1918.
It is absolutely indispensable to everybody interested in any kind of electrical research work. With it everything of importance in the advancement of electrical science during the last five years can be readily found.

Price 15c. Postpaid

EXPERIMENTER PUBLISHING CO.
Book Dept. 231 Fulton St., N.Y.

www.americanradiohistory.com



THE INSTRUMENT OF QUALITY
Sonora
CLEAR AS A BELL

Semi-Permanent Silvered
PHONOGRAPH
NEEDLES

Make your records last longer and play better!

THE ordinary steel needle fits the record groove when it is new. It wears rapidly, however, and being tapered tends to shear off the sides of the groove as shown above. This results in poorer tone and shortened record life.

Sonora needles have parallel sides and as they slowly wear down they fit the groove perfectly *always keeping the record in ideal playing condition.* Sonora needles are designed for use on ALL MAKES of steel needle lateral cut records.

These Sonora needles play many times, are more convenient, save constant needle changing and mellow the tone. These needles give the maximum of satisfaction and are the most economical ultimately.

FREE! A sample needle will be given FREE so that you can prove its merit for yourself. Write for yours today.

Three Grades
Loud, Medium, Soft

25c *per card of* 5 40c *in Canada*

Sonora Phonograph Sales Company, Inc.

George E. Brightson, President

279 Broadway, *Dept. G.*, New York
Toronto: Ryrie Building

CAUTION! Beware of similarly constructed needles of inferior quality.

Don't Wear a Truss



BROOKS APPLIANCE, the modern scientific invention, the wonderful new discovery that relieves rupture will be sent on trial. No obnoxious springs or pads. Has automatic Air Cushions. Binds and draws the broken parts together as you would a broken limb. No salves. No lies. Durable, cheap. **Sent on trial to prove it.** Protected by U. S. patents. Catalogue and measure blanks mailed free. Send name and address today.

C. E. BROOKS, 203C. State Street, Marshall, Mich

LEARN LANGUAGES
AT THE
BERLITZ SCHOOL

28-30 WEST 34th STREET
Brooklyn, 218-230 Livingston Street

Washington, Boston, Philadelphia, Detroit, Chicago, Baltimore, Orange, Havana, Rio de Janeiro, Buenos Aires, Sao Paola, Cordoba, Paris, London, Madrid, Rome, etc., etc.

FRENCH, GERMAN, SPANISH, ITALIAN, &c., &c.

By the Berlitz Method students learn not only to read and write, but especially to understand and to speak the foreign language.
TRIAL LESSONS FREE

The "Finer Workings" of Static Electricity

By Frederick Von Lichtenow

(*Continued from page* 774)

maximum value. The charge thus gained is then applied to the pith ball hanging from its insulating support, which was made use of in the preceding experiment (pith ball to be first neutralized, of course), with the result that the light body will be strongly repelled by the El-cover. This shows, that the former is fully charged. (It will retain the charge for quite a while!)

A sheet of glass, about 1/16 thick, of a somewhat smaller size than the hard rubber plate, is then placed between the latter and the metal cover (Fig. 2) and the charging process gone thru as before. The spark discharges will in this case, naturally, be of a weaker nature, but the polarity of the sparks will in both cases be the same, that is +, which is manifest thru the repulsive action upon the charged pith ball.

Simple as the experiment itself is, its underlying principle is of a more complicated character. There seems to exist only one tangible explanation for the whole action, which, broadly speaking, touches upon the condenser principle in *a modified form.* It is well to observe, that the glass, not being a conductor, will not take a charge directly applied, but will hold such of opposite sign (+) to that of the charging body (—) on its face next to the same *as long as it is in contact with the latter,* while this induced charge, on the other hand, superinduces such of, again, opposite polarity (—) upon the upper surface of the glass sheet.

What finally becomes of both these induced Electro-static charges remains an open question, since the glass plate can not be tested for its respective former polarities after being removed from the charging body; and so this particular problem winds up in a case of *"Spurlos Versenkt"!* The fact remains, that, in the above connection, a negative charge is found upon the glass's upper side and is retained there (it is never repelled there as it would on a conductor!) gradually diminishing in value with that upon the hard rubber plate.

For the sake of the uninitiated or some "Doubting Thomas" and to emphasize the fallacy of another possible (on their part) version of the principle action, I may state here, that in the above case the original charge *does not penetrate,* unchanged in sign and simply lessened in power *thru the sheet of glass,* for this fact alone would be sufficient to eliminate the use of glass for a condenser—as well as insulating—purposes and, for that matter, would have done so long ago.

The diagram in Fig. 2A. shows the distribution of the electrostatic charges upon the various parts of the apparatus, while the latter are in electrical contact with one another.

EXPERIMENT NO. 3.

(Inductive Action Upon Neutral Body)

This experiment, although again simple in its conduction, "Teaches a lot", as it demonstrates the inductive action of an electro-static charge upon a *neutral* object, from start to finish, in a very clear manner.

In order to make such a clear demonstration possible, a neutral insulating body (sheet of glass or hard rubber) is needed in conjunction with the other necessary instruments; electrophorus, insulating stand, and suspended pith ball, with which alone the very fine inductive action can be worked out only to a certain, limited extent.

The addition of the *sheet of glass* is *essential, because it "slows down," as well*

(*Continued on page* 839)

DRAFTING



Learn at Home!

Employers everywhere are looking for skilled draftsmen. They are offering splendid salaries, and good positions are always open.

No line offers greater opportunity for advancement. Drafting itself not only commands good pay, but it is the first step toward success in Mechanical or Structural Engineering or Architecture.

There is an easy delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving men and women just the training they need for success in Drafting and more than 200 other subjects. Hundreds of thousands have stepped into good positions through I. C. S. help but never were opportunities so great as now.

Let the I. C. S. help *you.* Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least and it will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

TEAR OUT HERE

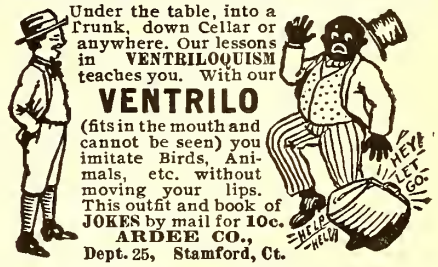
INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 6212, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

☐ MECHANICAL DRAFTING	☐ SALESMANSHIP
☐ STRUCTURAL DRAFTING	☐ ADVERTISING
☐ SHIP DRAFTING	☐ Show Card Writer
☐ ELECTRICAL DRAFTING	☐ Sign Painter
☐ ARCHITECTURAL DRAFTING	☐ ILLUSTRATING
☐ SHEET METAL DRAFTING	☐ Cartooning
☐ BOILERMAKER DRAFTING	☐ BUSINESS MANAGEMENT
☐ BRIDGE DRAFTING	☐ Private Secretary
☐ MACHINE DESIGN	☐ BOOKKEEPER
☐ ELECTRICAL ENGINEER	☐ Stenographer and Typist
☐ Electric Lighting and Railways	☐ Cert. Public Accountant
☐ Electric Wiring	☐ TRAFFIC MANAGER
☐ Telegraph Engineer	☐ Railway Accountant
☐ Telephone Work	☐ GOOD ENGLISH
☐ MECHANICAL ENGINEER	☐ Teacher
☐ Machine Shop Practice	☐ Common School Subjects
☐ Gas Engine Operating	☐ Mathematics
☐ CIVIL ENGINEER	☐ CIVIL SERVICE
☐ Surveying and Mapping	☐ Railway Mail Clerk
☐ STATIONARY ENGINEER	☐ AUTOMOBILE OPERAT'G
☐ Marine Engineer	☐ Auto Repairing
☐ ARCHITECT	☐ PLUMBING AND HEATING
☐ Contractor and Builder	☐ Textile Overseer or Supt.
☐ Concrete Builder	☐ Navigation ☐ Spanish
☐ Structural Engineer	☐ AGRICULTURE ☐ French
☐ CHEMIST	☐ Poultry Raising ☐ Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____

THROW YOUR VOICE

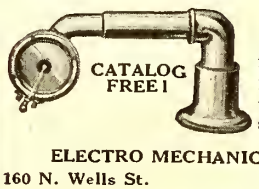


Under the table, into a trunk, down Cellar or anywhere. Our lessons in VENTRILOQUISM teaches you. With our

VENTRILO

(fits in the mouth and cannot be seen) you imitate Birds, Animals, etc. without moving your lips. This outfit and book of JOKES by mail for **10c.**

ARDEE CO.,
Dept. 25, Stamford, Ct.



BUILD A $100 PHONOGRAPH

Assemble your own Phonograph Do it yourself easily. Have the finest machine. Astounding saving. We give you the phonograph secrets. Complete instructions 10 cents.

ELECTRO MECHANICAL PARTS CO.
160 N. Wells St. CHICAGO

www.americanradiohistory.com

NAME .....

ADDRESS .....

STATE .....

ELECTRO IMPORTING COMPANY,
231 Fulton St., New York City.

I enclose herewith 6 cents in stamps or coin for which please send me your latest Cyclopedia Catalog No. 21 containing 176 pages, 263 illustrations and diagrams, including Treatise on Wireless Telegraphy, complete list of all U. S. Wireless Call Letters, and 20 coupons for your 160 page Free Wireless Course in 20 lessons.

FILL IN THIS COUPON FOR YOUR COPY OF

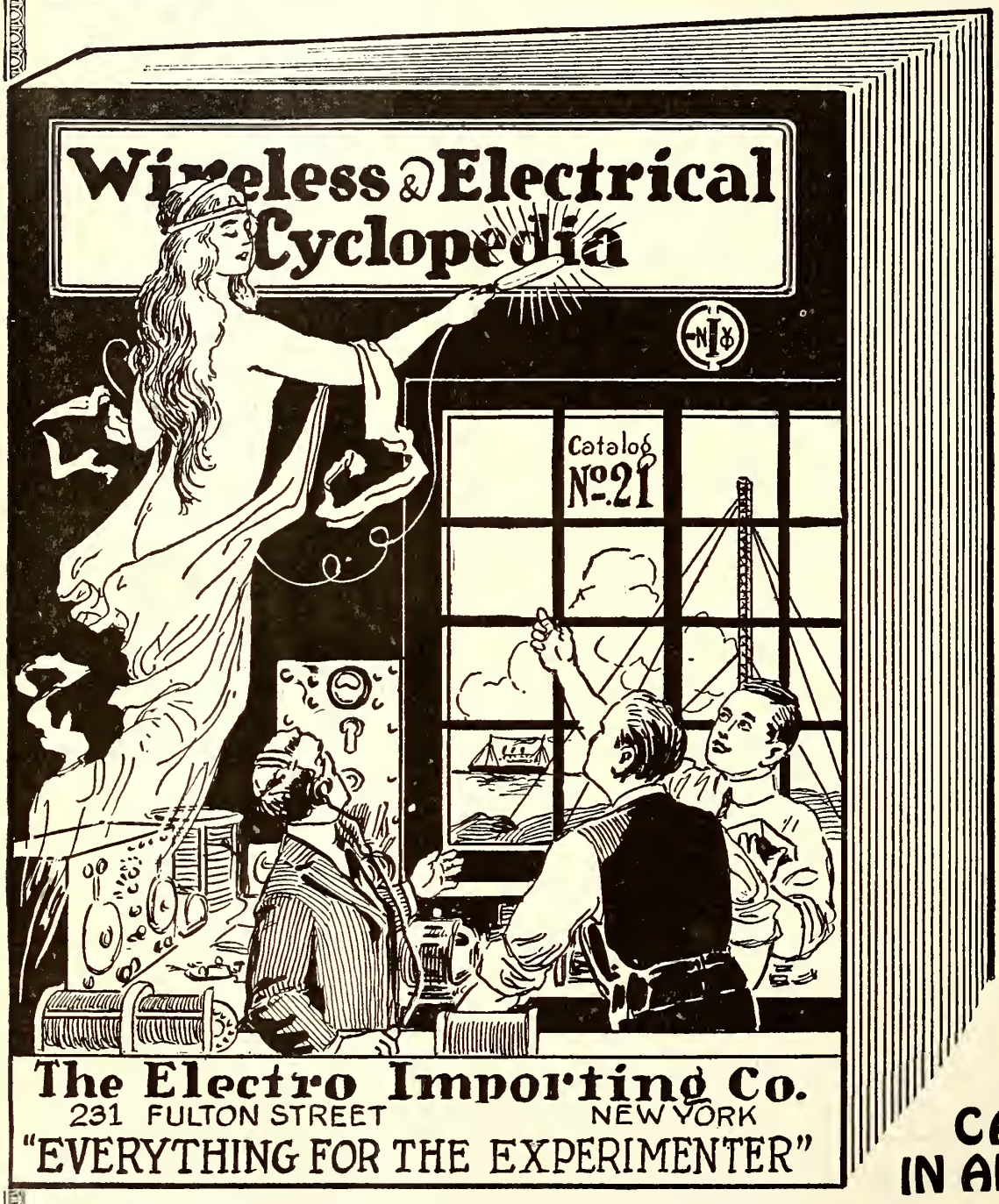
Our New 176 Page Cyclopedia No. 21

IT IS WAITING FOR YOU

Full size fac-simile of our catalog just as it looks when you get it

1-2 INCH THICK **WEIGHT ALMOST 1-2 POUND**

263 Illustrations



The Electro Importing Co.

231 FULTON STREET NEW YORK

"EVERYTHING FOR THE EXPERIMENTER"

A Few Interesting Things from Catalog No. 21

Treatise on Wireless Telegraphy by H. Gernsback, Editor **Electrical Experimnster** and **Radio Amateur News**—13 big pages, 3 illustrations.

The Wireless Law of 1912—all about it, what you can do and what you can't.

How to receive and send Radio messages.

How far you can send messages.

Table of wave lengths, of principal U. S. & foreign Radio high power stations.

How to receive time signals by Radio.

How to construct an amateur aerial.

How to use the test buzzer.

How to join the "Radio League of America" FREE, including application blank.

How telephone receivers are wound and built, tested and magnetized, 3 pages, 2 illustrations.

Experiments with a pony telephone receiver, with 6 illustrations.

Wireless Codes: Morse, Continental, Navy.

Experiments with spark coils, 3 pages.

How to photograph electrical discharges (sparks).

All about storage batteries, how to test them, recharging, etc.

Tesla experiments, 2 pages.

How to make Selenium Cells (illustrated).

FREE with this wonderful cyclopedia—20 coupons for our 160 page Wireless Course in 20 lessons. 350 illustrations, 30 tables. Catalog explains how you can get this Course absolutely free.

"THE LIVEST CATALOG IN AMERICA"

IN this cyclopedia you will find 116 pages all about radio. One of the greatest catalogs of its kind in print.

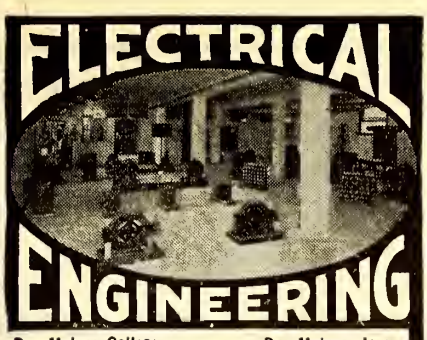
You will find in it dozens of wireless instruments of the famous E. I. Co. make. Remember always that this company was the FIRST to make and sell wireless instruments, the first wireless outfit having been placed upon the market by them in 1904. The E. I. Co. *knows how*, because it has the experience. Others imitate but cannot equal E. I. Co. for quality and workmanship.

Other things you will find listed in this catalog: Electrolytic Interrupters, Bulldog Spark Coils, Chemical Outfits, Omnigraphs, Code Practice Sets, Telegraph Instruments, Primary Batteries, Storage Batteries, Solenoids, Hydrometers, Volt and Ammeters, Batterymeters, Electrolytic Rectifiers, Rheostats, Tesla Coils, Nickel Plating Outfits, Lighting Plants, Dynamos and Motors, Microphones, Detectiphones, Loud Talkers, High Frequency Apparatus and supplies, Heating Pads, Electro-magnets, X-ray tubes, Telephones, Magnetos, Low Tension Transformers, Books, etc., etc.

IN A WORD THE MOST COMPLETE CATALOG IN PRINT

ELECTRO IMPORTING CO.
231 FULTON STREET NEW YORK, N. Y.
"Everything for the Experimenter"

www.americanradiohistory.com



Des Moines College Des Moines, Iowa
formerly
HIGHLAND PARK COLLEGE
The Great Practical School of the Middle West
Offers a remarkably complete course of Electrical Engineering in one year of 48 weeks, at low cost. A very fine laboratory unexcelled in the country for the performance of real tests and experiments. Several dates for entrance during school year. Other courses offered are the standard 4-year courses in **Civil, Mechanical, Electrical** and **Chemical Engineering.** One-year courses in **Surveying, Highway Engineering, Mechanical Engineering** and **Drafting,** and **Auto Electrical Expert Course.** Write for catalog, stating course in which you are interested. Address

Adolph Shane, E. E., Dean, Des Moines College
145 Highland Park, Des Moines, Iowa



INVARIABLY
Four-months-for-a-dollar subscribers renew their orders for
THE PHOTO PLAY WORLD
because they find this high class publication indispensable for their library every month.

If you are not a regular reader, a dollar will bring you the next four numbers, each bigger and better than ever. When your subscription has expired you'll want the Photo Play World regularly.

The yearly subscription is $3.50—35 cents on newsstands.

Sample copy on request.

THE DOWNS PUBLISHING COMPANY
Bulletin Building Philadelphia, Pa.

Star Storage Batteries
More Dependable
Lower in Price
The BEST Guarantee
Liberal discounts to dealers; write for particulars.
THE
STAR STORAGE BATTERY CO.
Manufacturers of
Automobile Starting and Lighting Batteries
Muncie, Ind. U. S. A.



GO INTO MOVING PICTURE BUSINESS
Small Capital Starts You
Our Catalog FREE. Show you how to earn $25.00 to $50.00 per day
on our easy payment plan. Begin now and get your share. We sell everything. Write today.
Atlas Moving Picture Co.
Dept. 50 538 S. Dearborn St., Chicago

Be FREE From STAMMERING
Home Exercise Course. Results GUARANTEED or NO PAY. Write for full particulars.
Sutherland Course, Educational Bldg., 70-5th Ave., N. Y.

The "Finer Workings" of Static Electricity

By Frederick Von Lichtenor

(*Continued from page* 837)

as exposes (as far as this possibly can be done) *"those workings" of, the action, which ordinarily take place, but do not manifest themselves,* all of which will be more fully understood later on.

Fig. 3 indicates the respective positions of the instruments to one another, which are to be placed in line, with the insulating sheet *very close* to the neutral body. This is important as the success of the experiment depends upon this factor more than on anything else. Care must, consequently, be taken in finding the *proper* distance between the sheet of glass and the pith ball, which, generally speaking, is about equal to the thickness of the glass itself, but which has really to be found by experimentation, since this is subject to the volume of the induced charge, the size of the pith ball, the temperature of the surrounding air, etc., etc.

With the apparatus arranged as above suggested, the charged El-cover is moved slowly in the direction of the pith ball, whereupon the latter, altho separated from the cover by several inches, will be "pushed" onto the insulating sheet and cling there. At this very juncture, that is, without bringing the charged cover any closer, all action on the part of the operator should cease for a while. Thus keeping the cover in its last position, the pith ball will soon loose its hold upon the surface of the glass and swing over toward the charged cover. As the gap between both is shortened or widened by the operator, so will the light object, naturally, be more strongly attracted or allowed to swing back onto the sheet of glass, as the case may be, but *it will not cling to the latter any more.* (Under no circumstances and at no stage of this experiment should the pith ball be permitted to make contact with the Electrophorus cover, for this would destroy the principle of the inductive action with one stroke!) On getting the light object once more "under control" by shortening this gap, the opportunity offers itself for the removal of the insulating body, which is then done. After this the charged cover is also removed. An investigation will show the existence of a small charge upon the pith ball, which the latter acquired during the process and which is evidenced thru its attractive properties when in contact with any neutral object.

Although quite a few things happen in this little experiment, the explanation for the whole action is very clear and as follows: The (+) charged El-cover, on being approached to the pith ball, induces a negative charge upon the part of the latter facing it, while a charge of opposite sign is repelled to the other side of the ball. This repelled positive element does *under ordinary conditions,* that is, without the addition of the insulating sheet, *not manifest its existence.* In the above case, however, it will find a complement of negative electrons on the sheet of glass, to which, in accordance with the *law of attraction of opposite polarities,* it will attach itself. This negative element, again, is the result of the disturbance of the "electrical balance" upon the insulating body, while under the influence of the repelled positive charge (if not even under that of the original [Electrophorus cover] charge); and to enable both these weak charges to reach one another, the sheet of glass must find its place close to the pith ball, which was clearly pointed out in the foregoing. Since a second object is absolutely imperative in order to bring out this, otherwise, "lost



LEARN
Armature Winding
Motor and Generator Repair and maintenance
In 6 Months
in the fully equipped shops and laboratories of the School of Engineering of Milwaukee.

Prepare quickly and efficiently to fill the constantly growing demands for *trained* men in this renumerative profession. You can

Earn While You Learn

if you like. Actual practice under wage-earning conditions will train you most successfully.

Send now for bulletin and full particulars *FREE!* Clip the coupon today.

School of Engineering of Milwaukee
134-373 Broadway Milwaukee, Wis.

—CLIP HERE—

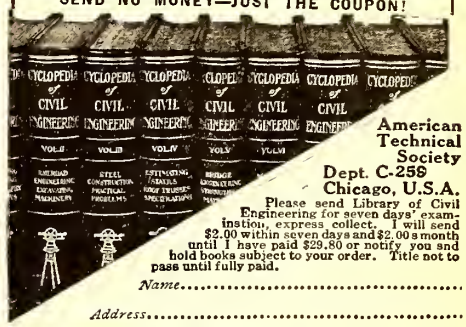
School of Engineering of Milwaukee,
134-373 Broadway, Milwaukee, Wis.
Gentlemen:
Please send me full information concerning your Armature Winding and Motor Generator Course.

Name .....
Address .....
Age .....Education.....

Learn in Spare Time to be a CIVIL ENGINEER



Earn $1500 to $5000 Yearly
Here's your big chance to become a full-fledged Civil Engineer! With this set of books you can fit yourself to make big money, in the greatest outdoor profession on earth! Offer fully explained in coupon. Good only within boundaries of the U. S. and Canada.
Great Books Shipped FREE
50c a Week if you keep them after 7 days' FREE TRIAL.
Nine big leather-bound volumes; 3900 pages, 7x10 inches; 3000 plates, maps, diagrams, etc. Written by world's greatest civil engineers. Books tell you ALL ABOUT surveying; highway construction; railway engineering; earth work; specifications; estimating contracts; bridge engineering; masonry; reinforced concrete; water supply; sewers and drains; water power equipment; irrigation engineering—etc., etc. Written in simple language—every point made plain.
Consulting Service Free
A $12 Consulting Membership solves your difficult problems for a whole year, FREE with the set of books.
SEND NO MONEY—JUST THE COUPON!



American Technical Society
Dept. C-258
Chicago, U.S.A.
Please send Library of Civil Engineering for seven days' examination, express collect. I will send $2.00 within seven days and $2.00 a month until I have paid $29.80 or notify you and hold books subject to your order. Title not to pass until fully paid.
Name.....
Address.....
Reference.....

35 Miles per hour
Is Record of this Car



Boys, Build This Car. This nifty little car driven by gasoline motor, can be built by any boy. Parts are furnished by us and are very cheap. Send 26c for building plans and price list of parts showing how to build this lad's car.

SYPHER MFG. CO.
156 Warren Street
TOLEDO, OHIO.

www.americanradiohistory.com



GLORIA SWANSON *Cecil B. DeMille Artcraft Player* WALLACE REID *Paramount Star*

Hermo "Hair-Lustr"

(Keeps the Hair Dressed)

FOR MEN AND WOMEN

The hair will stay dressed after Hermo "HAIR-LUSTR" has been applied. No more mussy, untidy looking hair. Adds a charming sheen and luster, insuring the life of the hair, as well as its beauty. Dress it in any of the prevailing styles, and it will stay that way. Gives the hair that soft, glossy, well groomed appearance so becoming to the stars of the stage and screen. Guaranteed harmless and greaseless.

Two Sizes—50c and $1

$1 size three times the quantity of 50c size. SEND FOR JAR TODAY. Remit in coin, money order, or U. S. stamps, and we will send Hermo "HAIR-LUSTR," and the Hermo Booklet, "Guide to Beauty," prepaid, under plain cover, at once. Use it five days and if not entirely satisfactory, return what is left, and we will REFUND YOUR MONEY IN FULL. Once you use Hermo "HAIR-LUSTR" you will never be without it. *SEND YOUR ORDER TODAY.*

HERMO CO., 1012 E. 63rd St., Dept. 12, CHICAGO

CARNOTITE

(Radium Mineral.) The American Pitchblende found in Colorado, from which *Radium* is extracted.

A generous piece, enough to conduct experiments, such as affecting photographic plates thru opaque material (similar to X-Ray pictures), first made by Sir W. Crookes and Mme. Curie, is furnished in neat, wooden box.

URANIUM ORE (*Radio-Active*)

Containing about 35% of pure Uranium; also Radium and Vanadium. One of the most rare and interesting minerals. Twenty milligrams are furnished in glass vial protected by lead cover.

One box of *Carnotite* and one vial of *Uranium Ore* as described above 50c sent prepaid.

FORMULAS

Luminous Paint—Silver Plating Powder—Liquid Court Plaster—Soap Bubble Liquid—Straw Hat Bleach—Collapsible Tube Tooth Paste—Resilvering Mirror Liquid—Polish for Tan Shoes—Dressing for Tan Shoes—Paint to make Oil Cloth.

These Ten Recipes in sealed envelope for 50c. Sent prepaid.

SIDNEY SPECIALTY CO.

233 Fulton Street New York City

REBUILT ELECTRIC MOTORS

General Electric
Westinghouse
Crocker-Wheeler
Emerson
Century
Wagner
etc.



All Motors Guaranteed For One Year

Motors bought, exchanged and repaired

ELECTRICAL SUPPLIES

Wholesale Prices

Sockets, wire, tape, loom, fuses, switches, cut outs, etc. New illustrated catalogue free. Satisfaction guaranteed or money refunded.

HYRE ELECTRIC CO.

631 S. Dearborn St. Chicago, Ill.

You can be quickly cured, if you

STAMMER

Send 10 cents coin or stamps for 70-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering for 20 years.

Benjamin N. Bogue, 761 Bogue Building, Indianapolis

action", which will now be fully understood, and since a conductor has, for obvious reasons, to be avoided, an insulating body, as the *"last* best thing", is consequently chosen.

The latter (sheet of glass in the above case) possesses qualities which tend to retard the process to a certain extent and which is clearly demonstrated, when the pith ball clings to the insulating sheet for a while. In doing so, the small amount of repelled positive charge becomes neutralized and *neutralization of a charged object in contact with an insulating body takes place very gradually,* which accounts for the "slowed down" action. The negative element induced upon the pith ball remains there, however, as at this stage of the experiment the electrophorus cover (+) is still held in its rigid position. Upon separating itself from the sheet of glass again, the ball will be evenly charged *negatively* and consequently strongly attracted by the (+) charged cover.

The minute charge found finally upon the pith ball, that is, after both sheet and cover have been removed, is acquired by the latter upon contact with the insulating body and is really not to be included in the inductive action of an electrostatic charge upon a neutral body, (altho similar conditions may prevail [for all we know] in space, where the "bigger workings" occur, and give reason for just such an action). It should, in the above case, rather be considered a "necessary evil", which finds its way into the experiment, with the operator not finding a way out of preventing it from getting in there. For with the elimination of the insulating body a successful "work-out" of the whole action is impossible, which is now quite clear; nor is it possible, while employing this very essential insulating factor, to prevent the pith ball from making contact with it, and yet observe the minute manifestation of the repelled element *by way of attraction only;* the close proximity of the two, necessitated by the very weak nature of the charge, stands against this.

If in this experiment the pith ball, after its separation from the sheet of glass, should again cling to the same, this shows that the repelled positive charge (on the ball) has *not* been completely *neutralized,* which, as pointed out in Experiment No. 1, finds its main reason in too low a potential of the Charge-source (El-cover) and, consequently, of the "counter-charges" induced upon the other instruments. The *proper* charge, neither excessively higher nor too low, for such purposes as the above, has to be found by actual experimentation.

The diagram in Fig. 3-A illustrates the experiment in its various, principal stages.

EXPERIMENT NO. 4.

(Imprisoning Charge Upon Neutral Body by Induction)

Many things, indeed, may be studied in this experiment, the main object of which is to prove the fact, that a neutral body may be put in a charged condition entirely thru the power of induction of an electrostatic element.

Depicted in Fig. No. 4 are the instruments, required for the experimental "work-out", which eliminates a further description of the same, beyond stating, that the two neutral bodies (pith balls) must hang side by side (touching one another) in the same plane and that they are suspended from *separate* silk-threads, so as to enable the operator to remove one of them, when the necessity arrives; the reason for this will be clear after a while.

The charged hard rubber plate is approached to the light objects in the manner that the plate faces only one of the balls, whereupon, at a certain distance, both of the latter (still keeping contact with one another) will be slightly attracted by the charged hard rubber sheet. Here the sheet should become "rigid," that is, not be moved any closer. After a short while the

Radio Diagrams and Formulae in Loose Leaf Form

The publishers of the CONSOLIDATED RADIO CALL BOOK have completed the preparation of diagrams and instructions on:—

Measurement of Capacity of a Condenser. (Substitution Method.) Calibration of a Variable Condenser. Two Diagrams and Curve.....No. 1
Measurement of Inductance of a Coil or Circuit. Two Methods—Two Diagrams.....No. 2
Measurement of Distributed Capacity of an Inductance. Diagram and Curve.....No. 3
Measurement of Fundamental Wavelength of an Antenna. Three Methods. Three Diagrams.....No. 4
Measurement of Wavelength of Distant Transmitting Station. Two Methods. Calibration of a Receiving Set. Two Diagrams....No. 5
Measurement of Effective Antenna Capacity. Two Methods. Two Diagrams.....No. 6
Measurement of Inductance of Antenna and a Third Method of Measuring Effective Capacity of Antenna. One Diagram.....No. 7
Measurement of Antenna Resistance. Substitution Method.....No. 8
Schematic Wiring Diagram of Regenerative Audion Receiving Set Suitable for Receiving High Power Undamped Wave Stations. Connections shown are those used in most Navy and Commercial Receivers.....No. 50
Table giving the value of LC (Product of Inductance and Capacity) for wavelengths from 300 to 20,000 meters. Inductance in Microhenrys.....No. 100
Table same as above but with Inductance in centimeters.....No. 101
Schematic Wiring Diagram of Signal Corps Type SCR-68 Radio Telephone Transmitting and Receiving Set.....No. 51
Schematic Wiring Diagram of Type CW-936 (Navy Submarine Chaser) Radio Telephone and Telegraph Transmitter and Receiver. No. 52
Schematic Diagram of Type S.E. 1100 (Navy Flying Boat) Radio Telephone and Telegraph Transmitter.....No. 53

These diagrams and instructions are the most CLEAR, CONCISE, COMPREHENSIVE and CONVENIENT form of instruction that has ever been presented. They are printed on pages size 8½ x 11.

Complete Set of 14 Sheets as described, sent postpaid 75c

CONSOLIDATED RADIO CALL BOOK CO., Inc.
41 Park Row, New York, N. Y.

5000 MILES

OF SERVICE AT ¼ THE PRICE

Guaranteed for 5000 Miles

STANDARD GUARANTEE



Strong Double Tread Tires are reconstructed by our skilled mechanics, made of double the amount of fabric than any ordinary tire. Free from punctures or blow-outs. Our customers receive from 4,000 to 10,000 miles of service. Reliner Free. Order today at these low prices:

Size	Price Tires	Tubes	Size	Price Tires	Tubes
30x3	$5.50	$1.60	34x4	$8.75	$2.60
30x3½	6.50	1.75	34x4½	10.00	3.00
31x3½	6.75	1.85	35x4½	11.00	3.15
32x3½	7.00	2.00	36x4½	11.50	3.40
31x4	8.00	2.25	35x5	12.50	3.50
32x4	8.25	2.40	36x5	12.75	3.65
33x4	8.50	2.50	37x5	12.75	3.75

Send $2.00 deposit for each tire ordered, balance C. O. D. Tires shipped subject to your examination. State whether S. S. or Cl, plain or non-skid is desired. All same price. By sending full amount of order you can save 5 per cent—our special cash-with-order discount.

STRONG TIRE AND RUBBER CO.
3019 Michigan Ave. Dept. 198 Chicago, Ill.
Reference Lincoln State Bank, Chicago

HANDY BINDER

for the Electrical Experimenter

Holds and preserves 12 issues, each of which can be inserted or removed at will, without tools. Will keep your magazines perfectly for all time or just preserve them like new till you bind them permanently. Made of heavy material, extra strongly reinforced at the back and covered with handsome green cloth, suitably lettered in gold. **65c**

Add postage for 2 lbs.

Experimenter Pub. Co., Inc. Book Department 233 Fulton St., N. Y.

www.americanradiohistory.com

Instructions on the ELECTRICAL SLIDE RULE



A set of concise lessons on the use of the Electrical Slide Rule has been prepared by Mr. Burgess in response to many requests from those who desire to take up the use of this instrument which is invaluable to many electrical men.

A High Grade Slide Rule in a leather case and the COMPLETE COURSE OF INSTRUCTION will be supplied at a VERY REASONABLE COMBINATION PRICE. We have selected the rule best adapted for the purpose and the lessons will enable you to thoroughly understand its use. Write for full information.

Burgess Electrical School
745 E. 42nd St., Chicago, Ill.

How to Get Rid of Moles



A simple, safe home treatment—15 years' success in my practice. Moles (also BIG growths) Dry Up.

Ask for Free Booklet of Full Particulars

WM. DAVIS, M. D.
4140 State Street Perth Amboy, N.J.

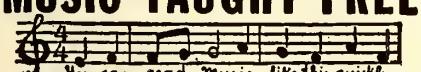
LEARN WATCH REPAIRING



You can learn by our modern and original system of instruction every part of the Watch Repairing Trade at home as good or better than at a shop. You can earn money while learning and secure a well paying position or start in business after completing our course of instruction. Good watch repairers are always in demand and earn from $20 to $35 per week. For particulars apply to the

Milwaukee School of Watchmaking 166 Mason St., Milwaukee, Wis

MUSIC TAUGHT FREE



You can read Music like this quickly.

In Your Home. Write today for our booklet. It tells how to learn to play Piano, Organ, Violin, Mandolin, Guitar, Banjo, etc. Beginners or advanced pupils.

American School of Music, 57 Lakeside Bldg., Chicago

Send for a Complete Catalog of

MASONIC BOOKS Jewelry and Goods

REDDING & CO.
Publishers and Manufacturers
Dept. 5 200 Fifth Avenue, N. Y.

The Seneca MOTOR CAR

Built for the Owner $1085.00



Simple, Sturdy construction. Low cost of up-keep and operation. Cantilever springs in rear. Comfortable E-Z riding

4 cyl. - 27 H. P. 108 in. wheel base

Dealers Wanted Immediate deliveries. Fifth successful year. Increased output. Liberal newspaper advertising in dealers' territory. Wonderful opportunities. Write or Wire NOW.

THE SENECA MOTORCAR CO., 52 Seneca Factory, FOSTORIA, OHIO



$3 a month AND $4 WILL BUY
A Beautifully Reconstructed
TYPEWRITER
With Every Modern Writing Convenience

WRITE TODAY FOR ILLUSTRATED CIRCULAR
Explaining Try-Before-You-Buy Plan

HARRY A. SMITH, 738-218 North Wells St., Chicago, Ill.



SAVE 25% to 60%
on slightly used
GRAFLEX-KODAKS

Cameras and Lenses of every description. Equal to new. Save money. Write now for **Free Bargain Book and Catalog** listing hundreds of money-saving bargains in slightly used and new cameras and supplies. All goods sold on 10 days' Free Trial. Money back if not satisfied. You take no chances dealing with us. We have been in the photographic business over 16 years. Write now.

CENTRAL CAMERA CO., Dept. 17C 124 S. Wabash, Chicago



Says the Master Mechanic. The Greb Automatic Grip Puller is a One-Man Puller—Quick-acting, strong and simple in the extreme. May be locked in any desired position. A combination of two or three arms. Heavy Duty Size capacity 1" to 18"—Junior size capacity 1" to 7". Two sets of jaws furnished with each size.

Ten Days' Trial If your dealer or jobber does not have them we will send you one. Try it ten days, if not satisfactory, return to us and we will refund your money. We also make the GREB RIM TYNDL.

THE GREB CO., 239 State Street, BOSTON

two bodies will separate; one will swing over toward the charge-source and attach itself to it, while the other (the one further away from the plate) evidences a *repulsive* action. The sheet of hard rubber (ebonite) and ball No. 1, are then removed together, by simply lifting the latter with the plate from its support (which is easily accomplished as long as the ball has not lost its "hold" upon the electrified sheet!) Great care must, however, be taken in doing so, not to bring these two objects any closer to the remaining ball; not to speak of permitting any contact between them. After this has been carefully done, the solitary ball will, upon test with a neutral body, be found to be in a charged condition, although in the above arrangement it never came in *direct* "touch" with the charge-source.

The explanation for the above will be found in the following: on approaching the two neutral bodies with the electrified hard rubber plate, its negative charge induces a (+) charge upon *the side* of the first ball, *which it faces,* repelling at the same time such of its own sign (—) to the other side of that ball. This repelled negative element, again, attracts the positive electrons found in the second pith ball to the part of the latter, which is in contact with ball No. 1, while a charge of opposite polarity (—) will be repelled toward its part farthest away from the charged plate. With the latter approaching gradually closer, both balls will be moderately attracted to the same (to be exact: the nearest ball is attracted, while the other one is simply pulled along!); and that they still keep together during this motion, is due to *neutralization* of their "inner charges", *which invariably manifests a "clinging action" while taking place.*

After the act of neutralization has been completed, both separate, whereupon the first ball, now left (+) charged, will be strongly attracted to the (—) electrified sheet and consequently attach itself to it, while ball No. 2, will be distinctly repelled on account of its now evenly negative polarity. At this stage of the experiment both, charge-source and ball No. 1, are removed, as was outlined before; and I may mention here, that the (in the above connection) slow process of neutralization of the (+) element induced upon that pith ball makes this "holding together"—removal possible. (This ball will finally, that is, after being neutralized, be negatively charged [higher potential of plate!] and repelled, which, however, has *no bearing in this experiment*).

The negative charge, which in the end is found imprisoned upon the remaining pith ball, is the direct result of neutralization of the induced "inner" charges between the *bodies,* with *their* immediately following *separation* and simultaneously *that* of *their "spell-bound" charges,* all happening under the influence of the inductive energy emanating from the charge-source; and, consequently, this negative charge is of a truly induced character.

Fig. 4-A, gives a clear demonstration of the principal actions which take place in this experiment.

Concerning the apparata themselves I may say, that they should be kept clean and in a dry condition, in which they always are, when in their *proper* place in a comfortably heated room. In case of excessive dampness of the atmosphere they may be placed upon a radiator for a short while, but must never be heated nor employed while in such a condition, because some of the apparatus (hard rubber sheet, for instance!) will doubtless suffer under such treatment and because thermo-(heat-) waves upon the apparatus will introduce erroneous manifestations into the experiments, which do not belong in there, thus counteracting the desired actions, if not nullifying them entirely.

(To be continued)



Voice Thrower 10c

Learn to throw your voice into a TRUNK, under the bed, out in the hall or anywhere. Lots of FUN fooling the Teacher, Janitor, Policeman, Parents, Neighbors, or Friends.

THE VENTRILO

is a little instrument that fits into the mouth out of sight. BOYS or GIRLS can use it in conjunction with the above for imitating birdsand animals. Never fails. A 32-page book on Ventriloquism sent with the Ventrilo for 10 cents.

NEW FORD JOKE BOOK 1920

All the latest jokes on the Ford auto. Hundreds of them, and all good ones. Spring a new one on your neighbors.

Large book with cover by mail, 10c





ROGEN X-RAY
Price 10 cents

HERE, BOYS, is just what you want. With this instrument you can apparently see the bones in your fingers. Think of the fun you can have with it. Sample by mail, TEN CENTS.



SKULL RING

Here is a handsome, up-to-date Ring, representing a Skull and Cross-bones. Has stones in the eyes and looks something frightful. Women won't like it, but for men or boys it is a great novelty. Sample, by mail, 15c.



Gee! What a Wad!
This is STAGE MONEY

Looks like the GENUINE STUFF. Some Green backs and some Yellow backs. Create a BIG sensation among your friends. The girls will all be after you when they see the wad. BIG roll of 15 pieces by mail, 10 cents.



ENCHANTED BARREL
The Most Wonderful Pocket Trick Made
CHANGE A CENT INTO A DIME

Ask your friend to drop a dime in the barrel. When he takes it out, Behold! It is a CENT. You make 9 cents every time you fool them. Never fails. They cannot get on to it. Sample barrel, with directions, only.... 10c



Hindoo Flower Pot Trick

You have all heard of the great Hindoo trick (making a plant grow out of a flower pot right in front of an audience). This trick has puzzled the whole world for years until an old Hindoo fakir gave it away. We send the whole outfit by mail with full instructions for 15 cents.

BIG VALUE for 10 Cts.



6 Songs, words and music; 25 Pictures Pretty Girls; 40 Ways to Make Money; 1 Magic Book; 1 Book Letter Writing; 1 Dream Book and Fortune Teller; 1 Cook Book; 1 Baseball Book, giving rules for games; 1 Toy Maker Book; Language of Flowers; 1 Morse Telegraph Alphabet; 12 Chemical Experiments; Magic Age Table; Great North Pole Game; 100 Conundrums; 5 Puzzles; 12 Games; 30 Verses for Autograph Albums. All the above by mail for 10c.

Trumpet in Handkerchief



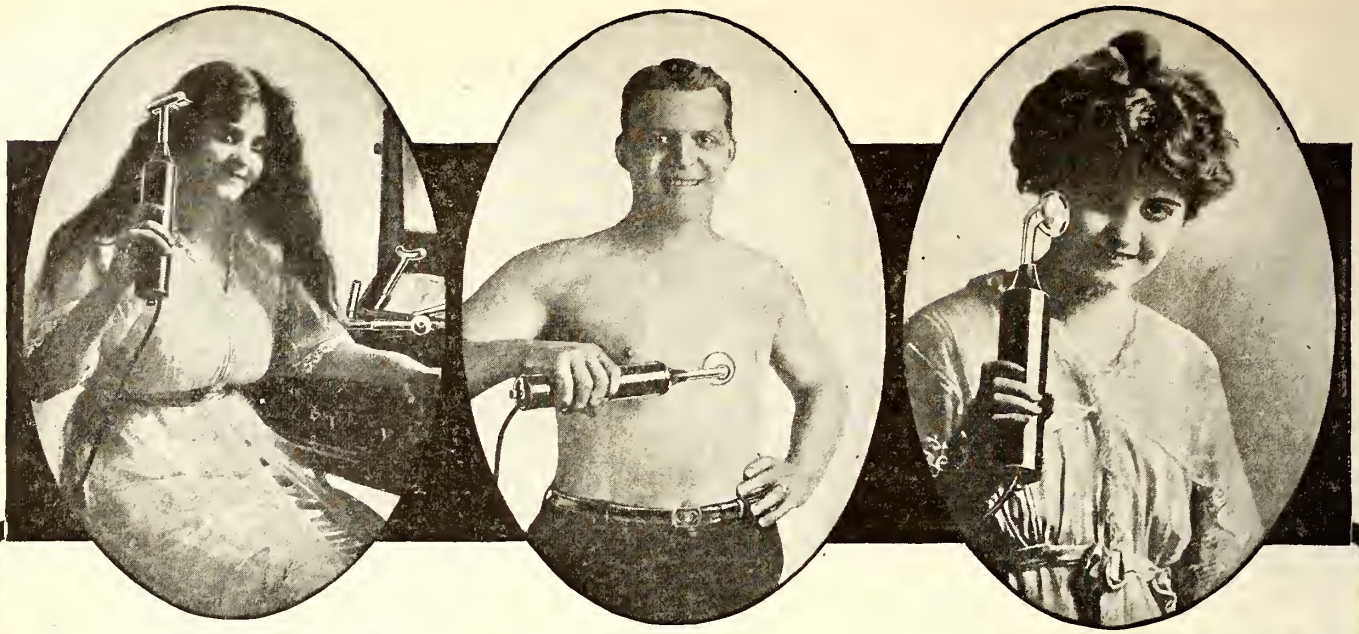
The Trumpet in the Handkerchief has come to torment us. It is a startler. A small metal trumpet is ingeniously concealed in a handkerchief. On meeting your friends, after chatting awhile, you take out this handkerchief and blow your nose. It's like a sudden clap of thunder! The ladies scream, and your male friends will think they heard the whistle of a steam engine. You can blame the hideous noise to your having a very bad cold, and keep the fun up as long as you like.

Price, 10c, 3 for 25 cents, by mail.

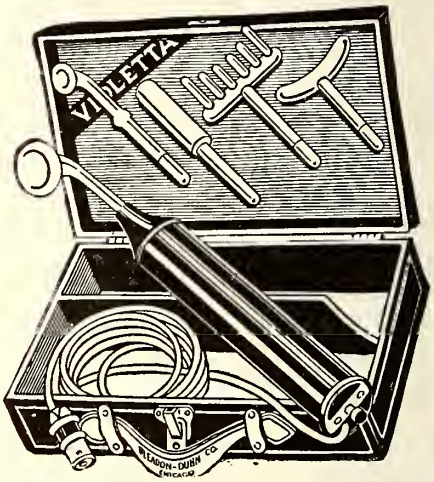
Any 3 for 30c Mailed with Catalog

ROYAL NOVELTY COMPANY
410 East Ave., South Norwalk, Conn.

www.americanradiohistory.com



Stop That Pain With Violet Rays



WHY suffer nervousness, headaches, rheumatism, skin diseases or any other ailment that keeps you from enjoying perfect health and a clear, beautiful complexion? The marvel of the age is the discovery of the curative value of electricity in treating the human system. Its mysterious, magical power has now been harnessed in its greatest curative form for human use—Violet Rays. A few minutes each day in your own home will not only relieve you of many annoying ailments, but will literally insure you an every-day vigorous, abounding health and beauty. Violet Rays penetrate every cell of the entire human system and bring almost instant relief. For blackheads, pimples, eczema, blotches and other blemishes to bodily beauty and complexion, Violet Rays produce amazing results.

Not a Vibrator

Don't confuse the VIOLETTA with Vibrating Machines. It is not a Vibrator. It does not contract the muscles or shock the nerves. Its magic rays pass completely through the body, producing "cellular massage," known to be far more beneficial than muscular massage. It leaves no soreness after use—only delightful, agreeable relief.



VIOLETTA
Violet Ray Machine

Try VIOLETTA For

Asthma	Eczema	Neuritis
Barbers' Itch	Eye Disease	Pains
Boils	Falling Hair	Paralysis
Blackheads	Hay Fever	Pimples
Catarrh	Headache	Rheumatism
Chilblains	Goitre	Skin Diseases
Colds	Insomnia	Sore Throat
Constipation	Lumbago	Sprains
Dandruff	Nervousness	Tonsilitis
Deafness	Neuralgia	Whooping Cough
Earache		

What Physicians and Users Say

Trixie Friganza, well known actress says: "Cheerfully will I add my praise for Violetta. It's the best "pain chaser" and "soother" I've had the good fortune to find. It's WONDERFUL. It cured my brother of neuritis. As for myself I use it for facial treatments and general massage. I cannot say too much for it."

Dr. Bert H. Rice, of Vinton, Iowa, says: "I have good results with the Violetta High Frequency Instrument in all cases of neuralgia. Almost instant relieve in Facial Neuralgia."

K. L. Allen, D. C., 205 Boone National Building, Boone, Iowa, says: "I have had very good results with the application of High Frequency Current in cases of Paralysis, Rheumatism and Neuritis, and think it a great help in drugless healing."

Dr. Daniels, Lisbon, North Dakota, says: "Have used the VIOLETTA in such cases as Goitre, Bronchitis, Pleurisy, Neuritis, Neuralgia, and Lumbago, and find it very beneficial. In fact, I would not be without it in my office."

Frank Borzone, Seattle, Wash., says: "I purchased the VIOLETTA for my wife who was suffering from an acute attack of Sciatica. From the very first treatment it induced peaceful rest and she is entirely well now."

These and many other ailments are relieved as if by magic. Violet Rays penetrate to every cell, tissue and nerve in the system. It soothes or stimulates, as desired. Remember, there is **NO shock or pain** in its use. Harmless and painless even to infants. Thousands of small babies have been successfully treated with it.

Get This Book—FREE!

We want to send you this wonderful book describing VIOLETTA in detail. Find out what it will do to help YOU. See how thousands of others have gained astounding results from its use. Read why it is the most compact Violet-Ray machine made. Attaches to any lighting socket. Special equipment where current is not available. Learn how you can have superb health and bewitching beauty.

BLEADON-DUN CO., Dept. 2-M, 326 W. Madison St., Chicago, Ill.

FREE BOOK COUPON

BLEADON-DUN COMPANY,
Dept. 2-M, 326 W. Madison St., Chicago

Please send me your free book describing VIOLETTA Violet Ray Machine.

NAME .....

ADDRESS .....

CITY..... STATE.....

You benefit by mentioning the "Electrical Experimenter" when writing to advertisers.

www.americanradiohistory.com

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section nine cents a word for each insertion. No advertisements for less than 75c accepted. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency.

Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the February issue must reach us not later than January 12.

The Circulation of the Experimenter is over 125,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 233 Fulton Street, New York, N. Y.

Aeronautics.

Learn Flying. Build your own aeroplane; we furnish Knock Down parts for successful motorcycle engined biplane, on installments. Plans free. Aeronautical supplies. Irwin Aircraft Co., 1220 Yale St., Sacramento, Cal.

100 Model Aeroplanes. Good flyers. 15c brings Working Drawing and prices. F. Bruland, Redford, Mich.

Auto Accessories.

Send for your copy of guaranteed, standard accessories and tires at money-saving prices. We guarantee to save you money. Send for the book today. David Stern Company. Value, Service, Satisfaction since 1885. 1027-K Madison St., Chicago, Ill.

Ford Fan Grease Guard. Prevents grease and oil splashing interior of hood, frame or motor; fits any Ford model; put on in a minute. Fifty cents postpaid or from your dealer or jobber. Agents wanted. American Valve Tool Mfg. Company, 354 West 50th St., New York.

Power increased, carbon eliminated; results guaranteed; write for booklet. No-Leak-O Piston Ring Co., Baltimore, Md.

Tires. Direct to You Prices. Exclusive representatives wanted each locality to use and sell Mellinger Extra Ply Tires. Guarantee Bond 8,000 Miles. Sample Sections furnished. Mellinger Tire Company, 980 Oak, Kansas City, Mo.

Auto Motors and supplies. Buick, Hupp, Franklin, Michigan, Everett, Hudson, Chalmers. Both water and air-cooled motors $40.00 each and up. Bosch Magnetos $15.00 each and up. Presto Tanks $5.00. Coils, Carburetors, Head Lamps, Horns, Air Compressors, Generators, Starters. Write for bargain bulletin second hand Auto accessories. Johnston, West End, Pittsburgh, Pa.

Ford Radiators; from factory to you; $17.25; guaranteed. American Auto Radiator Wks., 500 Rush St., Chicago, Ill.

Fords Start Easy In Cold Weather. Will run 34 miles per gallon on cheapest gasoline or half kerosene using our 1920 carburetors. Increased power; styles for all motors; can attach them yourself. Big profits to agents; money back guarantee; 30 days' trial. Air Friction Carburetor Company, 270 Madison St., Dayton, Ohio.

Ra-dine will stop that radiator leak. Makes good where others fail. To introduce our goods, three 50c cans for $1.00. Money back if not satisfied. Ra-dine Co., Grand Ledge, Mich.

Battery Charging Pays Big Profits. City current or gas engine operates. Easy terms. Hobart Brothers, Troy, Ohio.

Ford Owners.

Send for your copy of guaranteed, standard accessories and tires at money saving prices. We guarantee to save you money. Send for the book today. David Stern Company, Value, Service, Satisfaction Since 1885. 1027K Madison, St., Chicago, Ill.

Binoculars.

The Greatest Line of Hard-to-Get B-I-N-O-C-U-L-A-R-S in the country at amazing low prices. Nu-Sight Binocular, $13.50; World-Famous LeMaire, $9.50; the Victor Vinocular, $45.00 (made by Bausch & Lomb): Turner-Reich Binocular, $31.50; U. S. Navy Binocular, $37.50; High-Power Telescope, $14.75; Goerz Trieder Binocular, $37:50; Petit Binocular (made in France), $15.00; genuine Carl Zeiss Binocular, $75.00; 18X Busch Trelux, the finest binocular in existence, $150.00; Lumina High Power, $37.50; 8 Power Loma, $25.00; 7 Power Loma Binocular, $25.00. Send for your copy of our new catalog. Hundreds of similar values of standard merchandise. David Stern Company, "Value, Service, Satisfaction Since 1885." 1102 Davsco Bldg., Chicago, Ill.

Telegraphy.

Telegraphy (both Morse and wireless) and Railway Accounting taught thoroughly and quickly. Big salaries now paid. Great opportunities. Oldest and Largest School—est. 45 years. Catalogue free. Dodges Institute, 7th St., Valparaiso, Ind.

Scenery For Hire.

Collapsible Scenery for all plays. Decorations. Amelia Grain, Philadelphia.

Agents Wanted.

Mexican Diamonds flash like Genuine; fool experts; stand tests; yet sell for 1/50 the price. Few live agents wanted to sell from handsome sample case; Big profits, pleasant work. Write today. Mexican Diamond Imptg. Co., Box F1, Las Cruces, New Mexico.

Agents. Here is $50.00 to $200.00 weekly proposition. Permanent and repeat. Every office and home needs Argus Moistener for moistening stamps and envelopes. Argus paper clips and pencil and fountain penholders sell to every man you know; they are different and better than any on the market. Write for particulars. Argus Mfg. Co., 406 No. Paulina St., Dept. 19A, Chicago, Ill.

Kerosene Gas Burners in Cook Stoves stop use of wood or coal. Patented. Get exclusive territory. The Vapor Gas Burner Co., Desk 2, Columbus, Ohio.

Every Woman Wants Silvoplate. Magic Cleaner that never fails. Sure, easy sales plan; main or sideline; quick profits; prepaid deliveries. Sample, 10c; dozen, $1.60. L. B. Sutton, Manufacturer, D-5, New Canaan, Conn.

Beginners. Complete "Mail Order System," C, Box 1005, Atlantic City, N. J.

Agents. Big returns, fast office seller; particulars and samples free. One Dip Pen Co., 12 Daily Record Bldg., Baltimore, Md.

Insyde Tyres, inner armor for Automobile tires double mileage and prevent punctures and blowouts. Quickly applied. Cost little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 54, Cincinnati, Ohio.

Agents. $6 to $12 a day easy. 250 lightweight, fast selling, popular priced necessities, good flavors, perfumes, soaps, toilet preparations, etc. Agents' outfit free. Write today—quick—now. American Products Co., 1501 American Bldg., Cincinnati, Ohio.

Agents. If you are looking for something that will sell at every Demonstration, that cost you 8c and sells for 50c, then send us 50c for sample and instructions. Your 50c back on first order. C. M. Allen, Grinnell, Iowa.

Walk Agents. Men with spare time and specialty venders make $5.00 per day upward canvassing office buildings, banks and business offices selling the famous Calumet Piece-Pipe (three pieces), genuine French Briar. Put up in attractive individual package. Its sensible construction makes cleaning easy and appeals to everybody. Send for proposition. 10,000 Bankers Have Bought and Recommend It. The Calumet Co., Dept. Q, Mail Sales Division, Cincinnati, Ohio.

Signs for store and office windows. $50 week easily made. Chicago Sign System, G-326, River St., Chicago, Ill.

New Windshield Cloth solves baffling problem. One wipe cleans rain-blurred windshield. Stays clear 24 hours. Motorists amazed. Agents getting rich. 300% profit. Exclusive territory. Cabco Co., Toledo, Ohio.

Wonderful Chance. Men's Shirts and Furnishings at wholesale rates or make $10 daily as agent starting real business. Goodell Co., 103 Duratex Bldg., New York.

Agents. Make 50,000 Presto-Mystic Windshield Cloths at cost of few cents each. Sell for 50c to $1.00 each. Agents coining money. Season now on. Full instructions 50 cents. Chas. Mack, 626 20th St., Oakland, Cal.

Agents. Sell latest Joke Novelties. Stamp brings Wholesale Catalogue. Mears, 66, Anderson, Ind.

$10 Daily refinishing chandeliers, brass beds, automobiles by new method, without capital or experience. Free particulars and proofs. Write today. Gunmetal Co., Avenue D, Decatur, Ill.

Moving Pictures Plays.

Earn $1,200 a Year in Spare Time writing photoplays. Experience unnecessary. Send for free book valuable information, special prize offer. Photo Playwright College, Box 278 E-8, Chicago.

Mailing Lists.

1,000 names, addresses, live buyers, $1.50 Fowles' Sales Service, 416 Wilson Ave., Vallejo, Calif.

Short Stories, Manuscripts, Wanted.

Short Stories, Poems, Plays, etc., are wanted for publication. Literary Bureau, 165, Hannibal, Mo.

Business Opportunities.

Dollars Yearly in Your Back Yard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. Metz, 313 East 89, New York.

Make big money opening safes and setting combinations. Wayne Strong, Box 1430, Los Angeles, Cal.

Make More Money. Great monthly magazine of plans, schemes and ideas for advertisers, mail order men, agents and beginners; valuable service free to subscribers. Special two months' trial subscription, 10c. Special Service, 403 Shannon Bldg., Pittsburgh, Pa.

Money Making Farms, 19 States. $10 to $100 acre. Stock, tools, crops often included to settle quickly. Write for big illustrated catalogue. E. A. Strout Farms Agency, 150 EC Nassau St., New York.

$30 a Week Earnings. I made it with a small mail order business. Continued my regular job daytime. Free booklet tells how. 2c. postage. Al. Exp. Scott, Cohoes, N. Y.

Enter a new business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks, at small expense; no further capital required; no goods to buy; job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston, Mass.

An Entirely New Proposition is offered for the establishment of yourself in a pleasant and profitable business. The increased demand for our famous Detectagraph Deaf-Phone, Detective and Electrical instruments has caused us to lay extensive plans for the marketing of our products, a group of articles of universal appeal. Under our plan, sales can be made locally, through mail order business, agents and dealers. Nets a handsome profit. No experience necessary. Write at once for particulars which will interest you. Detectagraph, 26 Cortlandt St., New York.

Substantial manufacturing corporation wants capable men to establish branch and manage salesmen; $300 to $1,500 necessary. You handle own money. Will allow expenses to Baltimore if you will qualify. For particulars, address Secretary, 416 N. Howard St., Baltimore, Md.

Stop Daily Grind. Start business silvering mirrors, plating tableware. Plans free. Clarence Sprinkle, Dept. 48, Marion, Ind.

Amazing Profits manufacturing "Puffed Crisp." Delicious confection. Begin at home. Machine, instructions complete, $6.50. Samples, 10c. "Besco," 3253-EZ, Belleplaine Ave., Chicago.

Breed Canaries. Profitable pastime. Particulars free. Bird Farm, Lynnhaven, Virginia.

Read This. Want partner to pay patent fee on railway invention. Very valuable. Half interest. Write Elmer Erickson, 206 12th Ave., West, Ashland, Wis.

$5.25 One Evening's Home Work. Instructions 10c. John C. Hahn, Cullom, Ill.

Factory cost system—complete outline with original commercial size forms for $2.00. Industrial Systems, Burrough Hall, Brooklyn, N. Y.

Money-Talks Magazine. Published for progressive men. Send for sample copy. 70-B Park, Place, Newark, N. J.

For Sale. California farms; easy terms. Write for list. E. R. Waite, Shawnee, Oklahoma.

"Quick-Action Advertising. How it is building Business for the Progressive Advertisers of America." A little story of results, told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates—today. Douglas Wakefield Coutlee, 225 W. 39th St., New York.

Salesmen Wanted.

Salesman—Side or main line, to sell low priced 5,000-mile guaranteed tires. 30 x 3½ non-skid sells for $11.95; other sizes in proportion. Good money-making proposition for live wires. Write, Consolidated Tire Co., 616 So. Michigan, Chicago.

(Continued on page 844)

www.americanradiohistory.com

(Continued from page 843)

Help Wanted.

Several Thousand Men-Boys, 18 or over, wanted by U. S. Government as Railway Mail Clerks. Permanent life positions through poor times and good. Average pay, $1,400 year. Advance rapid. Pleasant work, constantly traveling. Every second week off at full pay. Paid vacation. Common education sufficient. Write immediately for full list positions open and Fall examination schedules. Franklin Institute, Dept. M 26, Rochester, N. Y.

Detectives Earn Big Money. Excellent opportunity. Particulars free. American Detective System, 1968 Broadway, New York.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 5665 St. Louis, Mo.

Secret Service Operatives and Detectives are in demand. Earn big money. Travel everywhere. Fascinating work. Learn this profession by home study. Particulars free. American School of Criminology, Dept. E., Detroit, Michigan.

American Made Toys Wanted. An opportunity for home-workers on small scale and manufacturers on large scale. Unlimited quantities needed of toy soldiers, army, navy, marines, cannons, machine guns, warships and other toys and novelties. Greatest chance for industrious people for independent business. Enormous demand and future in American made toys, all over United States, Canada, Mexico and South America, with over 50,000 10 cent stores and toy dealers. This new American industry stands out conspicuously. Factories are established, people trained, machineries made. Christmas sets needed in millions this year. The great hit for 1919 without any competition. We are buyers of these goods all year paying fixed prices. Attractive prices offered for painted goods. Experience or tools unnecessary. Hundreds and more made complete per hour. Casting form outfits from $3.00 up. If you mean business, send for booklet and information free. Toy Soldier Manufacturing Co., 32 Union Square, New York.

Are You Ambitious for better pay, shorter hours, easier work, etc.? Perhaps you can get just what you want in the Government Service which needs immediately thousands of men and women over 18 for all kinds of work. You really ought to investigate. Just send name, address and the number RN 2081 for free information and advice. Earl Hopkins, Washington, D. C.

Auto Experts Wanted. $35 week. Learn while earning. Write immediately. Franklin Institute, Dept. M 806, Rochester, N. Y.

Artists in Great Demand. Big salaries paid for full or part time. Learn quickly at home in spare time. Commercial Art Cartooning, Illustrating, Designing. Outfit free to new students. Send for handsome free book. Write now. Washington School of Art, Inc., 1449 H St. N. W., Washington, D. C.

Health.

Cigarette, pipe or chewing habit conquered. Nature's method. Guaranteed. Write for free brochure. Edw. J. Woods, TA-300, Station F., New York.

Tobacco or Snuff Habit Cured or no pay; $1 if cured. Remedy sent on trial. Superba Co., SA, Baltimore, Md.

Pyorrhea (Rigg's Disease—Bleeding or Swollen Gums). H. E. Kelty, D. D. S., M. D., pyorrhea specialist for 15 years, has developed a successful home treatment for pyorrhea, purifying, healing, preventative. Full month's treatment, $1 postpaid. Or write for free booklet. Pyorem Mfg. Co., 439 Seventh St., Brooklyn, N. Y.

Free—Stop using tobacco. We will give free information how to conquer habit easily and permanently. Results guaranteed. Anti-Tobacco League, Dept. C., Omaha, Nebr.

Instruction.

Your Opportunity — Used correspondence courses, all kinds, sold. Dollars saved. Write now. (Courses bought.) MacMichael Educational Bureau, Dept. 71, Victon, N. Y.

Cartooning Comics and Lettering in fourteen easy lessons. Only $3 postpaid. Over 300 illustrations. Order yours now. Ernie's School, Elyria, Ohio.

Learn Chemistry. It pays. Trial lesson 35c. Elbridge F. Ball, Box D147, Buckland, Conn.

Questions Answered. All subjects. Send for Circular 7. Answerall Information Bureau, 51 Cliff St., New York.

Learn Dancing; become popular. All dances taught by mail; easy; no music. Thousands taught successfully. Write for special offer. W. C. Peck (Graduate Castle House), Room 227, 821 Crescent Place, Chicago.

Become a Moving Picture Operator in your spare time. Elementary text book with questions and answers covering the entire course. Price, $2.00. Theatre Equipment Co., 124 West 45th St., New York.

"L. A.," $1. Dissatisfied—money back. Longhand abbreviated. Time-saving, educational. Vrooman, Box 796, Reno, Nevada.

Crystal Gazing—The craze. Send self-addressed stamped envelope for free instructions. Zancig's Studio, Asbury Park, N. J.

Exchange.

Microscope. Here is a bargain, Queen & Co., complete, $38.00. Must sell. E. Streiff, 332 Cumberland Pl., Toledo, Ohio.

For Sale or Exchange. 75 chemicals and apparatus, $12. Max Schaarschmidt, 3322 I St., Philadelphia, Pa.

For Sale. Complete set Hawkins Electrical Guides. Second edition. Good as new. $8.00. Arthur Still, Perris, Cal.

Exchange one K. W. Thordarson wireless transformer for Multi-Audi-Fone complete. All letters answered. C. Renfroe, 203 Valey St., Valdorta, Ga.

For Sale, ¼ H. P. A. C. motor, $30.00. Practically new. Motor and wood lathe, $35.00 Ralph Russell, Fitzgerald, Ga.

Will Sell. Edison motion picture machine and 220 D. C. ⅛ H. P. motor, $85.00; without motor, $70.00. Used one year; in good, mechanical condition. L. Priest, St. James, Minn.

For Sale. Dynamo and Hawkins Guides. A. J. Persall, 662 S. 18th St., Newark, N. J.

For Sale. A number of Weston millivolt meters complete with 150 A. shunt, $5.00. Turney 35-plate V. C., $2.50. Cecil Ostermeier, 227 W. Jackson St., Springfield, Ill.

Two Bargains. Baldwin Phones, $12.00; Telegraph transmitter, commercial type, fine motor, solid mahogany woodwork, $15.00. B. W. Allen, Box 1504, Providence, R. I.

Exchange. Electro 6-60 storage (new); Chambers coupler; half-inch spark coil; for stamp collections, or will sell. Describe fully. F. Atlee, 2038 Pine, Philadelphia.

Trade Generator, telephone. Klaxon horn for wireless, electrical, write for list. William Binfield, Kenmare, N. D.

Electric Laboratory Apparatus Wanted. Write particulars. 233 72d St., Brooklyn, N. Y. Phone Bay Ridge 9721.

For Sale. Two Stage Audio-frequency Amplifier, vacuum tube control panel, Tesla coil, O-150 voltmeter, 0-25 ammeter, 0-25 volt wire ammeter. George Price, 535 E. 71st St., New York City.

For Sale. Electro rectifier. Brownie camera No. 2. Developing set, Chemcraft No. 3, $11.00. Alec Clerihew, 203 Hoboken Ave., Jersey City, N. J.

Wireless Material Cheap. Big list, 6c. Clarence Evans, Nutley, N. J.

For Sale. ½ K. W. Clapp Eastham Hytone set complete with key and ammeter. Only used two weeks. Bargain at $125. Letters answered. William Florence, Jr., Reading, Mass.

For Sale. Ten-inch X-Ray induction coil, suitable also for wireless A. C. or D. C., cost $350.00. Price $100.00 for immediate sale. Lincoln B. Frazier, Jr., 120 S. Highland Ave., Aurora, Ill.

For Sale. Send stamp for list of electrical and other goods. Gus. Geier, 4314 Boulevard, West Hoboken, N. J.

Sale. Thousand-mile receiving set—banjo ukulele. E. Kieser, Haverstraw, N. Y.

For Sale. Radio and electrical instruments cheap. Electrician, 343 E. 135th St., N. Y.

For Sale. Brand new E. I. Voltmeter, $2.00; jeweler's lathe foot pedal wheel, $2.00. George Koresh, 419 50th Ave., West Allis, Wis.

Buy, Sell, Exchange. Wireless and electrical goods. Murdock, Clapp-Eastham, Thordarson, Brandes, etc. Send 10c. stamps for our circulars listing new standard apparatus at less than manufacturers' prices. We have to exchange: Wireless, electrical, optical, cameras, printing presses, typewriters. Large list free. LaRoy Zehrbach, 10 College Ave., Hiram, Ohio.

Electrical Blueprints of various kinds. See my ad under "Electrical" this issue. Charles L. Chittenden.

Stammering.

St-Stu-t-t-tering and Stammering cured at home. Instructive booklet free. Walter McDonnell, 105 Potomac Bank Bldg., Washington, D. C.

Tricks, Puzzles and Games

Boys! Wonderful Magic Card Trick, jumps right out of the pack, 12c. R. A. Mitchell, 91 Davenport Ave., New Haven, Conn.

250 Magic Tricks and Catalog, 10c.. Clarence A. Maugans, Anderson, Ind.

Magic. Entertain at home. Tricks, puzzles, novelties. Big Catalogue A, 25c. Martinka & Co., Inc., Harry Houdini, President, 493 Sixth Avenue, New York City.

Magic—Card Tricks. Sensational escapes, jokes, novelties. Everything in the amusement line. Large illustrated catalogue of a thousand tricks free. Write today. Largest amusement goods manufacturers in the world. Heaney Magic Co., Desk 208, Berlin, Wis.

Illusions—Stage tricks with 500 illustrations. Catalogue, 15c. Small catalogue free. Hornmann Magic Company, 304 W. 34th St., New York.

Magicians, Save Money! Lowest prices. Catalogues free. Collins Pentz, Minneapolis.

Cameras, Supplies—Photo Developing.

Mail us 15c. with any size film for development and six velvet prints. Or send six negatives any size and 15c. for six prints. Or send 25c. for one 8 x 10 mounted enlargement. Prompt, perfect service. Roanoke Photo Finishing Co., 255 Bell Ave., Roanoke, Va.

Developing Free when printing is ordered. 120-6 ex. roll, 25c. pack, 55c.; 116-6 ex. roll, 30c.; pack, 65c.; post card sizes, 35c.; pack, 70c. Frane, Eureka, Ill.

Send for our Catalog No. 121. It's the biggest little thing in the photographic world. Look over its pages and see the wonderful values we give and the money you will save by buying of us. Your money back if you are not satisfied for any reason what-so-ever. Every camera owner should have a copy of this catalog. Send for yours today. Its free. A post card will bring it to you. David Stern Company. Value, Service, Satisfaction Since 1885. 1027-K Madison St., Chicago, Ill.

For 15c. we will develop and furnish prints from one, six or eight exposure film or enlargement 8 x 10, your favorite negative, 20c. to show quality and service. Associated Photo Company, Sta. A 12, Cincinnati, Ohio.

Cameras. Lowest prices. Supplies and printing at reduced rates. Eliminate the middleman. Deal direct with us. Catalog free. Pearl Photo Place. 640 E. Clementine St., Philadelphia, Pa.

Clean, Neat, Perfect Kodak Finishing at the lowest prices. Work returned the same day received. Send film for sample print and copy of catalogue on developing, printing, enlarging and hand coloring, also copy of Photo Craft Magazine, which will help you make better pictures. Photo Craft Co., Box 69, Ann Arbor, Mich.

Why Not Settle That Christmas present question now. Give a camera. Write for free catalog. Pearl Photo Place, 640 E. Clementine St., Philadelphia, Pa.

Chemicals.

Free information. Write Systems Company, Burrough Hall Building, Brooklyn, New York.

One Hundred chemical expcriments printed in book form, 25c. Oliver R. Stalter, Oshawa, Ontario, Canada.

Experimenters, are you interested in novel, chemical experiments? Send 10c. for large collection. Merel Sager, 44 Apple St., Tiffin, Ohio.

Antimony Metal, powdered or lump, 25c. per once, postpaid. Robert Sagebiel, 25 W. Second St., Dayton, Ohio.

Rare Minerals, salts and chemicals. Laboratory outfits. Radio Chemical Supply Co., 915 Westcott St., Syracuse, N. Y.

Chemicals. 25 for $1.75. 1 oz. each. Robert Edwards, 70 Jewell St., Brooklyn, N. Y.

Chemicals. Dime Packets. Gleasman, Morris St., Utica, N. Y.

For the Photographer.

Do you take pictures? Write for free sample of our big magazine, showing how to make better pictures and earn money. American Photography, 465 Pope Building, Boston, Mass.

For Men.

Detectives Earn Big Money. Travel. Great demand. Experience unnecessary. We train you. Write for free particulars. American Detective System, 1968 Broadway, N. Y.

Get Vital Strength. Retain youthful vigor. Wonderful results. Intensely interesting booklet free. Winslow H. Chase, Washington, D. C.

Shaving Powder—Enough for five razorless shaves, 25c. Durso, Dept. 41, 25 Mulberry, New York City.

Dredge's Necktie Valet removes wrinkles (without ironing) from neckties. Sample 25c. Get one today. Dredge, 190 Pilgrim Avenue, Highland Park, Michigan.

Send us your dull razor blades. We re-edge them good as new, any kind, 2½c each. Prompt service and satisfaction guaranteed. Dealers wanted. Keenedge Company, Inc., 184 Washington St., Chicago, Ill.

For Advertisers.

Advertise—24 words in 100 syndicate magazines, $1; inch display, $4. Lists free. Stanford Agency, 403 Shannon Bldg., Pittsburgh, Pa.

Money? Jacobus Art Ads. make small space pay big dividends. Price $5.00. Write today. Jacobus Service, 1073 Sanford Ave., Irvington, New Jersey.

"Quick-Action Advertising—How it is Building Business for the Progressive Advertisers of America:" A little story of results, told by the advertisers themselves—not the publisher. You will be interested in reading this little booklet which we have prepared for prospective advertisers, a copy of which will be gladly mailed to you upon request. It tells you how to talk business with 1,000,000 intelligent, interested and responsive Americans every month—men who know what they want and who have the money to buy it. Write for particulars and rates—today. Douglas Wakefield Coutlee, 225 West 39th St., New York.

www.americanradiohistory.com

Books.

Buy Books for Christmas. Latest popular fiction at unheard of low price. Send for our complete list. You'll save money. David Stern Company. Value, Service, Satisfaction Since 1885. 1027-K Madison St., Chicago, Ill.

World-Romic System. Masterkey to all languages. Six textbooks, $1.44; French chart, 37c.; Spanish, 37c.; aviation dictionary, $1.50; French-English aviation dictionary, 61c. Languages, 143 W. 47th St., New York.

Dear Reader. If Occult, New-Thought and Scientific books appeal to you, send for my catalog, it's free. I have books on Personal Magnetism, Concentration, Spiritualism, Clairvoyance, Seership, Will, Mind, Hypnotism, Mesmerism, Character, Reading, Healing, Mysticism, Success, Salesmanship, Mechanics, Entertainments, etc. A. W. Martens, J-49, Burlington, Iowa.

Spiritism. Is it a delusion? Get the truth on this subject. Why has it overspread England? 125 page book of facts. 10c. R. C. Polston, Bookman, Omaha, Ill.

To Get Better Pictures. Read the Amateur Photographer's Weekly; illustrated; weekly prize competitions; print criticisms; many unique features; $1.50 per year; three months' trial subscription. 25c. Abel Publishing Company, 401 Caxton Bldg., Cleveland, Ohio.

Important Minerals. Book describing them and giving tests. Be prepared to know when you find them. 50 cents or two thrift stamps. Baker Dist. Co., Box 928, Atlanta, Ga.

Concordia contains essays, formulas, plans. Year's subscription, 50 cents; trial, 20 cents. Concordia Magazine, 9 Water, York, Pennsylvania.

Nature Laws every married and engaged person should know, 50c. Earn extra money. Learn how to conduct home mail order business, instructions, 50c. Central Company, 601 Ninth Ave., New York.

Accounting, cost systems, $2.00 postpaid, information free. Industrial Systems, Brooklyn, New York.

Books on Sex, for men and women. Catalog free. United Sales Co., Springfield, Ill.

"Star Amateur Electrician," 12c. pocket size. Joel Tillberg, Proctor, Vermont.

Books for Men. Also "classy" pictures. Catalog free. United Sales Co., Springfield, Ill.

Hurry! New device for indexing. Most wonderful results. Will sell directly to men of means. Rev. Emil Meyer, Route 1, Baker, Kans.

"How to Read Thoughts"—Mind reading at any distance, 20c; "How to Hypnotize"—Cure diseases. Give astounding exhibitions, $1.00; "Silent Friend"—Key to rapid and honest wealth, $1.00; "How to Win," 362 pages—Success assured, $2.00; "Health Culture"—Insures vital strength, 25c; 5 Dozen Money Makers, 30c. Catalogue gratis. Science Institute, E1336 Morse Ave., Chicago, Ill.

Experimental Electricity Course in 20 Lessons. By S. Gernsback and H. W. Secor, E. E. A Course of the theory and practice of Electricity for the Experimenters. Every phase of experimental electricity is treated comprehensively in plain English. New Experiments are described and explained and nearly every application of Electricity in modern life is given. 160 pages, 400 illustrations. Flexible cloth cover 75c postpaid. Stiff cloth cover $1.25 postpaid. Experimenter Publishing Co., Book Dept., 233 Fulton St., New York City.

Old E.E. Back Numbers: We have some valuable old E. E. back numbers on hand as follows: 1915, Jan., March, April, May, June, July, Aug., Sept., Oct., Nov., Dec., price, each 35c; 1916: Jan., March, May, June, Nov., Dec., price, each 35c; 1917: Jan., April, May, June, Aug., Nov., Dec., price, each 35c.; 1918: March, May, June, July, Aug., Sept., Dec., price, each 35c; 1919: Jan., Feb., March, April, May, June, July, Aug., Sept., Oct., Nov., price, each 20c. We can fill orders at once upon receipt of your remittance. If you have not these numbers already, now is your chance to get them as they probably will be snapped up very quickly. Experimenter Publishing Co., 233 Fulton St., New York City.

Song Poems Wanted.

You Write Words for a Song—We write the music, publish and secure a copyright. Submit poems on any subject. The Metropolitan Studios, 914 So. Michigan Ave., Room 113, Chicago, Ill.

Song-writers' Manual and Guide Sent Free! Contains valuable instructions and advice. Submit song-poems for examination. We will furnish music, copyright and facilitate publication or sale. Knickerbocker Studios, 319 Gaiety Bldg., New York.

Write the Words for a Song. We write music and guarantee publisher's acceptance. Submit poems on war, love or any subject. Chester Music Co., 920 So. Michigan Ave., Room 265, Chicago, Ill.

Write the Words for a Song. We revise poems, write music and guarantee to secure publication. Submit poems on any subject. Broadway Studios, 197C Fitzgerald Bldg., New York.

Blueprints.

Electrical Blueprints of various kinds. See my ad under "Electrical" this issue. Charles L. Chittenden.

Patents For Sale.

Sell—Royalty or partner. Newly patented Insect destroyer, investigated. 1542 Gates Ave., Brooklyn.

Combination Comb, Cleaner and Case. Nothing like it on the market. Keeps a comb absolutely clean. Carl Duede, Stuart, Iowa.

Three-In-One Hone, patent No. 1305602. It is exceptionally handy for barbers and private use also. Regular size carborundum hone. Can sharpen hair clippers, razors, safety razors and cutting shears on the same little hone. Greatest money-making proposition for a party who can handle same. Cost 50c, sells for $1.75 a piece. Will sell outright or royalty. Louis Hermann, 1949 W. Grand Ave., Chicago, Ill.

For Sale. The eight different United States patents on Caven electro-automatic street railway signal, also foreign patents. Exceptionally complete, durable, cheap to manufacture, and covers all conditions required by electric railways. Address A. H. Caven, Youngwood, Pa.

For Sale. Wire fastening device, U. S. patent No. 1,307,240; Canadian patent pending. Holds insulated wires securely which can be quickly removed or replaced. Nothing like it and is a necessity. Manufacturers and individuals interested. Address Anthony Christopher, Baldwinsville, New York.

Personal.

The Salesman Win$. Thousands of positions open. We teach traveling salesmanship by mail and guarantee offer of position or refund tuition. For interesting particulars, address Kansas Vocational Bureau, Miltonvale, Kansas.

Write to famous Hawaiian beauties, swimmers, etc. Membership, 25c. Hawaiian Correspondence Club, c/o L. de Roo, Box 306, Honolulu, Hawaii.

Postcards and Pictures.

A Dollar's Worth of fun for 20 cents. 12 funniest postcards you ever saw. A hearty laugh with every card. Good for the blues. Charles Mack, 626 20th St., Oakland, Calif.

Classy Pictures—Do you like real "snappy" photographs? Boys, these are all nifty pocket size pictures, and we know you will like them. Just the kind of pictures you men want for your private collection. Send for a set today; you'll never regret it. Prices, $1 per dozen; set of 30 (all different), $2; 50 real "live" ones, $3. Two samples, 25c. Sent in plain package. United Sales Co., Springfield, Ill.

Rare Real Photos: Bathing beauties, models, the kind you want. Sample dime. Write. Artiste, Auburn, Ind.

Real Photos: Handsome girl models. Rare poses. Samples 25c. Garvey, Dept. S., 20 Perkins Place, Brockton, Mass.

Wonderful Pictures taken from life. The real thing. Startling poses. Thrillers; you will keep these forever. 2 samples 25 cents, 12 for $1. Chas. Mack, 626 20th St., Oakland, Cal.

Phonographs.

Build Your Phonograph. "Perfection" high-quality spring and electric motors, tone arms, reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Ind.

Build your own phonographs and manufacture them for profit. Drawing, Instructions. Parts Price List, Blue Print, etc., complete, sent free upon request. Write today. Associated Phonograph Co., Dept. E 1, Cincinnati.

Make Your Own Phonograph. Particulars free. DeSelo-PhonE, P. O. Box 720, Attica, Indiana.

Musical Instruments.

Violins. Deep, Mellow, Soulful—on credit. Easy terms for wonderful instrument. Get details today. Gustav Henning, 231 11th St., Miami, Florida.

News Correspondents.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

Novelties.

Things That Are Different. Curios, art photographs, relics for your den. Monthly house organ for stamp. Gulf Curio Co., Houston, Texas.

Tie Pins—Coin silver face and sterling silver pin, $1; or with gold-plated pin, 85c. Excellent for Christmas and birthday gifts. A bargain. Charles Roth, 577 Broadway, Buffalo, N. Y.

Smokokraft Ash Tray, new, novel, unique; 50c postpaid. Vanco Mfg. Co., Dept. 57, Chelsea, N. Y.

Baby's Delight. Florida seashells; 50c, three big boxes $1; samples, 10c. Walker Walker, Elkhorn, Wisconsin.

Here, Boys. Make a toy aeroplane; see our Nifty ad., page 804.

Office Devices.

Addressographs, Multigraphs, Duplicators, Multicolors, Folders, Typewriters, Dictaphones, Check Writers, Sealers. Office Device Company, 222-Y North Wabash, Chicago.

Patent Attorneys.

Patents Procured—Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C. or 2278-T Woolworth Bldg., New York.

Millions spent annually for ideas! Hundreds now wanted. Patent yours and profit. Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. 212 Patent Dept., American Industries, Inc., Washington, D. C.

Inventors, send sketch of model of your invention, for opinion concerning patentable nature, and exact cost of applying for patent. Book, "How to Obtain a Patent," sent free. Gives information on patent procedure and tells what every inventor should know. Established twenty-five years. Chandlee & Chandlee, 414 Seventh St., N. W., Washington, D. C.

Patent Your Own Inventions. Save attorney's fees; we prepare applications; furnish full instructions and give satisfaction. Free information. Carl Larsen Co., Park Row Bldg., New York City.

Patents—Prompt, personal, efficient service by an attorney-at-law, skilled in all branches of patent practice. Over 12 years actual experience; full information upon request. B. P. Fishburne, 324 McGill Bldg., Washington, D. C.

Patents—Fees in installments. Frank T. Fuller, formerly Lieutenant Engineers, Washington, D. C.

Patents—Herbert Jenner, patent attorney and mechanical expert, 622 F St., Washington, D. C. I report if patent can be had and its exact cost. Send for circular.

Inventions Patented, Trade-Marks Registered, Labels, Prints, Publications Copyrighted, prompt service, reasonable fees, plain advice, request detailed information before placing your business. Jaynes & Jaynes, 802 Kellogg, Washington, D. C.

"How to Establish Your Rights." to patent protection is a bulletin every inventor should read before disclosing his idea to others. This bulletin, form "Evidence of Conception," and other interesting and valuable patent information free. Lancaster and Allwine, 242 Ouray Bldg., Washington, D. C. Originators of the form "Evidence of Conception."

"Inventers' Adviser" sent free on request. William C. Linton, 918 F St., N. W., Washington, D. C., 363 University St., Montreal, Canada.

Patents—Foremost word free. Write now. Metzger, Washington, D. C.

M. F. Miller, Ouray Bldg., Washington, D. C., Patent Attorney, Mechanical and Electrical Expert. Best quality of work and results. Moderate charges. Advice free.

John M. McLachlen, Attorney at Law. Patents, trade marks, copyrights. 410 McLachlen Bldg., Washington, D. C.

For Inventors.

"Sell or Finance Inventions. Read Money-Talks Magazine. Send for free sample copy. 70-B Park Place, Newark, New Jersey."

Inventions Wanted. Cash or royalty for ideas. Adam Fisher Mfg. Co., 205 St. Louis, Mo.

900 Mechanical Movements, also illustrations explaining 50 Perpetual Motions. My book, "Inventor's Universal Educator," fifth edition, tells how to procure and sell patents. Government and other costs. Covers the matter from A to Z. 160 pages elegantly bound. Contains noted decisions of U. S. Supreme and State Courts on patent cases. Mechanical Movements greatly assist inventors, suggest new ideas that may prove of great aid in perfecting inventions. Tells how to select an attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers. Price $2. Postage free everywhere. Fred G. Dieterich, 603 Ouray Bldg., Washington, D. C.

Inventors write me about patents. My fees payable monthly. Booklet free. Frank Fuller, Washington, D. C.

Inventors! Protect yourselves. Record idea before exposing to anyone, including attorneys. Paul E. Klein, Cons. Eng. Reg. Pat. Att'y, 21 Park Row, New York.

"Inventor's Guide" Free on request; gives valuable advice and information for all inventors. Write Frank Ledermann, Registered Patent Attorney, 17 Park Row, New York.

Inventors—We do Experimental, Model, Tool, Die and Jig Work; Light Manufacturing. Miller & O'Brien Mfg Co., St. Paul, Minn.

Inventors—Sell your ideas or patents thru National Institute of Inventors, 118 Fulton, New York City. Membership 2,500. We help you secure, develop and finance your inventions. Annual dues, $10.

"The Thinkers." Society of inventors, official organ, particulars, patents; dime. Swap Bulletin, the National Exchange Medium, established 1915, Detroit.

(*Continued on page* 846)

www.americanradiohistory.com

(Continued from page 845)

Miscellaneous.

Young Naturalists: A collection of shells, fossils, curios, etc., containing forty fine specimens from all over the world, postpaid for $1.00. Roger Mathes, Batavia, N. Y.

Wanted. Small gasoline and steam engines. small lathes, drill presses and other light machinery. Will pay high cash prices for good material. Johnston, West End, Pittsburgh, Pa.

Crude Rubber. Experiment with pure uncompounded India Rubber. Make tire patching cements, water proof cloth, porus tire filler, rubber stamps, etc. Pure para (highest grade India rubber), 4 oz., 50c.; 8 oz., 80c.; 1 lb., $1.25; 5 lbs., $5.00 Shipped postpaid. Address Bunsen Supply House, 14 S. Canal St., Akron, Ohio.

Big Mail for a stamp. C. E. Robinson, Portland, Conn.

The Master Key is the best and most convenient for household use; opens 20 different locks. Sent postpaid on receipt of 10c; or complete set of three for 25c. Safety Key Holder free. Sharpe Novelty Co., Paterson, N. J.

Australian Opals, black opals, cut stones, rough specimens, beautiful colors. Direct from Australia. Price lists free. Norman Seward, 453 Bourke St., Melbourne, Australia.

New Discovery Startles World. Anyone can make a violin talk. (Yes); we mean actually speak words, sing, laugh, etc. Greatest opportunity for anyone. Particulars free. A. H. Warren, Fairfield, Ill.

For Sale. High grade moving picture films at one cent per foot. Any length. Write for lists. Elmer Sanor, Bradley, Ill.

Rubber Stamps.

Rubber Stamps. If not delivered in five days return to your name and address, 50c. Stamp pads, 25c. Special offer to clubs. Order direct or send stamp for circular. Albert Porch, 7938 Bennett Ave., Chicago.

Printing.

250 Bond Letterheads or envelopes, $1.25. Both, $2.25, postpaid. B. F. Ball & Co., Dept. 23 A, Buckland, Conn.

Quality Printing on good stock note heads, envelopes, cards, tags. 100 either, 65c; 250, $1.10; 500, $1.65; 1,000, $2.75, postpaid. Samples free. E. W. Spafford & Co., Martville, N. Y.

3,000 two-color labels, $1.00. Erwin J. Wolf, Station E, Philadelphia.

Song Writers.

Song Writers: You cannot afford to miss our proposition. Reference, any bank or first-class sheet music house. Warner C. Williams & Co., Dept. L, Indianapolis, Ind.

Stamps and Coins.

Stamps—61 All Different Free. Postage, 3c. Mention paper. Quaker Stamp Co., Toledo, O.

California gold; quarter size, 27c; half dollar size, 53c. Columbian nickel and catalogue, 10c. Norman Schultz, King City, Mo.

300 Different Stamps, 50c. Fred Onken, 630 79th St., Brooklyn, N. Y.

250 Different Stamps from 50 countries, 35c; South America, 40 different, 25c. O. Chartier, Wallingford, Conn.

International Packet. 100 varieties from all over the world. Big value, only 10c. Cobert Stamp Co., 39 State, Rochester, N. Y.

50 Stamps for 10c. John Hammond, 700 Gladstone Ave., Roland Park, Md.

Free—63 different stamps to approval applicants. Postage 2c. J. Hull, 442 W. 124th St., New York City.

Have you seen The Stamp Herald?. Finest monthly stamp paper published. Subscription 50c a year, 3 months trial for 10c. Stamp Herald Publishing Co., Dept. E, Indianapolis, Ind.

100 Different Stamps, 12c; 200, 27c. Michaels, 5600 Prairie, Chicago.

200 All Different Stamps, including Bosnia, Bavaria, China, Guatemala, Bulgaria, Bohemia, Poland, Turkey, etc., and Dime Stamp Album, only one to customer, all for 25c. Our approval sheets contain bargains priced at 1c to 5c net. 150 different U. S. postage and Civil War revenues for only 75c. Indiana Stamp Co., Dept. E., Indianapolis, Ind.

Free—Duplicate Book board cover, 5 new entries 25 stamps mounted, 36 U. S., 45 European, all 20c. Approvals for reference. Nutley Stamp Exchange, Nutley, N. J.

"Best One-Cent Approvals in America." F. P. Hand, 1117 So. 60th St., Philadelphia, Pa.

South America. Buy direct. 1,000 fine assorted Paraguay, Uruguay, etc., for $2 bill. Exchange rare stamps with collectors and dealers; lots or on sheets. C. P. Mego, Necochea 193, Lomas Dezamora, Argentine Republic.

Old Coins Wanted.

We Buy and Sell Old Coins. $2 to $500 each paid. Keep All Old Money; you may have valuable coins. Send 10c. for New Illustrated Coin Value Book, 4 x 6. Guaranteed prices. Get posted. Clarke Coin Co., Box 110, Le Roy, N. Y.

Electrical Supplies and Appliances.

Mansfield's Automatic water and oil finder a proved success, silver medal awarded. Particulars from Edwin A. Mansfield & Co., 94 Victoria Road, New Brighton, England.

Electrical Blueprints. A. C. motor connecting diagrams, 236, contains 54 single, 42 two, 50 three phase Star, 40 Delta, 12 Star-Delta, Appendix, 38, changes of voltage, speed, cycles, phases, etc. D. C. diagrams, 123, voltage changing, etc. Transformer diagrams, 120. 10 samples A. C. 25c. Particulars free Charles Chittenden, 811 West Eighteenth, Kansas City, Missouri.

Battery Charging pays big profits with HB Equipment. Electric Light Generators and Motors can also be furnished on easy payments. Full information free. Hobart Brothers, Troy, Ohio.

Storage Batteries. Make the plates yourself. We will tell you how. Sample plate 40c. Windsor Specialty Co., not incorporated. 5419 Windsor Ave., Chicago, Ill.

Inventors: Models, Dies, Tools. 28 years' experience, work guaranteed, lowest price. Manufacturing of specialties our hobby. Peerless Die & Tool Co., 121 Opera Pl. D. B., Cincinnati, Ohio.

Lava Insulation is not molded but individually sawn, lathe turned, milled, drilled, threaded. No limitation on form, only on size. Kilned at two thousand degrees. Hard, strong, accurate, fire, acid proof. Ask for book. American Lava Insulator Company, Chattanooga, Tenn.

"Welding Plants designed for all purposes. Small payment; balance six months. Every mechanic or shop should have one. Ask for our rental plan. R. W. Bermo Company, Omaha, U. S. A."

Boys, build your own Electric Motor. Complete outfit $1.75. Blue Prints only 25c. A. F. Cassel, 52 W. 130th St., New York City.

Electrical Workers and All Others who are interested in Electrical work in the reconstruction that is taking place. To send us their name and receive descriptive literature of our Modern Blue Print Chart Method of Electrical Wiring. Souvenir information card included. Electrical Wiring Diagram Co., Box C. 173, Altoona, Pa.

Make Your Own flashlight batteries. Complete outfit $1.00. Send for circular. Eagleco, Darien, Connecticut.

Reversing Switches for battery circuits. Three positions, "Forward," "Off," "Reverse," 50c. Box 107, Dept. C., Sisseton, S. D.

Boys—Here is the simplest and cheapest electric telegraph ever devised. With the "K" Applicator you need no batteries. Get electricity free, instantly anywhere at any time. Send thirty cents (postal money order), for full instructions how to make the "K" Applicator and how to operate an electric telegraph without batteries. Is easier to make and requires less material than you would use in making a kite. Gives constant, smooth, even current day and night, never runs down even upon closed circuit. Works on any metallic line, even barbed wire fence as no insulators necessary. The "K" Applicator, Missouri Valley, Ia.

100 Induction Motor Winding Diagrams 1, 2, 3 Phase, star, delta, 2 to 12 poles inclusive. Postpaid $5.00. E. Glass, 2108 South Broad Street, Philadelphia, Pa.

Stanley Steamers exclusively, get list, used boilers, burners, engines, automatics, gauges, piping, fittings, accessories. Inclose Stamp. "Doc" Paine, Denver, Colorado.

Experimental Electricity Course in 20 lessons, by S. Gernsback and H. W. Secor, E. E. A course of the theory and practice of electricity for the experimenters. Every phase of experimental electricity is treated comprehensively in plain English. New experiments are described and explained and nearly every application of electricity in modern life is given. 160 pages—400 illustrations. Flexible cloth cover, 75c postpaid. Stiff cloth cover, $1.25 postpaid. Experimenter Publishing Co., Book Dept., 233 Fulton St., New York City.

Formulas.

500 Formulas. Successful money-making secrets, discoveries. Postpaid 25c. Edgar James, 315 Douglass, Indianapolis, Indiana.

500 Formulas, including Resilvering Mirrors, Renewing Dry Batteries, Mechanic Soap, Luminous Paint, 25c. Ideal Book Shop, 5501-EE North Robey, Chicago.

500 Successful money-making formulas and trade secrets. Postpaid, 25c. Charles Dynes, Winchester, Indiana.

370 Formulas, 10c. Fitzgerald, 15 West 65th St., New York.

1,000,000 Formulas. Processes. Trade secrets for every business. 1016 pages, $2. Ideal Book Shop, 5501-EE North Robey, Chicago.

For the Hair.

I Was Bald. Obtained hair growth by an Indian's ointment containing genuine bear oil and rare plant juices. Many others have good hair-growing results. Will send box, postpaid, with recipe, 10c. John Hart Brittain, 150 E. 32nd St., BA-300, New York.

Wireless.

Weston Model 280 Millivoltmeter 00-75, $9.00. Weston Model 279 Voltmeter, $4.00. Receiving cabinet with two condensers and audion, $16.00. 500-cycle 3/8 K. W. generator with transformer, condenser and gap, $25.00. Two French audions and two pliotrons, excellent for telephony, $6.00 each. Marconi key, $3.00. Baldwins amplifying phones, $13.00. 1/4 K. W. commercial quenched gap, $2.00. Semi-quenched rotary gap, $14.00. Spenser microscope, new, $35.00. Photos furnished. E. J. McGinniss, 900 Franklin Bank Bldg., Philadelphia.

Experimenters—Send us your name. Industrial Company, 391 Fulton, Brooklyn, N. Y.

We Buy, Sell and Make Wireless Apparatus. Write us your wants and we will satisfy them. Send three cents for particulars. Warwick, 2535 Tenth Ave. South, Minneapolis, Minn.

The Audion. Its early history and development, Electron Theory and Trigger Action, compiled by a Chief Electrician Radio who was stationed at the Naval Radio School as Instructor for two years, written by an old amateur for the amateurs in words that they can understand. Also blue print diagrams for hook ups for receiving damped signals, using both air exhausted and gas bulbs. Receiving undamped signals and regenerative circuits. Two-step amplifier, using same (A) and (B) batteries for both steps. Wireless telephony with power bulb. Working blue prints on how to build a "One to One" transformer for use with Audion Amplifier. All for $2.00. Address T. O. McKenzie, 104 Warburton Ave., Yonkers, N. Y.

Complete Receiving Sets, $7.00 and Up. With 1,000-ohm receiver, tested mineral; guaranteed. Bulletin for stamp. Jenkins, Room 2, 923 Purchase St., New Bedford, Mass.

Bargains To vacate our place we must sell 500 3/4-inch spark coils with vibrators at 85c, and 1,000 without vibrators at 40c. Send money orders, cash, and 15c postage on each coil—no checks. A. Dubs, 1534 Pitkin Ave., Brooklyn, N. Y.

Fifty Telephone Receivers, "Bell" type, 150-ohm, double pole, 40c each, postpaid. Bartholomew, 349 W. 79th St., Los Angeles, Calif.

Switch Points. Binding posts, switch levers, and small parts, send 2c for catalogue describing these and other goods. A. W. Bowman & Co., 23 Church St. (Harvard Square), Cambridge, Mass.

Attention Amateurs! Learn the code quickly by new method in from one to two hours. Chart by mail, 25c. Acme Chart Co., 618 Delafield Ave., W. N. Brighton, Staten Island, N. Y.

Loose Couplers—800-1500 meters, $4-$20. Order now. Supply limited. N. A. Radio Equip. Co., 510 Claremont Pkwy., Bronx, New York.

Quick—Something you really need. Instructions with drawings for winding honeycomb coils. Forms cost nothing. Easy to wind. Latest and most efficient. Small and compact. Amplifying. When once used, you'll throw away or give away all other coils. Price $1, with satisfaction guaranteed. Chas. E. Williams, Box 1001, Atlanta, Ga.

How to Make Wireless Receiving Apparatus. 100 pages, 90 illustrations. Only strictly modern radio apparata are described in this book and the illustrations and descriptions are so clear and simple that no trouble will be experienced in making the instruments. Paper covered. 25c postpaid. Experimenter Publishing Co., Book Dept., 233 Fulton St., New York City.

How to Make Wireless Sending Apparatus. 100 pages, 88 illustrations. Written and published entirely for the wireless enthusiast who wants to make his own radio apparatus. Contains more information on "how to make it" than any other book we know of. Paper bound, 25c prepaid. Experimenter Publishing Co., Book Dept., 233 Fulton St., New York City.

Wireless Course in 20 Lessons. By S. Gernback, A. Lescarboura and H. W. Secor, E. E. Tells you everything you want to know about "Wireless"—a theory, practice and history A clear, concise course on every phase of this subject. 160 pages, 350 illustrations, 30 tables. Flexible cloth cover, 75c postpaid. Stiff cloth cover, $1.25 postpaid. Experimenter Publishing Co., Book Dept., 233 Fulton St., New York City.

Wanted to Buy.

Cash for Old False Teeth—We pay up to $35.00 per set (broken or not). Also buy discarded gold jewelry, gold crowns, bridges, platinum, diamonds, watches and silver. Send now. Cash by return mail. Package held 5 to 10 days for sender's approval of our offer. U. S. Smelting Works, Dept. 73, Chicago, Ill.

Winter Fishing.

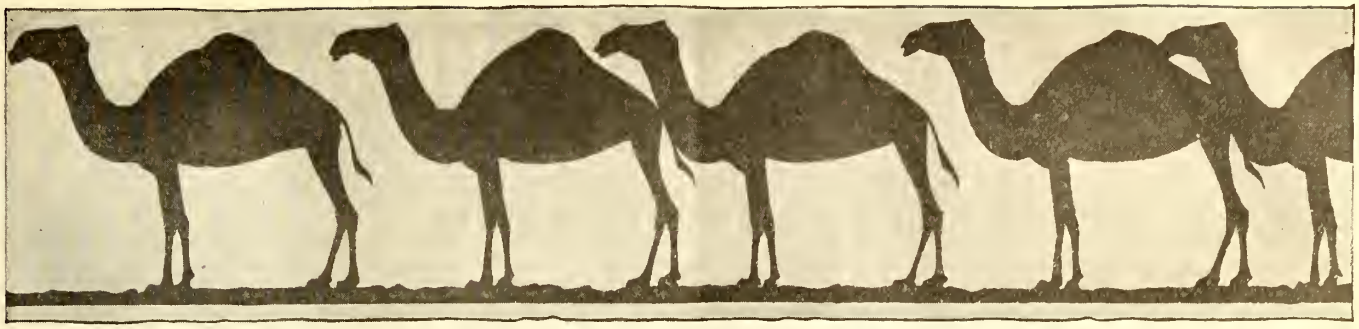
Julian's Liquid Fishing Lure. Whole winter's supply. One dollar George Julian, Albany Bldg., Boston, Mass.

Motor Engines and Dynamos.

Small Motors and Generators. Cancelled Government Contracts. A. C. motors, $9.50 each and up. 12 110-volt generators, $26.50 each, battery charging outfits, $30 each and up. New motors 1/4-1/2 up to 5 H. P. for all phases and frequencies of current. Write for late bulletin. Bargains in motors and generators. Address Motor Sales Dept., No. 12, West End, Pittsburgh, Pa.

Motors—1/12 and 2 h. p. 110 volts d. c. Krug Realty Co., Cincinnati, Ohio.

www.americanradiohistory.com



CAMELS are unique—a real cigarette revelation! That's due to their quality and to the unusual and expert blend of choice Turkish and choice Domestic tobaccos!

YOUR enthusiasm for Camel Cigarettes will steadily increase! They will not tire your taste, no matter how liberally you smoke! And, each cigarette will just add a little more to the joy and contentment the wonderfully refreshing Camel flavor hands you so lavishly!

Once you know Camels you'll prefer their blend—and what it gives you—*the most fascinatingly mellow-mild-body ever realized in a cigarette*—to either kind of tobacco smoked straight!

You'll enjoy Camels freedom from any unpleasant cigaretty aftertaste and from any unpleasant cigaretty odor!

And, the longer you smoke Camels the more you'll appreciate that they are *made to meet your taste!*

Compare Camels with any cigarette in the world at any price—and forget coupons, premiums and gifts!

Camels are sold everywhere in scientifically sealed packages of 20 cigarettes; or ten packages (200 cigarettes) in a glassine-paper-covered carton. We strongly recommend this carton for the home or office supply or when you travel.

R. J. Reynolds Tobacco Company
Winston-Salem, N. C.



Camel
CIGARETTES

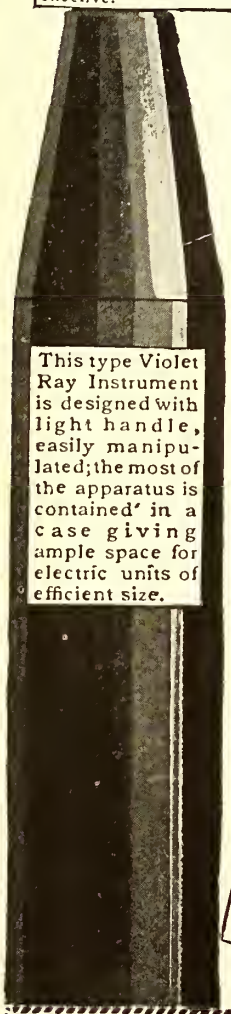
www.americanradiohistory.com

Regain Your Health Thru Renulife VIOLET RAY Treatments at Home



Unequaled for neuritis and rheumatism

More Than 25,000 Volts
No pain, shock or muscular contraction. Entirely harmless — powerfully effective.



This type Violet Ray Instrument is designed with light handle, easily manipulated; the most of the apparatus is contained in a case giving ample space for electric units of efficient size.

There is no "quackery" or uncertainty about *Renulife Violet Ray*. It is not claimed to be a "Cure All," but it has proved in thousands of cases a practical health-producing, revitalizing agent—powerful in restoring normal physical conditions—yet gentle, soothing and perfectly safe. *You* can treat yourself. Get full information regarding uses shown on coupon below.

Users Get Wonderful Results

(Voluntary Testimonials)

"The Renulife Violet Ray High Frequency Generator is superior in efficiency because of its perfect character and control of current, compactness and perfect insulation. The smallness and lightness of Electrode holder is also a great advantage." "The doctor told me that the trouble was hardening of the arteries. I wish I had got it a year ago. I would not be without it for all the money in the world." "I cannot recommend it too highly." "I have been using mine now for a week for Sciatica and I am highly pleased with results." "I think it is one of the best little machines that was ever invented." "I have used it with excellent results for the restoration of hair and stiff and sore rheumatic finger joints." "Am well pleased with the Generator, and the kind treatment received from your Company." "My Generator has stopped my neuritis." "Every house should have a Renulife Violet Ray High Frequency Generator, for the treatment of Neuraigia, Neuritis, Sore Throat, Kernels in Neck, Cramps, Headache, Stiff Neck, Muscular Soreness, Rheumatism, Paralysis—in short, pains of all kinds."—M. D. "I have been much relieved by the use of your Violet Ray Generator." "It is fine for Insomnia." "I find it such a help in nervousness." "I would not part with it for five times the price. It is sure a little wonder." "I am more than pleased with the Generator; the whole family are using it." "A neighbor lady was suffering from lumbago and could not move, and my wife brought over the Generator and in less than ten minutes the lady was greatly relieved." "Your Generator is just the thing for me. That tired feeling has left me, and I feel like myself again." "It has relieved me of the nervousness and also it has helped me a great deal in using it for the treatment of rheumatism."

How Renulife Benefits

Science has demonstrated a strange relation between electricity and life cells. This instrument harnesses a tremendous current of electricity and applies in the form of Violet Rays so that the body welcomes and responds to it in a marvelous manner—no pain—shock or the slightest harmful effects. A few seconds of Renulife Violet Ray gives more benefit than hours of the old time battery methods—because a thousand times as much voltage is made use of.

The irresistible, revitalizing powers of *Renulife Violet Ray* reach every nerve cell, fibre and part of body. Blood is enriched and purified by a flood of oxygen, giving added vitality and strength. Assimilation and digestion improved—functions retored to normal—extra supply of fresh blood quickly brought to area treated, removing congestion and supplying nourishment. While relieving pains and aches, the manifest results of disorders, it removes the deep seated cause, combines the benefits of electricity, vibration, exercise, stimulation and oxidation.

Get Book "Health via Violet Ray"

Learn the whole marvelous story of the Violet Ray—this method that works with nature to restore and build up. Learn how you, at home, can now use these great curative forces of Violet Ray—heretofore only available at big expense from physicians or beauty doctors. Send coupon or postal card now and receive free book describing uses, quoting low prices (within the reach of all) and explaining liberal *Trial Plan*.

Renulife Electric Co., Inc.

1212 Marquette Bldg., Detroit, Mich.
CANADIAN RENULIFE ELECTRIC CO., Ltd.,
1212 Netting Bldg., Windsor, Ont.
Toronto Office: 612 C. P. R Building

Live Sales Representatives write for proposition



Increases energy and vitality



Treatment for nervousness and general debility

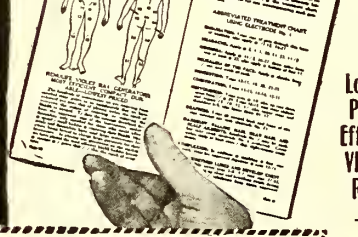


Ozone most beneficial for catarrh, throat and lungs. Also anemia

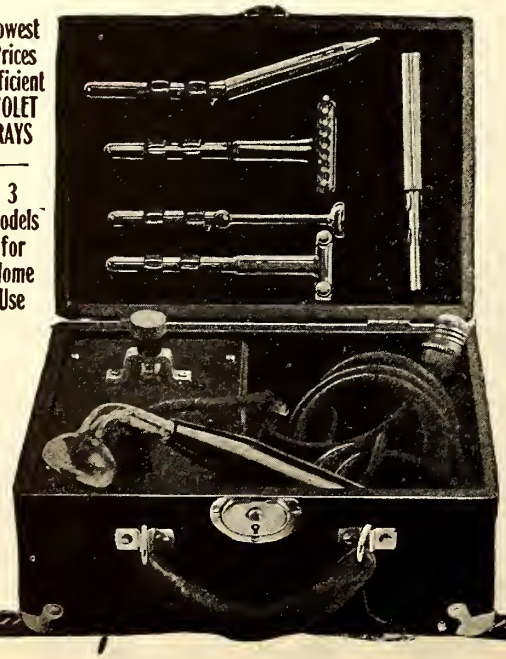


Stops falling hair — promotes hair growth. Wonderful beauty aid

BOOK **FREE**



Lowest Prices Efficient VIOLET RAYS — 3 Models for Home Use



COUPON FOR BOOK and Special Information

RENULIFE ELECTRIC CO.,
1212 Marquette Bldg., Detroit, Mich.

Please send without obligation, your book "Health," explaining Violet Ray treatments with Renulife Generators; also give full particulars as to its application for ailments checked below.

TREATS SUCCESSFULLY

..Abscesses	..Facial Neuralgia	. Piles
..Anemia	..Falling Hair	..Pimples
..Asthma	..Goitre	..Pyorrhea
..Arteriosclerosis	..Gout	..Rheumatism
..Baldness	..Hay Fever	. Scars
..Blackheads	. Infantile Paralysis	. Sciatica
. Brain Fag	..Insomnia	..Skin Diseases
..Catarrh	..Lameness	..Throat Diseases
..Colds	. Locomotor Ataxia	. Sprains
..Chilblains	. Lumbago	..Toothache
..Dandruff	. Nervous Affections	..Weak Eyes
..Deafness	..Neuralgia	..Wrinkles
..Eczema	..Neuritis	..Warts and Moles
. Enlarged Prostate	..Paralysis	

Write your name and address in margin below and cut out with coupon

Chicago Office
Room 410
123 West Madison

Copyright, 1919, R E Co.

www.americanradiohistory.com